

May 18, 1926.

R. G. HANDY ET AL

1,584,929

GOVERNOR

Filed May 21, 1920

3 Sheets-Sheet 1

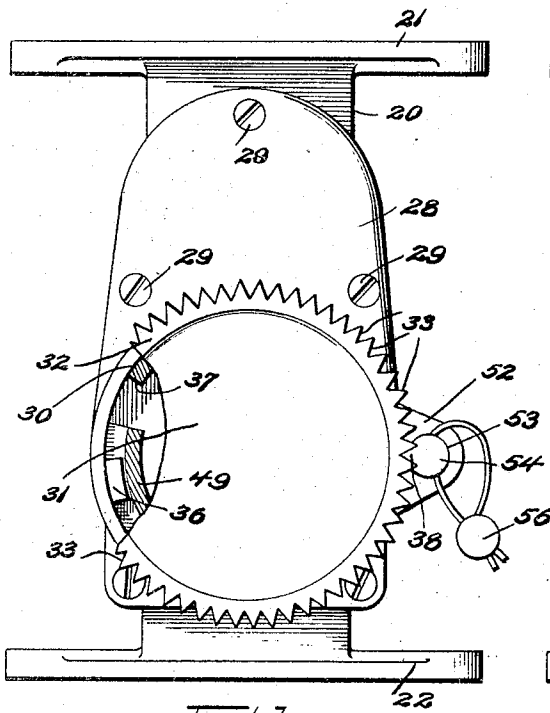


FIG. 1.

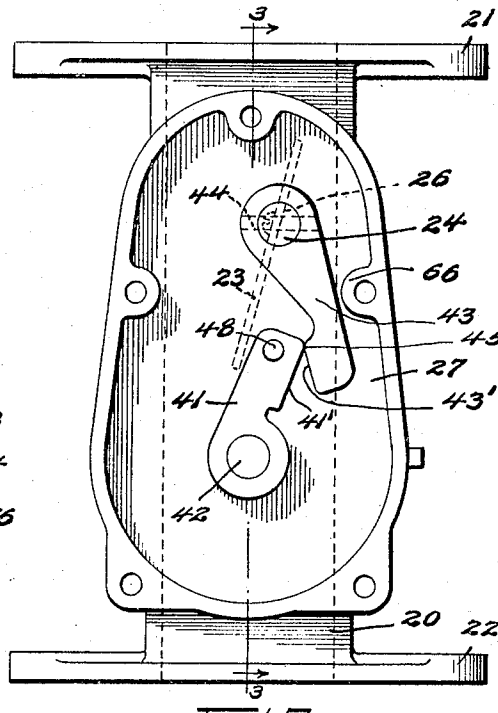


FIG. 2.

FIG. 3.

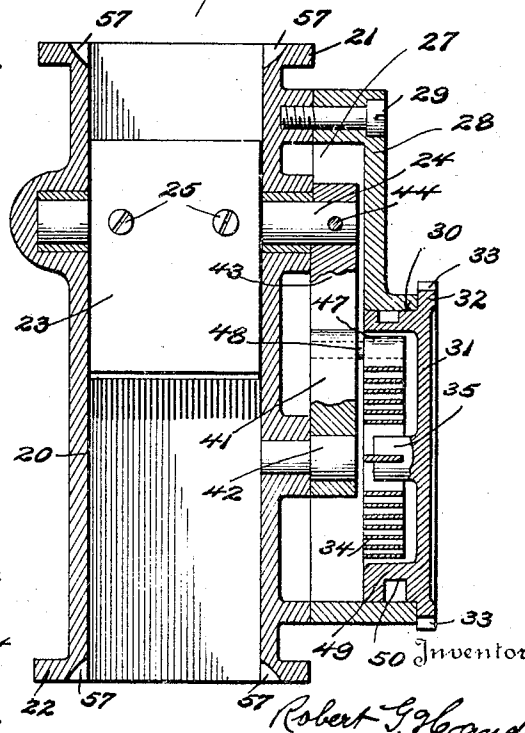
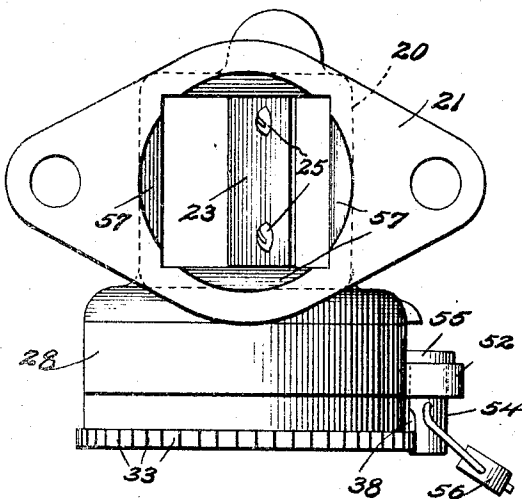


FIG. 4.



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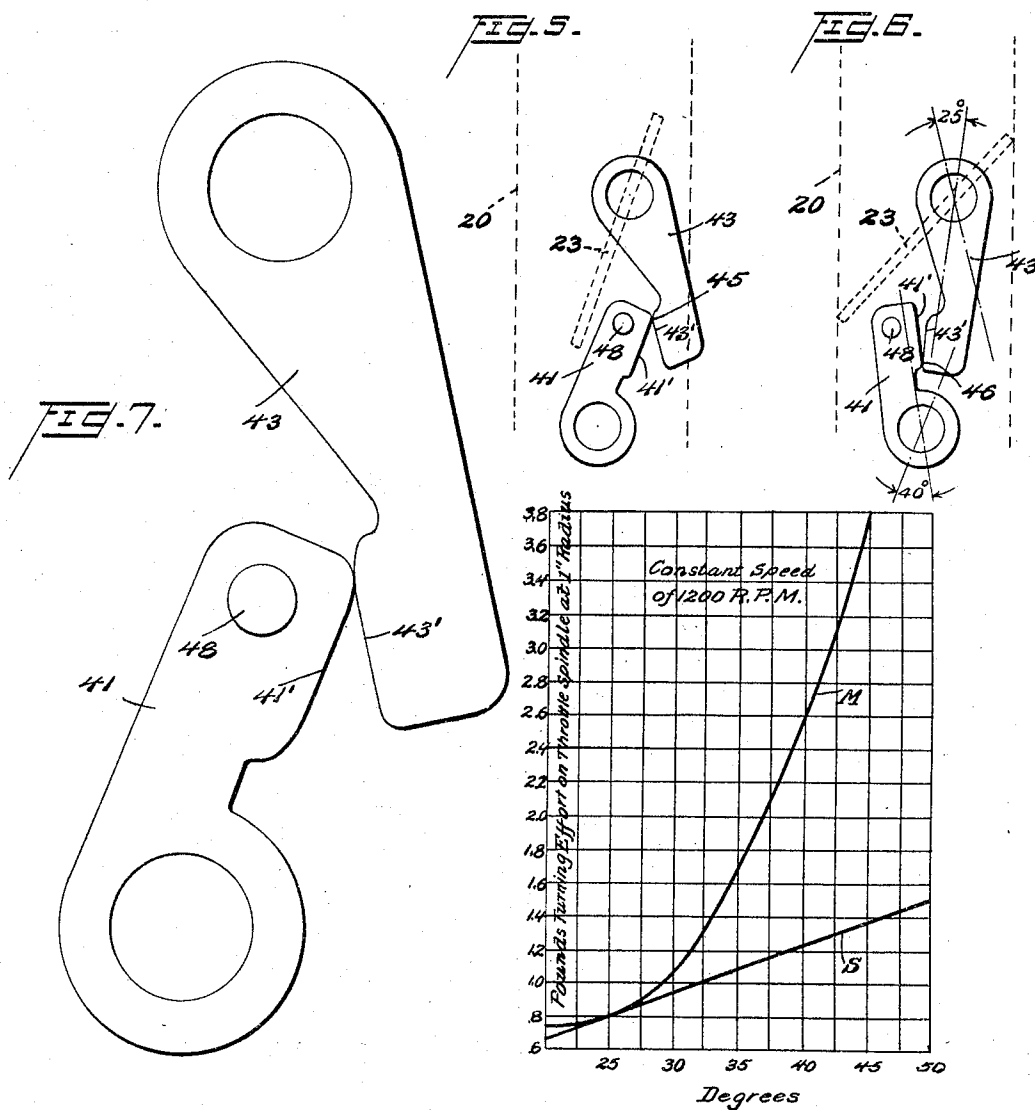
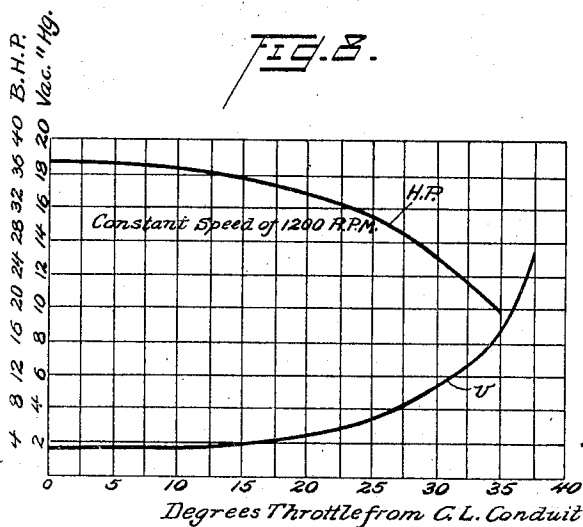
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GOVERNOR

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3 Sheets-Sheet 2



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GOVERNOR

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Fig. 10.

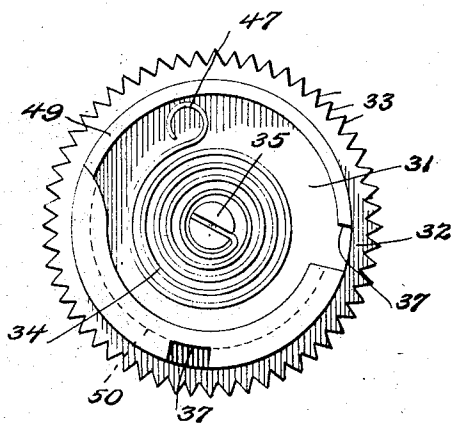
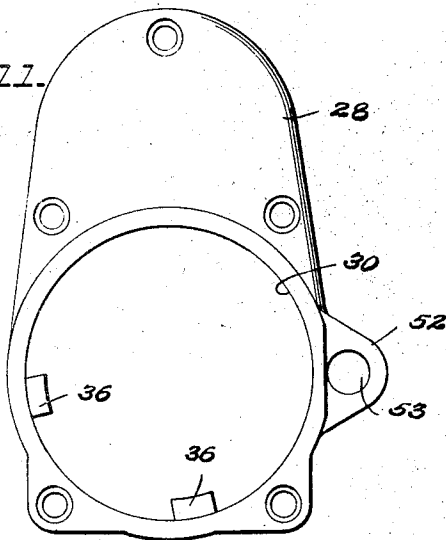


Fig. 11.



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1,584,929

# UNITED STATES PATENT OFFICE.

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GOVERNOR.

Application filed May 21, 1920. Serial No. 383,259.

The present invention relates to governors, more particularly for hydrocarbon motors and of the type actuated in accordance with the flow of fluid in the intake of the motor.

If the intake of a hydrocarbon motor is obstructed, it is found that the vacuum therein on the cylinder side of the obstruction increases very rapidly as the obstruction becomes more complete; that is to say, the vacuum increases at an accelerated rate as distinguished from a uniform or regular rate, when the motor is operating at a constant speed. As is well known, a spring or similar yielding device offers a gradually increasing resistance as it is deformed. Hence, governors of the type mentioned, which employ obstructing or flow controlling means the closing effort of which increases at an accelerated rate as the intake is obstructed, can not be directly balanced by a spring at all positions of the obstructing means. The spring may balance the means at one or at two points, but will not balance the same at any other points.

It is one of the principal objects of the present invention to provide a governor of the type mentioned in which the effort acting to close the flow controlling means in the intake is substantially balanced at all positions thereof, it being understood that this applies when the motor is operating at a constant predetermined speed, and that said effort is over or under-balanced at other speeds. In connection with governors of the type mentioned which have several parts disposed in the intake, it is found that the wear resulting from the use of the device and from dust, sand, and the like drawn through the intake, loosens parts so that they become detached and are drawn over to the main valves of the motor and may cause considerable damage. It is another object of the present invention to provide a governor wherein this defect will be eliminated as far as possible. In other words it is an aim of the invention to have as few parts as possible disposed in the intake. In one of the simplest forms of the invention, this result is obtained by making the obstructing device also act as the controlling device. Thus a single unbalanced butterfly valve may be used and is the only part disposed in the intake conduit.

Other objects of the invention are to pro-

vide a governor, which is readily adaptable to any motor; is reliable; is simple in construction; has simple means for adjusting the same; is rugged; is durable; correctly maintains the predetermined speed within required limits; and controls the speed without appreciably affecting the power of the motor.

Other features and objects of novelty will be apparent from the description taken in connection with the drawings, in which—

Figure 1 is a front side elevation of a governor constructed in accordance with the present invention;

Figure 2 is a similar view with the cover plate removed;

Figure 3 is a sectional elevation taken substantially on the line 3—3 of Figure 2;

Figure 4 is a top plan view;

Figure 5 is a view illustrating the position of the counter-balance transmission means when the governor valve is open,

Figure 6 is a view similar to Figure 5 but showing the positions of the parts when the valve is closed;

Figure 7 is an enlarged view of the transmission means, illustrating one form of cam surfaces;

Figure 8 is a plot illustrating the increase in vacuum in the intake as the same is obstructed;

Figure 9 is a plot illustrating the increase of the effort acting to close the obstruction in the intake of a motor as the same is made more complete, in comparison with the corresponding deformation of a spring;

Figure 10 is an inside view of the spring carrying cap, and

Figure 11 is an elevation of the cap piece forming part of the housing enclosing the transmission mechanism and supporting the spring carrying cap.

Referring to Figure 8 of the drawings the plot there shown has reference to a certain motor having a butterfly valve in the intake thereof, said valve having its axis at one side of its center line, so that it is unbalanced. In the plot the abscissæ represent the angle in degrees that the throttle valve makes with the center line of the intake conduit, the valve being wide open when the angle is zero. The ordinates represent horsepower and pressure in inches of mercury. The curve *v* represents the difference of pressure on the two sides of the valve, in

other words it shows the suction force operable on the valve. It will be observed that this curve increases at an accelerated rate as the valve is closed. The curve H. P. represents the horsepower derived from the motor and it will be noted that this falls off as the valve is closed. All the observations for making this plot were made with the motor running at a constant speed.

It is well known that a spring exerts a gradually increasing force as it is deformed. It is clear therefore that a spring can not be employed directly to counter-balance the effort acting on the valve as disclosed in Figure 8. In order to obtain a successful governor the obstructing means must be counter-balanced in all positions, when the motor is operating at a constant speed.

Referring to Fig. 9 of the drawings curve M represents the turning effort acting to close a throttle valve of the unbalanced butterfly type, at various positions of the valve. The abscissæ represent the angle in degrees that the valve makes with the center line of the conduit. The ordinates represent pounds turning effort on the throttle spindle at one inch radius. The curve S represents the corresponding turning effort from a spring deformed in accordance with the movement of the valve. Clearly if this curve S is tangent to or intersects the curve M at one or two points the spring can balance the valve at said points only. According to the present invention means is provided for balancing an obstructing means in the intake of a hydrocarbon motor, when the motor is operating at a predetermined speed, said obstructing means being unbalanced at other speeds.

In the embodiment of the invention illustrated in the drawings a hollow casting 20 is provided, having end flanges 21 and 22 adapting the casting to be secured to form a part of the intake conduit of the motor. It will be observed that this casting may be easily applied to motors already constructed, as it is only necessary to disconnect the carburetor from the intake manifold, secure the flanges 21 to the flanges of the intake manifold and fasten the carburetor to the flanges 22 of the casting, or intake conduit as this part may be termed.

Disposed within the intake conduit is an obstructing means adapted to control the flow of fluid therein. As shown this means is in the form of a butterfly valve comprising the plate 23 secured to the spindle 24 in any suitable manner as by means of the screws 25. As clearly shown in Fig. 2 the spindle 24 is slabbed off at 26 to afford a flat seat for the plate 23. Furthermore the axis of spindle 24 is disposed toward one side of the valve plate 23 with respect to its center line, so that the valve is unbalanced. As clearly shown in Figures 2 and 5, when the valve is in its open position, it is inclined slightly to

the direction of flow of the gases, so that there is a slight turning effort acting to move the valve in its closing direction, even when it is in its most open position. As previously explained the effort tending to close the valve 23 or similar obstructing means increases at an accelerated rate as the valve is moved in a closing direction. However, according to the present invention suitable counterbalancing means is provided so that the force tending to close the valve is counterbalanced when the motor is operating at a predetermined speed. In the form shown this is accomplished by providing a yielding device and a transmitting mechanism which is constructed and arranged to equalize the force of the yielding device and the effort tending to close the valve.

As illustrated, a chamber 27 is formed between one wall of the intake conduit and an enclosing cap piece 28, this piece being secured to the side of the conduit in any suitable manner as by means of the screws 29. The removable cap piece 28 is formed with a circular opening 30 within which is fitted a circular cap 31 having a radially extending flange 32 formed with serrations 33. The yieldable device referred to, in the present embodiment of the invention, consists of a coiled or watch spring 34 carried by the cap 31. For this purpose the cap is provided with an inwardly extending central boss 35 which is slotted and has the inner end of the spring disposed therein as shown in Fig. 10.

For the purpose of transmitting the force of the spring to the valve, a pair of rotatable members are employed. As shown a rotatable member or arm 41 is pivoted on a pin 42 coaxial with the shaft 36, and is forced in a clockwise direction as seen in Fig. 2 by the spring 34, the outer end of which is formed with a loop 47, (see Fig. 10) in which is disposed a pin 48 near the end of arm 41. This arm adjacent its outer end is adapted to contact with an arm 43 secured to the projecting end of the valve spindle 24 as by a pin 44. The arms are so shaped, that, as the valve is turned the point of contact is shifted radially. Thus as shown in Fig. 5, with the valve open, the point of contact of the arms is at 45, but this point is shifted to 46 when the valve is closed, as shown in Fig. 6. These points are chosen so that the moment exerted by the spring counterbalances the effort tending to close the valve at the two positions of the valve shown in Figs. 5 and 6, it being understood that the balancing is for a predetermined speed of the motor. The points of contact intermediate the two points illustrated in Figs. 5 and 6 are located so that the valve is properly counterbalanced by the spring. The form of the cam surfaces for obtaining the proper moments with the type of governor described herein is illustrated in Fig. 7, arm 43 having cam surface

43' and arm 41 cam surface 41'. Knowing the effort on the valve when open and when closed and the force of the spring at the corresponding positions, it is an easy matter to calculate the length of arms required to balance the valve at the two positions of Figs. 5 and 6. The intermediate points of the cam surfaces may be determined empirically. The arrangement is such that the valve arm increases in length as the spring arm decreases. Hence according to the present invention, means is provided to increase the effort exerted on the valve by the yielding means as the valve is moved in the closing direction. Referring to Figs. 5 and 6, it will be observed that the spring arm moves through a greater angle than the valve arm. Thus in the figures shown the valve arm moves through substantially 25° while the spring arm moves through substantially 40°. The resistance offered by the spring is therefore correspondingly increased. In the construction just described, the force exerted by the spring is less than the closing effort of the valve and hence it was necessary to increase the resistance offered by the spring. It will be apparent, however, that the invention is not limited to the use of a resistance of this order as a resistance of any amount might be utilized, the transmission device being designed to convert the resistance into an effort just counterbalancing the closing effort of the obstructing means.

Referring to Fig. 3 it will be seen that in the form of the invention shown, the spring carrying cap 31 includes an axially extending flange 49 rotatively fitting within the opening 30. As one end of the spring is secured to the boss 35 the tension of the spring may be adjusted by rotating the cap 31. It is desirable therefore to mount this cap to permit such adjustment and further to provide means for locking it in adjusted position. For this purpose a bayonet and slot connection may be provided between the cap and the bore of the cap piece or casing 28. Thus as shown a pair of spaced lugs 36 extend inwardly from the bore 30 and the flange 49 of the cap is formed with a peripheral groove 50 extending around about half of the circumference of the flange. At two points spaced the same as the lugs 36, the rear wall of the groove 50 is cut away so that the cap may be inserted in the bore with the lugs in the two cut-away portions 37 and thereafter a slight turn of the cap will lock it against removal from the casing. In order to adjust the tension of the spring 34 it is merely necessary to turn the cap in one direction or the other. It may be locked in adjusted position in any suitable manner. As shown, the casing member 28 is provided with a lug 52 formed with an opening 53 for a pin 54. This pin has a head 55 engaging one side of the lug and is long enough to ex-

tend by the serrations 33 of the periphery of the cap, the portion of the pin adjacent the serrations being provided with similar serrations 38 engaging the serrations on the cap. The pin 54 may be held against removal in any suitable manner as by means of a sealing means such as indicated at 56.

From the foregoing it will be apparent that the tension of spring 34 may be adjusted by turning cap 31 so that the governor will limit the speed of the motor in accordance with the adjustment, and means is provided for locking the cap against removal or unauthorized adjustment.

As clearly shown in Fig. 4 the passage through the casting 20 is rectangular, and at the ends thereof the casting is formed with the concave recesses 57 to form a smoother surface between the rectangular passage and the generally circular passages in the carburetor and intake manifold of the motor. The invention is not limited to a rectangular passage nor to a pivoted valve, but in the preferred form a rectangular passage is used because it permits a uniformly close fit at the sides of the plate valve 23, regardless of the angular movement of the same. Furthermore, the rectangular plate valve 23 gives a larger area at a greater distance from the axis than in the case of an elliptical or other shaped valve, in consequence whereof the effect of the flow of gases will be to provide a greater turning effort of the valve than if other shapes were employed. Hence, small changes in the velocity of the incoming fluid will affect the stability of the valve thus giving a mechanism very sensitive to changes in speed of the engine. Further, it has been found that the path of the fluid in the intake conduit of a hydrocarbon motor is in the form of a helix, with a tendency to so continue without breaking up liquid globules of the fuel that may be carried along. The rectangular orifice around the governor acts to break up this helical path of flow, thus giving a more homogeneous mixture. The rectangular passage also has the effect of causing the gases to flow in relatively straight paths as they approach the throttle valve.

In the form of the invention described above the power for operating the governor in one direction is obtained directly by the action of the incoming fluid on the controlling valve itself. However the invention is not limited to this construction or arrangement as the valve may be actuated in other ways.

In the operation of the form of the invention described herein the cap 31 is locked by means of pin 54 so as to set the governor to limit the speed of the motor to the required R. P. M. If this speed is exceeded, the effort acting to close the valve will overcome the effort exerted by the spring and the valve will move in a closing direction, there-

by cutting down the supply of mixture to the motor with a resulting decrease in speed. On the other hand if the speed of the motor is below the maximum for which the governor is set, the effort exerted by the spring overcomes the effort exerted to turn the valve in a closing direction, so that the valve is opened as far as possible, that is to the position shown in Fig. 2. Further opening is prevented by the arm 43 striking the boss 66.

Although one form of the invention has been described in detail it is to be understood that it is not thus limited but includes modifications and changes which come within the scope of the appended claims.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. A governor for the intake of hydrocarbon motors including in combination, an intake conduit, a governing member in said conduit actuated in a closing direction by the operation of the motor, and means opposing said closing movement at a predetermined speed of the motor with a substantially equal effort in all positions of said member, said opposing effort being unequal to the closing effort of the member at other speeds.

2. A governing device for the intake of hydrocarbon motors including in combination, an intake conduit having a portion of substantially uniform cross sectional area, a flow controlling member in said portion directly acted on by the suction, means exteriorly of said conduit opposing movement of said member in a direction to obstruct the conduit with an effort substantially equal and opposite to the effort acting to actuate said member in any position thereof when the motor is running at a predetermined speed, said efforts being unequal at other speeds.

3. A governing device comprising in combination, a conduit, a valve in said conduit adapted to be actuated in the closing direction in accordance with the flow of fluid in the conduit, a spring, and means transmitting the force of said spring to oppose the closing movement of said valve, said means constructed and arranged to increase the effort exerted on the valve by the spring as the valve is moved in the closing direction to such an extent as to balance the closing effort on the valve in all positions thereof when the motor is running at a predetermined speed.

4. A governing device comprising in combination, a conduit, a valve in said conduit adapted to be actuated in the closing direction in accordance with the flow of fluid in the conduit, a yielding device, and means transmitting the effort of said device to oppose closing movement of said valve, said

means constructed and arranged to increase the effort exerted on the valve by said device as the valve is moved in the closing direction to such an extent as to balance the closing effort on the valve in all positions thereof when the motor is running at a predetermined speed.

5. A governing device comprising in combination, a conduit, a valve in said conduit adapted to be actuated in the closing direction in accordance with the flow of fluid in the conduit, a spring, and means transmitting the force of said spring to oppose the closing movement of said valve, said means constructed and arranged to increase the effort exerted on the valve by the spring as the valve is moved in the closing direction to such an extent as to balance the closing effort on the valve in all positions thereof when the motor is running at a predetermined speed, said spring and means being disposed exteriorly of said conduit.

6. A governing device comprising in combination, a conduit, a valve in said conduit adapted to be actuated in the closing direction in accordance with the flow of fluid in the conduit, a yielding device, and means transmitting the effort of said device to oppose closing movement of said valve, said means constructed and arranged to increase the effort exerted on the valve by said device to such an extent as to balance the closing effort on the valve in all positions thereof when the motor is running at a predetermined speed and said means being disposed exteriorly of said conduit.

7. A governing device for the intake of hydrocarbon motors comprising in combination, a conduit, a portion thereof having two flat parallel surfaces, a plate valve in said conduit mounted to swing about an axis perpendicular to said surfaces and adapted to be moved in a closing direction by the operation of the motor, and means to oppose said movement with an effort equal to the closing effort of the valve in any position thereof at a predetermined speed of the motor, said efforts being unequal at other speeds.

8. A governing device for the intake of hydrocarbon motors including in combination, a valve in the intake adapted to control the flow of fluid therein, the tendency of said valve to close increasing at an accelerated rate as the valve is moved in the closing direction when the motor is running at a predetermined constant speed, and means to counterbalance said tendency at said speed in any position of the valve, said counterbalancing means being unequal to said tendency at other speeds.

9. A governing device for the intake of hydrocarbon motors including in combination, an intake conduit, means in said conduit adapted to be actuated to obstruct said

conduit in accordance with the flow of fluid therein, yielding means, and mechanism transmitting the effort of said yielding means to oppose the obstruction of said conduit, said transmitting mechanism being constructed and arranged to increase the effort exerted on said obstructing means by said yielding means as the obstruction of the conduit increases whereby the closing effort exerted on said obstructing means is balanced in all positions thereof when the motor is operating at a predetermined speed.

10. A governing device for the intake of hydrocarbon motors including in combination, an intake conduit, means in said conduit adapted to be actuated to obstruct said conduit in accordance with the flow of fluid therein, yielding means, and mechanism transmitting the effort of said yielding means to oppose the obstruction of said conduit, said transmitting mechanism being constructed and arranged to increase the effort exerted on said obstructing means by said yielding means as the obstruction of the conduit increases, said mechanism including two force transmitting arms each movable with one of said means, the effective length of at least one arm varying with its movement.

11. The combination with an intake conduit for hydrocarbon motors, of a governing device associated therewith comprising means controlling the flow of fluid in said conduit actuated in a closing direction in accordance with the flow of fluid, and means opposing said closing movement with an equal and opposite resistance when the motor is running at a predetermined speed including a yielding device, a pivoted arm operated thereby having a cam surface, a second pivoted arm movable with the first mentioned means having a cam surface in contact with a part of the cam surface of the first arm, said cam surfaces being shaped to vary the point of contact of said arms as they turn.

12. The combination with an intake conduit for hydrocarbon motors, of a governing device associated therewith comprising means controlling the flow of fluid in said conduit actuated in a closing direction in accordance with the flow of fluid, and means opposing said closing movement with an equal and opposite resistance when the motor is running at a predetermined speed including yielding means and mechanism to transmit the force of said yielding means to the controlling means including a pivoted arm associated with one of said means, and a cam associated with the other, said arm engaging said cam.

13. The combination with an intake conduit for hydrocarbon motors, of a governing device associated therewith comprising means controlling the flow of fluid in said

conduit actuated in a closing direction in accordance with the flow of fluid, and means opposing said closing movement with an equal and opposite resistance when the motor is running at a predetermined speed including yielding means, and mechanism to transmit the force of said yielding means to the controlling means comprising a pair of pivoted arms being in contact at a point removed from their pivots, said arms being constructed and arranged to vary said point of contact as they move.

14. The combination with an intake conduit for hydrocarbon motors, of a governing device associated therewith comprising means controlling the flow of fluid in said conduit actuated in a closing direction in accordance with the flow of fluid, and means opposing said closing movement with an equal and opposite resistance when the motor is running at a predetermined speed including yielding means and mechanism to transmit the force of said yielding means to the controlling means comprising a pivoted arm associated with said controlling means, said yielding means acting on said arm and having its point of action shifted radially of the arm as said arm turns.

15. The combination with an intake conduit for hydrocarbon motors, of a governing device associated therewith comprising means controlling the flow of fluid in said conduit actuated in a closing direction in accordance with the flow of fluid, and means opposing said closing movement with an equal and opposite resistance when the motor is running at a predetermined speed including yielding means and mechanism to transmit the force of said yielding means to the controlling means comprising a pivoted arm associated with said yielding means, said arm transmitting the force of the yielding means to said controlling means and having its point of action shifted radially of the arm as the arm turns.

16. A governing device for hydrocarbon motors comprising an intake conduit, an unbalanced butterfly valve therein, and a counterbalancing means connected to balance the turning effort of said valve at a predetermined speed of the motor including an arm secured to turn with said valve, yielding means acting on said arm having its point of action shifted radially as the arm turns to increase the effort of the yielding means on the valve as it closes.

17. A governing device for hydrocarbon motors comprising an intake conduit, an unbalanced butterfly valve therein, and a counterbalancing means connected to balance the turning effort of said valve at a predetermined speed of the motor including a member connected to turn in accordance with said valve, a second rotatable member engaging the first member, yielding means

acting to turn the second member, said members being constructed and arranged to shift their point of contact radially as they turn to increase the effort of the yielding means on the valve as it closes.

18. A governing device for hydrocarbon motors including in combination, an intake conduit, an unbalanced butterfly valve therein having a spindle, an arm secured to said spindle, yielding means, a second pivotally mounted arm acted on by said means, said arms having adjacent cam surfaces constructed to shift the point of contact thereof radially of the arms as they turn.

19. A governing device for hydrocarbon motors comprising an intake conduit, an unbalanced butterfly valve therein, and a counterbalancing means connected to balance the turning effort of said valve at a predetermined speed of the motor including a member connected to turn in accordance with said valve, a second rotatable member engaging the first member, yielding means acting to turn the second member, said members being constructed and arranged to shift their point of contact radially as they turn to vary the effort of the yielding means on the valve as it closes.

20. A governing device for hydrocarbon motors comprising an intake conduit, an unbalanced butterfly valve therein, and a counterbalancing means connected to balance the turning effort of said valve at a predetermined speed of the motor including an arm secured to turn with said valve, yielding means acting on said arm having its point of action shifted radially as the arm turns to vary the effort of the yielding means on the valve as it closes.

21. A governing device for the intake of hydrocarbon motors including in combination, an intake conduit, means in said conduit adapted to be actuated to obstruct said conduit in accordance with the flow of fluid therein, resisting means, and mechanism transmitting the effort of said resisting means to oppose the obstruction of said conduit, said transmitting mechanism being constructed and arranged to vary the effort exerted on said obstructing means by said resisting means as the obstruction of the conduit varies to such an extent as to balance the obstructing means in all positions thereof when the motor is operating at a predetermined speed.

22. In a device for governing the speed of an internal combustion engine by controlling the volume of the gas admitted thereto, comprising a throttle valve disposed in a conduit, a counterbalancing means adapted to resist the closing movement of said throttle valve and compensating connections intermediate said throttle and said counterbalancing means for compensating the variations in the forces acting to close said

valve set up by the flow of gas in said conduit to balance the effort on the valve in all positions thereof at a predetermined speed of the motor.

23. In a suction responsive governor for hydrocarbon motors, a member responsive to the suction in the intake, a spring opposing movement of said member in one direction, and means operative on the spring to vary the resistance thereof to balance the effort exerted by the member, when the motor is running at a predetermined speed, said resistance and effort being unequal at other speeds.

24. In a suction responsive governor for hydrocarbon motors, a member responsive to the suction in the intake, a spring opposing movement of said member in one direction, and means to vary the resistance of the spring to balance the effort exerted by the member, when the motor is running at a predetermined speed, said resistance and effort being unequal at other speeds.

25. In a suction responsive governor for hydrocarbon motors, a member responsive to the suction in the intake, a spring opposing movement of said member in one direction, and cam means to vary the resistance of the spring to balance the effort exerted by the member, when the motor is running at a predetermined speed, said resistance and effort being unequal at other speeds.

26. In a suction responsive governor for hydrocarbon motors, a member responsive to the suction in the intake, a spring opposing movement of said member in one direction, and cam means operative on the spring to vary the resistance thereof to balance the effort exerted by the member, when the motor is running at a predetermined speed, said resistance and effort being unequal at other speeds.

27. In a suction responsive governor for hydrocarbon motors, in combination, a member responsive to the suction in the intake, yielding means opposing movement of said member in one direction, and equalizing means between said member and yielding means including two members, one being pivoted and one acting on the other and said members constructed to shift their point of contact radially of the pivoted one as the latter turns.

28. In a suction responsive governor for hydrocarbon motors, in combination, a member responsive to the suction in the intake, yielding means opposing movement of said member in one direction, and equalizing means between said member and yielding means including two pivoted members having adjacent cam surfaces constructed to shift the point of contact radially of one arm as they turn.

29. In a suction responsive governor for

hydrocarbon motors, a member responsive to the suction in the intake, and means opposing movement of said member in response to increased suction with a resistance equal and opposite to the effort of the member in all positions thereof when the motor is operating at a predetermined speed, said effort and resistance being unequal at other speeds.

30. A governing device for hydrocarbon engines including in combination, a conduit, a valve in said conduit adapted to be actuated in a closing direction in accordance with the flow of fluid in said conduit, a yielding device, and means transmitting the force of said device to oppose the closing movement of said valve, said means including a cam and constructed and arranged to increase the effort exerted on the valve by the yielding means as the valve is moved in the closing direction.

31. In a suction responsive governor for hydrocarbon motors, a throttle valve in the intake conduit, operating means for said valve actuated in one direction by the suction in said conduit, said operating means including a spring to oppose the action of said suction and a cam mechanism for modifying the action of said spring to balance the action of said suction in all positions of said valve when the motor is running at a predetermined speed.

32. In a suction responsive governor for hydrocarbon motors, a member responsive to the suction in the intake of the motor, yielding means exerting an effort to oppose the suction effort on such member, and means including cam mechanism modifying one of said efforts so that said member is balanced in all positions thereof when the motor is running at a predetermined speed.

33. In a suction responsive governor for hydrocarbon motors, a flow controlling valve in the intake conduit, operating means for said valve actuated in one direction by a force proportional to the suction in said conduit and in the other direction by a yielding force, said operating means including cam mechanism balancing the action of said forces in all positions thereof when the motor is running at a predetermined speed.

34. In a suction responsive governor for hydrocarbon motors, a flow controlling valve in the intake conduit, operating means for said valve actuated in one direction by a force proportional to the suction in said conduit and in the other direction by a spring, said operating means including cam mechanism for balancing the efforts of said

force and spring in all positions of said operating means when the motor is running at a predetermined speed.

35. In a suction responsive governor for hydrocarbon motors, a member responsive to variations of pressure in the intake conduit of the motor, yielding means exerting an effort to oppose the effort of said member, and means modifying one of said efforts so as to balance the other effort in all positions to said member when the motor is running at a predetermined speed.

36. In a suction responsive governor having a throttle valve and a yielding element, means including a cam device for balancing the suction effect and said yielding element in all positions of the throttle valve at a predetermined speed of the motor.

37. In a suction responsive governor, a member responsive to the suction in the intake, a spring opposing movement of said member, and means including a cam device balancing the suction effect and said spring at a predetermined speed of the motor and all positions of said member.

38. In a suction responsive governor for hydrocarbon motors, a flow controlling valve in the intake conduit, a spring, means to move the valve in accordance with the difference between the suction effort and the effort of said spring, said means including a cam device for effecting balance between said efforts when the motor is operating at a predetermined speed and all positions of said valve.

39. In a suction responsive governor for hydrocarbon motors, a member responsive to variations of pressure in the intake conduit of the motor, yielding means opposing movement of said member in response to increased suction and means including cam mechanism for effecting a balance between the suction effect on said member and the effect of said spring, when the motor is running at a predetermined speed and all positions of said member.

40. In a suction responsive governor, a member responsive to the suction in the intake of the motor, yielding means opposing movement of said member, and means including a cam device balancing the suction effect and said yielding device at a predetermined speed of the motor for all positions of said member.

In testimony whereof we affix our signatures.

ROBERT G. HANDY.  
ARTHUR A. BULL.