May 26, 1959 W. MALECKI 2,888,031

GOVERNOR

Filed Dec. 20, 1956 2 Sheets-Sheet 1

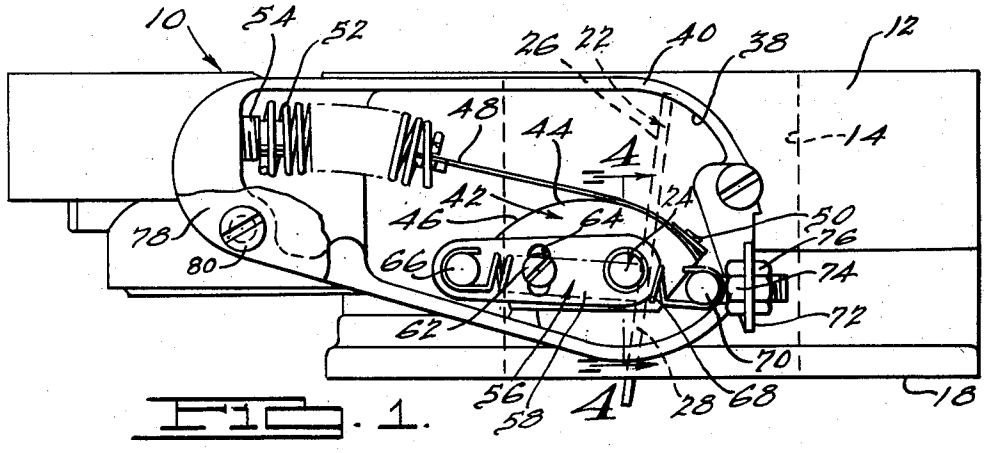


Fig. 1.

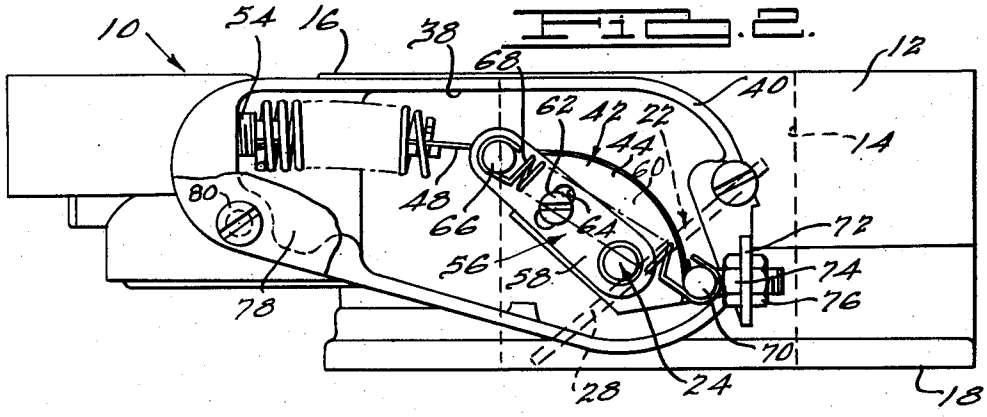


Fig. 2.

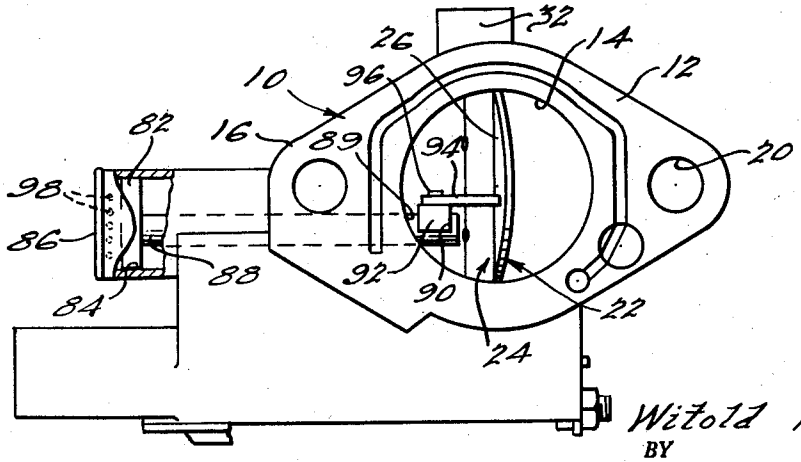


Fig. 3.

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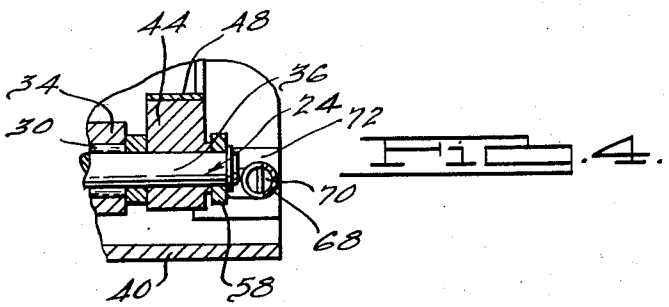


Fig. 4.

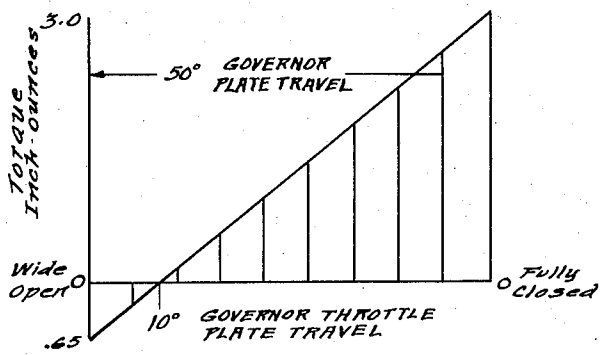


Fig. 5.

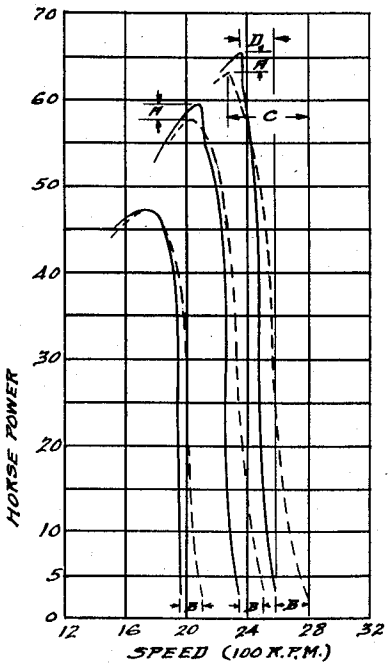


Fig. 6.

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2,888,031

GOVERNOR

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8 Claims. (Cl. 137—484)

This invention relates to governors for internal combustion engines and, more particualrly, to an improved velocity or mixture flow-type governor for controlling the speed of an internal combustion engine on an automotive vehicle.

An object of the invention is to provide an improved velocity or mixture flow-type governor of the indicated character incorporating improved means for controlling the governed speed range or regulation of the governor over a wide range of engine load conditions.

Another object of the invention is to provide an improved velocity or mixture flow-type governor incorporating improved means for increasing the peak horse power obtainable at governed speeds by the engine associated therewith.

Another object of the invention is to provide an improved velocity or mixture flow-type governor incorporating improved means for controlling the governing speed of the governor under no load and light engine load conditions at relatively high altitudes.

Another object of the invention is to provide an improved velocity or mixture flow-type governor which prevents the engine of an automotive vehicle from exceeding a predetermined speed over a wide range of engine load conditions and which operates quickly and efficiently in response to changes in speed and load on the engine.

Another object of the invention is to provide an improved velocity or mixture flow-type governor that is economical to manufacture and assemble, durable, efficient and reliable in operation.

Another object of the invention is to provide an improved velocity or mixture flow-type governor which may be easily and quickly adjusted with a minimum of labor and expense to meet the requirements of a particular internal combustion engine.

The above as well as other objects and advantages of the present invention will become apparent from the following description, the appended claims and the accompanying drawings, wherein:

Figure 1 is a side elevational view, with portions broken away, of a velocity or mixture flow-type governor embodying the present invention, showing the throttle plate thereof in the wide open position;

Fig. 2 is a side elevational view similar to Figure 1 but showing the throttle plate thereof in a no load governing position;

Fig. 3 is a top plan view, with portions in section, of the structure illustrated in Figure 1;

Fig. 4 is a sectional view of a portion of the structure illustrated in Figure 1, taken on the line 4—4 thereof;

Fig. 5 is a graph showing the effective torque applied to the throttle plate by the over center device of the present invention; and

Fig. 6 is a graph illustrating certain characteristics of a governor embodying the present invention.

Referring to the drawings, and more particularly to

Figures 1–4 thereof, a velocity or mixture flow-type governor generally designated **10** is illustrated which embodies the present invention, although it will be understood that the present invention is applicable to other uses. The governor **10** is adapted to be inserted between the carburetor and the intake manifold (not shown) of the fuel induction system of an internal combustion engine, such as conventionally employed on an automotive vehicle. The fuel mixture emanating from the carburetor passes through the governor **10** and passes from the governor into the intake manifold which serves to distribute the fuel mixture to the engine cylinders.

The governor **10** is comprised of a body **12** that defines a passageway **14** which is open at each end and which, in the embodiment of the invention illustrated, is substantially circular in cross section, although it will be understood that the cross-sectional configuration of the passageway **14** may be other than circular. The body **12** is provided with mounting flanges **16** and **18** which facilitate the installation of the governor **10** between the carburetor and the intake manifold, the governor being retained by bolts (not shown) which pass through openings **20** in the body in outwardly spaced relationship with respect to the passageway **14**. A throttle plate **22** is provided which is fixed to a shaft **24**, the longitudinal axis of the shaft **24** extending transversely of the passageway **14** and being offset in parallel relationship with respect to the diameter of the passageway. The throttle plate **22** is also offset with respect to the longitudinal axis of the shaft **24** so that the portion **26** of the throttle plate with the greatest area extends generally upwardly, as viewed in Figs. 1 and 2, and upstream with respect to the direction of the flow of the fuel mixture while the portion **28** of the throttle plate with the least area extends generally downwardly, as viewed in Figs. 1 and 2. With such a construction, the velocity and pressure forces exerted on the throttle plate **22** by the passage of the fuel mixture through the passageway **14** tend to move the throttle plate toward the closed position.

The end portions of the shaft **24** are journaled for oscillation in needle-type roller bearings, such as **30**, mounted in suitable bosses **32** and **34** provided on the housing **12** on opposite sides of the passageway **14**. As shown in Fig. 4, the end portion **36** of the shaft **24** extends through the bearing in the boss **34** and projects into a chamber **38** defined by a housing portion **40** provided on the body **12**.

The forces exerted on the throttle plate **22** by the passage of the fuel mixture through the passageway **14** tend to vary non-linearly in value as the throttle plate changes position, and in order to balance the closing forces exerted on the throttle plate, at governed speed, in all positions, a reactance mechanism generally designated **42** is provided which is disposed in the open sided chamber **38** defined by the housing portion **40**. The reactance mechanism **42** is comprised of a cam **44** which is fixed to the shaft **24** at a position adjacent the boss **34**, the configuration of the surface **46** of the cam **44** being determined by the characteristics of the particular engine with which the governor is associated. A flexible tape **48** is provided, one end of which is fixed to the cam **44** as at **50**. The tape **48** extends over the cam surface **46** and the distal end of the tape is fixed to one end of a coil spring **52** while the convolutions of the opposite end portion of the spring **52** threadably engage an adjusting screw **54** carried by the housing portion **40** of the body **12**. With such a construction, the force exerted by the spring is applied through varying radii to resist the non-linear closing effort of the throttle plate.

In accordance with the present invention, the reactance mechanism is provided with an over center device

56 which is comprised of an operating arm 58, one end portion of which is mounted on the shaft 24. The operating arm 58 is adjustably secured to the side wall 60 of the cam 44 through the agency of a screw 62 which passes through an elongate slot 64 and threadably engages the cam. With such a construction, the angular position of the arm 58 relative to the cam 44 may be adjusted and the arm 58 locked in a selected adjusted position through the agency of the screw 62. The end portion of the arm 58 remote from the shaft 24 carries a pin 66, and one end portion of a coil spring 68 is secured to the pin 66. The other end portion of the coil spring 68 is secured to an adjusting screw 70 which projects through an outwardly projecting flange 72 provided on the housing portion 40, the screw 70 being retained by nuts 74 and 76.

As shown in Figure 1, when the throttle plate 22 is in the wide open position, the line of action of the coil spring 68 acting on the arm 58 is below the longitudinal axis of the shaft 24 with the result that the over center device 56 applies torque to the shaft 24 so as to resist closing movement of the throttle plate 22. As shown in Fig. 2, as the line of action of the coil spring 68 acting on the arm 58 passes above the longitudinal axis of the shaft 24, the over center device 56 applies torque to the shaft 24 which assists in closing the throttle plate 22. With such a construction, the over center device 56 aids in no load or light load control by the addition of closing torque on the shaft and also enables the engine to reach higher full load speeds and greater full load power by the addition of opening torque which resists the initial closing movement of the throttle plate.

Referring to Fig. 5, a graph is illustrated showing the effective torque applied to the throttle plate 22 by the over center device 56. As shown in Fig. 5, when the throttle plate is in the wide open position, a negative or opening torque is applied to the shaft 24 so as to resist the initial closing movement of the throttle plate. As the throttle plate moves toward the fully closed position due to the velocity and pressure forces exerted thereon by the passage of the fuel mixture through the passageway 14, the negative torque is reduced so that the torque applied by the over center device 56 may be zero when the throttle plate has traveled, for example, approximately ten degrees. It will be understood that this relationship may be readily varied through the agency of the screw 62. Positive or closing torque is then applied to the shaft 24 by the over center device 56 so as to assist the closing movement of the throttle plate, the torque reaching a maximum when the throttle plate is at the fully closed position. By way of illustration, the maximum negative or opening torque when the throttle plate is in the wide open position may be in the order of .65 inch-ounces and the maximum positive or closing torque may be in the order of 3.0 inch-ounces, the throttle plate having a total travel of approximately 57 degrees.

Referring to Fig. 6, a graph is illustrated with the engine horsepower plotted as the ordinate and the engine speed plotted as the abscissa. In the graph of Fig. 6, the dotted lines represent the engine governor curves of a governor without the over center device 56 and the solid lines indicate the engine governor curves of the same governor provided with the over center device 56. In the graph of Fig. 6, "A" indicates the gain in peak horse power obtaintable under full load conditions when the over center device resists the initial closing movement of the throttle plate. "B" indicates the reduction in no load speed which is effected by the over center device which serves to assist the closing movement of the throttle plate. "C" represents the total regulation or speed control range of a governor without the over center device, and "D" represents the total regulation or speed control range of the same governor provided with the over center device. It will also be appreciated that the over center device 56 will reduce the governing speed

of the governor at relatively high altitudes where the pressure differential on the throttle plate is inherently reduced from that prevailing at sea level under the same load and speed conditions. In such cases, the over center device assists in the closing movement of the throttle plate and compensates for the reduction in the pressure differential.

The chamber 38 is closed by a closure member 78 which is secured to the housing portion 40 of the body 12 as by screws 80. For the purpose of stabilizing the throttle plate 22 and to prevent throttle cheat, a piston 82 is provided which is reciprocally mounted in a bore 84 provided in the housing portion 40 at a position spaced from the chamber 38, the outer end of the bore 84 being sealed by a plug 86 retained by any suitable or conventional means. One end of a piston rod 88 is fixed to the piston 82 and the piston rod 88 extends through an opening 89 provided in the wall defining the passageway 14. The end portion of the rod which extends into the passageway 14 is provided with a recess 90 adapted to receive a laterally extending portion 92 of an actuating member 94, the portion 92 being fixed to the member 94, as by a rivet 96, and the end portion of the member 94 remote from the portion 92 is fixed to the upper portion 26 of the throttle plate 22. With such a construction, longitudinal movement of the piston toward the right, as viewed in Fig. 3, effects rotation of the throttle plate 22 about the longitudinal axis of the shaft 24 in a direction to move the throttle plate toward the closed position, while movement of the piston 82 toward the left, as viewed in Fig. 3, effects rotation of the throttle plate 22 about the longitudinal axis of the shaft 24 in a direction to move the throttle plate toward the open position. The rod end portion of the bore 84 is connected with the passageway 14 by the opening 89 in the wall defining the passageway 14 while the head end portion of the bore 84 communicates with the atmosphere, such communication being effected through openings such as 98 provided in the wall of the housing portion 40 defining the bore 84. With such a construction, an increase in the vacuum in the passageway 14 effects an increase in the vacuum at the rod end of the bore 84 with the result that the piston 82 tends to move toward the right, as viewed in Fig. 3. As the piston moves to the right, the distal end of the rod engages the portion 92 of the actuating member 94 so as to move the member 94 toward the right, as viewed in Fig. 3, thereby effecting rotation of the throttle plate and moving the throttle plate toward the closed position. Since the piston is actuated by the vacuum in the passageway 14, such a construction substantially prevents throttle cheat. Such a construction also enables the piston to assist the forces exerted on the throttle plate by the flow of the fuel mixture through the passageway to move the throttle plate toward the closed position and at the same time provides a stabilizing effect on the throttle plate because of the dashpot action of the piston, thereby reducing hunting of the governor to a minimum.

While a preferred embodiment of the invention has been shown and described, it will be understood that various changes and modifications may be made without departing from the spirit of the invention.

What is claimed is:

1. In a governor for internal combustion engines, a body defining a fuel mixture passageway, an unbalanced throttle plate mounted in said passageway, said throttle plate being adapted to be moved toward the closed position by the flow of fuel through said passageway, resilient means operatively connected to said throttle plate and urging said throttle plate toward the open position, and means effective to urge said throttle plate toward the open position during an initial increment of travel of said throttle plate from the open position toward the closed position, said last mentioned means also being effective to urge said throttle plate toward the closed position after

said throttle plate has traveled a predetermined amount toward the closed position.

2. In a governor for internal combustion engines, the combination including a body defining a fuel mixture passageway, an unbalanced throttle plate pivotally mounted in said passageway, said throttle plate adapted to be moved toward the closed position by the flow of fuel through said passageway, resilient means operatively connected to said throttle plate and urging said throttle plate toward the open position, and means operatively connected to said throttle plate and effective to urge said throttle plate toward the open position during a predetermined increment of pivotal movement of said throttle plate and effective to urge said throttle plate toward the closed position during another increment of pivotal movement of said throttle plate.

3. In a speed governor for internal combustion engines, a body defining a fuel mixture passageway, an unbalanced throttle plate pivotally mounted in said passageway and supported by said body, said throttle plate being adapted to be moved toward the closed position by the flow of fuel through said passageway, resilient means urging said throttle plate toward the open position, and additional resilient means urging said throttle plate toward the open position during one increment of movement of said throttle plate, and urging said throttle plate toward the closed position during another increment of movement of said throttle plate.

4. In a speed governor for internal combustion engines, the combination including a body defining a fuel mixture passageway, an unbalanced throttle plate pivotally mounted in said passageway and supported by said body, said throttle plate being adapted to be moved toward the closed position by the flow of fuel mixture through said passageway, resilient means operatively connected to said throttle plate and urging said throttle plate toward the open position, and means including additional resilient means operatively connected to said throttle plate and urging said throttle plate toward the open position during the initial increments of movement of said throttle plate from the open position toward the closed position, said additional resilient means also being effective to urge said throttle plate toward the closed position during the final movement of said throttle plate toward the closed position.

5. In a speed governor for internal combustion engines, the combination including a body defining a fuel mixture passageway, an unbalanced throttle plate pivotally mounted in said passageway and supported by said body, said throttle plate being adapted to be moved toward the closed position by the flow of fuel mixture through said passageway, resilient means operatively connected to said throttle plate and urging said throttle plate toward the open position, and means including spring means operatively connected to said throttle plate and urging said throttle plate toward the open position during the initial increments of movement of said throttle plate from the open position

toward the closed position, said spring means also being effective to urge said throttle plate toward the closed position during the final movement of said throttle plate toward the closed position.

6. In a velocity-type governor for internal combustion engines, a body defining a fuel mixture passageway, an unbalanced throttle plate pivotally mounted in said passageway, said throttle plate being adapted to be moved toward the closed position by the flow of fuel mixture through said passageway, resilient means operatively connected to said throttle plate and urging said throttle plate toward the open position, and means including over center spring means operatively connected to said throttle plate and responsive to the movement of said throttle plate for urging said throttle plate toward the open and closed positions.

7. A speed governor for internal combustion engines comprising, in combination, a body defining a fuel mixture passageway, an unbalanced throttle plate pivotally mounted in said passageway, the larger of the unbalanced areas of said throttle plate normally projecting upstream of said passageway whereby the fuel mixture flowing through said passageway urges said throttle plate toward the closed position, first resilient means operatively connected to said throttle plate and urging said throttle plate toward the open position, and second resilient means operatively connected to said throttle plate and actuable in response to the movement of said throttle plate to urge said throttle plate toward the open position during a predetermined initial increment of movement of said throttle plate toward the closed position and effective after said predetermined increment of movement to urge said throttle plate toward the closed position.

8. A speed governor for internal combustion engines including, in combination, a body defining a fuel mixture passageway, an unbalanced throttle plate pivotally mounted in said passageway, the larger of the unbalanced areas of said throttle plate normally projecting upstream of said passageway whereby the fuel mixture flowing through said passageway urges said throttle plate toward the closed position, first resilient means carried by said body and operatively connected to said throttle plate for urging said throttle plate toward the open position, and means including second resilient means operatively connected to said throttle plate and operable in response to pivotal movement of said throttle plate for urging said throttle plate toward the open position during a predetermined increment of pivotal movement of said throttle plate and urging said throttle plate toward the closed position during another increment of pivotal movement of said throttle plate.

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