

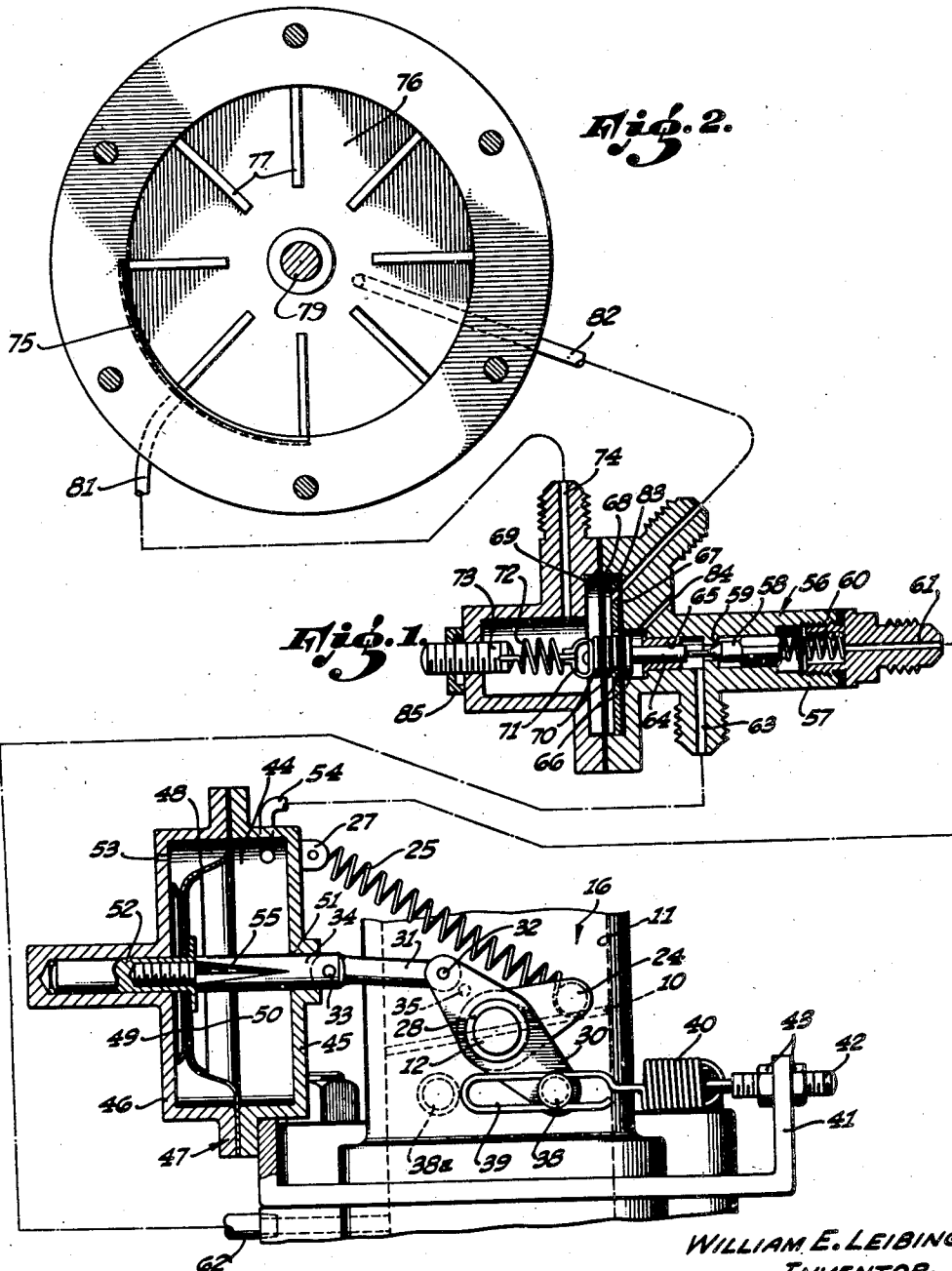
Sept. 28, 1948.

W. E. LEIBING
GOVERNOR

2,450,199

Filed June 24, 1946

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 5.

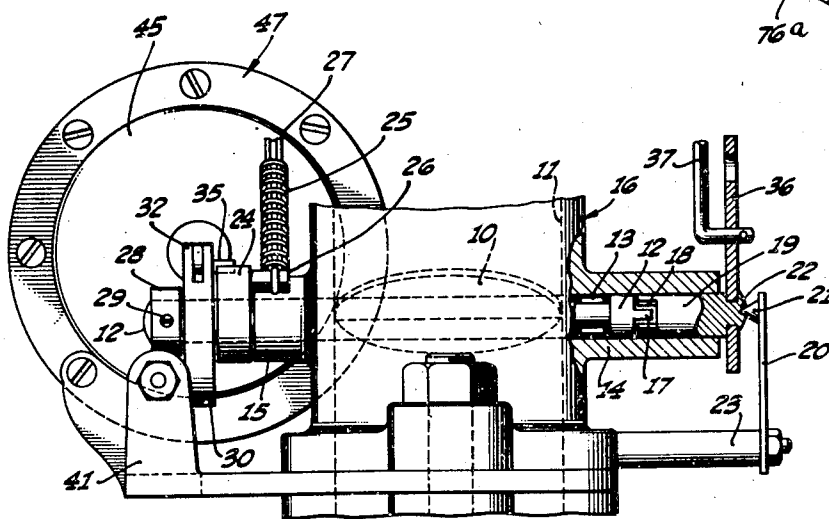
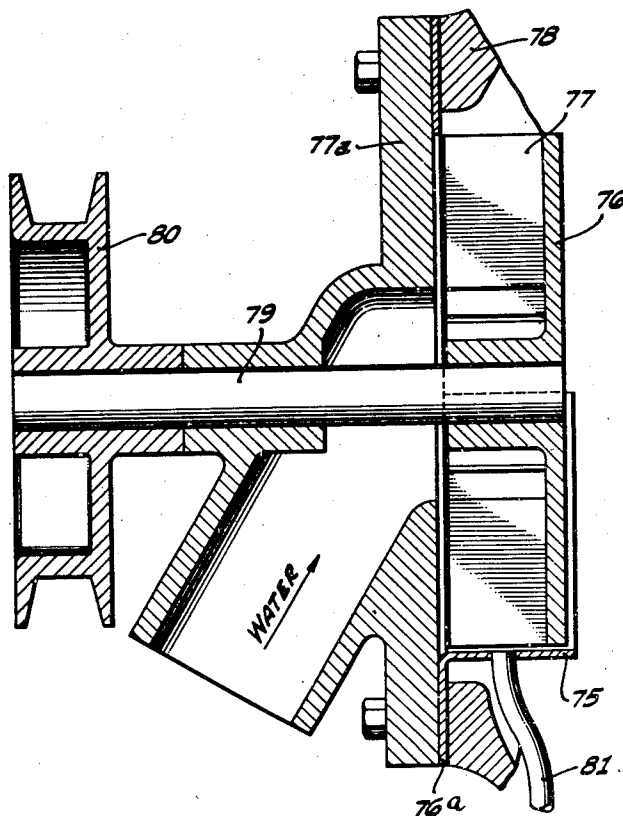


Fig. 4.

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GOVERNOR

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7 Claims. (Cl. 123-103)

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This invention relates to an engine speed governor and is particularly directed to a device for regulating the maximum speed of an internal combustion engine. This governor finds particular usefulness as applied to the carburetor throttle valve for limiting the extent of opening of such valve in response to speed of the engine.

The principal object of this invention is to provide a governor for the throttle valve of an internal combustion engine which will regulate engine speed within acceptable limits and which is free from the disadvantages common to the centrifugal type governor.

Another object is to provide a speed governor for an engine which is actuated by a power cylinder under the control of a valve, the valve being moved toward operative position upon increase in engine speed above a predetermined maximum.

Another object is to provide a device of this type in which the speed responsive means is opposed by an adjustable spring.

Another object is to provide a speed governor of this type in which the power cylinder is actuated via the valve by means of suction from the intake manifold of the engine.

Another object is to provide a speed governor for a liquid cooled engine which utilizes a curved element adjacent the rotor of the liquid circulating pump for providing a source of liquid under pressure, the pressure increasing as the engine's speed increases.

Another object is to provide a governor of this type in which provision is made for balancing out any pressure existing generally through the cooling system of the engine in order that the liquid pressure developed by the rotor and curved element may increase in a predetermined relationship with increasing engine speed regardless of variations in temperature within the engine cooling system.

Another object is to provide suction actuated diaphragm means for limiting the extent of movement of the engine throttle in conjunction with means for decreasing the effect of the suction in accordance with lateral movement of the diaphragm.

Another object is to provide a power operated device for limiting the range of movement of the engine throttle in accordance with speed of the engine, which device is provided with resilient means effective at the extreme range of movement of the device for minimizing surging or hunting.

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Other objects and advantages will appear hereinafter.

In the drawings:

Figure 1 is a sectional elevation of the valve and control unit forming a part of a preferred embodiment of my invention.

Figure 2 is a rear elevation showing adaption of a conventional circulating pump as employed in an engine cooling system.

Figure 3 is a partial side elevation, partly in section, showing details of the power cylinder for actuating the throttle shaft of the engine carburetor.

Figure 4 is an end elevation of the device shown in Figure 3.

Figure 5 is a sectional view of the water pump illustrated in Figure 2.

Referring to the drawings the throttle valve generally designated 10 operates in the usual passage 11 for the combustible fuel mixture and this throttle valve 10 is secured on a speed control shaft 12 mounted in needle bearings 13 contained within laterally extending hubs 14 and 15 on the carburetor unit generally designated 15. The throttle shaft 12 is provided at one end with a transverse fin 17 adapted to be actuated by a slot 18 formed in the end of a stub shaft 19 mounted coaxially of the shaft 12 within the hub 14. The slot 18 provides angular clearance so that in effect a lost motion connection is provided between the stub shaft 19 and the throttle control shaft 12. Means are provided for maintaining the stub shaft 19 in assembled relation and as shown in Figure 4 this means comprises a flat spring element 20 provided with a conical tip 21 adapted to seat within a corresponding recess 22 formed in the end of the stub shaft 19. The spring element 20 is fixed to the carburetor base by the spacer element 23.

Secured on the speed control shaft 12 is a crank arm 24 connected to an operating spring 25 by means of the lateral pin 26. The other end of the spring 25 is secured to a stationary fitting 27. A collar 28 is secured to the speed control shaft 12 by means of the set screw 29. Loosely mounted on the shaft 12 between the collar 28 and the crank arm 24 is a double ended crank arm 30. The arm 30 is bifurcated at its upper end for pivotal connection at 32 with the link 31. The link 31 is pivoted at 33 to the diaphragm shaft 34. A pin 35, mounted on the upper portion of the double arm 30, serves to engage the side of the crank arm 24 under certain conditions described below in order to limit the

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action of the spring 25 in moving the throttle 10 toward its open position.

The manual throttle control arm 36 is non-rotatably secured to the stub shaft 19 and may be provided with an actuating lever 37 for operation of the usual accelerating pump, not shown. The lower end of the double arm 30 carries a pin 38 adapted to travel in the slot 39 carried at one end of the dampener spring 40. The dampener spring 40 is adjustably secured on the bracket 41 by means of the bolt 42 and nuts 43.

From this description of the apparatus illustrated in Figures 3 and 4 it will be understood that manual operation of the stub shaft 19 by means of the lever 36 permits the operating spring 25 to rotate the speed control shaft 12 and hence turn the throttle valve 10 within the passage 11. The relationship of the relatively narrow tongue 17 and the relatively wide slot 18 connecting the shafts 12 and 19 permits motion of the speed control shaft 12 in opposition to the tension of the spring 25 without corresponding movement of the shaft 19. Thus, for any angular position of the stub shaft 19 the speed control shaft 12 and throttle 10 may assume any position within the range of angular movement permitted by the lost motion connection 17, 18. The double arm 30 having the pin 35 adapted to contact the side of the crank arm 24 is thus effective in moving the shaft 12 and throttle 10 toward closed position in opposition to the spring 25 regardless of the position of the stub shaft 19.

Means are provided for actuating the shaft 34 and as shown in Figures 3 and 4 this means includes a chamber 44 enclosed by split halves 45 and 46 of the housing generally designated 47. A pre-formed diaphragm 48 is mounted within the chamber 44 and secured between the mating halves of the housing 47. Supporting rings 49 and 50 may be secured on the shaft 34 for limiting the flexing movement of the diaphragm to the annular portion thereof positioned between the housing 47 and the rings 49, 50. Aligned bearings 51 and 52 are provided in the housing sections 45 and 46 respectively for slidably supporting the diaphragm shaft 34. A port 53 is provided in the housing section 46 for venting the interior of the member 46 to atmosphere. Suction applied to the chamber 44 through the suction inlet 54 is effective to shift the diaphragm 48 and diaphragm shaft 34 to the right as viewed in Figure 3. Such action serves to effect engagement of the pin 35 with the crank arm 34 for moving the throttle 10 toward closed position.

In order to prevent surging or hunting of the governor control apparatus under conditions of relatively high vacuum means are provided for limiting the degree of force applied by the diaphragm shaft 34 in its fully operative position. This means comprises the angular cut 55 formed in the diaphragm shaft 34. When the shaft 34 moves to the right, the angular cut 55 is exposed to the atmosphere in progressive amount as the shaft moves through the bearing 51. When the shaft 34 is in its extreme right hand position as viewed in Figure 3, the leakage to atmosphere provided by the angular cut 55 is effective in reducing the suction pressure within the chamber 44. The provision of the angular cut 55 therefore serves to limit the endwise force applied to the link 31 at the extreme limit of movement of the shaft 34.

Cushioning means are also provided for limiting the angular travel of the double arm 30. 75

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Thus, the pin 38 is gradually decelerated upon striking the end of the slot 39 so that as the pin 38 moves to the position 38a indicated in dotted lines in Figure 3, the dampening spring 40 is extended. It has been found by test that provision of the dampening spring 40 together with the angular cut 55 provides smooth action of the governor mechanism and prevents surging or hunting with consequent objectionable racing and lagging of the engine.

Means are provided for controlling the application of suction to the chamber 44 and as shown in the drawings this means includes the valve unit generally designated 56. This unit includes a housing 57 having a needle valve 58 slidably mounted therein and urged toward its seat 59 by means of the compression spring 60. A passage means 61 communicates with the valve seat 59 and with the conduit 54 leading to the suction chamber 44. Suction from the intake manifold is admitted to the housing 57 by way of the conduit 62 and the inlet port 63. Thus, when the valve is closed the diaphragm 48 remains in the position illustrated in Figure 3. When the valve 58 moves away from its seat 59 suction from the intake manifold is admitted through passageway 61 and conduit 54 to the diaphragm chamber 44.

Means responsive to the speed of the engine are provided for moving the valve 58 toward open position. This means includes a push rod 64 slidably mounted in a bushing 65 within the housing 56 and connected by buttons 66 to the diaphragm 67 which has a relatively small effective diameter. A larger diaphragm 68 operates in a chamber 69 and is connected by means of buttons 70 to a swivel 71. An extension spring 72 connects the swivel 71 to the adjusting screws 73 mounted on the housing 56. Lock means 85 are provided for securing the screw 73 in its adjusted position.

Upon introduction of pressure through the inlet port 74, the diaphragm 68 is deflected to bring adjacent buttons 70 and 66 into contact. Further movement of the diaphragm then serves to shift the push rod 64 to the right, thereby unseating the valve 59. The tension of the spring 72 can be adjusted by the screw 73 so that a predetermined unit pressure is required before the diaphragm 68 will move sufficiently to impart motion to the push rod 64. By supplying fluid under pressure into the inlet 74, which pressure increases as the speed of the engine increases, it is possible to limit the engine speed to a predetermined maximum. Thus, as the engine speed increases the pressure of fluid admitted into the inlet 74 increases. When the pressure within the chamber 69 is sufficient to overcome the spring 72, the valve 58 is moved toward open position. This action serves to energize the power cylinder 47 and thus move the throttle valve 10 toward closed position as described above.

The fluid pressure for the inlet 74 may be provided by any convenient means. As shown in the drawings, the water pump ordinarily employed in internal combustion engines for circulating cooling water is modified in order that the pump may provide increasing pressure with increasing speed. In ordinary automotive construction the rotor of the water pump is not closely enclosed by the surrounding walls since it is not desired to have the cooling system operate under increasing pressure as the engine speed increases.

As shown in Figures 2 and 5, I provide a curved member 75 encircling a portion of the conventional pump rotor 76 having the usual radial vanes 77. The curved member 75 may be formed

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of a simple stamping 76a inserted between the pump housing 77a and the motor block 78. This stamping is thin enough so that it may be inserted in existing devices without alteration of parts. As the pump shaft 79 is rotated by the V-belt pulley 80, the pump rotor 76 cooperates with the stationary curved element 75 to develop increasing pressure adjacent the curved member 75 with increasing speed of the pump shaft 79. Since the pulley 80 is driven directly from the engine the pressure within the conduit 81 connected to the curved member 75 increases as the engine speed increases. The conduit 81 is connected to the inlet 74 by any convenient means.

In some automotive engine cooling systems provision is made for operating the system under a few pounds of pressure which is developed after the engine has heated up. In order to avoid the error which would be introduced in the relationship of engine speed to unit pressure in the conduit 81 by reason of a few extra pounds of pressure in the system due to heat, means are provided for balancing out this error.

This means includes the conduit 82 which leads from the chamber 83 on the opposite side of the diaphragm 68 from the pressure chamber 69. The conduit 82 communicates with the cooling system at a point remote from the curved member 75 so that the pressure in the conduit 82 is independent of the speed of the engine. Therefore, if the pressure of the liquid in the cooling system is raised slightly because of the heat of the engine this effect does not vary the point at which the valve 58 is moved toward open position with respect to speed of the engine.

A vent port 84 is provided so that any leakage of suction from the inlet 63 is not communicated to the diaphragm 67.

Many other embodiments of the invention may be resorted to without departing from the spirit of the invention.

I claim:

1. In a governor for limiting the maximum speed of an internal combustion engine, the engine having speed control means associated with the carbureter thereof for regulating the rate of flow of combustible fuel mixture to the engine, the combination of a power cylinder adapted to limit the range of operation of the speed control means, conduit means connected to the intake manifold of the engine adapted to energize the power cylinder by partial vacuum, a valve device including a valve element interposed in the conduit means whereby the valve element may regulate action of the power cylinder, a fluid pump driven by the engine adapted to deliver fluid at increasing pressure in response to increasing speed of the engine, means responsive to said fluid pressure adapted to move the valve element toward open position, and resilient means normally acting to oppose the pressure responsive means whereby the valve element is maintained in a closed position until the engine speed exceeds a predetermined maximum.

2. In a governor for limiting the maximum speed of an internal combustion engine, the combination of a valve device having a movable valve element, means responsive to the speed of the engine adapted to move the valve element toward open position, said means including a fluid pump driven by the engine adapted to deliver fluid at increasing pressure in response to increasing speed of the engine, resilient means normally acting to oppose the speed responsive means whereby the valve element is maintained in a

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closed position until the engine speed exceeds a predetermined maximum, means including a power cylinder for limiting the range of movement of the engine throttle, conduit means for energizing the power cylinder, the said valve device being interposed in said conduit means whereby the valve element may regulate action of the power cylinder.

3. In a governor for limiting the maximum speed of a liquid cooled internal combustion engine, the engine having a speed control element and provided with a rotary pump driven by the engine for circulating cooling liquid, the combination of a curved member positioned adjacent the pump rotor and cooperating therewith to develop increasing liquid pressure upon increasing engine speed, a valve, means responsive to said liquid pressure adapted to open the valve, resilient means adapted to oppose the pressure responsive means, and power means controlled by the valve adapted to limit the range of movement of the speed control element.

4. In a governor for limiting the maximum speed of a liquid cooled internal combustion engine, the engine having a speed control element and provided with a rotary pump driven by the engine for circulating cooling liquid, the combination of a curved member positioned adjacent the pump rotor and cooperating therewith to develop increasing liquid pressure upon increasing engine speed, a diaphragm, a first conduit associated with the curved member and communicating with one side of the diaphragm, a second conduit associated with the rotary pump at a point remote from said member and communicating with the other side of the diaphragm, a valve, means actuated by the diaphragm adapted to open the valve, resilient means adapted to oppose the last said means, and power means controlled by the valve adapted to limit the range of movement of the speed control element.

5. In a governor for limiting the maximum speed of a liquid cooled internal combustion engine having a throttle valve, the combination of a pump driven by the engine for circulating cooling liquid, means including a conduit whereby the pump may deliver liquid under increasing pressure with increasing engine speed, a control valve, means including a diaphragm responsive to said liquid pressure adapted to open the valve, resilient means adapted to oppose the pressure responsive means, and power means controlled by the control valve for limiting the range of movement of said throttle valve.

6. In a governor for limiting the maximum speed of a liquid cooled internal combustion engine having a throttle valve, the combination of a pump driven by the engine for circulating cooling liquid, means including a conduit whereby the pump may deliver liquid under increasing pressure with increasing engine speed, a control valve, means including a diaphragm responsive to said liquid pressure adapted to open the valve, means for reducing the force exerted by the diaphragm by an amount corresponding to the increase in liquid pressure caused by heat, resilient means adapted to oppose the pressure responsive means, and power means controlled by the control valve for limiting the range of movement of said throttle valve.

7. In a governor for limiting the maximum speed of an internal combustion engine provided with a throttle valve, the combination of: a pump driven by the engine and adapted to deliver

liquid under increasing pressure with increasing engine speed; a control valve having an open position and a closed position; means including a diaphragm responsive to said liquid pressure adapted to move the valve to one of said positions; resilient means adapted to oppose the pressure responsive means; and power means controlled by the control valve for limiting the range of movement of said throttle valve.

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