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SPEED RESPONSIVE VALVE

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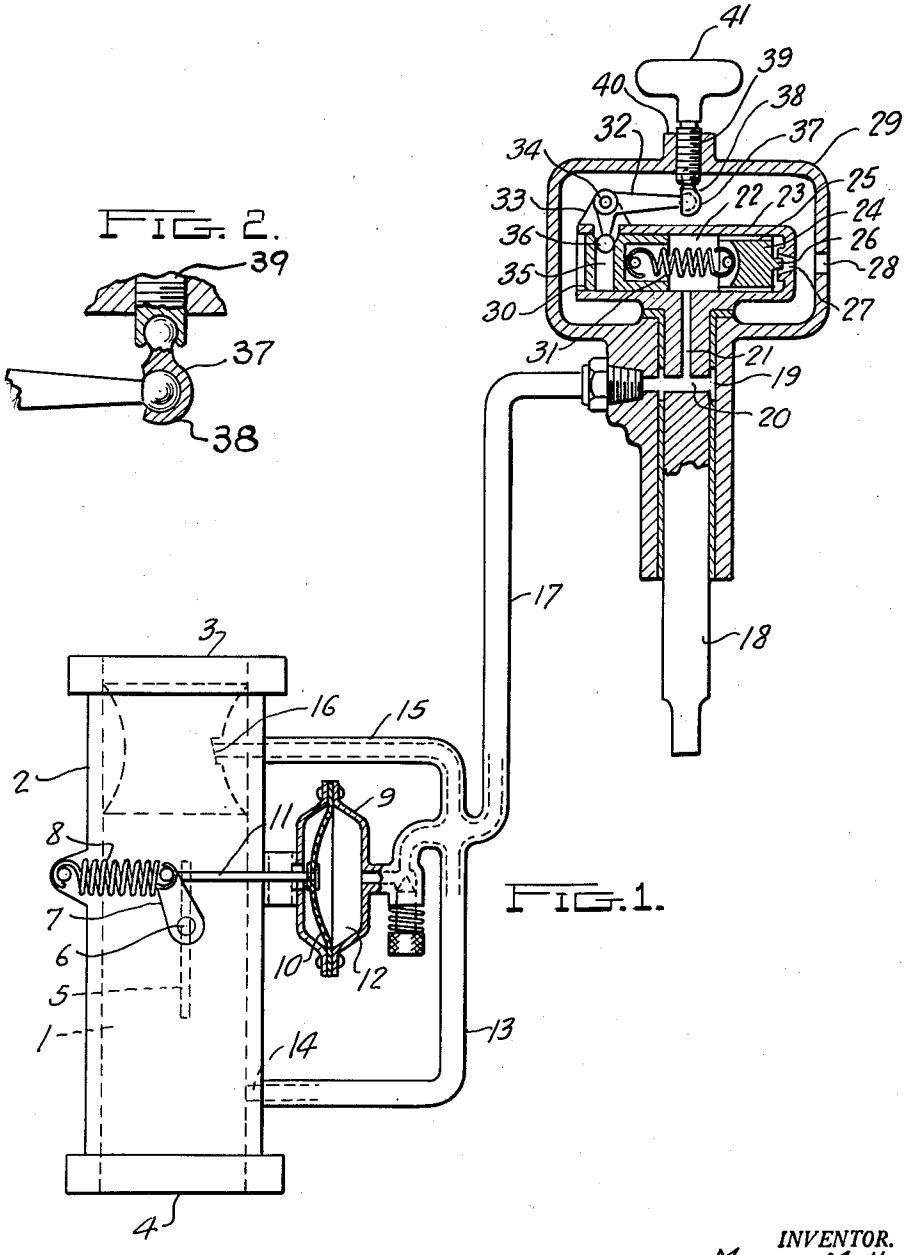


FIG. 1.

FIG. 2.

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SPEED RESPONSIVE VALVE

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14 Claims. (Cl. 137—140)

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This invention relates to a governor for controlling the speed of an internal combustion engine.

This application is a continuation-in-part of my copending application, Serial No. 466,961, filed November 25, 1942, now Patent No. 2,381,550.

It is the object of this invention to produce a governor which will efficiently and accurately control the speed of an internal combustion engine, which can be readily and easily adjusted, either while the engine is running or dead, to control the engine at any speed desired within a wide range of speeds.

Fig. 1 is a view partly in section showing my governor.

Fig. 2 is a view partly in section of a detail of the governor.

The elements of my governor are as follows: intake passageway 1 in governor housing 2 having an inlet 3 and an outlet 4 to the engine, unbalanced throttle valve 5, throttle shaft 6, crank 7, tension spring 8 tending to hold valve 5 open, suction device 9, flexible diaphragm 10 connected to crank 7 by rod 11, suction chamber 12 connected by conduit 13 with orifice 14 in the intake passageway on the engine side of valve 5, conduit 15 connecting suction chamber 12 with orifice 16 in the intake passageway on the atmosphere side of valve 5, conduit 17 connected into conduits 13 and 15 and also with suction chamber 12, engine driven shaft 18, circumferential passageway 19, diametrical passageway 20 in shaft 18, axial passageway 21 in shaft 18 connecting passageway 20 with chamber 22 within valve housing 23 fixed on shaft 18, piston valve 24 in housing 23, bypass passageway 25 in valve 24, metering pin 26 on valve 24, conical air bleed orifice 27 controlled by valve 24, port 28 in stationary housing 29, piston 30, coil spring 31 connected at one end to valve 24 and at the other end to piston 30, bell crank 32 pivoted on ears 33 (fixed on housing 23) by pin 34, bore 35 in piston 30 which receives ball 36 on the end of one arm of bell crank 32, ball 37 on the other arm of bell crank 32 and journalled in socket 38 which in turn is journalled in the lower end of screw shaft 39 having a screw fit in boss 40 on housing 29, knob 41 for adjusting screw 39.

The operation of my device is as follows: As soon as the engine is set in operation, the engine speed will accelerate until it reaches the governed speed whereupon valve 24 will close orifice 27 to cut off the air bleed through orifice 27, bypass 25, passageways 21, 19 and 20, and conduit 17 to suction chamber 12. With air bleed 27

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momentarily closed, a vacuum will be built up in suction chamber 12 through conduit 13 and orifice 14 in the intake passageway and diaphragm 10 will respond to the vacuum and move valve 5 toward closed position in opposition to spring 8 to throttle the engine in accordance with the load on the engine. If valve 5 moves toward closed position, then orifice 16 acts as an air bleed to suction chamber 12 so that the full intake passageway vacuum is not established in chamber 12. The speed of the engine will decrease slightly whereupon valve 24 will be opened slightly by tension spring 31 and also due to the intake passageway suction which tends at all times, while the engine is running, to hold valve 24 open. Valve 24 rides the vacuum and metering pin 26 controls the effective size of air bleed orifice 27 so that suction device 9 will move valve 5 to more or less open position in accordance with the fuel requirements of the engine as the load varies.

If it is desired to raise the top governed speed of my engine, then I turn knob 41 clockwise which moves screw shaft 39 downwardly which acts through bell crank 32 to move piston 30, spring 31 and valve 24 to the left, as viewed in the drawing, that is, piston 30 moves away from the center of rotation and piston 24 toward the center of rotation. This adjustment does not change the tension or stress on coil spring 31 because spring 31 is the sole connection between piston 30 and valve 24 and valve 24 is entirely free, except for spring 31, to move toward piston 30. It can be readily seen that this adjustment to change the governed speed of the engine can be effected while the engine is rotating because the socket 38 rotates in the lower end of shaft 39 which is positioned in line with the axis of rotation of shaft 18 and housing 23.

When valve 24 is adjusted to raise the governed speed of the engine, then metering pin 26 is moved toward the large end of tapered opening 27 to increase the effective size of air bleed opening 27. When piston 24 is adjusted toward the right by turning knob 41 counterclockwise, then metering pin 26 moves toward the small end of tapered orifice 27 and decreases the effective size of the air bleed. This is very important in this type of suction actuated or controlled governor because at higher governed speeds greater air bleeding of the suction device is required than when the governor is set to govern the engine at low speed. If there is too much air bleeding at low speed, the governor will surge and if one reduces the size of the air bleed orifice to pre-

vent surging, then there will not be enough air bleed for the suction device when this type of governor is set to govern at higher speeds. In other words, with this type of suction actuated governor, the higher the speed at which the engine is governed the greater the air bleed, and vice versa.

It is evident that my air bleed valve can be operated to change the governed speed of the engine either while the engine is running or dead, and in so doing the effective size of the air bleed orifice is increased as the governed speed is increased and the effective size of the air bleed orifice is decreased as the governed speed is decreased. I have shown my suction device 9 actuated by intake passageway suction because this is the preferred arrangement for operating my suction device, but it is understood that I can operate my suction device by any vacuum means which increases the vacuum established in chamber 12 as the speed of the engine increases. This, for example, may be accomplished by connecting my suction device 9 into an engine driven vacuum pump rather than into the intake passageway.

I claim:

1. In a governor system for an internal combustion engine having an intake passageway and wherein said governor system comprises a valve for controlling the flow of motive fluid through said passageway, a suction actuated device connected to said governor valve for imparting movement thereto, and means for establishing a vacuum in said suction device, the combination of a valve housing rotatable about an axis, an air bleed orifice in said valve housing, a centrifugally unbalanced valve in said housing controlling said air bleed inlet and tending to close the air inlet as the housing reaches a predetermined speed of rotation, resilient means opposing the closing of said air bleed valve, a support member fixed relative to said rotatable housing, and mechanism mounted partly on said valve housing and partly on said support member for adjusting said valve relative to said orifice, the part of said mechanism mounted on said valve housing being rotatable relative to the part of said mechanism mounted on said fixed support, the part of said mechanism mounted on said fixed support being axially movable and the part of said mechanism mounted on said valve housing including an anchor for said resilient means which anchor is movable transversely of the above said axis, the part of the adjusting mechanism mounted on the fixed support being aligned with the axis of rotation of the valve housing, said mechanism being constructed and arranged so that a portion thereof is adjustable on said support member whereby adjustment of the valve relative to the orifice may be effected while the housing is rotating.

2. In a governor system for an internal combustion engine having an intake passageway and wherein said governor system comprises a valve for controlling the flow of motive fluid through said passageway, a suction actuated device connected to said governor valve for imparting movement thereto, and means for establishing a vacuum in said suction device, the combination of a valve housing rotatable about an axis, an air bleed orifice in said valve housing, a centrifugally unbalanced valve in said housing controlling said air bleed inlet and tending to close the air inlet as the housing reaches a predetermined speed of rotation, a piston in said valve housing, resilient means connecting said piston and valve, a bell crank pivoted on said housing having one arm operatively connected to said piston and the other arm having a portion located substantially in the axis of rotation of said valve housing, and means having a rotatable connection with the said portion of said bell crank for moving said portion substantially along the axis of rotation whereby the bell crank can be pivoted to adjust said piston, resilient means and valve relative to the air bleed orifice to change the closing speed of the said valve while the valve housing is rotating.

3. In a governor system for an internal combustion engine having an intake passageway and wherein said governor system comprises a valve for controlling the flow of motive fluid through said passageway, a suction actuated device connected to said governor valve for imparting movement thereto, and a conduit connecting said suction device into the intake passageway on the engine side of said governor valve for establishing a vacuum in said suction device, the combination of a valve housing rotatable at variable speed about an axis, an air bleed orifice in said valve housing, a centrifugally unbalanced valve in said housing controlling said air bleed inlet and tending to close the air inlet as the housing reaches a predetermined speed of rotation, resilient means opposing the closing of said air bleed valve, and a support member fixed relative to said rotatable housing, and mechanism mounted partly on said valve housing and partly on said fixed support for adjusting said resilient means and said valve relative to said orifice, said mechanism being constructed and arranged so that a portion thereof is positioned on the axis of rotation of said valve housing, the part of said mechanism mounted on the valve housing being rotatable relative to the part of said mechanism mounted on the fixed support whereby adjustment of the resilient means and valve relative to the orifice may be effected while the housing is rotating and without adjusting the stress on said resilient means.

4. In combination a rotatable shaft, a cylinder mounted on said shaft and extending transversely of the axis of rotation of the shaft, an orifice in said cylinder, a centrifugally unbalanced valve in said cylinder controlling said orifice and tending to close the orifice as the shaft reaches a predetermined speed of rotation, resilient means opposing the closing of said valve, an adjustable anchor in said cylinder, said resilient means being connected between said anchor and valve, a support fixed relative to said shaft and cylinder, and mechanism mounted partly on said cylinder and partly on said support for adjusting said anchor, resilient means and valve as a unit relative to said orifice without changing the stress on said resilient means whereby the rotary speed at which said valve closes can be changed by actuation of said adjusting mechanism, said mechanism comprising a member adjustable on said support member axially of said shaft, and a rotary connection between said adjustable member and the remaining portion of said mechanism positioned on said cylinder.

5. In a governor system for an internal combustion engine having an intake passageway and wherein said governor system comprises a valve for controlling the flow of motive fluid through said passageway, a suction actuated device connected to said governor valve for imparting movement thereto, and a conduit con-

necting said suction device into the intake passageway on the engine side of said governor valve for establishing a vacuum in said suction device, the combination of a shaft rotatable at variable speed, a cylinder mounted on said shaft with the longitudinal axis of the cylinder perpendicular to the axis of rotation of said shaft, an air bleed orifice in one end of said cylinder, a centrifugally unbalanced valve in said cylinder controlling said air bleed orifice and tending to close the air bleed orifice as the cylinder and shaft reach a predetermined speed of rotation, resilient means opposing the closing of said air bleed valve, mechanism mounted on said cylinder for adjusting said resilient means and said valve relative to said orifice, a connection between said mechanism and said resilient means, a support fixed relative to said shaft and cylinder, a member adjustably mounted on said support and aligned with the axis of rotation of said cylinder, a connection between said adjustable member and mechanism, the said mechanism mounted on said cylinder being rotatable relative to the member adjustably mounted on said fixed support whereby adjustment of the resilient means and valve relative to the orifice may be effected while the cylinder and shaft are rotating.

6. In a governor system for an internal combustion engine having an intake passageway and wherein said governor system comprises a valve for controlling the flow of motive fluid through said passageway, a suction actuated device connected to said governor valve for imparting movement thereto, and a conduit connecting said suction device into the intake passageway on the engine side of said governor valve for establishing a vacuum in said suction device, the combination of a shaft rotatable at a variable speed, a cylinder mounted on said shaft with the longitudinal axis of the cylinder perpendicular to the axis of rotation of said shaft, an air bleed orifice in one end of said cylinder, a centrifugally unbalanced valve in said cylinder controlling said air bleed orifice and tending to close the air bleed orifice as the cylinder and shaft reach a predetermined speed of rotation, resilient means opposing the closing of said air bleed valve, mechanism mounted on said cylinder for adjusting said resilient means and said valve relative to said orifice, a connection between said mechanism and said resilient means, a support fixed relative to said shaft and cylinder, a member adjustably mounted on said support along the extended axis of rotation of said shaft and cylinder, a rotary connection between said adjustable member and mechanism whereby adjustment of the resilient means and valve relative to the orifice may be effected while the cylinder and shaft are rotating.

7. A centrifugal valve mechanism comprising a housing having an orifice, a centrifugally unbalanced valve in said housing and controlling said orifice, said valve and housing being arranged and constructed to rotate about an axis whereby the valve responds to centrifugal force to close said orifice, resilient means opposing the closing of said valve, means carried by said housing and actuatable for adjusting said resilient means and valve as a unit, and setting the same in various positions, relative to said orifice, a stationary support, and actuating means for the aforesaid adjusting means mounted on said support and rotatably connected to the aforesaid means at the axis of rotation of said valve housing whereby said adjusting means can be actuated while said

valve mechanism is rotating and the speed at which the centrifugally unbalanced valve closes said orifice is varied.

8. A centrifugal valve mechanism comprising a housing having an orifice, centrifugally unbalanced valve means mounted for reciprocation in said housing, said valve means and housing being constructed and arranged to rotate about an axis whereby the valve responds to centrifugal force to close said orifice, said valve means itself constituting the weight which responds to centrifugal force, resilient means opposing the closing of said valve, and mechanism for effecting an adjustment of the resilient means and valve means relative to said orifice, part of said mechanism being constructed and arranged to revolve around a center aligned with the axis of rotation of said housing and the remainder of said mechanism being actuatable substantially along the axis of rotation of said housing, and actuating means rotatably connected with said last mentioned part of said mechanism at the axis of rotation of said housing whereby said mechanism can be operated while the valve and housing are rotating to adjust and set the resilient means and valve means relative to the orifice to change the speed at which the valve means closes said orifice.

9. The combination as set forth in claim 8 wherein the first mentioned part of said mechanism includes a bell crank lever pivoted on the valve housing and having one arm operatively connected to said resilient means and the other arm having a portion which rotates substantially on said axis of rotation and is rotatably connected with said last mentioned actuating means so that the bell crank can be pivoted by moving said portion substantially along the axis of rotation to adjust the resilient means and valve relative to said orifice.

10. A centrifugal valve mechanism comprising a housing having an orifice, a centrifugally unbalanced piston valve mounted for reciprocation in said housing, said piston valve and housing being constructed and arranged to rotate about an axis whereby the valve responds to centrifugal force to close said orifice, said piston valve itself constituting the weight which responds to centrifugal force, resilient means opposing the closing of said valve, a bell crank pivoted on said housing offset from the axis of rotation, one end of said bell crank being operatively connected to said resilient means and the other end of said bell crank being positioned upon the axis of rotation whereby movement of said other end of the bell crank substantially along the axis of rotation adjusts said resilient means and valve relative to said orifice, and means having a journalled connection with said other end of said bell crank and adapted for adjustment substantially along said axis of rotation for moving said bell crank whereby the valve mechanism can be adjusted while in operation to change the speed at which the valve closes.

11. A centrifugal valve mechanism comprising a housing having an orifice, a centrifugally unbalanced valve in said housing and controlling said orifice, said valve and housing being arranged and constructed to rotate about an axis whereby the valve responds to centrifugal force to close said orifice, resilient means opposing the closing of said valve, and means constructed and arranged for adjusting both said resilient means and valve and setting the same in various

positions relative to said orifice while said valve mechanism is rotating whereby the speed at which the centrifugally unbalanced valve closes said orifice is varied, the said adjustment means comprising a piston in said housing on one side of the axis of rotation and the centrifugally unbalanced valve is positioned on the other side of the axis of rotation and wherein the piston is connected to a bell crank lever pivoted on the valve housing and revolving about the axis of rotation of said housing.

12. The combination as set forth in claim 11 including means having a rotary connection with one end of the bell crank for adjusting the same about its pivot while the valve mechanism is rotating.

13. A centrifugal valve mechanism comprising a housing having a wall provided with an orifice, a centrifugally unbalanced valve in said housing controlling said orifice, said valve and housing being arranged and constructed to rotate about an axis such that the valve responds to centrifugal force to close said orifice, resilient means opposing the closing of said valve, means for relatively adjusting said valve and the wall of said housing having said orifice and set the same at various positions relative to each other, and means rotatably connected with said adjusting means at the axis of rotation of said housing whereby the adjusting means can be adjusted while in operation to change the speed at which the valve closes.

14. A centrifugal valve mechanism comprising a housing having a wall provided with an orifice, a centrifugally unbalanced valve in said housing controlling said orifice, said valve and housing being arranged and constructed to rotate about an axis such that the valve responds to centrifugal force to close said orifice, resilient means opposing the closing of said valve, means mounted on said housing for relatively adjusting said valve and the wall of said housing having said orifice and set the same in various positions relative to each other, said adjusting means having a portion actuatable along the axis of rotation of said housing, a stationary support, and actuating means mounted on said support and rotatably connected with said adjusting means at the axis of rotation of said housing whereby the adjusting means can be adjusted while in operation to change the speed at which the valve closes.

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