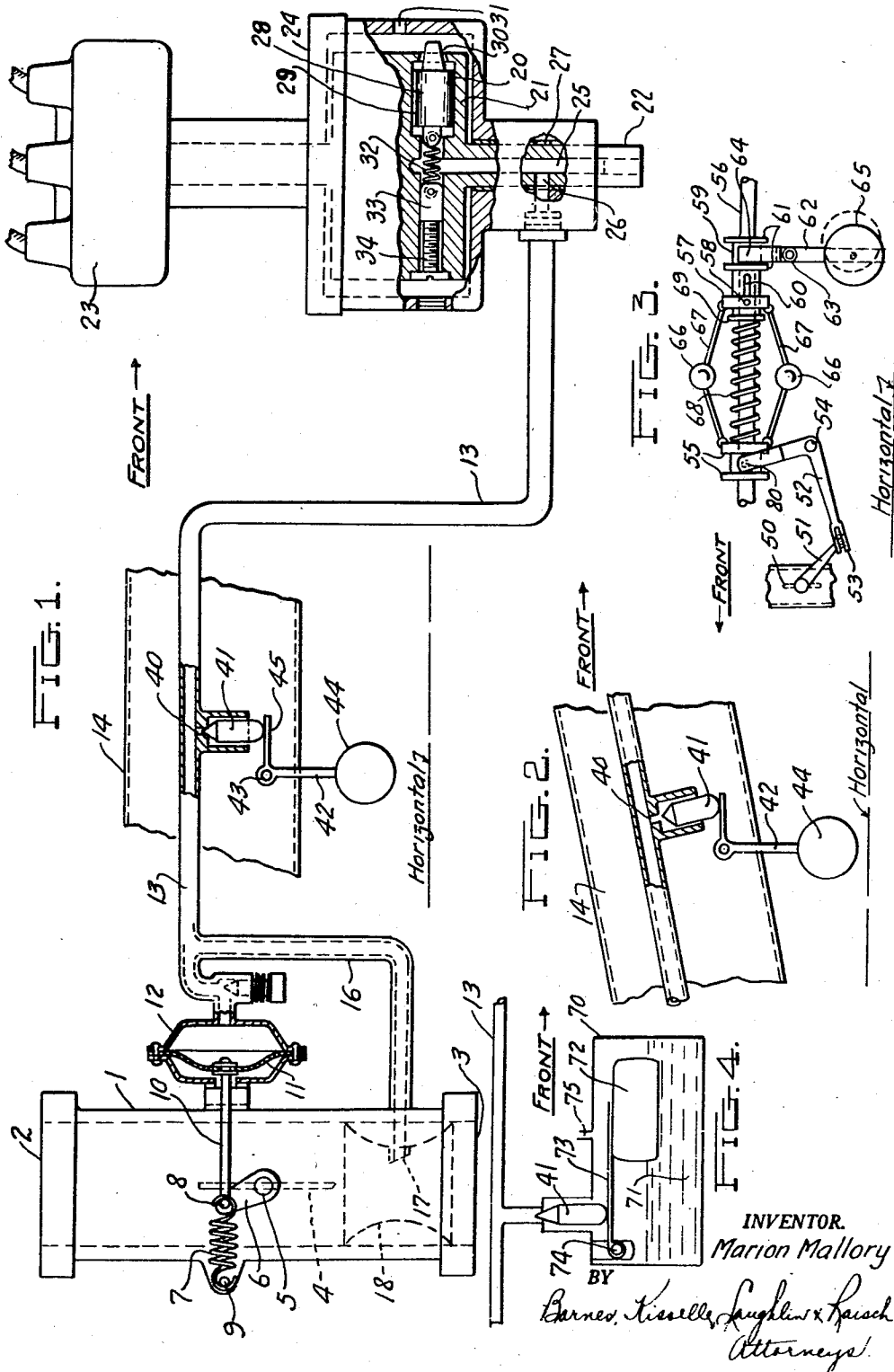


Dec. 9, 1947.

M. MALLORY
ENGINE GOVERNOR

2,432,166

Filed April 26, 1944



UNITED STATES PATENT OFFICE

2,432,166

ENGINE GOVERNOR

Marion Mallory, Detroit, Mich.

Application April 26, 1944, Serial No. 532,719

4 Claims. (Cl. 180-77)

1

This invention relates to a multiple speed governor for an internal combustion engine.

It is essential in controlling the speed of some internal combustion engines, especially truck and bus engines, that the engine should be governed at a plurality of speeds depending upon the operating conditions. For example, supposing that the engine of a truck is governed to have a top speed of 2500 R. P. M. to give the vehicle a top speed of 40 miles per hour, if such truck were heavily loaded it would be necessary to shift into very low gear for climbing a hill which would make the vehicle speed very low due to the engine being governed at a top speed of 2500 R. P. M. Under such a condition it would be desirable to have the engine governed at a higher top speed. Of course, the higher top governed speed would be under a speed at which the engine would tear itself to pieces.

It is the object of this invention to produce a governor for controlling an internal combustion engine at different speeds, and more particularly to produce a governor which will control an internal combustion engine at a plurality of different top speeds dependent upon the particular conditions under which the engine is operated.

In the drawings:

Fig. 1 is an elevation partly in section showing my engine multiple speed governor.

Fig. 2 is a detail showing the position of the pendulum controlled air bleed valve when the vehicle is traveling uphill.

Fig. 3 is a detail of a modified form of my engine multiple speed governor.

Fig. 4 is a detail of a second modified form of my governor.

Referring more particularly to the drawings there is shown a governor housing 1 having an inlet 2 and an outlet 3. The governor housing is adapted to be connected into the intake manifold of an internal combustion engine on the engine side of the carburetor.

A governor valve 4 of the butterfly type is mounted within the housing on shaft 5 journaled in housing 1. Crank 6 is fixed on shaft 5 outside of the housing 1. A tension spring 7 having one end connected to the crank 6 as at 8 and the other end connected to a lug on the housing as at 9 tends to keep the governor throttle valve 4 open.

A suction device is provided for operating governor valve 4. This suction device comprises a housing 12 and flexible diaphragm 11. Diaphragm 11 is connected by rod 10 to crank 6. Housing 12 to the left of diaphragm 11 com-

2

municates with atmosphere whereas housing 12 to the right of diaphragm 11 communicates only with and is connected into, conduit 13. Conduit 16 communicates at one end with conduit 13 and at the other end with orifice 17 in venturi 18 in the intake passageway on the engine side of valve 4.

The frame of the vehicle upon which my engine governor is mounted is designated 14.

Conduit 13 is arranged to communicate with atmosphere but this communication is controlled by a plurality of valves, one of which actuates in response to engine speed and the other of which opens when the vehicle is climbing a hill and closes when the vehicle is traveling on a horizontal roadway.

The centrifugal valve is designated 20 and mounted within valve housing 21 fixed on shaft 22 which rotates in accordance with the speed of the engine. As herein shown, shaft 22 is the engine distributor shaft. The distributor is designated 23. Thus, the speed of rotation of valve housing 21 varies directly with the speed of the engine. Shaft 22 is journaled in stationary housing 24.

Shaft 22 is provided with an axial passageway 25 and a diametrical opening 26. Diametrical opening 26 is in continuous communication with circumferential clearance 27 about shaft 22. Clearance 27 communicates at all times with conduit 13. Passageway 25 is in continuous communication with cylinder 28 in valve housing 21. Piston valve 20 is mounted in cylinder 28 and provided with a longitudinal external groove 29. Piston valve 20 controls port 30 in housing 21. Port 30 communicates with passageway 25 through groove 29. Stationary housing 24 is provided with a port 31 to atmosphere. Valve 20 is at all times urged toward open position by tension spring 32 which is connected at one end to valve 20 and at the other end to block 33 having a threaded fit with a screw 34 for adjusting the tension of spring 32.

The centrifugally unbalanced valve 20 functions to control the speed of the engine in the same manner as described in my copending application Serial No. 466,961, filed November 25, 1942, now Patent No. 2,381,550, granted August 7, 1945, and therefore will not be described in detail. The tension of spring 32 will be adjusted to control the closing of valve 20 at whatever engine speed desired. As soon as the engine reaches its governed speed, say, for example, 2500 R. P. M., valve 20 will close or almost close orifice 30 thereby shutting off the air bleed to atmosphere of dia-

phragm 11 which now tends to move throttle 4 toward closed position. The centrifugal force acting to close valve 20 is counterbalanced or played against the tension of spring 32 plus the suction acting on valve 20 so that the speed of the engine is accurately controlled either by a slight variation from the desired governed speed or as described in my above mentioned application.

When the vehicle starts to climb a hill it will be necessary to shift the engine transmission into a low gear or speed which, of course, will materially cut down the road speed of the vehicle. It is desirable to increase somewhat the low gear road speed of the vehicle over the low gear road speed of the vehicle that would be possible if the governed speed of the engine remained the same in low gear as when operating in high gear. To this end it is proposed to change the top governed speed of the engine when the vehicle is climbing a hill which will necessitate shifting into low gear. This top governed speed, of course, will be below any speed which would be damaging to the engine. It is proposed to increase the top governed speed of the engine when traveling up a hill by increasing the air bleed to suction operated device 12. This air bleed comprises an orifice 40 leading from conduit 13 to atmosphere which is controlled by a needle valve 41. Needle valve 41 in turn is controlled by a pendulum comprising a bell crank 42 pivoted on the vehicle frame as at 43 and carrying a weight 44. Valve 41 is supported on arm 45 of the bell crank.

When the vehicle is operating on a horizontal or level road, pendulum 42 holds valve 41 closed so that the speed of the engine is governed by the centrifugally unbalanced valve 20. Upon reaching a hill, as soon as the vehicle starts to climb, the vehicle frame will be inclined from the horizontal, that is, it will be inclined downwardly from the front to the rear of the vehicle. This inclination of the vehicle will cause pendulum 42 to swing clockwise about pivot 43 thus causing valve 41 to open air bleed orifice 40 to atmosphere, Fig. 2. Thus, the manifold vacuum impressed upon diaphragm 11 through orifice 17 and conduit 16 will be bled down or decreased through air bleed orifice 40. In other words, air bleed orifice 40 now being open raises the pressure in suction device 12 somewhat and therefore permits spring 7 to hold governor valve 4 further open to thereby increase the speed of the engine. To put it another way, as long as air bleed 40 is open the engine must travel at a higher speed in order to induce sufficient vacuum in suction device 12 to cause diaphragm 11 to move valve 4 toward closed position. The net effect of the opening of air bleed orifice 40 is to raise the governed speed of the engine. The size of orifice 40 will determine the degree of air bleed and the extent to which the top governed speed of the engine is increased. If the engine is governed at, say, 2500 R. P. M. for horizontal road speed, it may be desirable to increase the speed of the engine for climbing hills in low gear to, say, 3000 R. P. M. As soon as the vehicle returns to a level or horizontal road, pendulum 44 swings back to the position shown and closes air bleed valve 41 thereby returning the engine to the control of the centrifugal governor.

This same principle can be applied to a governor using centrifugal weights. Such an arrangement is shown in Fig. 3. In this form of the invention the governor throttle valve is desig-

nated 50 and is operated by arm 51 connected to bell crank lever 52 by a pin and slot connection 53. Bell crank lever 52 is pivoted at 54. One end of bell crank 52 is in the form of a yoke 80 which engages in and straddles collar 55 mounted to slide on and rotate with shaft 56. Shaft 56 is operated off the engine and the speed of shaft 56 varies directly in accordance with the speed of the engine. A collar 57 is connected to shaft 56 by pin 58 so that collar 57 is fixed to and rotates with shaft 56. A sleeve 59 is slidably mounted on shaft 56 and keyed to rotate with shaft 56 by means of pin 58 and elongated slot 60 in sleeve 59. Sleeve 59 has fixed thereto collar 61. A pendulum arm 62 pivoted on the vehicle frame as at 63 has a yoke 64 at one end and a weight 65 at the other end. Yoke 64 engages between collar 61. Collars 55 and 57 are connected to centrifugal weights 66 by links 67. A coil spring 68 is mounted between collar 55 and collar 69 on sleeve 59 to resist the spreading apart of weights 66 by centrifugal force.

The operation of this form of the device is as follows: As the speed of the engine approaches its governed speed, the centrifugal force of weights 66 overcomes the force of spring 68 thereby moving slidable collar 55 toward collar 57 which acts through arms 52 and 51 to move throttle valve 50 toward closed position. This is a conventional centrifugal weight controlled governor. As the vehicle starts to climb the hill, pendulum 65 swings from the full line position, Fig. 3, to the dotted line position, thereby acting through yoke 64 and collar 61 to slide sleeve 59 to the left on shaft 56 thereby compressing or increasing the tension of spring 68. This increase in the tension or compression of spring 68 will require a higher engine speed before weights 66 can spread apart and operate to move throttle valve 50 toward closed position. Thus, by increasing the tension of centrifugal governor spring 68, I increase the top speed at which the engine is governed while climbing a hill. When the vehicle reaches level ground, weight 65 will return to the full line position thereby decreasing the tension of spring 68 and correspondingly reducing the governed top speed of the engine for horizontal road travel of the vehicle.

In Fig. 4 I have shown a modified control for air bleed valve 41 of the form of invention shown in Fig. 1. In this form a float chamber 70 is partly filled with a liquid, such as oil 71. The float is designated 72, the float arm 73 and the pivot for the float arm 74. Float chamber 70 is provided with an air vent 75 to atmosphere. Needle valve 41 is supported on float arm 73. When the vehicle is climbing a hill the float chamber will set on an angle from the horizontal and the liquid will fall back to the rear of the chamber permitting float 72 to drop and needle valve 41 will also drop admitting air to the suction device, thereby raising the governed speed of the engine in the same manner as described with respect to the form of invention shown in Fig. 1. Mercury can be used in the float chamber instead of the oil 71. In such case float 72 will not be necessary because needle valve 41 itself would float on the heavy metal mercury.

All of the forms of this device above described will give the engine more speed on rapid acceleration of the vehicle such as occurs when operating in low or intermediate gear. A vehicle, such as a passenger car or light truck, will accelerate from 5 to 25 miles per hour in about ten seconds,

but it would take about twice as long to accelerate

5

from 25 to 45 miles per hour. The pendulum, Figs. 1 and 3, and the liquid, Fig. 4, would move back on rapid acceleration to thereby open valve 41 or increase the tension of spring 68, thereby increasing somewhat the top governed speed of the engine during such rapid acceleration. When the acceleration occurs at high speed, the pendulum would not swing back because the rate of acceleration at high speeds is considerably less than at low speeds.

From the above it will be seen that the pendulum principle can be applied to several types of governors for controlling the speed of internal combustion engines. The pendulum principle can be used for bleeding suction devices where the manifold suction is used for controlling the governor throttle valve, for tightening the spring on a governor valve controlled by centrifugal weights, and for tightening the spring on unbalanced or velocity governor throttle valves.

I claim:

1. The combination with an internal combustion engine having an intake passageway provided with a throttle valve for controlling the flow of motive fluid to the engine, a device actuated by suction from a point in said passageway between the throttle valve and the engine and having an operative connection with said throttle valve, first and second air bleeds to atmosphere for said pressure actuated means, a centrifugally unbalanced valve rotated in accordance with the engine speed for controlling one of said air bleeds and tending to close said air bleed at a predetermined engine speed whereby the device tends to move said throttle valve towards closed position, and valve means responding upon inclining the engine to the vertical for opening said other air bleed whereby when the centrifugal valve is closed the fuel intake passageway suction is partly bled down and the engine is governed at a speed higher than that at which the centrifugally unbalanced valve for the other air bleed tends to close said other air bleed.

2. The combination with an internal combustion engine having an intake passageway provided with a throttle valve for controlling the flow of motive fluid to the engine, means actuated through vacuum in the intake passageway on the engine side of said throttle valve for imparting closing movement to said throttle valve, first and second air bleed ports to atmosphere positioned in parallel relation for bleeding air into said vacuum actuated means, a valve for one of said air bleed ports normally open and closing in response to a predetermined engine speed whereby, when the other air bleed port is closed, the said vacuum actuated means responds to intake passageway vacuum and tends to move said throttle valve toward closed position, and valve means for the other of said air bleed ports responsive to a change in inclination of the engine from the horizontal for opening said second port and bleeding air into said vacuum actuated means to thereby increase the governed speed of the engine.

6

3. In a vehicle propelled by an internal combustion engine having an intake passageway provided with a throttle valve for controlling the flow of motive fluid to the engine, means actuated through the suction in the intake passageway on the engine side of said valve for imparting closing movement to said valve, first and second air bleed ports opening to atmosphere independently of each other and positioned in parallel relation for bleeding air into said suction actuated means, a normally open valve for one of said air bleed ports, means connected to said valve for closing the same in response to a predetermined engine speed whereby said suction actuated means, when the other air bleed port is closed, responds to intake passageway suction and tends to close said throttle valve, a valve for the other of said air bleed ports, and inertia responsive mechanism connected to said second valve for opening the same when the speed of the vehicle is quickly accelerated and also when the vehicle is traveling uphill whereby when the first air bleed port is closed the full intake passageway suction is bled down in said suction device and the governed speed of the engine is increased.

4. In a vehicle propelled by an internal combustion engine having an intake passageway provided with a throttle valve for controlling the flow of motive fluid to the engine, means actuated through the suction in the intake passageway on the engine side of said valve for imparting closing movement to said valve, resilient means biasing said throttle valve toward open position, first and second air bleed ports opening to atmosphere independently of each other and positioned in parallel relation for bleeding air into said suction actuated means, a normally open valve for one of said air bleed ports, centrifugal means rotated in accordance with the engine speed and connected to said valve for closing the same in response to a predetermined engine speed whereby said suction actuated means, when the other air bleed port is closed, responds to intake passageway suction and tends to close said throttle valve, a valve for the other of said air bleed ports, and inertia responsive mechanism connected to said second valve for opening the same when the speed of the vehicle is quickly accelerated and also when the vehicle is traveling uphill whereby opening of said second air bleed valve will at all times reduce the suction in said suction actuated means regardless of the position of the first air bleed valve.

MARION MALLORY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,115,878	Rodman	May 3, 1938
2,224,600	Howard	Dec. 10, 1940
2,289,014	Howard	July 7, 1942
2,302,322	Howard	Nov. 17, 1942