

Aug. 15, 1944.

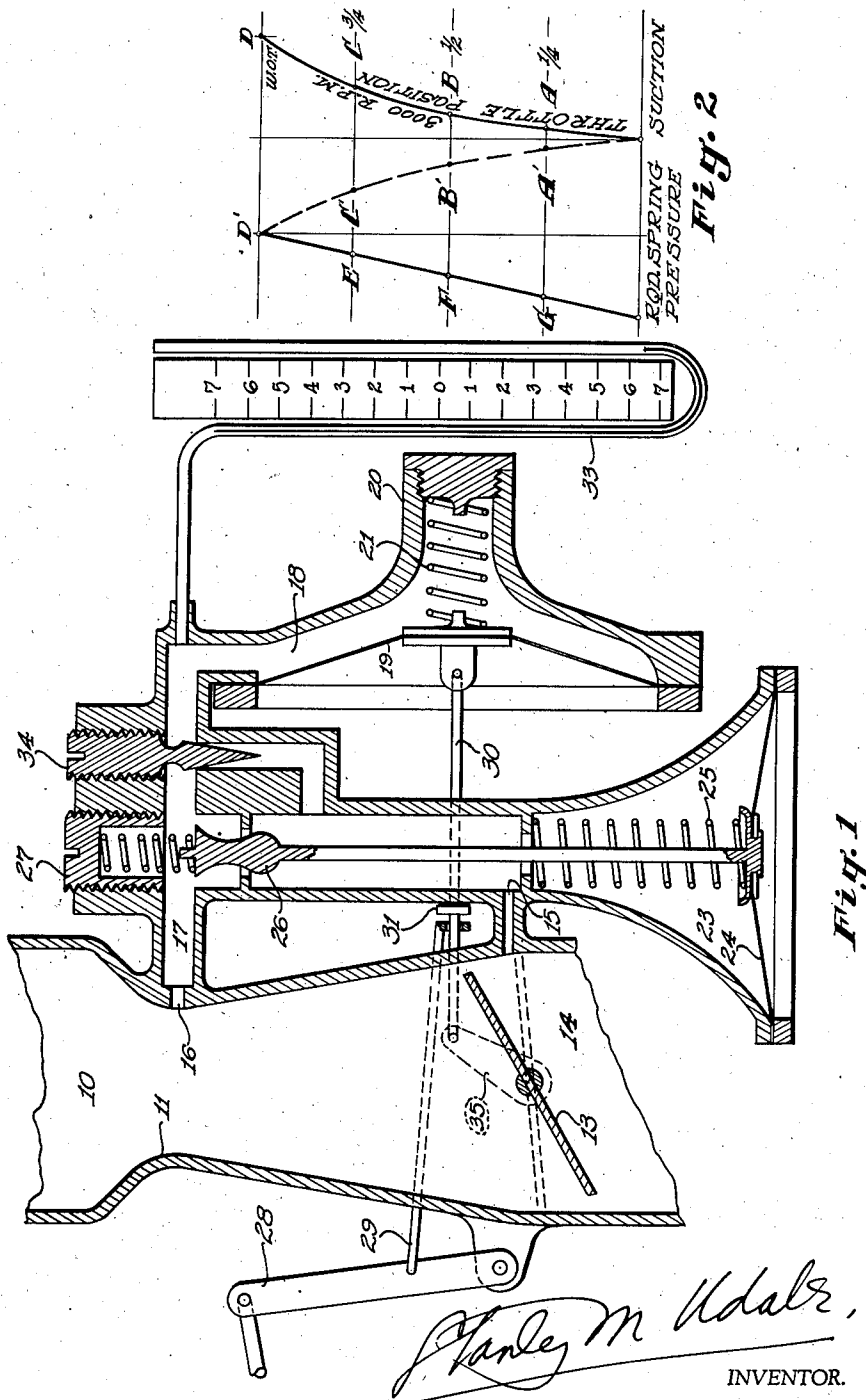
S. M. UDALE

2,356,017

GOVERNOR

Filed March 25, 1944

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

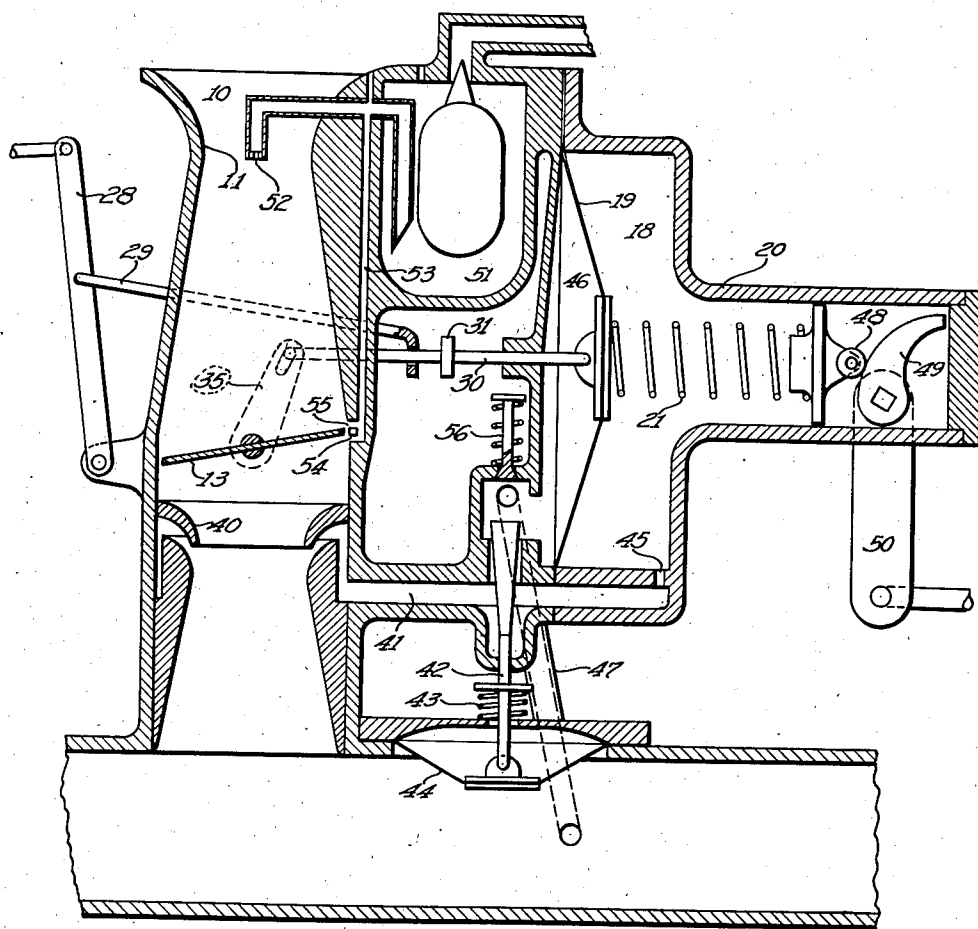


Fig. 3

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3 Claims. (Cl. 123-103)

The object of this invention is to regulate the speed of an internal combustion engine without using centrifugal means.

Fig. 1 shows diagrammatically the elements of my invention.

Fig. 2 shows the pressure variations with throttle positions at the governed speed of the engine. Figure 3 shows an alternative.

In Fig. 1, 10 is the air entrance, 11 a venturi therein. 12 is a throttle controlling the air flow to the engine through mixture outlet 14. 15 is a passage which is normally in communication with outlet 14. However, when the throttle 13 is closed as shown, passage 15 communicates with the atmospheric side of throttle 13. Passage 17 communicates with the throat of the venturi 11 through the restriction 16 and also with a diaphragm chamber 18 which is bounded on the left by a diaphragm 19 and on the right by the housing 20 which contains a compression spring 21 which spring may be adjusted. Passage 15 communicates through the passage 22 with the chamber 23, the lower wall of which consists of a flexible diaphragm 24 which is flexed in the position shown by the spring 25 which seats the valve 26 and prevents communication between the passage 22 and the passage 17. An accessible adjusting spring 27 is provided to oppose the spring 25, the spring 25 not being accessible.

Manually controlled lever 28 is connected through the link 29 which pushes a rod 30 to the right when it is desired to close the throttle 13. The rod 30 carries a shoulder 31 which engages with the right hand end of the link 29. Rod 30 is connected through a lever 32 to throttle 13 so that throttle 13 may be closed manually by a clockwise movement of lever 28 and is opened by the movement of diaphragm 19 to the left and closed by the movement of the diaphragm 19 to the right.

Fig. 2 shows the method of calibrating the variable needle 26. Vertical distance corresponds to suction horizontal to throttle position. Points A, B, C and D represent the value of the suction created by the venturi 11 at the selected critical speed (3,000 R. P. M.) at which governing is desired. A', B', C' and D' represent the corresponding opposing pressure to be exerted by the spring 21 to balance the suction at the critical speed at these throttle positions. Now the spring 21 will follow a straight line corresponding to the line D', E, F and G. D' will equal D so that at wide open throttle at 3,000 R. P. M. the spring will just balance the suction created in venturi 11. Under such conditions

there will be no suction in the mixture outlet 14 and spring 25 will close valve 26. When the throttle moves to a three-fourths open position, there will be a smaller suction at 3,000 R. P. M. in the throat of the venturi 11 represented by the point C and there will be greater suction in outlet 14 than there is in venturi 11. On the other hand, the spring 21 will be compressed and therefore it will require a greater suction than the corresponding 2D represented by the rise of the line D'E to the point E to hold the throttle in equilibrium. Therefore, the suction at the three-fourths position must be increased by the value indicated by C', E, E being the pressure exerted by the spring when the throttle is three-fourths open. Valve 26 must, therefore, be designed so that sufficient of the suction below throttle 13 is available to increase the suction in chamber 18 above that of the suction in the venturi 11 admitted through the restriction 16 and this increase must be such that the total suction is now equal to spring pressure E. At one-half throttle the suction in the venturi 11 has fallen to point B and therefore much greater suction is required and therefore 26 must open to admit a greater portion of suction from below the throttle 13 to raise the suction from that corresponding to point B represented by the incline B' to F. However, the suction below the throttle 13 increases rapidly as the throttle approaches closed position so that enough suction is available to cause the suction in 18 to follow DEFG. Therefore, there is sufficient suction available so that the desired suction can be obtained to regulate the speed within close limits. In making the necessary calibration in a U tube 33 records the suction in 18 and the valve 26 is prevented from opening. A bypass needle valve 34 is opened until the desired suctions are read on gage 33. The valve 26 is then machined so that at the various throttle openings the valve 26 opens up to the amount found desirable with the needle 34, which is only used in calibrating the valve 26 in the experimental sample. The valve 26 duplicates the valve 34 which valve is adjusted by hand.

In Fig. 1, 33 indicates a manometer tube for calibrating this valve 34. The valve 34 is adjusted by hand so that the reading on the manometer at each position of the throttle corresponds to the figures indicated in Fig. 2. The valve 26 is then adjusted to duplicate the opening at each suction found desirable with valve 34 which valve is then shut off.

Operation

In Fig. 1 when the throttle is first moved from the wide open position, the valve 26 must move quickly to admit suction from below the throttle to a considerable degree in order that the suction in chamber 18 may increase from D to E. When the throttle approaches one-quarter open position, the suction in the outlet 14 is so great that the suction at the point F will be much greater than desired and hence, valve 26 must now restrict the suction so that the valve 26, as it continues to rise, restricts the suction imposed in passage 16 into chamber 18, the reason being that the suction may approach as high as 15" Hg whereas the suction at wide open throttle will be in the order of 3" or 4" Hg and that the point E will be of the order of below 5" Hg, point F be less than 6" Hg and point G being less than 7" Hg so that the valve 26, when it moves, must first rapidly increase the suction in chamber 18 and as it continues to rise must prevent suction in 18 from becoming equal to suction in outlet 14 because suction in outlet 14 will become far greater than the compression spring 21 can take care of.

Hence, the valve 26 must be designed so that it first opens the passageway between 22 and 17 and then closes the same passageway as the suction in the mixture outlet increases.

Alternative construction

In Fig. 3, 10 is the air entrance, 11 is the venturi in which there is a discharge fuel nozzle 52, fuel being supplied from float chamber 51. The low speed fuel is supplied through the passage 53 and through the outlets 54 and 55 which outlets are adjacent to the up-stream lip of throttle 13. A second venturi 40 is located on the engine side of the throttle 13. The suction in the venturi 40 is applied from the passage 41 through the opening 45 to the chamber 18, the left-hand wall of which consists of a diaphragm 19. The diaphragm 19 is moved to the left by a compression spring 21, mounted in the housing 20. A roller 48 engages with a cam 49 controlled by lever 50 and thus adjusts the pressure on the spring 21. A diaphragm 44 responds to the static suction below the throttle. The motion of the diaphragm 44 is opposed by a spring 43. A valve 42 is thus moved in response to engine suction. The chamber 46 to the left-hand side of the diaphragm 19 responds by means of the passage 47 to the static suction below the throttle modified by the valve 42 which at wide open throttle neutralizes some of the suction in chamber 18, because the valve 42 is then open. After the throttle 13 closes, the valve 42 also closes so that as the density is reduced, density of air flowing through venturi 40 is reduced, the effect of the flow becomes greater because the valve 42 closes. At extreme idle, there is practically no flow at all, when this happens, the suction exceeds 18" of mercury, possibly going as high as 20. A valve 56 then opens, admitting a little atmospheric air

to the chamber 46 so that the throttle 13 is closed for idle, but opens when a load is applied to lower the suction below 18" of mercury.

The diaphragm 19 engages through a link 30 with a lever 35 which operates the throttle 13. The shoulder 31 is engaged by the manually operated link 29 which is moved by the lever 28.

What I claim is:

1. A governor for an internal combustion engine, having an air passage, a venturi therein, a throttle valve located between the venturi and the engine, a chamber, a moving wall therein connected to said throttle, spring means engaging with said wall and adapted to open said throttle, a restricted passage connecting the chamber with the said venturi, a second passage connecting the chamber with the air passage on the engine side of the throttle, a valve in said second passage, means including a second moving wall connected to said valve and responsive to the suction on the engine side of the throttle and adapted to open said valve whenever the throttle by closing creates a suction in the passage spring means adapted to oppose said movement, said valve being adapted as it continues to move in response to an increase in suction to restrict the second passage whereby the excessive suction existing in the air passage at idle is only partially transmitted to the chamber.
2. A governor for an internal combustion engine comprising an air entrance, a venturi therein, a throttle valve adapted to control the flow of air through said venturi, engine speed controlling means for said throttle including a suction chamber a moving wall therein connected to said throttle, spring means engaging with said wall and adapted to open said throttle a passage connecting the throat of said venturi with said chamber, means responsive to the static suction in the air passage on the engine side of said throttle, said means being adapted to increase the force due to the air flow through said venturi, tending to close the throttle as the throttle moves toward its closed position.
3. A governor for an internal combustion engine having an air entrance, a throttle valve on the atmospheric side of said venturi, speed controlling means comprising a suction chamber a moving wall therein engaging with said throttle, a spring engaging with said wall so as to open said throttle, a passage connecting the throat of said venturi with said chamber so that the suction in the venturi opposes said spring, a second chamber on the other side of said moving wall, a passage connecting said second chamber with the static suction on the engine side of said throttle, a second passage connecting said second chamber with the throat of said venturi, a valve responsive to said static suction located in said second passage, said valve being adapted to increase the suction in said second chamber by opening said second passage when the static suction is reduced as the throttle opens.

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