Feb. 7, 1939. C. HOLT 2,146,070

AUTOMATIC SPEED CONTROL DEVICE

Filed Feb. 7, 1938 2 Sheets-Sheet 1

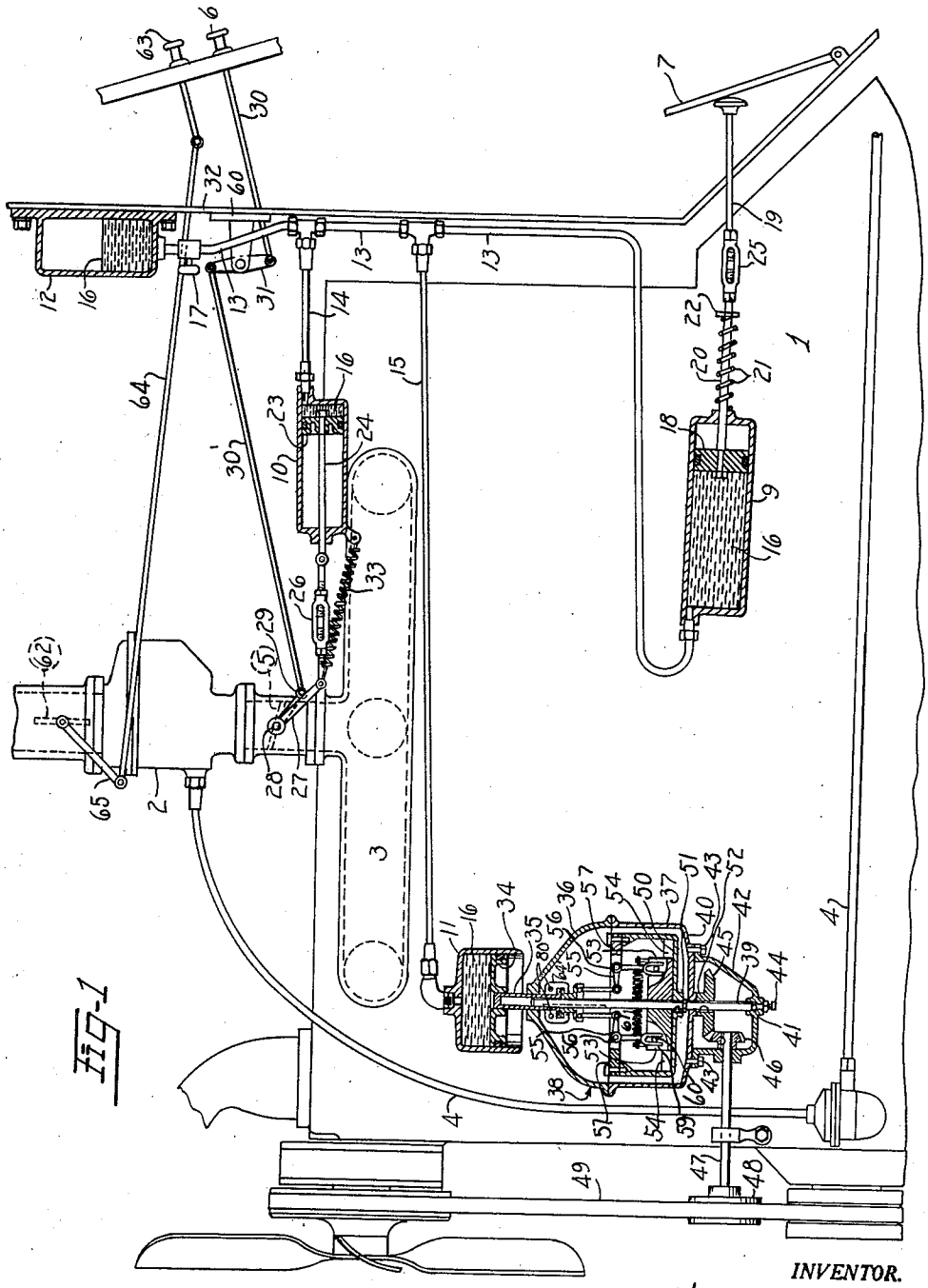


FIG-1

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AUTOMATIC SPEED CONTROL DEVICE

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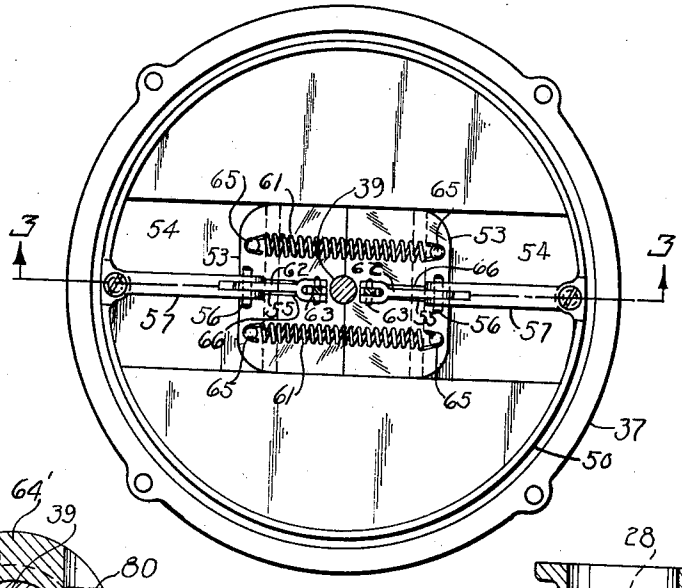


Fig-2

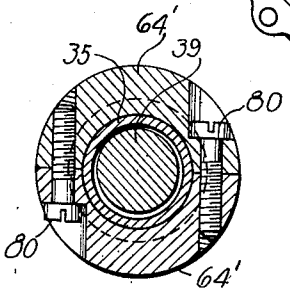


Fig-5

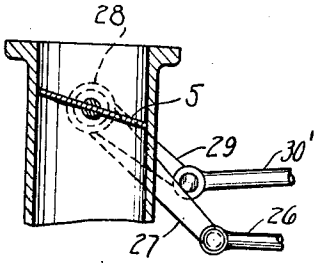


Fig-4

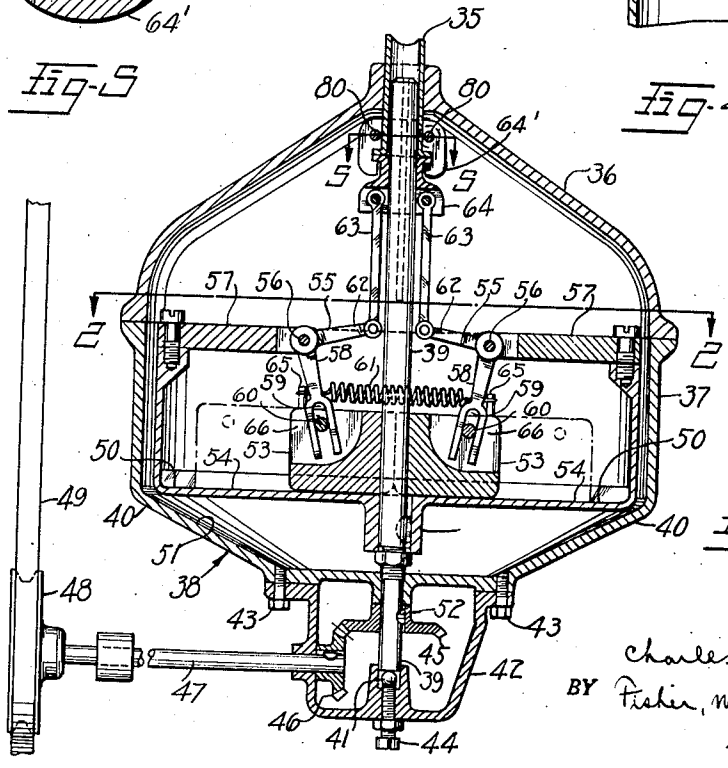


Fig-3

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Patented Feb. 7, 1939 2,146,070

UNITED STATES PATENT OFFICE

2,146,070

AUTOMATIC SPEED CONTROL DEVICE

Charles Holt, Cleveland, Ohio

Application February 7, 1938, Serial No. 189,211

9 Claims. (Cl. 123—108)

My invention relates to automatic speed control devices for internal combustion engines.

An object of the invention is to provide an efficient and highly sensitive controlling device which will automatically positively maintain the engine speed (R. P. M.) at a substantially constant predetermined manually fixed rate regardless of variations in load.

Other objects and advantages of the invention will be understood as the description is considered with the accompanying drawings, in which:

Figure 1 is a side elevation of my improved speed control apparatus;

Figure 2 is an enlarged plan view of the governor with the housing cover removed;

Figure 3 is an enlarged vertical section through the governor;

Figure 4 is a fragmentary detail of the intake manifold and valve operating means; and

Figure 5 is a section on the line 5—5 of Figure 3.

Referring more particularly to the drawings, 1 denotes a conventional internal combustion engine for automobiles, trucks and the like, on which my control device or system is installed, only the upper part of the engine being shown. Gasoline is fed in any suitable manner to a carburetor 2, mounted on an intake manifold 3, by means of a gasoline line 4, leading from a gasoline tank, not shown. Communication between the carburetor and the intake manifold is controlled by a butterfly throttle valve 5, in turn operatively connected with a hand throttle 6 and a foot accelerator 7.

The automatic control device comprises a plurality of interconnected hydraulic cylinders 9, 10 and 11, which get their supply of hydraulic fluid from a supply tank or reservoir 12, and which directly or indirectly influence the movements of the carburetor valve 5, in a manner hereinafter described. Any relatively non-compressible fluid such as commonly used in hydraulic brake systems is suitable for my purposes. A main liquid supply pipe 13 leads from the bottom of reservoir 12 to the cylinder 9, and an intermediately disposed branch pipe 14 connects the main pipe 13 with cylinder 10, while a second branch pipe 15, places pipe 13 in communication with the cylinder 11. In each instance the elevation of the supply and branch pipes with respect to the respective cylinders is such that fluid 16 will flow by gravity from the reservoir 12 into the cylinders when shut off valve 17 is open, thus insuring that any leakage loss in the system will be automatically replenished.

The piston 18 of cylinder 9, which may be termed the master cylinder, is operatively connected to the foot pedal or accelerator 7, through the medium of a pedal rod 19, attached at one end to the pedal and at its other end adjustably secured to one end of a turn buckle 25, the other end of the latter being pivoted to the piston rod 20 of piston 18. A heavy coil spring 21, on piston rod 20 seating at opposite ends against cylinder 9 and a collar 22, tends to pull the piston 18 and rod 20 outwardly or against the pressure of the foot accelerator. The piston 23 of cylinder 10 is connected through its piston rod 24 with the butterfly valve 5 which controls the flow of gas from the carburetor to the intake manifold. Thus a turn buckle 26, pivotally connected at one end to an arm 27 fixed to the shaft 28 of the butterfly valve 5, is pivotally secured at its opposite end to the piston rod 24. Hand throttle 6 is pivotally connected to an arm 29 on the shaft 28 of the butterfly valve through the medium of rods 30 and 30' respectively connected to opposite ends of a link 31, the latter being pivotally secured intermediate its ends to a front frame or part 32, by means of a bracket 60. A coil spring 33, connected at its respective ends to the cylinder 10 and turn buckle 26, normally moves the piston 23 toward the fluid 16 in cylinder 10 or to the right viewing Figure 1.

Cylinder 11 is provided with a horizontally reciprocable piston 34, actuated by a piston rod 35, extending reciprocably through the cover 36 of a housing or casing 37 for a centrifugal governor 38. The lower end of piston rod 35 is hollow for freely receiving the upper end of an axially aligned shaft 39, extending at its lower end through the bottom wall 40 of housing 37 and seated at its lower extremity in a roller bearing 41, in turn supported in a gear case 42 secured to the bottom wall 40, by bolts or other suitable fasteners 43. An adjusting screw 44 permits of slight vertical adjustment of the roller bearing and shaft for the purpose of properly meshing gears 45 and 46. These gears are mounted respectively on and rotatable with the shaft 39 and a shaft 47, the latter carrying a pulley 48 driven by the fan belt 49, in turn preferably driven from the crank shaft of the automobile, not shown. A frame 50 for housing and supporting the centrifugal governor 38 is keyed to the shaft 39 as at 51, and a threaded lock nut 52 is also provided for an obvious purpose.

The centrifugal governor 38 comprises a pair of oppositely arranged horizontally disposed weights 53 mounted for axial movement with

respect to shaft 39, on the bottom wall 54 of frame 50. Bell cranks 55, one for each weight, are rotatably secured to stub shafts 56 fixedly mounted in frame members 57. One arm 58 of each bell crank is bifurcated as at 59 for engagement with a pin 60 in turn attached to weights 53, the bifurcations being free to swing in recesses 66 formed in the weights. A pair of springs 61 connect the two weights together. These springs 61, one on each side of shaft 39, have their opposite ends connected to pins or posts 65 anchored in the outer ends of the weights. The other arm 62 of each lever 55, is pivotally connected to the lower end of an arm 63, the upper end of which is pivoted to a bearing member 64 in turn slidably but non-rotatably mounted on the shaft 39. The extent of outward radial movement of the weights 53 under the action of centrifugal force, when shaft 39 is rotated, is limited due to the resistance offered by the springs 61. Fixed to the lower end of the piston rod 35 is a two part ball race collar 64', which cooperates with the bearing member 64 in an obvious manner. The two halves of the collar are suitably secured to the rod 35 by means of screws 80.

In practice the operator advances the foot accelerator 7 in the usual way until the desired speed of travel is attained. Thereafter, the position of the accelerator is manually held fixed by the operator and the desired uniform speed will be automatically maintained, regardless of load, by the action of the governor 38, upon the hydraulic balancing system previously described, as will be presently understood. Forward movement of the foot pedal compresses spring 21 and causes the piston 18 to force the fluid 16 from cylinder 9, supply pipe 13 and branch pipe 14 into cylinder 10, against piston 23. The piston 23 and its associated rod is thus moved to a forward position against the tension of spring 33. The resulting corresponding movement of turn buckle 26 and arm 27 causes the valve 5 to open and admit a correspondingly increased supply of gas from the carburetor to the intake manifold with consequent acceleration of engine speed. As the engine speed is increased the governor 38 moves the crank lever 55 in an anti-clockwise direction and the piston rod 35 and piston 34 will move downwardly, thus creating a suction upon and causing fluid to be drawn from line 15, and thereby reducing the fluid content of cylinder 10. The suction plus the action of spring 33 then slightly moves butterfly valve 5, in an anticlockwise direction or toward closed position, thereby retarding the flow of gasoline through the carburetor and maintaining R. P. M. practically constant.

When the car ascends a grade or the engine load is otherwise increased it of course becomes necessary to increase the fuel supply to prevent the speed from dropping below the uniform minimum which the operator desires to maintain without further manual effort. As previously stated this is automatically accomplished through the medium of centrifugal governor 38. The R. P. M. of the governor shaft 39 coincides with that of the motor due to the shaft and gear connection between the fan belt pulley 48 and the shaft 39. Consequently as the R. P. M. of shaft 39 decreases by reason of increased load or hill climbing the weights 53 will move inwardly toward the axis of the governor under the action of springs 61. As the bifurcations 59 of lever arms 58 engage pins 60 fixed to the weights 53, the stub shafts 56 and the bell crank levers 55 are moved in a clockwise direction thus elevating piston rod 35 and its associated piston 34. Hydraulic fluid 16 thus dispelled from piston 11, through lines 15 and 14 into piston 10, causes piston 23 to open valve 5 sufficiently to increase the R. P. M. the desired extent. The change in speed is slight and so quickly corrected as to insure a substantially uniform speed. By releasing all pressure from the foot pedal 7, spring 21 pulls the piston 18 rearwardly whereupon hydraulic fluid will be pulled by suction from lines 13 and 14 and cylinder 10 into cylinder 9, piston 23 and its associated rod being simultaneously moved in a rearward direction thus causing valve 5 to be rocked anti-clockwise to closed or idling speed position, This is aided by spring 33.

The capacity of cylinder 11 between the high speed and low speed positions of its piston must be at least equal to but is preferably approximately double that of cylinder 10, depending upon the degree of sensitivity desired, whereas foot accelerator cylinder 9, is slightly larger in operative area or capacity than cylinders 10 and 11 combined, in order to take care of any leakage. The operative area or capacity of the system, including the cylinders and supply lines must always be completely filled with fluid in order to be effective. Piston 34 in cylinder 11 completely controls action of piston 23 in cylinder 10 at all times, except when the operator applies pressure to or relieves pressure from the foot pedal during speed changing operations. Whereas after the desired speed has been attained and while the foot accelerator is kept in fixed position the action of piston 23 is controlled by the pumping action of piston 34, in turn actuated by the governor. The action of fluid in cylinder 9 controls the entire system because spring 21 is the master and strongest spring, that is, much stronger than spring 33. Springs 21 and 33 have no material effect on cylinder 11, that is, their primary purpose is to control cylinder 10 only. It will of course be understood that by increasing the size of cylinder 11 and its piston 34, the sensitiveness of the system can be correspondingly increased, that is, the range of R. P. M. variation can thus be reduced to the desired minimum. Should slight seepage occur the only affect on operation would be a slight change in the position of accelerator 7 and piston 18, both moving rearwardly to a slight extent. No bleeders are necessary as all lines and cylinders are arranged in a slightly inclined position to the horizontal in order that when shut off valve 17 is opened hydraulic fluid will flow by gravity to the cylinders.

The forces exerted by hydraulic fluid against pistons 34 and 23 do not materially affect the action in cylinder 11 as the springs 61 are very much stronger than spring 33, spring 33 being weaker than springs 61 and 21 is immediately affected by the action of pistons 18 and 34.

A conventional choke valve 62 is operated by a handle or knob 63 through the medium of rods 64 and 65, for controlling the admission of air to the carburetor 2.

Having thus described my invention, what I claim is:

1. In a speed control mechanism for internal combustion engines having a throttle valve in the combustible mixture outlet of a carburetor, a shaft controlled by the speed of the motor, a throttle valve cylinder having a piston operatively connected to said valve, a foot accelerator, a master cylinder having a piston opera-

tively connected to said foot accelerator, a centrifugal governor having a shaft operatively connected with the said first mentioned shaft, a governor cylinder and piston and piston rod therefor, means connecting said piston rod with the governor shaft for actuating said governor piston, a supply tank for a relatively non-compressible fluid, a main and a branch supply pipe for supplying fluid from said tank to said master cylinder and to said throttle valve cylinder respectively, and another branch connected to said main supply pipe and said master cylinder for supplying fluid to said governor cylinder.

2. In a speed control mechanism for internal combustion engines having a throttle valve in the combustible mixture outlet of a carburetor, a shaft controlled by the speed of the motor, a throttle valve cylinder having a piston operatively connected to said valve, a foot accelerator, a master cylinder having a piston operatively connected to said foot accelerator, a centrifugal governor having a shaft operatively connected with said first mentioned shaft, a governor cylinder and piston and piston rod therefor, means connecting said piston rod with the governor shaft for actuating said governor piston, a supply tank for a relatively non-compressible fluid, a main and a branch supply pipe for supplying fluid by gravity from said tank to said master cylinder and to said throttle valve cylinder respectively, and another branch connected to said main supply pipe between said first mentioned branch and said master cylinder for supplying fluid by gravity to said governor cylinder.

3. In a speed control mechanism for internal combustion engines having a throttle valve in the combustible mixture outlet of a carburetor, a shaft controlled by the speed of the motor, a throttle valve cylinder having a piston operatively connected to said valve, a foot accelerator, a master cylinder having a piston operatively connected to said foot accelerator, a centrifugal governor having a shaft operatively connected with said first mentioned shaft, a governor cylinder and piston and piston rod therefor, means connecting said piston rod with the governor shaft for actuating said governor piston, a supply tank for a relatively non-compressible fluid, a main and a branch supply pipe for supplying fluid from said tank to said master cylinder and to said throttle valve cylinder respectively, and another branch connected to said main supply pipe between said first mentioned branch and said master cylinder for supplying fluid to said governor cylinder, the operative capacity of said master cylinder being approximately equal to the operative capacity of the remaining cylinders.

4. In a speed control mechanism for internal combustion engines having a throttle valve in the combustible mixture outlet of the carburetor, a container for a relatively non-compressible fluid, a foot accelerator, a pair of oppositely disposed cylinders and pistons therefor, one of said cylinders having a greater operative capacity than the other, a supply pipe for supplying fluid from said container to said cylinders, the piston of said smaller cylinder being operatively connected to the throttle valve, the piston of larger cylinder being operatively connected to the foot accelerator, whereby forward movement of the accelerator forces fluid from said larger cylinder to said smaller cylinder to cause said throttle valve to open, a third cylinder connected to said supply pipe intermediate the connections of the latter with said first two mentioned cylinders, a centrifugal governor and shaft therefor controlled by the speed of the automobile and operatively connected with the piston of said third cylinder for drawing fluid from the smaller of said first two mentioned cylinders when the engine speed increases and permitting the piston of said smaller cylinder to move the throttle valve toward closed position.

5. In a speed control mechanism for internal combustion engines having a throttle valve in the combustible mixture outlet of the carburetor, a container for a relatively non-compressible fluid, a foot accelerator, a pair of oppositely disposed cylinders and pistons therefor, one of said cylinders having a greater operative capacity than the other, a supply pipe for supplying fluid from said container to said cylinders, the piston of said smaller cylinder being operatively connected to the throttle valve, the piston of said larger cylinder being operatively connected to the foot accelerator, whereby forward movement of the accelerator forces fluid from said larger cylinder to said smaller cylinder to cause said throttle valve to open, a third cylinder connected to said supply pipe intermediate the connections of the latter with said first two mentioned cylinders, a centrifugal governor and shaft therefor controlled by the speed of the automobile and operatively connected with the piston of said third cylinder for drawing fluid from the smaller of said first two mentioned cylinders when the engine speed increases and permitting the piston of said smaller cylinder to move the throttle valve toward closed position, the operative capacity of said larger cylinder being greater than that of the remaining cylinders.

6. In a speed control mechanism for internal combustion engines having a throttle valve in the combustible mixture outlet of the carburetor, a container for a relatively non-compressible fluid, a foot accelerator, a pair of oppositely disposed cylinders and pistons therefor, one of said cylinders having a greater operative capacity than the other, a supply pipe for supplying fluid from said container to said cylinders, the piston of said smaller cylinder being operatively connected to the throttle valve, the piston of larger cylinder being operatively connected to the foot accelerator, whereby forward movement of the accelerator forces fluid from said larger cylinder to said smaller cylinder to cause said throttle valve to open and the engine to operate at desired speed, a third cylinder connected to said supply pipe, governing means controlled by the speed of the motor adapted to actuate the piston of said third cylinder for drawing fluid from the smaller of said first two mentioned cylinders when the engine speed increases beyond the desired maximum and permitting the piston of the cylinder of smaller capacity to move the throttle valve toward closed position.

7. In a speed control mechanism for internal combustion engines having a throttle valve in the combustible mixture outlet of the carburetor, a foot accelerator, a pair of cylinders and pistons therefor, one of said cylinders having a greater operative capacity than the other, a source of supply for supplying a relatively non-compressible fluid to said cylinders, the piston of said smaller cylinder being operatively connected to said throttle valve, the piston of said larger cylinder being operatively connected to the foot accelerator, whereby movement of the accelerator forces fluid from said larger cylinder to said smaller cylinder to cause said throttle valve to

open and the engine to operate at desired speed, a third cylinder connected to said source of fluid supply, governing means controlled by the speed of the motor adapted to actuate the piston of said third cylinder for drawing fluid from the smaller of said first two mentioned cylinders when the engine speed increases beyond the desired maximum, thus permitting the piston of said smaller cylinder to move the throttle valve toward closed position.

8. In a speed control for internal combustion engines having a throttle valve in the combustion mixture outlet of a carburetor, a foot accelerator, a master cylinder having a piston operatively connected to the foot accelerator, a fluid system connected to the master cylinder for operating the throttle valve, and a centrifugal governor operated by the engine and operating a piston in said fluid system maintaining the throttle valve in a position to maintain the speed set in the master cylinder previously set by the accelerator, regardless of the load on the engine.

9. In a speed control for internal combustion engines having a throttle valve in the combustion mixture outlet of a carburetor, a foot accelerator, a master cylinder having a piston operatively connected to the foot accelerator, a fluid system connected to the master cylinder and operating a piston for operating the throttle valve, a centrifugal governor operated by the engine, and a piston in said fluid system operated by the governor for maintaining the speed set in the master cylinder by the accelerator, regardless of the load on the engine.

CHARLES HOLT.