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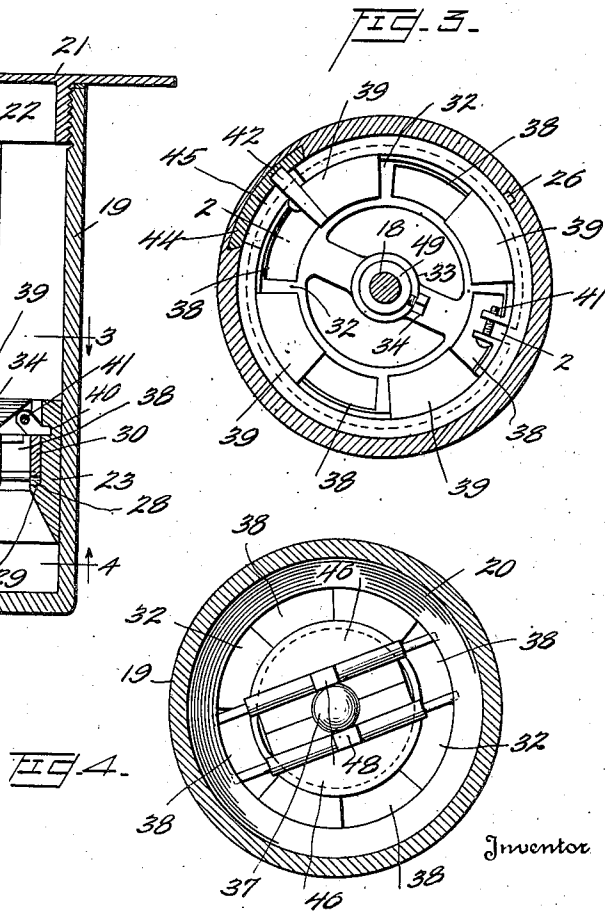
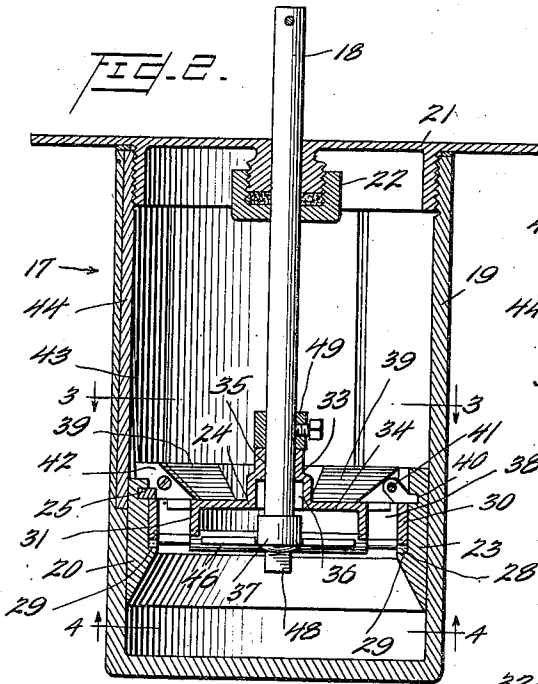
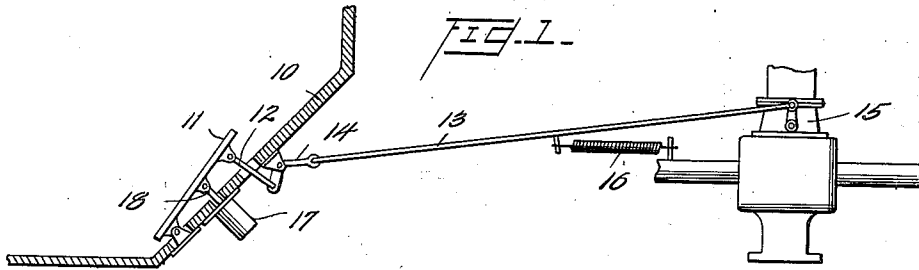
E. M. HINTON

2,104,649

ACCELERATOR GOVERNOR

Filed June 13, 1936

2 Sheets-Sheet 1



Inventor
Edward M. Hinton,
By Watson, Coit, Moore
& Gindler Attorneys

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2 Sheets-Sheet 2

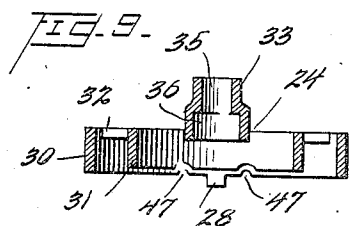
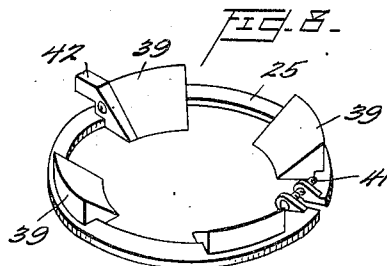
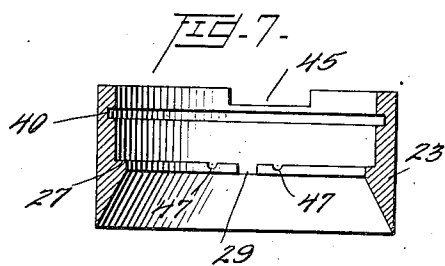
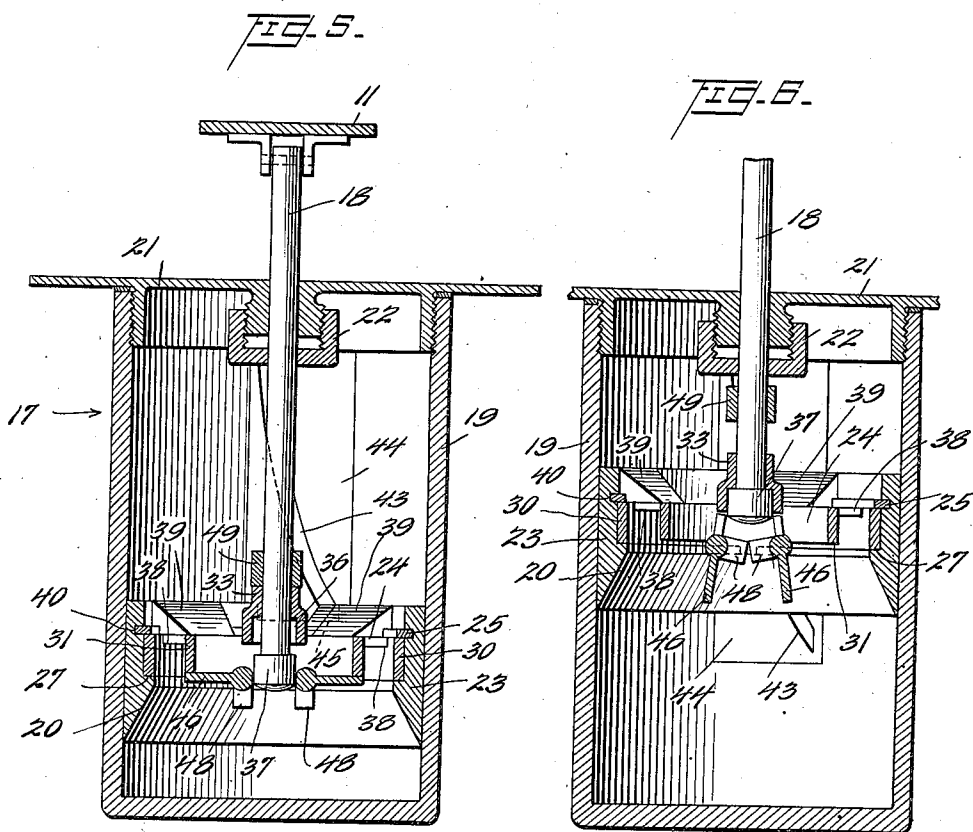


FIG. 10. Inventor
Edward M. Hinton
By Watson, Coit, Morse & Grindle
Attorney

UNITED STATES PATENT OFFICE

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ACCELERATOR GOVERNOR

Edward Martin Hinton, Drexel Hill, Pa.

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14 Claims. (Cl. 123-98)

This invention relates to internal combustion engines, and more particularly to devices for use in connection therewith for controlling the rate of fuel feed thereto, in order to permit such rate to be increased with the maximum speed at which the engine is capable of efficiently utilizing the fuel, while at the same time preventing the rate of feed from being increased so quickly as to cause choking of the engine, due to an oversupply of fuel, or an inefficient or wasteful use of fuel.

As is well-known, internal combustion engines, and particularly those adapted for driving motor vehicles, aircraft, and the like, wherein the fuel valves are manually controlled, are sensitive to an oversupply of fuel caused by the operator opening the throttle valve too rapidly at lower speeds. It frequently happens, especially when the vehicle is in the hands of a more or less inexperienced operator, that a too rapid opening of the throttle will cause the engine to choke and stop, or to "buck" by reason of the oversupply of fuel. This occurrence is not only annoying but wasteful, and may occasionally be exceedingly dangerous, as when the vehicle is on or approaching a grade crossing or when, for any reason a rapid but sure acceleration of speed is required.

By means of the present invention, the throttle valve may be so controlled that it will be impossible for the operator to open the throttle more rapidly than the engine is able to utilize the increasing fuel supply. On the other hand, the throttle may be opened at the optimum rate for accelerating the vehicle, i. e., at such a rate as to secure the maximum acceleration of the vehicle without risk of choking the engine, and without waste of fuel. Other attendant advantages will immediately be apparent, such as avoidance of the introduction of unburned fuel into the lubricating system, lessening of the tendency to the accumulation of carbon deposits in the cylinders, lessening of wear and tear on the moving parts due to jerky or uneven operation, and so forth. Other and further objects, features and advantages will be apparent from the description which follows, taken in connection with the accompanying drawings, in which

Fig. 1 is a schematic illustration of one mode in which the present invention may be applied to a motor vehicle;

Fig. 2 is a vertical section on line 2-2 of Fig. 3 of a control device constructed in accordance with the present invention;

Fig. 3 is a horizontal section on line 3-3 of Fig. 2;

Fig. 4 is a horizontal section on line 4-4 of Fig. 2;

Fig. 5 is a vertical section in a plane perpendicular to that of Fig. 2, showing the device as it appears during acceleration;

Fig. 6 is a view similar to Fig. 5, but showing the device during deceleration; and

Figs. 7, 8, 9, and 10 are detailed views of certain of the parts of the device of the foregoing figures.

Referring to Fig. 1, the numeral 10 designates the floor of the operator's compartment of a motor vehicle. Pivotaly mounted on the floor board is the usual accelerator pedal 11, which is connected, by means of the links 12 and 13, and bell crank 14, with the throttle valve 15. The throttle valve 15 and pedal 11 are normally biased to closed throttle position by means of a spring 16. A control device according to the present invention is indicated at 17, being secured to the underside of the floor board 10 by any suitable means. The piston rod 18 of the device 17 may be secured to the underside of the pedal 11 by any suitable means making provision for converting the slightly arcuate motion of the latter to rectilinear motion of the piston rod.

The control device 17, in its preferred form, comprises a cylinder 19 and piston 20, the latter being connected, by means of the piston rod 18, to partake of and control the movements of the accelerator pedal 11. The cylinder 19 is adapted to contain any suitable fluid, such as air or a liquid of any desirable viscosity, and is closed at the top by a cylinder head 21, provided with a gland 22 in which the piston rod 18 is slidably mounted. The piston 20 comprises an annular wall member 23, illustrated in Fig. 7, a fixed valve ring 24, illustrated in Fig. 9, and a rotary valve ring 25, seen in Fig. 8. The wall member 23 fits closely the inner surface of the cylinder 19, and is keyed thereto, as at 26 (Fig. 3) to prevent relative rotation therebetween. The fixed valve ring 24 fits closely within the wall member 23, and rests upon an annular shoulder 27 formed on the latter. Rotation of the fixed valve ring is prevented by the lugs 28 which are received in recesses 29 formed in the shoulder 27.

The fixed valve ring 24 comprises an outer flange 30, an inner flange 31, connected thereto by web portions 32, and a hub 33 connected to flange 31 by a spider 34 (Fig. 3). The hub 33 is formed with a constricted portion 35 adapted to slidably engage the piston rod 18 and an en-

larged portion 36 adapted to receive an enlarged head 37 formed on the end of the piston rod. As may be seen in Fig. 3, the webs 32 are spaced apart to form a series of apertures 38 in the fixed valve ring 24.

The rotary valve ring 25 is provided with spaced closure members 39, and is adapted to be expanded into an annular groove 40 in the wall member 23 by means of an expansion screw 41. The relation of the closures 39 to the apertures 38 of the fixed valve ring is such that each closure member is adapted to cover completely one of the apertures 38. Secured to one of the closure members 39 is a cam follower 42 adapted to cooperate with a cam groove 43 formed in the cylinder wall. The cam groove 43 is preferably formed in a removable portion of the cylinder wall designated by the numeral 44, in order that the characteristics of the device may be varied simply by removing the cylinder wall insert 44 and replacing it with another having a cam groove of any desired shape.

It is intended that the cam groove 43 shall be formed in accordance with the previously determined characteristics of the particular engine, so as to provide for maximum acceleration at all speeds. In the ordinary case the groove 43 will be in the nature of a helix, but curving toward the horizontal in its lower portions. For convenient reference, the varying rate, determined by the characteristics of the particular engine, at which the throttle should be opened in order to provide for maximum acceleration at all engine speeds will be hereinafter referred to as the "curve of acceleration" of the engine.

The wall member 23 is provided with an elongated recess 45 within which the cam follower 42 is adapted to oscillate in accordance with the curvature of the cam groove 43. The total curvature of the latter will ordinarily be approximately equal to the width of the apertures 38, and the parts are assembled in such relation that when the piston is in its uppermost position the rotary cam ring 25 will occupy a position wherein each of the closure members 39 will almost completely cover one of the apertures 38, while, on the other hand, when the piston is in its lowermost position the valve ring 25 will have been rotated to a position wherein the apertures 38 are substantially or entirely unobstructed. The extent of obstruction of the apertures 38 at any and all vertical positions of the piston is determined by the conformation of the cam groove 43.

The central opening of the fixed valve ring 24 is adapted to be closed, upon the down stroke of the piston, by a butterfly valve comprising vanes 46 (Fig. 10) pivotally mounted in bearings 47 formed between the outer flange 30 of the fixed ring 24 and the shoulder 27 of the wall member 23. Each of the vanes 46 is provided with a dog 48 for engagement by the head 37 of the piston rod 18 at the beginning of the down stroke of the latter. The piston rod 18 is also provided with a collar 49 for engagement with the hub 33 upon the down stroke of the piston rod. Thus the piston rod 18 has a short initial movement downward before the collar 49 engages the hub 33, after which further movement of the piston rod will result in a corresponding movement of the piston 20.

When the piston rod starts upward, the piston will remain stationary until the head 37 of the piston rod has been withdrawn from between the dogs 48, releasing the vanes 46, at which time

the head 37 engages the hub 33 to move the piston upwardly.

The operation of the device will be apparent from the foregoing description. The cylinder being filled with any suitable fluid, and the piston being in its uppermost position, pressure of the operator's foot upon the pedal 11 will cause the piston rod 18 to move downwardly. The head 37 will engage the dogs 48 of the vanes 46 and succeeding downward motion of the rod 18 will result in swinging the vanes 46 into horizontal position as illustrated in Fig. 5, thus closing the central opening of the fixed valve ring 24. The collar 49 will then engage the hub 33 and cause the piston to move downwardly. The downward movement of the piston is retarded by the pressure of the fluid beneath, which may only escape through the apertures 38. Since the latter are almost entirely closed at the beginning of the down stroke, the first part of the down stroke will necessarily be slow. As the piston moves downward the obstruction of the apertures 38 is gradually lessened by the rotation of the ring 25 in accordance with the movements of the cam follower 42 in the cam groove 43. Accordingly, the downward movement of the piston may be accomplished with increasing speed, the latter part of the movement being relatively unobstructed. When the pressure upon the foot pedal 11 is removed or lightened, the piston rod 18 will move upwardly, releasing the vanes 46, which will drop into substantially vertical position thus opening the central aperture of the fixed valve ring 30. Thus the upward movement of the piston is substantially unimpeded and will be accomplished rapidly.

By virtue of the control thus imposed upon the movements of the accelerator pedal 11, it will be impossible for the throttle to be moved abruptly from closed to wide open position. When the throttle is almost or entirely closed it may be opened slowly at first but with increasing speed, thus avoiding choking of the engine and waste of fuel. After the throttle has been opened to a considerable extent and the vehicle accelerated accordingly, the throttle may be further opened with considerable speed, as the engine is capable of accelerating rapidly at higher speeds.

Although the upward movement of the piston is substantially unobstructed, this movement will require a certain short length of time, which is advantageous in that it prevents such an abrupt deceleration of the engine as to cause a jar when the engine ceases to drive the vehicle and commences to brake.

The terms and expressions employed in the foregoing specification are terms of description and not of limitation, and it is recognized that many variations of the described construction may be made without departing from the scope of the present invention.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:—

1. In a device of the character described, a cylinder having a cam groove formed in the wall thereof, a piston comprising a non-rotatable member provided with apertures therethrough and a rotary member having portions adapted to cover said apertures and having a cam follower adapted to engage in said cam groove, and a piston rod, means associated with said piston and operable by the initial movement of said piston rod to retard the advance of said piston.

2. In a device of the character described, a

cylinder, a piston having a central aperture and circumferential apertures, a piston rod adapted for limited longitudinal movement relative to said piston, and means controlled by the said movements of said piston rod for opening and closing said central aperture and circumferential apertures.

3. In a device of the character described, a cylinder having a removable wall sector, said removable wall sector having a cam groove formed therein, and a piston adapted for reciprocal movement within said cylinder, said piston comprising a non-rotatable member provided with apertures, a member rotatable for closing and opening certain of said apertures, said rotatable member having a cam follower secured thereto for engagement with said cam groove, and separate means associated with said piston for opening and closing another of said apertures.

4. In a device of the character described, a cylinder, a piston adapted for reciprocal movement with said cylinder, a rotary valve associated with said piston, a butterfly valve associated with said piston, means for closing said butterfly valve during the instroke of said piston, and means for opening said rotary valve at a variable rate during the instroke of said piston.

5. In a device for controlling the throttle valve of an internal combustion engine, a cylinder, a piston having apertures therethrough, closures for said apertures, means associated with said piston for opening certain of said apertures at a varying rate in accordance with a predetermined curve of acceleration, upon inward movement of said piston, separate means for closing another of said apertures preceding initial inward movement of said piston and means connecting said piston and said throttle valve.

6. In a device for controlling the throttle valve of an internal combustion engine, a cylinder, a piston having apertures therethrough, closures for said apertures, means associated with said piston for opening certain of said apertures at an increasing rate in accordance with a predetermined curve of acceleration, upon inward movement of said piston, separate means for closing another of said apertures preceding initial inward movement of said piston, and means connecting said piston and said throttle valve.

7. In a device for controlling the throttle valve of an internal combustion engine, a cylinder, a piston having apertures therethrough, closures for said apertures, means associated with said piston for opening certain of said apertures in accordance with a predetermined curve of acceleration, upon inward movement of said piston, separate means for closing another of said apertures preceding initial inward movement of said piston, means for causing rapid outward movement of said piston, and means connecting said piston and said throttle valve.

8. In a device for controlling the throttle valve of an internal combustion engine, a cylinder, a piston having apertures therethrough, closures for said apertures, means associated with said piston for opening certain of said apertures in accordance with a predetermined curve of acceleration, upon inward movement of said piston, separate means for closing another of said apertures preceding initial inward movement of said piston and opening said aperture upon initial outward movement of said piston, means urging said piston toward its outward position,

and means connecting said piston and said throttle valve.

9. In a device for controlling the throttle valve of an internal combustion engine, a cylinder, a piston reciprocally mounted therein, means connecting said piston and said throttle valve, means for applying force to said piston for causing it to advance into said cylinder, and means for controlling the rate of movement of said piston in accordance with a predetermined curve of acceleration.

10. In a device for controlling the throttle valve of an internal combustion engine, a cylinder, a piston reciprocally mounted therein, means connecting said piston and said throttle valve, means for applying force to said piston for causing it to advance into said cylinder, means for controlling the rate of movement of said piston in accordance with a predetermined curve of acceleration, and means for rapidly retracting said piston.

11. In a device for controlling the throttle valve of an internal combustion engine, a cylinder, a piston reciprocally mounted therein, means connecting said piston and said throttle valve, means for applying force to said piston for causing it to advance into said cylinder, and means for controlling the rate of movement of said piston in accordance with a predetermined curve of acceleration, said controlling means including a rotary valve associated with said piston and controlled in accordance with the position of said piston within said cylinder.

12. In a device for controlling the throttle valve of an internal combustion engine, a cylinder having a cam groove formed in the wall thereof, said cam groove being formed in accordance with a predetermined curve of acceleration, a piston comprising a non-rotatable member provided with apertures therethrough and a rotary member having portions adapted to cover said apertures and having a cam follower adapted to engage in said cam groove, and means connecting said piston and said throttle valve.

13. In a device for controlling the throttle valve of an internal combustion engine, a cylinder having a cam groove formed in the wall thereof, said cam groove being formed in accordance with a predetermined curve of acceleration, a piston comprising a non-rotatable member provided with apertures therethrough and a rotary member having portions adapted to cover said apertures and having a cam follower adapted to engage in said cam groove, means for applying force to said piston for movement into said cylinder, means for rapidly retracting said piston, and means connecting said piston and said throttle valve.

14. In a device for controlling the throttle valve of an internal combustion engine, a cylinder having a cam groove formed in the wall thereof, said cam groove being formed in accordance with a predetermined curve of acceleration, a piston comprising a non-rotatable member provided with apertures therethrough and a rotary member having portions adapted to cover said apertures and having a cam follower adapted to engage in said cam groove, a piston rod, means associated with said piston and operable by the initial movement of said piston rod to retard the advance of said piston, and means connecting said piston and said throttle valve.

EDWARD MARTIN HINTON.