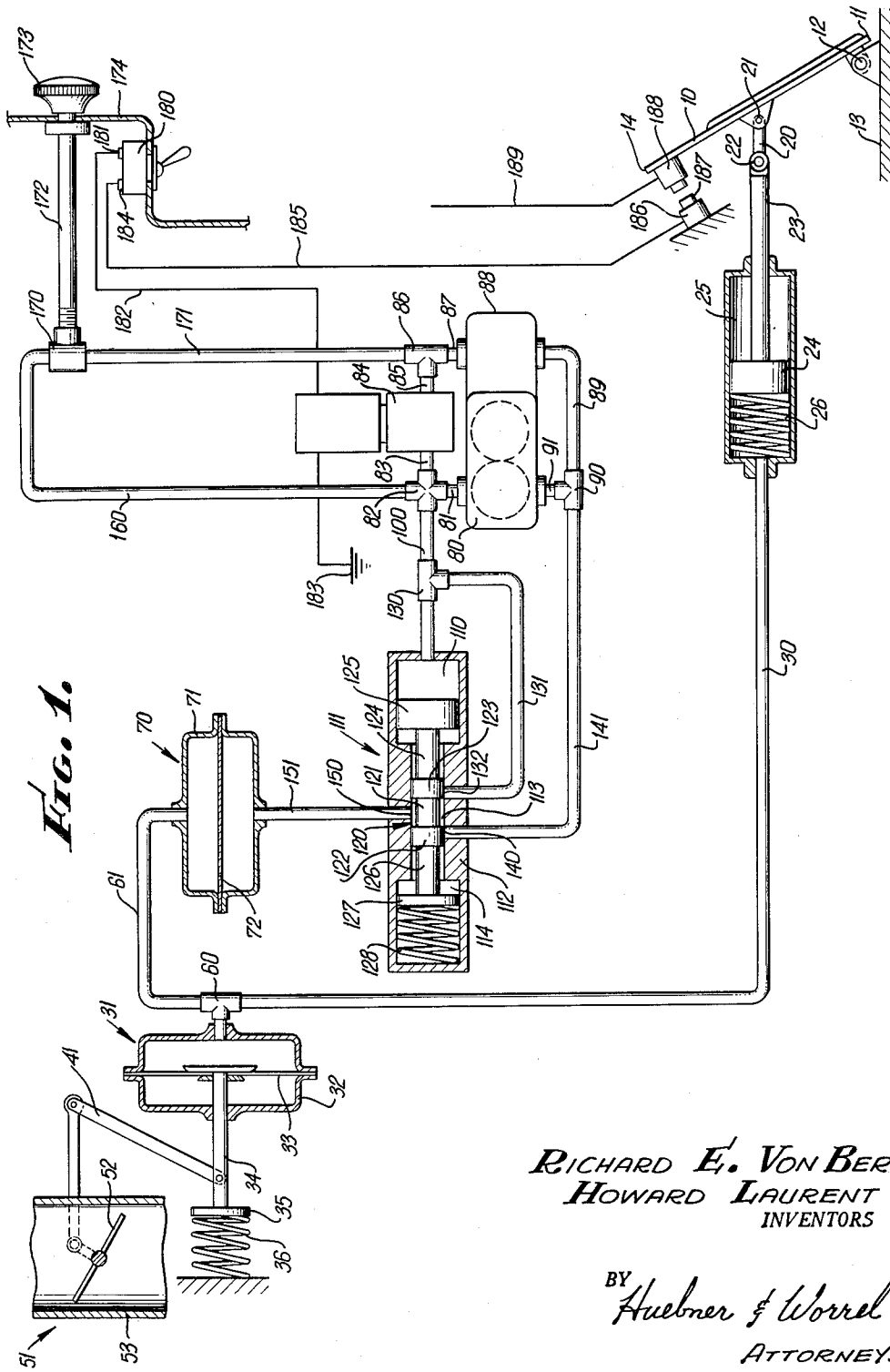


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 INTERNAL COMBUSTION ENGINE
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DEVICE FOR CONTROLLING THE SPEED OF OPERATION OF AN INTERNAL COMBUSTION ENGINE

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This invention relates to a device for controlling the speed of operation of engines, and the device is particularly adaptable for use as a speed control on automobiles having internal combustion engines.

Modern automobiles, with their substantial horsepower and their operative smoothness, are so easy to operate that excessive rates of speed may be quickly, and often unintentionally, attained, and driving them, particularly on cross-country trips through open country and also through populated areas, requires constant attention to the speedometer so that excessive speeds will not be continuous, and so that restrictive speeds will not be constantly exceeded.

The device of the present invention is a relatively trim and compact device that may be readily and inconspicuously mounted on a car's engine, and that will aid automatically in arresting speeds in excess of predetermined limits, but that at the same time will permit the operator to exceed intentionally the predetermined limits whenever excessive speeds are required, such as when passing another car, or in any emergency when faster car operation becomes desirable.

Speed control devices in the form of so-called "governors" are well known, but the limitations of such devices are their lack of flexibility, and the inability to readily adjust or disconnect them to change or eliminate their speed setting to meet varying conditions.

Several other forms of devices designed to accomplish speed control of automobiles are in use, but said devices are often complex, and are most frequently operated by vacuum, by manifold pressure, or by an electrical motor system, all of which means of operation are more elaborate and complex than the hydraulic pressure system which motivates the device of the present invention.

It is an object of the present invention to provide a speed control device for use on internal combustion engines, which may be readily adjusted to various speeds, which will give constant speed control at any selected speed, but which makes provision for attaining speeds in excess of any predetermined speed when such excess speed is desired, and at the same time provides for reducing speed simply by removing or reducing pressure on a throttle.

It is another object of the invention to provide a speed control device of the character described which is operated by a hydraulic power system.

It is still another object of the invention to provide such a device which is simple in construction, compact, and easy to install on a modern internal combustion engine without major alterations in the engine or in the vehicle in which such engine is installed.

A further object of the invention is to provide such a device which is easy and inexpensive to manufacture and assemble, uncomplicated, and simple to operate.

With these and other objects in view, the invention consists of the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings, the figure, which is marker "FIG. 1,"

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is a diagrammatic representation of the device of the present invention.

A throttle accelerator pedal 10 is pivotally mounted adjacent one end 11 thereof by any suitable hinge mounting means, such as 12, to the floor board 13 of an automobile, with its other end 14 standing free to swing above said floor board 13.

A link 20 is operatively, pivotally mounted at one end 21 of said link 20 to said accelerator pedal 10, intermediate the ends of said accelerator pedal 10. It will be understood that said mounting of the link 20 on accelerator pedal 10 need not be substantially at the center of said accelerator pedal 10, as illustrated, but may be conveniently arranged anywhere intermediate the ends of said accelerator pedal 10, or even at or adjacent the end 14 thereof.

Said link 20 is operatively, pivotally connected at its other end 22 thereof to a piston rod 23, which has mounted thereon a piston 24, operating in a master hydraulic cylinder 25. A spring 26 biases said piston 24 outwardly in said cylinder 25.

A hydraulic conduit 30 is mounted on master cylinder 25 at the end thereof opposite the end at which piston rod 23 enters said master cylinder 25. Conduit 30 leads from said master cylinder 25 to a carburetor assembly which consists of a diaphragm assembly 31 having a housing 32, a diaphragm 33 mounted in transverse suspended position therein, and a piston rod 34 operatively connected to said diaphragm 33 at one end thereof, and to an abutting plate or piston 35 mounted externally of said housing 32 at the other end thereof; a spring 36 mounted in abutting position against said piston 35, and biasing it towards said diaphragm housing 32; and a mechanical linkage 41 mounted on said piston rod 34 and connected to a carburetor butterfly valve assembly 51. Carburetor butterfly valve assembly 51 comprises a butterfly valve 52 operatively mounted on a suitable carburetor housing 53.

The lead-in from conduit 30 to diaphragm assembly 31 is made by a suitable take-off connector, which may be in the form of a T 60.

Hydraulic conduit extension 61 of conduit 30 is connected to said T 60 and leads to a power diaphragm assembly 70 which may comprise a housing 71 and a diaphragm 72 mounted in transverse suspended position therein.

The hydraulic system from master cylinder 25 through conduit 30 and T 60 to a diaphragm 33, and through conduit extension 61 to diaphragm 72, is a hydraulically filled and sealed system.

A standard fixed-volume hydraulic pump 80 is driven by the automobile's speedometer cable (not shown), or any other suitable drive means related to vehicle speed, or, in the case of a stationary engine, related to load change. It has a discharge or output outlet 81 leading to a cross-joint 82. From cross-joint 82 conduit 83 leads to by-pass solenoid valve 84. Conduit 85 leads away from by-pass solenoid valve 84 to a T 86, to which in turn is connected conduit 87 leading to a hydraulic fluid reservoir 88. Leading out of reservoir 88 is conduit 89, which runs to a T 90. Conduit 91 leads off T 90 and forms the feed or suction inlet to pump 80, so that a complete hydraulic circuit is formed from pump 80 through by-pass solenoid valve 84 and reservoir 88, back to pump 80.

From cross-joint 82, conduit 100 leads to a chamber 110 of a slide valve assembly 111.

Slide valve assembly 111 has a body housing 112, in which an elongate and narrow chamber 113 is disposed intermediate the ends of said body 112. Chamber 113 has access at one end of said chamber 113 to said chamber 110, which is relatively wider than said chamber

113. Chamber 113 has access at its other end to a chamber 114, which is also relatively wider than said chamber 113.

Mounted in chamber 113 is a slide valve 120, which has a center body 121 of somewhat smaller outside diameter than the inside diameter of chamber 113, and which also has an annular flange 122 mounted at one end of said body 121 and an annular flange 123 mounted at the other end thereof, said annular flanges 122 and 123 being of larger outside diameter than center body 121 and adapted to slidably engage the inside walls of chamber 113.

Mounted on flange 123 and extending externally therefrom is piston rod 124, which extends out of chamber 113 into chamber 110, and to which is connected piston 125, slidably disposed in chamber 110.

Mounted on the opposite side of slide valve 120 on flange 122 and extending externally therefrom is piston rod 126, which extends out of chamber 113 into chamber 114, and to which is connected piston 127, slidably disposed in chamber 114. Also disposed in chamber 114 is spring 128, which biases piston 127 toward said chamber 113. In lieu of spring 128 and piston 127, a bellows or other means of biasing slide valve 120 toward chamber 110 may be provided.

Conduit 100 has mounted, intermediate the ends thereof, a T 130, from which auxiliary conduit 131 leads off to a port 132 in chamber 113, which said port is disposed relative to flange 123 so as to be opened or closed by said flange 123 and the sliding action of valve 120 in the manner hereinafter described.

Leading out of chamber 113 is port 140, which is spaced apart from port 132 and disposed relative to flange 122 so as to be opened or closed by said flange 122 and the sliding action of valve 120 in the manner hereinafter described. Leading from said port 140 is conduit 141, which is connected to T 90 so as to lead from port 140 through T 90 and conduit 39 to reservoir 88.

A port 150 in chamber 113 is spaced apart from said ports 132 and 140, and connected to said port 150 is conduit 151, which leads to power diaphragm assembly 70 at the side of diaphragm 72 opposite the side thereof at which conduit extension 61 is mounted.

From cross-joint 82 conduit 160 leads to a pressure regulating valve 170, and leading from pressure regulating valve 170 to reservoir 88 by way of T 86 and its connection with conduit 87 is conduit 171.

Pressure regulating valve 170 may be connected by suitable operating means, such as rod 172, to a dial knob 173 mounted externally on the dashboard 174 of the automobile in association with a dial (not shown) bearing selective speed indications.

Also mounted on dashboard 174 is an electrical switch 180, to one pole 181 of which is connected line 182 leading to by-pass solenoid valve 84 and then to a ground 183. To the other pole 184 is connected line 185 leading to one side 186 of a foot pedal switch 187, the other side 188 of which is mounted on end 14 of accelerator pedal 10. Side 188 of switch 187 is in turn connected by line 189 to a power source, for instance through the standard ignition switch of the automobile (not shown).

If it is desired to operate the automobile in which the device of the present invention is installed without utilizing the speed control features of the device, the switch 180 is turned to the "Off" position, whereupon, in addition to the by-pass flow hereinafter mentioned, only the part of the device which includes the master cylinder 25, conduit 30, carburetor diaphragm assembly 31, piston rod 34, piston 35, spring 36, linkage 41, carburetor butterfly assembly 51, conduit extension 61, and that part of power diaphragm assembly 70 up to that side of diaphragm 72, will be operable. In such operation, pressure on accelerator pedal 10 will depress it so that master hydraulic cylinder 25 will be acted upon to cause a greater hydraulic pressure flow in conduit 30, thus acti-

vating diaphragm 33, and by movement of piston rod 34 and mechanical linkage 41, opening butterfly valve 52 to permit a larger gasoline flow through the automobile's carburetor. Release of pressure on pedal 10 will similarly reduce the gasoline flow through the carburetor.

While the automobile is being operated without using the speed control device, by-pass solenoid valve 84 will be open, and pump 80 will merely cause the hydraulic fluid to circulate in the by-pass circuit hereinabove described, i.e., through by-pass solenoid valve 84 and reservoir 88 back to pump 80.

When it is desired to operate the automobile with the speed control device of the present invention in operation, the dashboard switch 180 is first placed in the "On" position, and the desired maximum speed is selectively set by means of dial knob 173.

Foot pressure is continually maintained on pedal 10. Foot pedal switch 187 is closed by contact of sides 186 and 188 thereof, thereby completing an electrical circuit and closing by-pass solenoid valve 84 to arrest the by-pass hydraulic circuit hereinabove described from pump 80 through by-pass solenoid valve 84 to reservoir 88 and return to pump 80.

Pump 80 being a fixed volume pump which is operated at vehicle speed by the speedometer cable, the by-pass through the solenoid valve 84 having been interrupted, hydraulic pressure builds up in conduit 160. The selective setting of pressure regulating valve 170 will allow a desired amount of bleed-off of excess hydraulic pressure through conduit 171 back to reservoir 88, and the selected hydraulic pressure in conduit 160 thus will be something less than the full output of pump 80. Consequently, the pressure in conduit 100 and in chamber 110 will also be selectively less than the output of pump 80.

In the drawing, valve 120 is shown in the "neutral" position it would be in if the speed of the automobile and the selected dial knob setting were the same, with ports 132 and 140 closed by flanges 123 and 122 respectively. In this position, pressure resistance will be built up to pedal 10 to indicate that the automobile is traveling at the desired speed.

Let us assume that the automobile then starts up a fairly substantial grade. The automobile will start to slow down, and the output pressure from pump 80 (which as above stated is a fixed volume pump operating at vehicle speed by reason of its connection to the speedometer cable) will drop. There then being a lessened hydraulic pressure in conduit 100 and chamber 110 and against piston 125, slide valve 120, impelled by spring 128, will move to the right, as the device is shown in the drawing, thus moving flange 123 clear of and opening port 132. When port 132 is open, additional hydraulic pressure will be free to flow from pump 80 through port 132 into chamber 113 by way of conduit 100, T 130, and conduit 131, and in turn from chamber 113 through conduit 151 into power diaphragm assembly 70. The distortion outwardly of diaphragm 72 will pass increased hydraulic pressure through conduit 61 into carburetor diaphragm assembly 31, and by distortion of diaphragm 33 and by the operation of mechanical linkage 41, butterfly valve 52 will be further opened to permit a greater gasoline flow and a resultant increase in speed, until the selected speed is again attained.

Let us assume next that the automobile then comes to a fairly substantial downgrade. With the increased speed of the vehicle, the speed of pump 80 will increase, thus increasing the hydraulic pressure output from pump 80 into the system. It will be obvious that it will now be necessary to bleed-off excess hydraulic pressure from the system. The increased hydraulic pressure will build up in chamber 110 of slide valve assembly 111, which additional pressure, applied to piston 125, will cause slide valve 120 to move to the left, opening port 140, while port 132 will be closed by flange 123. When port

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140 is open, excess pressure may flow back from diaphragm 72 through conduit 151, chamber 113 and said port 140 into conduit 141, by which means it will bleed-off back to reservoir 88, until the desired speed is again attained, indicated by back pressure through conduit 30 on pedal 10.

It will be seen that if the driver of the automobile should desire to suddenly exceed his selected speed (for instance, if he should want to pass a slower moving vehicle), he need only press down hard on accelerator pedal 10, causing a heavier hydraulic flow in conduit 30, and overcoming any back pressure from conduit extension 61, consequently opening butterfly valve 52. When the driver then desires to slow down to his previously selected speed, he need only lighten his foot pressure on accelerator pedal 10 until the hydraulic flow from pump 80 through conduit extension 61 is again controlling.

It will be understood that the device of the present invention may be used effectively with stationary engines as well as with engines on automotive vehicles, where the effects on the load changes on the engine are sought to be overcome. It will be seen that is such an application, the throttle elements, which are a pertinent part of the device as applied to automotive vehicles, will no longer be the important elements of the device, and one of the diaphragm assemblies may also be eliminated, so that the hydraulic pump, driven by means related to load changes on the engine, will operate on the sleeve valve assembly herein described, and in turn on one diaphragm assembly and a butterfly valve carburetor directly for attainment of speed control.

Although we have herein shown and described our invention in what we have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of our invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures and devices.

What is claimed is:

1. A device for controlling the speed of operation of an internal combustion engine comprising: an accelerator pedal; a hydraulically filled and sealed conduit system operatively connected to said accelerator pedal so as to be actuated by movement of said accelerator pedal; a first hydraulically actuated diaphragm; a hydraulic fluid line connection between said first diaphragm and said conduit system; a carburetor butterfly valve operatively connected to said first diaphragm and disposed so that increased pressure on said accelerator pedal will increase pressure on said first diaphragm and move said carburetor butterfly valve toward open position; a hydraulic pump; a slide valve assembly; a hydraulic fluid line connection between said slide valve assembly and said pump; and a second hydraulically actuated diaphragm operatively connected to said slide valve assembly, and also operatively connected to said first diaphragm and said conduit system so that increased speed of operation of said pump will decrease pressure on said second diaphragm, and in turn, on said first diaphragm, and move said carburetor butterfly valve toward closed position.

2. A device for controlling the speed of operation of an internal combustion engine as defined in claim 1, wherein the operative connection between said accelerator pedal and said conduit system is a piston and cylinder assembly.

3. A device for controlling the speed of operation of an internal combustion engine as defined in claim 1, wherein said pump is driven by drive means related to vehicle speed.

4. A device for controlling the speed of operation of an internal combustion engine as defined in claim 1, including an adjustable pressure regulating valve between said pump and said slide valve assembly.

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5. A device for controlling the speed of operation of an internal combustion engine as defined in claim 1, including a by-pass solenoid valve mounted on the hydraulic fluid line connection between said pump and said slide valve assembly and disposed so as to interrupt hydraulic pressure flow between said pump and said slide valve assembly and return said flow to said pump; and means for selectively opening and closing said by-pass solenoid valve.

6. A hydraulic speed control device for an automotive vehicle comprising: a throttle; a hydraulic conduit system operatively connected to said throttle; a first hydraulically actuated diaphragm; a hydraulic fluid line connection between said first diaphragm and said conduit system; a carburetor butterfly valve operatively connected to said first diaphragm and disposed so that increased pressure on said accelerator pedal will increase pressure on said first diaphragm and move said carburetor butterfly valve toward open position; a hydraulic pump driven by the speedometer cable of an automobile; a slide valve housing; a first piston chamber at one end of said housing; a hydraulic conduit leading from said pump to said first piston chamber; a first piston slidably disposed in said first piston chamber; a narrow, elongate chamber intermediate the ends of said housing and open at one end of said elongate chamber to said first piston chamber; a slide valve disposed in said elongate chamber; a first annular flange at one end of said slide valve; a first piston rod connecting said first piston and said end of the slide valve; a second annular flange at the other end of said slide valve; a second piston chamber at the other end of said housing; a second piston slidably disposed in said second piston chamber; a second piston rod connecting said second piston and the other end of said slide valve; a spring disposed in said second piston chamber in abutment with said second piston so as to bias said slide valve toward said first piston chamber; an outlet port in said elongate chamber disposed between said first and second flanges; a hydraulic conduit extension connected to said outlet port; a second hydraulically actuated diaphragm; a hydraulic fluid line connection between said second diaphragm and said conduit extension; and a hydraulic fluid line connection between said second diaphragm and said first diaphragm.

7. A hydraulic speed control device for an automotive vehicle as defined in claim 6, including an auxiliary conduit operatively connected to the conduit leading from the pump to said first piston chamber; and an inlet port in said elongate chamber to which said auxiliary conduit is connected.

8. A hydraulic speed control device for an automotive vehicle as defined in claim 7, including a bleed-off port in said elongate chamber; and a bleed-off conduit from said bleed-off port to said pump and to said reservoir.

9. A hydraulic speed control device for an automotive vehicle as defined in claim 8, wherein said inlet port is in spaced relationship to said first flange of said slide valve, and said bleed-off port is in spaced relationship to said second flange of said slide valve, so as to be alternately opened and closed by said flanges respectively.

10. A hydraulic speed control device for an automotive vehicle comprising: a throttle; a hydraulic conduit system operatively connected to said throttle; a first hydraulically actuated diaphragm; a hydraulic fluid line connection between said first diaphragm and said conduit system; a carburetor flow valve operatively connected to said first diaphragm and disposed so that increased pressure on said throttle will increase pressure on said first diaphragm and move said flow valve toward open position; a hydraulic pump driven by drive means related to the vehicular speed of an automobile; a slide valve assembly; a hydraulic fluid line connection between said slide valve assembly and said pump; a second hydraulically actuated diaphragm operatively connected to said slide valve assembly, and also operatively connected to

said first diaphragm and said conduit system so that increased speed of operation of said pump will decrease pressure on said second diaphragm, and in turn, on said first diaphragm, and move said flow valve toward closed position; an adjustable pressure regulating valve mounted on the hydraulic fluid line connection between said pump and said slide valve assembly; means for manually adjusting said adjustable pressure regulating valve; a hydraulic reservoir; a hydraulic fluid line connection between said reservoir and said pressure regulating valve; a hydraulic fluid line connection between said reservoir and said pump; a by-pass solenoid valve; a first hydraulic fluid line connection between said pump and said solenoid valve; a second hydraulic fluid line connection between said solenoid valve and said reservoir; a first electrical switch mounted on said dashboard; an electric current line connection between said first electric switch and said solenoid valve; a second electric switch disposed so as to be opened and closed by operation of said throttle; an electric current line connection between said first electric switch and said second electric switch; an electric current line connection between said second electric switch and a power source; and means for electrically opening and closing said bypass solenoid valve so as to form a hydraulic bypass flow from said pump through said by-pass solenoid valve to said reservoir and return to said pump when the device is inoperative to control the speed of the automotive vehicle, and so as to close said by-pass solenoid valve and interrupt said by-pass flow when said speed control device is in operation.

11. A hydraulic speed control device for an automotive vehicle comprising: a throttle; a hydraulic conduit system operatively connected to said throttle; a first hydraulically actuated diaphragm; a hydraulic fluid line connection between said first diaphragm and said conduit system; a carburetor butterfly valve operatively connected to said first diaphragm and disposed so that increased pressure on said accelerator pedal will increase pressure on said first diaphragm and move said carburetor butterfly valve toward open position; a hydraulic pump driven by the speedometer cable of an automobile; slide valve assembly; a hydraulic fluid line connection between said slide valve assembly and said pump; a second hydraulically actuated diaphragm operatively connected to said slide valve assembly, and also operatively connected to said first diaphragm and said conduit system so that increased speed of operation of said pump will decrease pressure on said second diaphragm, and in turn, on said first diaphragm, and move said carburetor butterfly valve toward closed position; an adjustable pressure regulating valve mounted on the hydraulic fluid line connection between

said pump and said slide valve assembly; a hydraulic reservoir; a first hydraulic fluid line connection between said reservoir and said pump; and a second hydraulic fluid line connection between said pressure regulating valve and said reservoir.

12. A hydraulic speed control device for an automotive vehicle comprising: a throttle; a hydraulic conduit system operatively connected to said throttle; a first hydraulically actuated diaphragm; a hydraulic fluid line connection between said first diaphragm and said conduit system; a carburetor butterfly valve operatively connected to said first diaphragm and disposed so that increased pressure on said throttle will increase pressure on said first diaphragm and move said carburetor butterfly valve toward open position; a hydraulic pump driven by drive means related to the vehicular speed of an automobile; a slide valve assembly; a hydraulic fluid line connection between said slide valve assembly and said pump; a second hydraulically actuated diaphragm operatively connected to said slide valve assembly and also operatively connected to said first diaphragm and said conduit system so that increased speed of operation of said pump will decrease pressure on said second diaphragm, and in turn, on said first diaphragm, and move said carburetor butterfly valve toward closed position; an adjustable pressure regulating valve mounted on the hydraulic fluid line connection between said pump and said slide valve assembly; a rod mounted on said pressure regulating valve and extending through an opening in a dashboard of an automobile; a dial knob mounted on said rod in association with a dial on said dashboard bearing selective speed indications; a hydraulic reservoir; and hydraulic fluid lines leading from said pressure regulating valve to said reservoir and from said reservoir to said pump so as to feed hydraulic fluid from said reservoir to said pump, and to receive excess hydraulic fluid from said pressure regulating valve.

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