Sept. 11, 1951 N. O. MYKLESTAD 2,567,890

CONTROL DEVICE

Filed Nov. 12, 1949

Fig. 1.

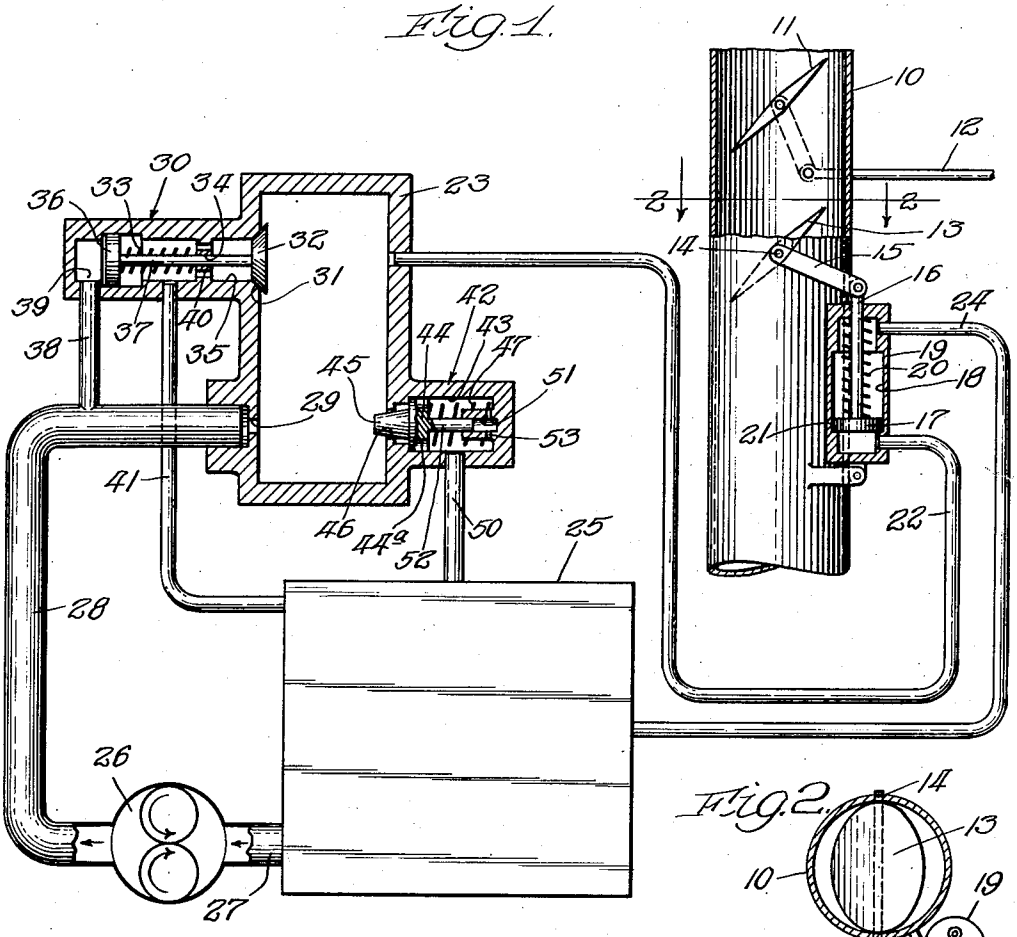
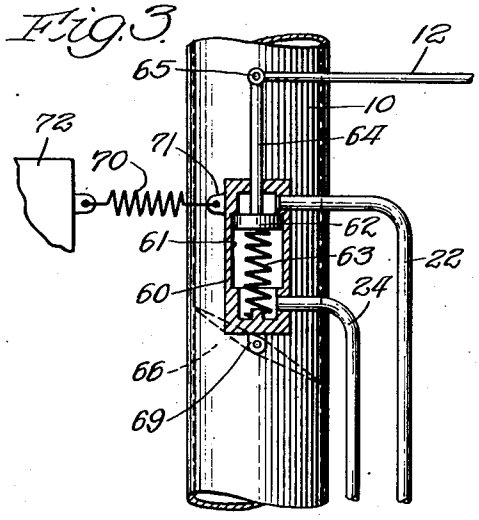


Fig. 2.

Fig. 3.



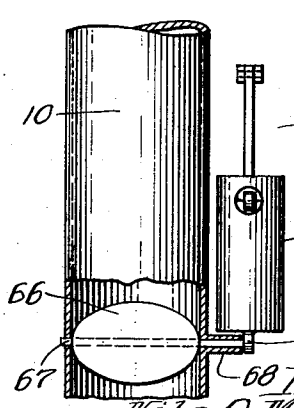


Fig. 4.

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CONTROL DEVICE

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4 Claims. (Cl. 123—103)

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This invention relates to a control device and more particularly to a device for controlling the function and operation of a motor.

It is the general object of this invention to produce a new and improved control device for a motor, particularly for an engine of the internal combustion type.

It is a more specific object of the invention to provide a control device having a pressure producing means driven by the engine and thus responsive to the speeds thereof, and to utilize the varying pressures produced by such means effectively to control functions and operations of the engine.

Another object of the invention is to produce a control device particularly adapted to control the flow of fuel to an internal combustion engine in a manner to prevent excess losses of power and fuel when the engine is operating at low speeds.

Yet another object of the invention is to produce a control device of the type described in the previous paragraph which is wholly automatic in operation and which is capable of regulating fuel delivery to the engine regardless of the manipulation of manual fuel metering devices.

A further object of the invention is to produce a control for the fuel intake passage of an internal combustion engine which includes a valve controlling the passage and to provide means whereby the amount of fuel delivered from the passage to the engine is determined in part by manually operated devices and in part by the automatic operation of the control.

Another object of the invention is to produce a control valve for the fuel intake passage of an internal combustion engine and movable automatically with changes in engine speed to limit the amount of fuel delivered to the engine to the amount the engine can economically use at the particular speed at which it is operating, regardless of the operation of other throttle means by the operator.

Other and further objects of the invention will be clear from the following specification and drawings in which:

Fig. 1. The sectional view, somewhat schematic in character, showing the control device of this invention as applied to a fuel intake passage of an internal combustion engine.

Fig. 2 is a horizontal section along line 2—2 of Fig. 1.

Fig. 3 is a view of the right hand portion of Fig. 1 showing a modified form of construction; and

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Fig. 4 is a view like Fig. 3 taken from a position 90° therefrom.

While the invention is susceptible of various modifications and alternative constructions, it is herein shown and will hereinafter be described in its preferred embodiments. It is not intended, however, that the invention is to be limited thereby to the specific constructions disclosed. On the contrary, it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as defined in the appended claims.

While the control device of this invention may be used to control many of the operations of an engine or vehicle I have, for the purpose of exemplary disclosure, shown the control used as a means for regulating the amount of fuel delivered to an internal combustion engine at various engine speeds and regardless of throttle settings.

In internal combustion engines, and particularly in gasoline engines, the maximum power and efficiency is not necessarily obtained at maximum throttle settings except when the engine is operating at high speed. When the engine is operating at lower speeds too much fuel delivered to the engine has a tendency to choke the engine and reduce the power. In such a situation not only is the power of the engine reduced but fuel is wasted.

The control of this invention regulates the amount of fuel delivered to the engine at any particular speed to the amount required for maximum power or maximum efficiency as the case may be. As used in an automobile engine, for example, the control reduces engine wear and prevents stalling by limiting the amount of fuel delivered to the engine at any particular engine speed. Furthermore, the control allows the driver to obtain maximum acceleration by merely pushing the accelerator to the floorboard, whereupon the control device of this invention will automatically feed the correct amount of fuel to the engine. As engine speed increases the amount of fuel delivered to the engine will be increased by the control. Thus, maximum acceleration can be obtained with maximum efficiency.

Referring now to Figures 1 and 2 of the drawings, I show my control device as associated with the intake passage 10 of a gasoline engine. Normally, the passage 10 is located between the carburetor and the intake manifold of the engine. The passage 10 is equipped with the usual butterfly valve 11 operated by the rod 12, which in turn is operated by a hand or foot throttle in the customary manner. Also located within the

intake passage 10 is a second butterfly valve 13 rotatably mounted on a shaft 14, which shaft may be rocked to operate the valve by means of the connecting bracket 15. The bracket 15 is pivotally secured to one end of rod 16 whose other end is secured to a piston 17 reciprocally mounted in a bore 18 in the cylinder 19. Resilient means in the form of a spring 20 is provided to constantly urge the piston 17 toward the bottom of the bore 18 and against a shoulder portion 21 formed therein to move the valve 13 to closed position. A flexible conduit 22 connects the lower end of the bore 18 with an accumulator tank 23 while the upper end of the bore is connected by means of a flexible conduit 24 to a sump tank 25.

A gear pump 26 is connected to and driven by the engine. The intake side of the gear pump is connected by means of a passage 27 to the sump 25 while the discharge side of the pump is connected by means of a second passage 28 to the accumulator. An orifice 29 is interposed in the passage 28 between the pump and the accumulator.

A relief valve 30 is provided with an opening 31 in communication with the interior of the accumulator 23 with the opening being normally closed by a valve 32 urged towards closed position by a spring 33 having one end bearing against a partition 34 extending across the bore 35 of the relief valve and having its other end bearing against a piston 36 secured to the end of the valve rod 37. A passage 38 connects that portion of the passage 28 intermediate the pump and the orifice 29 with a chamber 39 formed at the left hand end (as seen in Fig. 1) of the relief valve bore. Thus the piston 36 is urged toward movement closing the valve 32 by the spring 33 and is urged towards movement opening the valve by the pressures existing in the passage 28 which latter pressures are of course directly responsive to the speed of the engine. When the valve 32 is opened fluid within the accumulator 23 may flow through the opening 31 and through passage 40 in the partition 34 to connect with a conduit 41 connected to the sump.

Also connected to the accumulator 23 is a metering valve 42 comprising a bore 43 in which a guide piston 44 is reciprocable. The piston is provided with a number of holes 44*a* to permit fluid to flow therethrough. Attached directly to and guided by the piston 44 is a metering pin 45 which extends through an opening 46 in the sidewalls of the accumulator. A spring 47 within the bore 43 serves to urge the piston 44 to the left (as seen in Fig. 1) to move the metering pin to the position shown wherein it substantially, but not completely, closes the opening 46.

The operation of the control device just described is as follows: The usual butterfly valve 11 is set to whatever idling position may be necessary to keep the engine operating under no throttle actuation while the butterfly valve 13 is set to be open slightly more under the same conditions so that the engine is capable of accelerating when the lever associated with the rod 12 is operated. With the engine idling the orifice 29 will pass all the oil delivered by the pump 26 with substantially no build-up in pressure within the passage 28. Similarly the small opening remaining in the opening 46 with the metering pin fully seated, as shown, is also sufficient to return all the oil pumped to the sump. If the throttle is now depressed fully opening the valve 11 the engine will begin to accelerate. However, all of the fuel which could normally pass the valve 11 is not delivered to the engine inasmuch as the valve 13 remains in its partially closed position. Sufficient fuel is delivered to the engine, however, to increase its speed thereby increasing the speed of the pump 26. With the increase in speed of the pump 26 the pressure of fluid within the accumulator 23 also increases, which pressure is delivered by means of the conduit 22 to the lower end of the bore 18 to move the piston 17 upward against the spring 20. Movement of the piston in this direction serves to partially open the valve 13 and allow the engine to accelerate further. Such further acceleration of course increases the speed of the pump and increases the pressure in the accumulator 23. However, as the pressure in the accumulator increases it tends to unseat the metering pin 45, allowing fluid to pass through the opening 46 and into the bore 43 from which it is returned to the sump by means of the passage 50. Fluid in the guide channel 51 at the right hand end of the bore 43, which guides the rod 52 attached to the piston 44, is allowed to escape in the bore by means of the small passages 53. As the engine continues to accelerate the pressure within the accumulator continues to build up until, when the engine has reached full speed, the butterfly valve 13 is in a vertical position and fully opened. The shape of the metering pin, of course, determines the pressure in the accumulator 23 which in turn determines the position of the butterfly valve 13. Thus the pin can be so shaped as to give either the maximum efficiency at any given speed or the maximum power, whichever is desired.

The relief 30 serves as a safety device to prevent excessive pressures from being built up within the accumulator 23 and also serves as a top-speed control device. As the engine accelerates to high speed, the differential pressure across the orifice 29 will cause a substantial rise of pressure within the passage 28, which pressure rise is communciated to the piston 36 through the passage 38 and the chamber 39. When the pressure reaches a point sufficient to overcome the tension of the spring 33 the valve 32 is unseated, thus dumping fluid from within the accumulator to the sump.

The modified form of device shown in Figures 3 and 4 is, so far as the sump, accumulator, relief valve, metering pin, and pump are concerned, constructed in the same manner as the device of Figure 1 and, hence, such parts are not again illustrated and will not again be described. In this embodiment, however, the passages 22 and 24 are connected to a cylinder 60 having a bore 61 therein in which a piston 62 is reciprocal. A spring 63 serves to urge the piston upwardly to the position shown. A rod 64 is connected to the piston and pivotally connected at 65 to the actuating rod 12 which is operated by a hand or foot throttle, as previously described. A butterfly valve 66 is rotatably mounted within the intake passage 10 on a shaft 67 which is mounted in a journal portion 68 formed on the intake passage and to which the lower portion of the cylinder 60 is connected by means of a fitting 69. Thus, with movement to the left and right of the control rod 12, the butterfly valve 66 is rotated within the intake passage with the rod 64 and the cylinder 60 forming a single lever arm to accomplish this motion. A spring 70 is secured to a bracket 71 on the side of the cylinder and to

a stationary part 72 of the engine to maintain the rod and cylinder and, hence, the butterfly valve in the idling position shown. It also serves to return the rod and cylinder to the position shown after they have been pivoted by movement of the control rod 12 to the right.

Inasmuch as the upper portion of the bore 61 is connected to the accumulator by means of the line 22, increase of pressure within the accumulator serves to move the piston 62 downwardly within the cylinder and thus shorten the lever arm formed by the rod and cylinder. Thus, if the rod 12 is moved to the right a predetermined distance, say for half-throttle, the butterfly rod will be partially opened. As the engine speed increases and the piston 62 is moved downwardly, the butterfly valve will be slowly opened further, even though no further rightward movement of the rod 12 occurs. Thus, with the engine idling, full depression of the throttle will not open the butterfly valve fully but only to the position delivering to the engine the maximum quantity of fuel it can use at that speed As engine speed increases pressure is, of course, built up within the accumulator to move the piston 62 downward slowly increasing the opening of the butterfly valve. The opening of the valve thus regulated by the piston is such as to deliver to the engine the maximum quantity of fuel it can use at each engine speed.

I claim:

1. A fuel control for an internal combustion engine having a fuel intake passage comprising a valve in said passage for metering the flow of fuel therethrough, an oil pump driven by the engine, an accumulator, a conduit having an orifice and connecting the discharge side of the pump to the accumulator, a sump connected to the intake side of the pump, a passage connecting the accumulator to the sump, a metering pin in the last named passage and biased toward movement closing the same, a relief valve having a valve chamber connected to the sump, an opening connecting said chamber to the accumulator, a valve member normally closing the opening, a bore in the relief valve, a piston slidable in the bore and connected to the valve member, spring means biasing the valve member to a position closing the opening, a passage connecting the bore with the portion of the conduit between the pump and the orifice, a cylinder, a piston in the cylinder, means biasing the piston toward movement in one direction, a passage connecting the accumulator to the cylinder for urging the last named piston toward movement in the other direction, and means connecting the first mentioned valve to the last named piston for movement therewith.

2. A fuel control for an internal combustion engine having a fuel intake passage comprising a valve in said passage for metering the flow of fuel therethrough, a lever system for moving the valve, manual means for operating the lever system, an oil pump driven by the engine, an accumulator connected to the discharge side of the pump, a sump connected to the intake side of the pump, a passage connecting the accumulator to the sump, a metering pin in the last named passage and biased toward movement closing the same, a piston and cylinder device, a member connected to the piston and extending from the cylinder and forming with the cylinder a part of said lever system, means biasing the piston toward movement in one direction, a passage connecting the accumulator to the cylinder for urging the piston toward movement in the other direction, movement of said member with movement of said piston being adapted to operate said lever system independent of the manual means to move the valve.

3. A fuel control for an internal combustion engine having a fuel intake passage comprising a pressure producing device driven by the engine, an accumulator, a conduit having an orifice and connecting the pump to the accumulator, a valve in said passage for metering the flow of fuel therethrough and opening in response to pressure in said accumulator, means responsive to the pressure in the accumulator for limiting the pressure therein, and means operating in response to a predetermined pressure in the portion of the conduit between the pressure producing means and the orifice to dump the pressure in the accumulator.

4. In combination with an engine having a control device, means for operating the control comprising a pressure producing device driven by the engine, an accumulator, a conduit having an orifice and connecting the pressure producing device to the accumulator, a sump connected to the pressure producing device, a passage connecting the accumulator to the sump, a metering pin in the passage and biased toward movement closing the same, a relief valve having a valve chamber connected to the sump, an opening connecting said chamber to the accumulator, a valve member normally closing the opening, a bore in the relief valve, a piston slidable in the bore and connected to the valve member, means biasing the valve member to a position closing the opening, a passage connecting the bore with the portion of the conduit between the pressure producing device and the orifice, pressure responsive means for actuating the control device, and a passage connecting the pressure responsive means with the accumulator.

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