April 4, 1961 F. BARFOD 2,977,949

MIXTURE CONTROL

Filed June 24, 1959 3 Sheets-Sheet 1

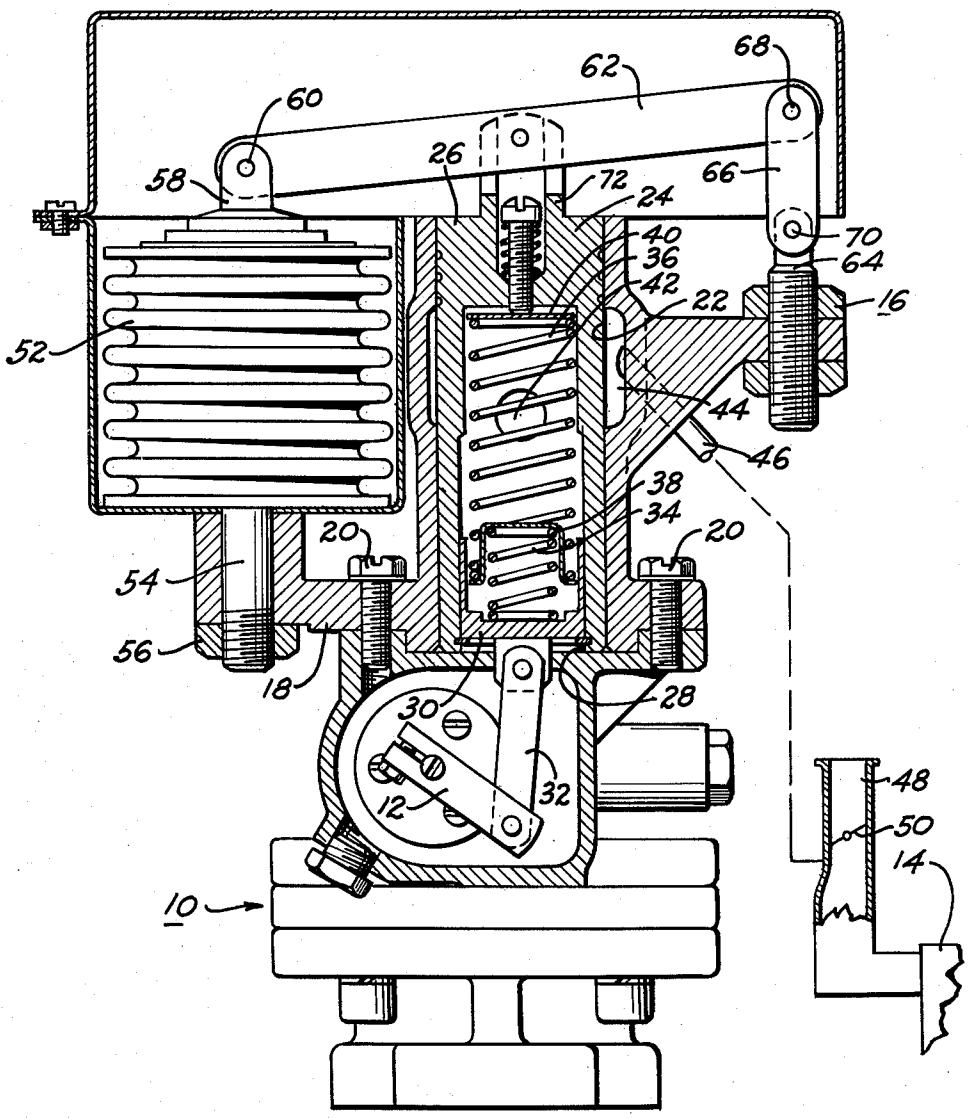


FIG. 1

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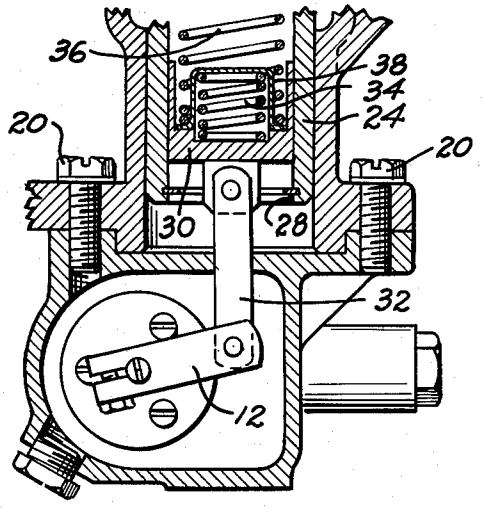
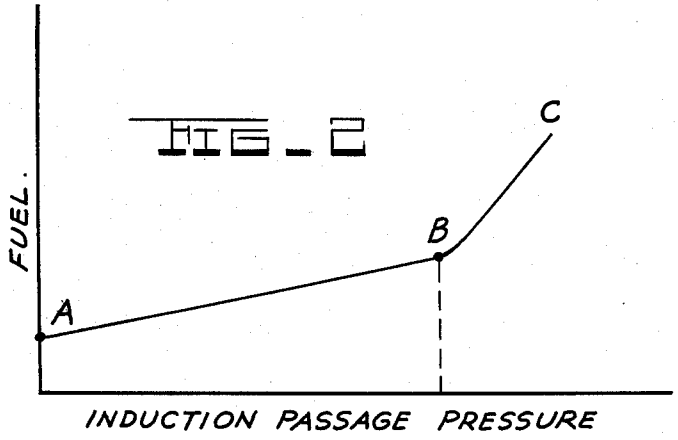


FIG. 3



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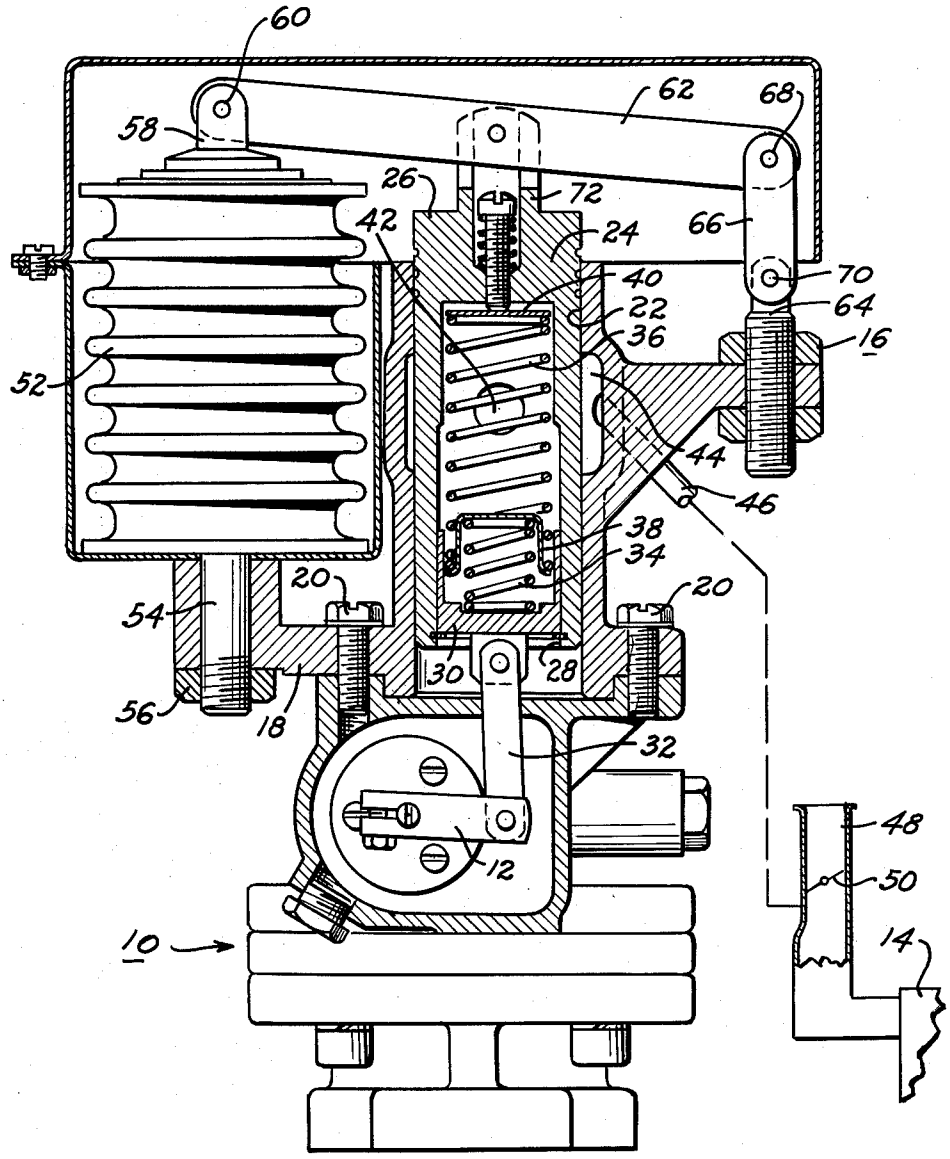


FIG_4

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MIXTURE CONTROL

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3 Claims. (Cl. 123—140)

The present invention relates generally to a mixture control for an internal combustion engine fuel supply system and more particularly to mixture control for regulating the fuel supply to an engine as a function of atmospheric pressure and induction passage pressure.

It is an object of the present invention to provide in a mixture control power enrichment means which is simple in construction and reliable and accurate in operation.

It is another object of the present invention to provide in a mixture control integrated atmospheric pressure and induction passage pressure responsive controls wherein the atmospheric pressure control is effective throughout the operating range of the mixture control to modulate fuel flow with changes in atmospheric pressure.

These and other objects of the invention will become readily apparent from the following description taken in connection with the accompanying drawings wherein:

Figure 1 is a sectional view of a mixture control embodying the present invention;

Figure 2 is a graph of the operation of the mixture control shown in Figure 1; and

Figures 3 and 4 are partial views of Figure 1 showing the rearrangement of parts under different operating conditions.

Referring now to the drawings, numeral 10 designates a fuel injection device which may be of the type shown in my copending application Serial No. 604,483, filed August 16, 1956. A lever 12 is connected to the fuel injection device 10 for varying the quantity of fuel to the engine 14.

The mixture control is designated generally by the numeral 16 and includes a housing 18 which is bolted to the fuel injection device 10 by suitable bolts 20. Housing 18 is provided with a cylindrical bore 22 in which is reciprocably mounted a hollow cylinder 24. Cylinder 24 is closed at end 26 and open at its opposite end 28. A cup-shaped piston 30 is reciprocably disposed in cylinder 24 and is connected to lever 12 by a rod 32. Piston 30 is urged toward its lower extremal position by first and second springs designated respectively 34 and 36 disposed in cylinder 24. The first spring 34 reacts against a spring retainer 38 and the end wall of piston 30. The second spring 36 reacts against an adjustable abutment 40 mounted adjacent the closed end 26 of cylinder 24 and spring retainer 38. A port 42 connects the interior of cylinder 24 with an annular chamber 44 formed in bore 22. Chamber 44 is connected by means of conduit 46 with the induction passage 48 of engine 14 downstream or posterior to throttle valve 50.

A bellows 52 is secured to housing 18 adjacent cylinder 24 by means of stud 54 and nut 56. Bellows 52 may be evacuated so as to be responsive to ambient or atmospheric pressure and insensitive to temperature; or it may be filled with an inert gas such as nitrogen whereby the bellows will be rendered responsive to both ambient air pressure and ambient air temperature.

A stud 58 projects from one end of bellows 52 and carries a pin 60 which pivotally secures one end of a

lever 62 to the stud. Lever 62 is connected at its other end to an adjustable pivot or fulcrum 64 by an intermediate lever 66 which is pivoted at its ends to lever 62 and fulcrum 64 by pins 68 and 70 respectively. Lever 62 is pivotally connected intermediate its ends to a bifurcated member 72 which projects from the closed end 26 of cylinder 24. Expansion or contraction of bellows 52 in response to changes in atmospheric pressure is transmitted through lever 62 to cause cylinder 24 to reciprocate in bore 22. Figure 1 represents the position of parts at sea level with the induction passage pressure equal to atmospheric pressure. Figure 4 shows the position of parts with bellows 52 expanded to reflect reduction in atmospheric pressure. When the induction passage pressure is reduced a predetermined amount below atmospheric pressure, piston 30 will be moved upwardly in opposition to spring 34 to bring spring retainer 38 into engagement with piston 30 such as is shown in Figure 3. When spring retainer 38 is in engagement with piston 30, spring 34 is rendered ineffective.

In operation the position of lever 12 which controls the amount of fuel supplied by the fuel injection device 10 is determined by the position of piston 30 which is movable within cylinder 24 under the influence of induction passage pressure and which moves with cylinder 24 when said cylinder is reciprocated by movement of bellows 52 through lever 62.

When the engine is operating in the idling range a relatively low induction passage pressure exists and is transmitted to the interior of cylinder 24 whereby piston 30 will be moved to an upper extremal position. In the upper extremal position of piston 30 spring 34 is in its ineffective position and spring 36 is partly compressed. As the throttle 50 is moved toward open position increasing the induction passage pressure piston 30 will move downwardly. Spring 34 is calibrated such that when the induction passage pressure reaches a predetermined value that the force of spring 34 will exceed the pressure differential action on piston 30 and cause the piston to be moved downwardly. The effect of spring 34 is shown graphically in Figure 2 wherein the curve A—B represents the modulation of fuel by the mixture control when only spring 36 is effective. The curve B—C represents the effect of spring 34 at higher induction passage pressures. At the predetermined induction passage pressure designated B in Figure 2, spring 34 commences to be effective and markedly increases the fuel supply to the engine with increase in induction passage pressure to provide a power enrichment mixture.

While only one embodiment of my invention has been described it will be readily apparent to those skilled in the art that changes or arrangement of parts may be made without departing from the spirit of the invention.

I claim:

1. A control for a fuel supply device comprising a bellows responsive to ambient air pressure, a lever fulcrumed at one end and pivotally secured to said bellows at its other end, a cylinder having a closed and an opened end, means pivotally securing said cylinder to said lever intermediate the ends of said lever, a piston reciprocably disposed in said cylinder, means operatively connecting said piston to said device for controlling the fuel supplied thereby, a spring retainer in said cylinder, a pair of springs in said cylinder reacting respectively against the closed end of said cylinder and said retainer and against said retainer and said piston, and means for connecting the interior of said cylinder intermediate the closed end thereof and said piston with a source of pressure lower than atmospheric pressure, said piston being moved into engagement with said retainer when the pressure in said cylinder reaches a predetermined value.

2. A mixture control for a fuel injection device adapted

to supply fuel to an internal combustion engine having an induction passage comprising a housing, a cylinder reciprocably mounted in said housing, a bellows responsive to ambient air pressure mounted on said housing, a lever fulcrumed at one end and connected to said bellows and cylinder respectively at its other end and intermediate its ends, means adapted to connect the interior of said cylinder to said induction passage, a piston in said cylinder responsive to changes in induction passage pressure, a spring retainer in said cylinder, a first spring in said cylinder reacting between said retainer and said piston, said piston being movable into engagement with said retainer at a predetermined induction passage pressure, a second spring in said cylinder reacting between a portion of said cylinder and said retainer adapted to oppose further movement of said piston after said piston engages said retainer, and means adapted to connect said piston to said fuel injection device.

3. A mixture control for a fuel injection device adapted to supply fuel to an internal combustion engine having an induction passage comprising a bellows responsive to ambient air pressure, a cylinder closed at one end, means connecting said cylinder to said bellows for axially moving said cylinder as a function of bellows movement, means connecting the interior of said cylinder to said induction passage, a piston in said cylinder and movable in one direction therein in response to changes in induction passage pressure, a pair of serially disposed springs in said cylinder adapted to successively oppose the movement of said piston in said one direction, and means adapted to connect said piston to said fuel injection device.

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