

July 28, 1942.

J. LICHTENSTEIN

2,291,048

CARBURETOR

Filed June 29, 1939

2 Sheets-Sheet 1

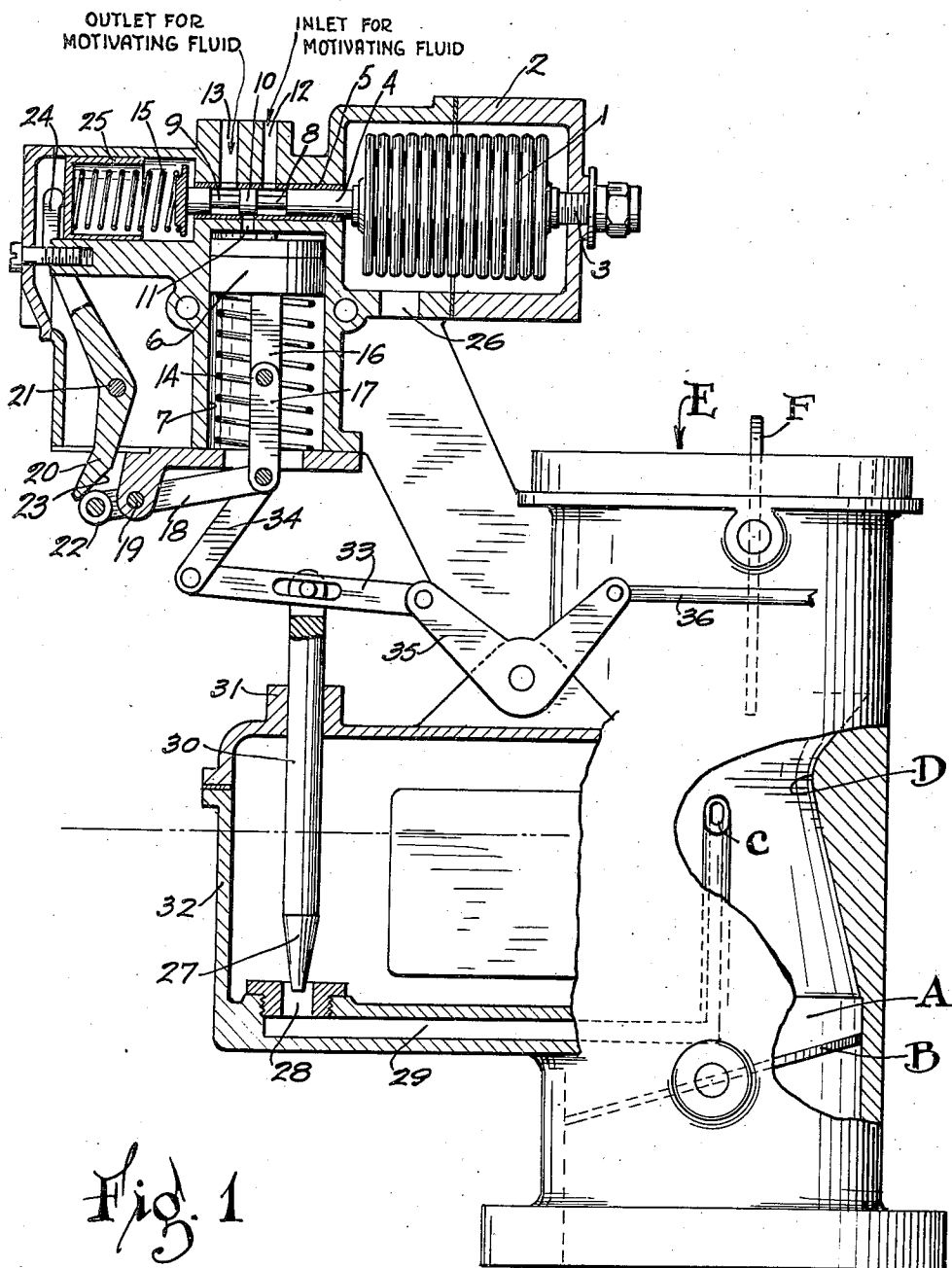


Fig. 1

JOHAN LICHTENSTEIN.
BY *A. D. M. Crady.*
INVENTOR.
ATTORNEY.

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Fig. 2

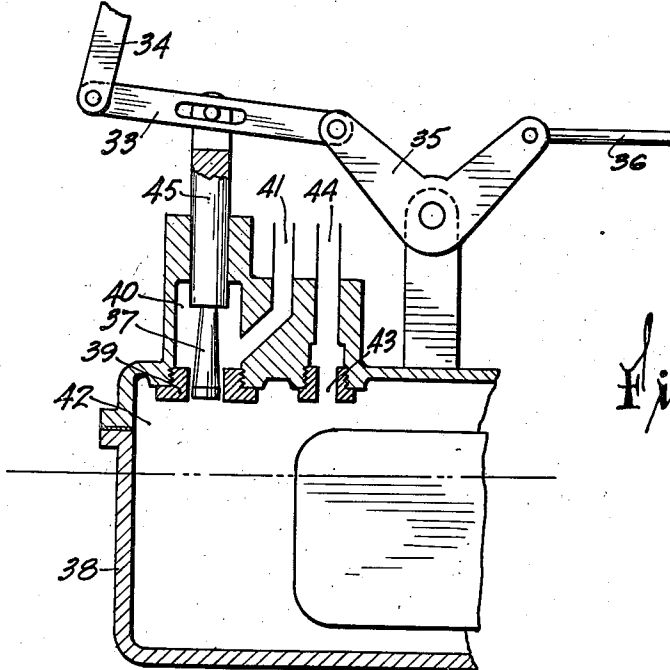
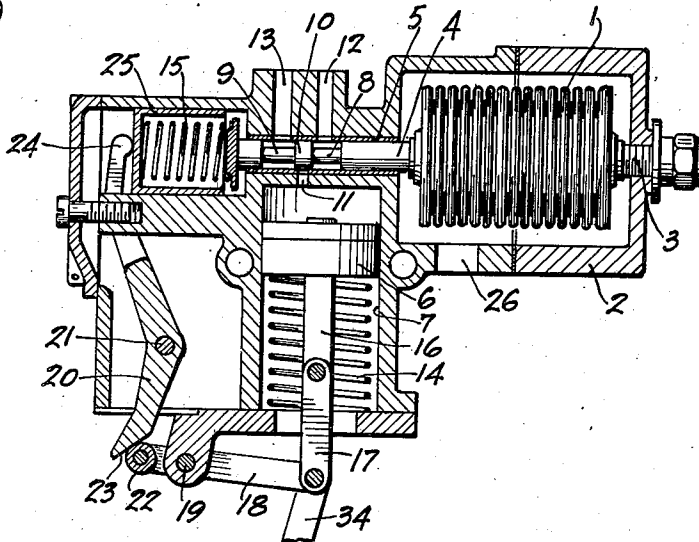


Fig. 3

INVENTOR.
JOHAN LICHTENSTEIN.
BY A. Q. M. Crady
ATTORNEY.

UNITED STATES PATENT OFFICE

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CARBURETOR

Johan Lichtenstein, Levallois-Perret, France, assignor to Societe Generale des Carburateurs Zenith, Geneva, Switzerland, a corporation of Switzerland

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4 Claims. (Cl. 261-39)

This invention relates to an improvement in automatic altitude correctors for internal combustion engines in which a manometric capsule controls, by means of a servomotor, a member which regulates the richness of the combustible mixture delivered to the engine.

It is known that these manometric capsules are relatively fragile and delicate, also that it is difficult to obtain a series of capsules having identical mechanical characteristics, that is to say, producing the same elongation for a given variation in the pressure to which they are subjected.

An object of the invention is to decrease the fatigue experienced by the manometric capsule of an automatic altitude corrector of the kind referred to, and also to decrease the risk of rupture of said capsule. A further object is to make it possible to produce a plurality of altimetric correctors which will operate alike in spite of differences in the mechanical characteristics of the individual capsules mounted therein.

According to the invention the capsule of the corrector is connected to the pilot member of a servomotor and is biased by a spring. The pressure exerted by the spring upon said capsule is controlled by the motor member of the servomotor, which also actuates the member controlling the mixture richness. The servomotor remains at rest for any given value of the pressure acting upon the capsule, but if that pressure varies and reaches a new value the capsule elongates or contracts correspondingly, thereby displacing the pilot member of the servomotor. The motor member of the servomotor is thereby put into movement, and by such movement modifies the pressure exerted by the spring upon the capsule and correspondingly changes the length of the capsule in such direction as to restore the capsule to its initial length and the attached pilot member to its neutral position. Operation of the servomotor, and hence further movement of the motor member, is thereby arrested.

Because of the arrangement just described, the capsule is always brought back to its initial length irrespective of the pressure to which it is subjected. It therefore is subjected only to such slight variations in length as are necessary to the starting of the servomotor. In the devices of the prior art, wherein the capsule elongates and contracts due to the variations in pressure to which it is subjected, the capsule experiences relatively great variations in length each time it is subjected to material pressure variations, and eventually these repeated length variations cause

hardening and rupture of the capsule. This disadvantage is avoided by the control structure herein disclosed.

Furthermore, the degree of deformation of a capsule which is freely dilated or contracted by means of pressure variations to which it is subjected, depends upon the elasticity of the capsule, which characteristic is very difficult to obtain in uniform degree in a series of capsules. These variations in elasticity between individual capsules in the known altitude correctors result in different operating characteristics in altitude correctors of the same series. This difficulty is avoided by the arrangement disclosed herein, in which the capsule remains at substantially the same length, thereby eliminating the influence of the elastic characteristics of the capsule upon the operation of the device.

The description which follows, taken in connection with the appended drawings, given as an example, will explain the manner in which the invention may be practiced.

Figure 1 is a vertical elevation, partly in section, of a carburetor embodying the invention, the parts of the altitude control being in the positions which they would assume at ground level.

Figure 2 is a vertical section of the altitude control unit with the parts in the positions which they would assume at altitude.

Figure 3 is a partial sectional view of an alternative arrangement for controlling the mixture richness and is adapted to be controlled by the altitude control unit represented in Figures 1 and 2.

The invention is shown in Figure 1 as applied to a carburetor of any known design, having an induction passage A, controlled by a throttle B and having a fuel nozzle C discharging into a venturi D. The air entrance E to the induction passage may be controlled by a choke valve F.

The altitude corrector represented in Figures 1 and 2 has a capsule 1 located within a casing 2. The stem 3 of the capsule is threaded into the end wall of the casing, so as to permit the initial adjustment to be made, after which the stem may be locked in position by known means.

The casing 2, containing the capsule 1, communicates with atmosphere through a port 2a, but it may instead be connected to any other suitable pressure to effect the altitude correction.

The servomotor illustrated in the drawings is of the oil pressure actuated type in which the pilot member is a plunger 4 sliding in a cylindrical sleeve 5, while the motor member comprises a

cylinder 7 and a piston 6 biased by a spring 14. The sleeve 5 communicates with cylinder 7 through a port 11, and has an inlet 12 for oil under pressure and an oil outlet 13. Plunger 4 has grooves 8 and 9 separated by a median portion 12.

Plunger 4, which is the pilot member, or control member, of the servomotor, is connected at one of its ends to capsule 1 and is biased at its other end by a compression spring 15. The rod 16 of piston 6 is connected through a link 17 with a lever 18, pivoted at 19 to the body of the corrector. Lever 18 is provided at its outer end with a roller 22 which engages a cam surface 23 on a lever 20, which is pivoted at 21. Surface 23, as shown, is straight but it may be of curved form in order to obtain any desired relation between the movement of piston 6 and the movement of lever 20. The other end 24 of lever 20 operates the spring 15 through the cup member 25.

Piston 6, which is the motor member, or driven member, of the servomotor, is connected by any suitable means to the member regulating the mixture richness, which may be of any desired type.

In Figure 1, the member regulating the mixture richness has been represented as a needle 27 controlling the effective cross-section of a calibrated orifice 28 which meters the fuel delivered to the mixture passage of the carburetor through a duct 29. The stem 30 of the needle 27 is slidably mounted in a guide 31 formed in the cover of the float chamber 32, in the bottom of which is the calibrated fuel orifice 28. Stem 30 is connected to a floating lever 33, one end of which is pivoted to a connecting link 34, which is in turn connected to the piston 6 through connecting link 17 and rod 16. The other end of lever 33 is joined to a bell crank lever 35 which is operated by the pilot means of a rod or cable 36. Needle 27 is thus conjointly operable by hand as well as by the automatic altitude corrector.

In Figure 3, the member regulating the richness of the mixture consists in a profiled valve 37 which regulates the depression transmitted to the float chamber 38 of the carburetor. Valve 37 regulates the effective cross-section of the calibrated orifice 39 through which the space 42, situated above the fuel level in float chamber 38, communicates with a chamber 40, to which is transmitted, through duct 41, the depression obtaining in the mixture passage of the carburetor. Space 42 also communicates, through a calibrated orifice 43 and a duct 44, with atmosphere or with the air intake of the carburetor. Valve 37 is carried by a stem 45 which is operated manually and by the automatic altitude control, in the same way as stem 30 of the mechanism shown in Figure 1.

The operation of the mechanism is as follows:

On the ground, the various members of the automatic altitude control occupy the positions represented in Figure 1. The pilot member of the servomotor occupies the neutral position in which the median part 10 of the plunger 4 closes port 11. Under these conditions, the motor member (piston 6) of the servomotor is at rest. If the hand control connected to lever 35 by cable 36 (Figures 1 and 3) occupies the position "normal richness," the needle 27 (Figure 1) or valve 37 (Figure 3) occupies such a position that the mixture delivered by the carburetor is of proper richness for operation on the ground.

If the apparatus leaves the ground to go up in altitude, the atmospheric pressure acting on capsule 1 decreases, and the capsule elongates.

Plunger 4 thereby moves towards the left and groove 8 of plunger 4 effects communication between the cylinder 7 and the oil inlet 12 which communicates with a source of oil under pressure. The oil under pressure pushes piston 6 downwardly, against the force of spring 14, and pivots lever 18 about its axis 19. Roller 22, mounted at the end of the lever 18 in engagement with surface 23, rotates lever 20 in a clockwise direction. End 24 of lever 20 thereby compresses spring 15, and, under the effect of this compression, plunger 4 moves towards the right, compressing capsule 1. The movement of piston 6 ceases when, under the pressure of the spring 15, the pilot member 4 of the servomotor has been brought to its original position, in which the central part 10 of the plunger closes the port 11 and cuts off the flow of oil under pressure to cylinder 7.

At a predetermined altitude, the various members will assume the positions indicated in Figure 2. In the transition from the position represented in Figure 1 (ground) to the position represented in Figure 2 (altitude), the increase in the force exerted by spring 15 balances the force of the capsule 1 created by the decrease in the atmospheric pressure applied to said capsule. The length of the capsule therefore remains substantially unchanged.

Conversely, if the altitude decreases, capsule 1 contracts in response to the increase in atmospheric pressure acting on it and plunger 4 moves toward the right, thereby effecting communication between the port 11 and the discharge outlet 13 by means of groove 9. Piston 6 moves upwardly in response to the force of the spring 14, and the movements of the piston are transmitted to lever 20, the end 24 of which moves to the left and thus decreases the compression of spring 15. The movement of the piston ceases when the pilot member of the servomotor (plunger 4) has returned to the neutral position, at which time the capsule 1 has recovered its original length.

The variations in the atmospheric pressure (or any other pressure which may be transmitted to capsule 1 to obtain an altitude correction) are exclusively compensated for by variations in the length of and the force exerted by spring 15, hence the elastic characteristics of capsule 1 do not play any part in the functioning of the apparatus. Also, the deformations to which the capsule is subjected are reduced to the small amounts necessary for the starting of the servomotor; that is to say, for uncovering port 11, the capsule being brought immediately back to its initial length by the functioning of the servo control. The capsule is thus but little deformed during variations in altitude, and its fatigue and the risks of rupture are correspondingly decreased.

When the apparatus has risen from the ground level to a predetermined altitude, the movement of the motor member (piston 6) of the servomotor has been transmitted by means of rod 16, connecting rods 17 and 34, and lever 33, to the stem 30 and needle 27 (Figure 1), or to stem 45 and valve 37 (Figure 3). The profile of needle 27 or valve 37 is such that at each altitude the composition of the mixture is correct when the hand control is maintained in the position "normal richness."

For any given altitude, the pilot may modify the richness of the mixture by operating lever 35 by means of the control cable 36.

Figures 1 and 2 disclose, as an example, a servo motor using oil under pressure as a motive fluid, but it is clear that, as far as the inven-

tion is concerned, a servo motor of any type may be used. For example, one might utilize a pressure fluid other than oil, such as air from the outlet of a supercharger delivering air to the engine. An electric servo motor may also be used in which, for example, the motor member of the servo motor is actuated by an electric motor through an endless screw, and the pilot member consists of a switch or commutator placed in the circuit of the electric motor. The invention may be readily applied to an altitude corrector having a servo motor of this kind. The capsule is in such case joined to the switch or commutator which replaces plunger 4 of the mechanism represented in Figures 1 and 2. The motor member of the servo motor is driven by the endless screw and is connected to the device regulating the richness of the mixture (needle 27, Figure 1, or profiled valve 37, Figure 3) and operates a lever such as lever 20 represented in Figures 1 and 2, which operates the spring biasing the capsule. The operation is then entirely similar to that of the apparatus described above, and it is unnecessary to describe it further, since the nature of the servo motor in itself is not an essential element of the invention.

I claim:

1. A mixture control for a charge forming device including a sealed capsule responsive to the difference in pressures acting on the inside and outside of said capsule, an element for varying the mixture richness, and a servomotor for actuating said element comprising a motor control member in alignment with said capsule and secured thereto to be directly actuated thereby, a driven member operatively connected to said element, a spring biasing said capsule, a separate spring biasing said driven member, and means connecting the driven member and the first named spring for varying the pressure of said first named spring upon movement of the driven member, said connecting means comprising a pair of pivoted levers having a cam and follower connection therebetween.

2. In a servo motor for a carburetor altitude control having an element for controlling the mixture richness, a valve for controlling a motivating fluid, a movable wall adapted to be actuated by the fluid, means operatively connecting the movable wall and the element, a barometric capsule directly connected to the valve in abutting relation therewith for directly actuating the valve, a spring yieldingly resisting movement of said valve in one direction, means interconnecting said movable wall and the spring to vary the resisting force of the spring, and a second spring biasing the movable wall.

3. A charge forming device having an induction passage, a fuel chamber, a fuel conduit connecting said chamber with the induction passage, and an altitude control unit comprising a servomotor having a pilot member and a motor member, a barometric capsule operably connected to said pilot member and biased by a spring, a second spring biasing said motor member, means controlled by the motor member for varying the absolute pressure of the fuel in the fuel chamber, and means including a pair of pivoted levers having a variable leverage connection therebetween for interconnecting the motor member and the first named spring for varying the compression of said spring upon movement of the motor member.

4. In a fluid operated servomotor for a carburetor mixture control, a valve for controlling the flow of motivating fluid, a movable wall subjected to said fluid to be actuated thereby, a sealed pressure responsive capsule secured directly to and in alignment with said valve for actuating the same, a spring biasing said valve and in alignment therewith, a separate spring biasing the movable wall, mechanism interconnecting the movable wall and the first named spring for varying the compression thereof, and means operated by the movable wall for varying the richness of the mixture.

JOHAN LICHTENSTEIN.