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[54] ARRANGEMENT FOR REGULATING FUEL INJECTION

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[51] **Int. Cl.** **F02m 51/00**
[58] **Field of Search** .... 123/32 EA, 119 R, 179 A

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[57] **ABSTRACT**

A regulating arrangement maintains proper fuel-air mixing ratios in a combustion engine by regulating the fuel-injection time as a function of airflow through the air-intake passage. The arrangement includes an electrically controllable fuel-injection valve, adjustable electric timing means for opening the valve for an adjustably predetermined time, and an adjusting member for adjusting such predetermined time. An airflow sensing member is operatively associated with the adjusting member and is mounted in the air-intake passage for displacement by air flowing through such passage. The sensing member is displaceable to a plurality of positions each corresponding to a different amount of airflow. A pneumatic damping unit is operative in response to airflow changes and applies to the sensing member a damping force which decreases with time. In this manner, the damping means opposes displacement of the sensing member in response to sudden and short-lasting changes in airflow conditions.

13 Claims, 8 Drawing Figures

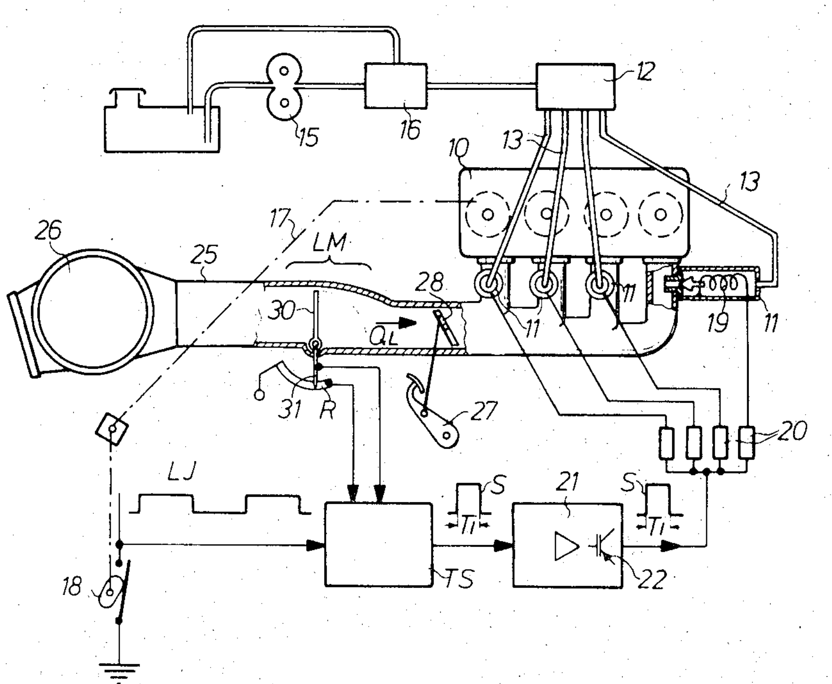

Fig. 1

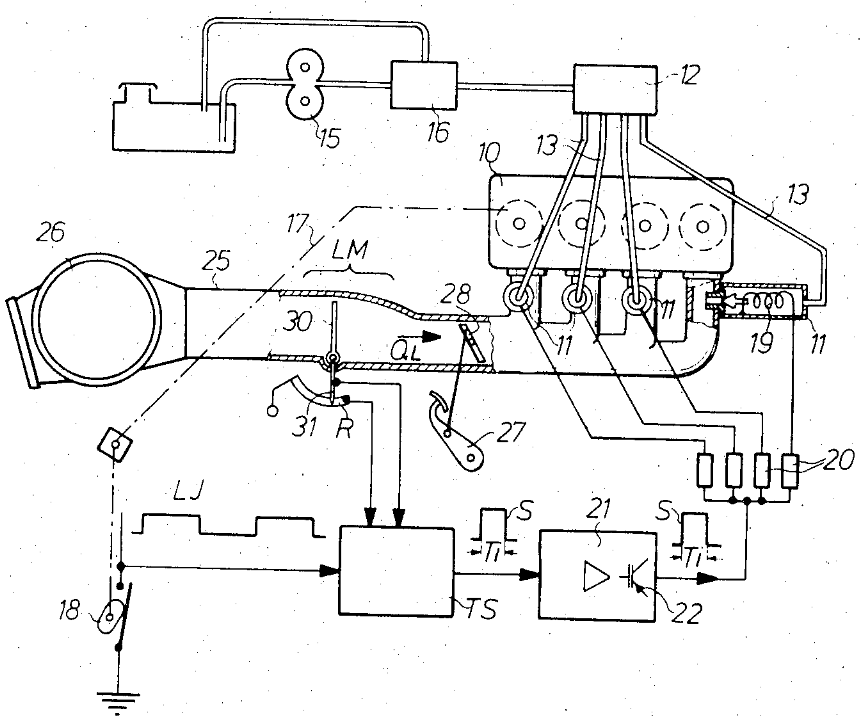
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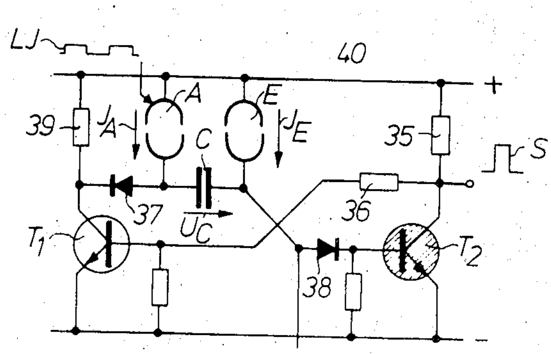
Fig. 2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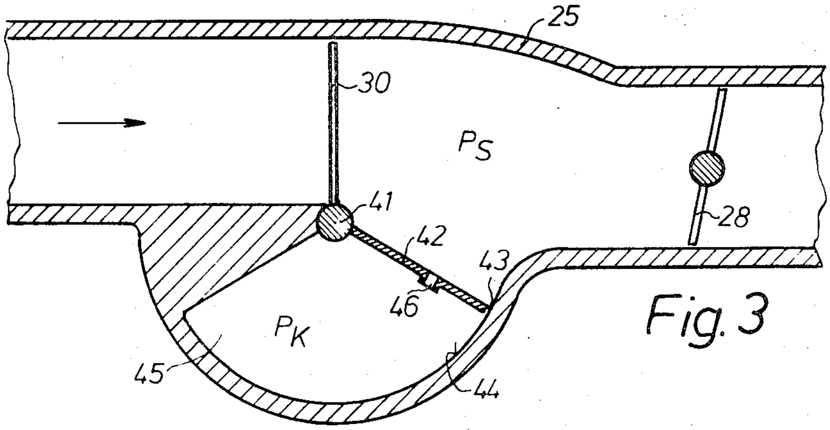

Fig. 3

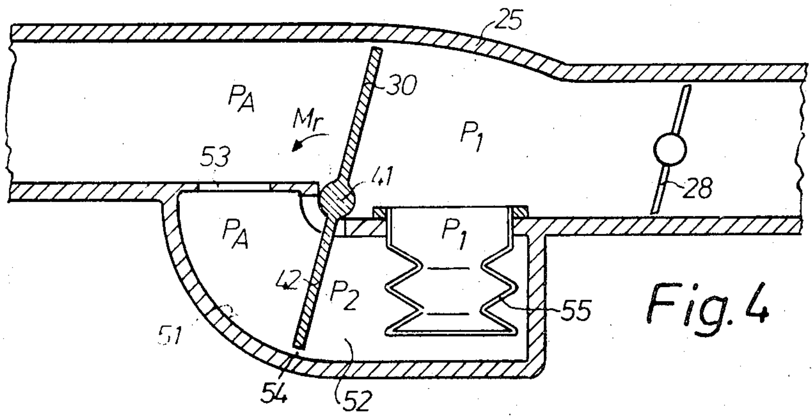

Fig. 4

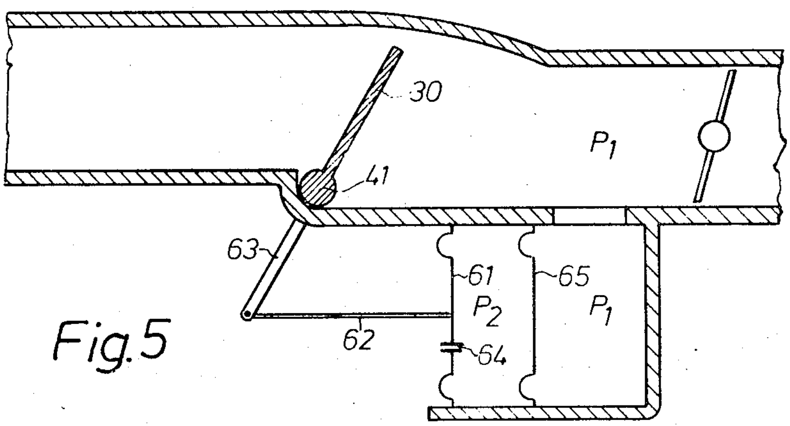

Fig. 5

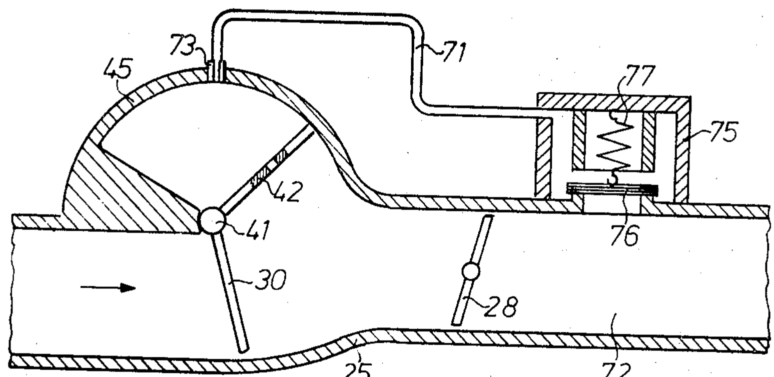

Fig. 6

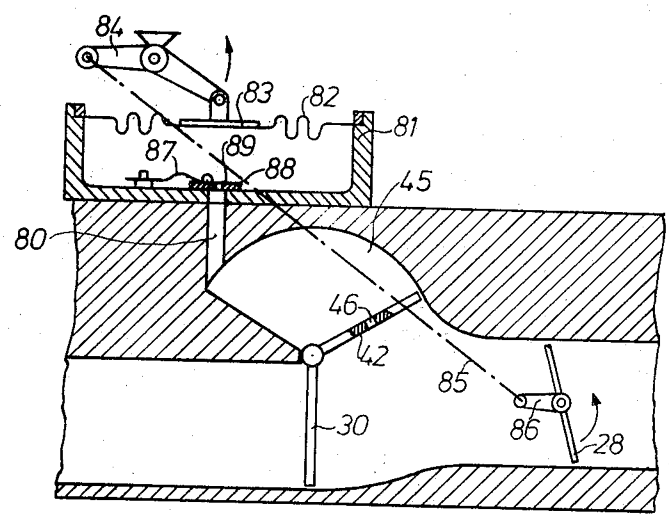

Fig. 7

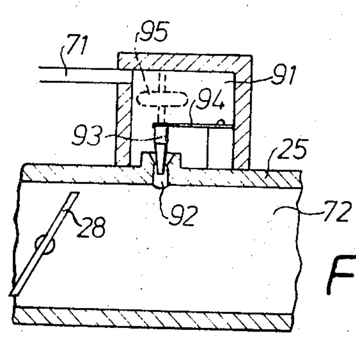

Fig. 8

ARRANGEMENT FOR REGULATING FUEL INJECTION

BACKGROUND OF THE INVENTION

The invention relates to electrical and electronic fuel-injection control systems for combustion engines. More particularly, the invention relates to such systems of the type including an air-intake passage, a throttle valve disposed in such passage and operatively linked with the gas pedal.

Still more particularly, the invention relates to such systems as maintain proper fuel-air mixing ratios in a combustion engine by regulating the fuel-injection time, and thereby the amount of injected fuel as a function of airflow through the air-intake passage.

The invention furthermore relates to such systems as comprise one or more electromagnetically operated fuel-injection valves associated with one or more engine cylinders, and each valve being associated with a power transistor stage and a switching transistor stage, the switching stage being operated in synchronism with crankshaft rotation. Such systems furthermore include electrical timing means which effect valve opening for an adjustable period of time, in dependence on the pressure within the air-intake passage. Such timing means conventionally comprise an energy-storing element, such as a capacitor or inductor, which is energized or deenergized at an adjustable rate dependent, in the prior art, on the air pressure within the air-intake passage.

The great advantage of such fuel-injection control systems is that they permit very precise coordination between the quantity of injected fuel and the quantity of air which is drawn into the cylinder during the intake stroke of the piston. Such precise coordination of air and fuel permits the maintenance stoichiometric mixing ratios which result in nearly complete combustion of the fuel, which means reduced exhaust of air pollutants without a decrease in engine efficiency.

Known arrangements of this type employ a sensing mechanism which does not directly monitor the airflow, but instead monitors the air pressure. Such known arrangements comprise a pressure-responsive inductive element located downstream of the gas-pedal-controlled throttling valve. Such inductive element forms part of a timing circuit, for instance a multivibrator, which controls the length of time during which the valve is held open. Variations in prevailing pressure affect the inductance value of the inductor and as a result can be made to change the ON-time of one of the alternately conductive transistors of the multivibrator, for instance. Conventionally, the multivibrator is triggered in synchronism with crankshaft or camshaft rotation. A great problem of such systems is that the air resistance characteristic in the intake passage is highly speed-dependent, and accordingly changes in the inductance of the inductive sensor can not be made to reflect the actual airflow in a simple manner. Thus, complex compensating arrangements are used in the prior art to coordinate the actual values of inductance with the different valve-opening times necessary.

It has already been proposed, to simplify such fuel-injection control systems by replacing the pressure-responsive inductor with a pivotably displaceable spring-biased baffle plate mounted in the air-intake passage. The pivot axis of such baffle plate is located at the side of the intake passage, and the baffle plate will assume an angularly displaced position corresponding to the degree of airflow through the air-intake passage. The timing means for the fuel-injection control arrangement may again include a multivibrator whose ON-time is for instance determined by the resistance of a variable resistor having a slidable wiper. A mechanical linkage connects the baffle plate to the wiper in force-transmitting manner, so that angular deflection of the baffle plate effects a corresponding resistance change of the variable resistor, and accordingly a change of the rate at which the energy-storing element of the multivibrator charges or discharges.

However, such known construction is not very effective, because of pressure pulsations which develop in the air-intake passage, particularly when the air-throttle valve is fully or nearly fully open — i.e., at high loads. The suction downstream of the throttle valve is of course a function of the intake stroke of the cylinder. When the throttle valve is nearly closed, the air flow sucked into the cylinder past the throttle valve will be quite even; however, when the valve is more open, the airflow is less even, and characterized by many sudden and short-lasting variations. These variations produce corresponding movements of the baffle plate, and result in pulsating resistance values of the variable resistor. Inasmuch as the fuel-injection time is very short, such superimposed oscillations of the resistance value can interfere very greatly with proper timing action, and result in a greatly reduced combustion efficiency. Actually this difficulty arises even at lower speeds, and particularly in four-cylinder four-stroke engines.

SUMMARY OF THE INVENTION

It is accordingly a general object of the invention to overcome the disadvantages of the prior art.

It is a more particular object to provide a novel fuel-injection control arrangement which overcomes such disadvantages.

It is a further object to provide a novel control arrangement including electrical timing means and an improved airflow transducer.

It is a related object to provide such control arrangement with an airflow transducer of very simple and sturdy construction.

It is another object to provide such an airflow transducer which is quickly responsive to changes in air-flow actually corresponding to changes in gas-pedal position and/or changes in intake suction associated with different parts of the intake stroke, but which is largely unresponsive to the higher-frequency airflow variations superimposed upon the aforementioned airflow changes.

It is a concomitant object to provide such an arrangement which is unresponsive to airflow variations lying within a particular frequency range.

It is another object to provide such an airflow transducer which is responsive to relatively slow changes in airflow actually corresponding to the relatively slow changes of gas-pedal position.

It is a similar object to make such transducer responsive to relatively slow airflow variations associated with different segments of the intake stroke.

It is a concomitant object to make such transducer largely unresponsive to the relatively fast stray airflow variations which develop particularly when the airflow throttle is opened to a considerable extent.

It is a related and more specific object to make such transducer quickly responsive to airflow changes whose frequency is in a first lower range, and unresponsive to airflow changes whose frequency is in a predetermined second higher range associated with stray airflow changes.

These objects, and others which will become apparent hereafter, can be met by a regulating arrangement which maintains proper fuel-air mixing ratios in a combustion engine by regulating the fuel-injection time as a function of airflow through the air-intake passage. Such arrangement includes an electrically controllable fuel-injection valve, adjustable electric timing means for opening the valve for an adjustable predetermined time, and adjusting means for adjusting such predetermined time. An airflow sensing member is operatively associated with the adjusting means and mounted in the air-intake passage for displacement, by air flowing through the passage, to any of a plurality of different positions respectively corresponding to different amounts of airflow. Pneumatic damping means is operative in response to airflow changes for applying to the sensing member a damping force which decreases with time and which in that manner reduces the sensitivity of the sensing member to sudden and short-lasting changes in airflow conditions.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic overall illustration of a regulating arrangement according to the invention;

FIG. 2 is a detailed view of a portion of the timing circuitry of FIG. 1;

FIG. 3 is a longitudinal section through the air-intake passage of the engine shown in FIG. 1, and depicting sensing means and pneumatic damping means according to the invention;

FIGS. 4–7 are views similar to FIG. 3, but illustrating different sensing means and/or different pneumatic damping means according to the invention; and

FIG. 8 illustrates a modification of part of the damping means of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The illustrated arrangement regulates fuel injection in a four-cylinder four-stroke internal combustion engine **10**, provided with four electromagnetically controllable fuel-injection valves **11** which each regulate the flow of fuel from a fuel-distributer **12** through a respectively associated fuel conduit **13**, the fuel flow being established by a gas-supply pump **15** and a regulator **16** adapted to maintain the flow pressure constant.

The illustrated control arrangement includes electrical timing means which is synchronized with the rotation of (schematically illustrated) camshaft **17** by means of an interrupter **18** coupled with the camshaft. Interrupter **18** generates two rectangular pulses LJ for each rotation of camshaft **17**, and these pulses are used for the generation of an OPEN-pulse S which is transmitted to the solenoid of a valve **11**. The duration T_1 determines the length of time during which the fuel-injection valve **11** is open, and in that way determines the amount of fuel which is injected. The correspondence is very precise because, as already indicated, the fuel is injected at constant pressure, for example 2 atm. The solenoid windings **19** of the valves are each connected in series with a respective coupling resistor **20** and connected to a common amplifier andd power stage **21**, which contains at least a power transistor indicated schematically in FIG. **1** as transistor **22**, the collector-emitter path of the transistor being connected in series with the coupling resistor **20**. The other end of each solenoid winding **19** is connected to ground.

It is emphasized that the electrical timing arrangement, as such, does not form part of the invention and can be of any conventional type.

In the combustion engine illustrated, a mixture of fuel and air is ignited by a separate ignition system, and the amount of fuel injected into the cylinder is to be carefully coordinated with the amount of air which enters during the intake stroke of the piston, so as to result in the most complete combustion possible. For the sake of efficiency, moverover, it is important that there be no substantial excess of air. In order to maintain the desired stoichiometric ratio between fuel and air, a regulating arrangement is provided.

The regulating arrangement includes airflow sensing means generally designated LM in FIG. **1** and located in the air-intake passage **25** downstream of the air filter **26** but upstream of the throttle valve **28** associated with the gas pedal. In simple terms, the airflow sensing means of FIG. **1** comprises a baffle plate **30** whose angular orientation is indicative of airflow, and which is mechanically coupled to the wiper **31** of a variable resistor R. Wiper **31**, as will later be appreciated, constitutes adjusting means for varying the fuel injection time. Variable resistor R is incorporated in a transistor switching circuit TS which provides timing signals whose duration is a function of the resistance of resistor R.

FIG. **2** illustrates somewhat schematically the circuitry contained in transistor switching circuit TS. It is strongly emphasized that such circuitry may be of many conventional types.

Unit TS comprises two alternately conductive transistors, namely an input transistor T_1 and an output transistor T_2, which are cross-coupled in a manner common in multivibrators. The circuit further includes an energy-storing element C, here in the form of a simple capacitor; a modified but equivalent circuit could employ an inductor. The duration of the discharge of capacitor C determines the On- and OFF-times of transistors T_1, T_2 and thereby the duration of the fuel-injection. Clearly, precise regulation of the fuel injection will require a precise control of the discharge of capacitor C.

The circuit TS is triggered by interrupter **18**, which can be a mechanical interruptor or a unit incorporating a multivibrator, and which generates the prolonged triggering pulses LJ. As already mentioned, interruptor **18** is synchronized with camshaft rotation and effects a connection between capacitor C and an energy source C for the duration of a pulse LJ corresponding to a predetermined angular rotation of the camshaft. During such time, a charging current J_A flows through the capacitor, and the capacitor voltage increases. In the illustrated embodiment, it is assumed that interruptor **18** comprises a (non-illustrated) multivibrator which is in one state for 180° of camshaft rotation and in its other state during the subsequent 180° of camshaft rotation.

The arrangement of FIG. **2** permits initiation of the discharge period immediately following the termination of the charging period, which for example can occur after the camshaft has rotated 0°, 360°, 720°, etc. when the conductive output transistor T_2 becomes nonconductive. Simultaneously, the non-conductive transistor T_1 becomes conductive because, as a result of blocking of transistor T_2, the base voltage of transistor T_1 is sufficiently high to turn the transistor T_1 on and establish a flow of base current through resistors **35** and **36.** The energy acccumulated by capacitor C during charging is discharged through diode **37** and the emitter-collector path of transistor T_1. Regulating means E maintains the discharge current constant, this being a well known expedient in time base generators, and thus the capacitor voltage decreases linearly. It will be appreciated that during the ON-time of T_1 its collector-emitter voltage is low, and so the positive capacitor electrode will be at a low voltage. The more negative terminal of the capacitor accordingly will enforce upon the base of T_2 a voltage which maintains the transistor T_2 off. However, as the capacitor voltage decreases during discharge, the base voltage of T_2 will rise until eventually a forward-bias is achieved. At that point T_2 will go on, and its greatly lowered collector voltage will terminate the forward-bias of the base of T_1. After the discharge period, when T_1 is off, charging current cannot flow through capacitor C via resistor **39**, because of diode **37.** Capacitor C will recharge only at the beginning of the next charging pulse LJ, namely, after a camshaft rotation of 180°, 540°, etc. It is emphasized that the circuitry of FIG. **2** is merely exemplary. It is extremely well known how to provide such timing circuitry, and many equivalents will be obvious.

At rotational speeds of less than 2,000 RPM and at high loads, the air sucked through the intake passage **25** towards the engine **10** will exhibit marked pulsations. These can result in oscillations of baffle plate **30** about an angular position not actually corresponding to the average airflow. In order to avoid the faulty regulation of fuel-injection which can result, the regulating arrangements described below include not only airflow sensors, but also pneumatic damping arrangements which counteract the tendency of the baffle plate **30** to oscillate about a mean value in response to high-frequency airflow pulsations, but which permit the baffle plate **30** to quickly respond to flow changes having a real significance for the combustion process.

FIG. **3** illustrates an airflow sensing means **30** having a form of a first baffle plate mounted for pivotal movement about an axis **41** located to one side of the air-intake passage **25.** A damping member **42** constitutes a first dashpot portion and has the form of a second baffle plate which shares the movement of the first plate **30.** Damping plate **42** is of rectangular outline and is pivotable through a damping chamber **45** which has the shape of a sector of a cylinder and is defined by a wall which constitutes a second dashpot portion. The periphery of damping plate **30** defines with the inner peripheral wall **44** of chamber **45** a very limited pressure-leakage clearance **43.** It will be appreciated that damping plate **42** in part defines the dashpot chamber **45,** and that movement of the damping plate **42** causes a variation in the volume of damping chamber **45.** A small pressure-leakage opening **46** is provided on the face of the damping plate **42,** in addition to opening **43.** In the steady-state, the pressure P_K in damping chamber **45** is equal to the pressure P_S in the section of passage **25** immediately downstream of baffle plate **30.** Each of plates **30, 42** has a major surface facing this section of passage **25,** and advantageously these surfaces are of equal area so that the force exerted by reason of suction pressure P_S will be the same on both plates. Accordingly, variations in P_S cannot of themselves produce displacement of plates **30, 42,** because of the torques developed on plates **30, 42** cancel. However, when the pressure P_S changes, the pressure P_K will tend to approach such new value of P_S, due to the provision of pressure-leakage openings **46** and **43.** Accordingly, as the pressure is equalized, a new steady-state angular orientation of plate **30,** indicative of the changed airflow conditions, is established. Moreover, this pressure equalization occurs at a limited rate. This rate is so chosen that equalization does not occur in response to pressure pulsations having a frequency of for example more than about 30 Hz; thus sensing member **30** tends not to respond to such high-frequency pulsations. (The figure of 30 Hz has been determined by empirical testing of a four-cylinder four-stroke combustion engine). In particular, the cross-section of the pressure-leakage opening **46** and/or the clearance **43** is so selected that when for example the engine is accelerated and the airflow changes rapidly, the pressure equalization in response to such rapid airflow change will occur in about 1/10 second, a response time significantly greater than the time of stray airflow pulsations.

FIG. **4** depicts another version of the airflow transducer arrangement. As in FIG. **3,** the baffle plates **30, 42** are pivotable about a common axis **41,** and the periphery of damping plate **42** again defines a pressure-leakage clearance, here identified with numeral **54.** A wall **51** defines a damping or dashpot chamber **52** to the right of damping plate **42** and having a volume which is dependent on the position of plate **42.** The part of damping chamber **52** not actually enclosed by plate **42** communicates freely through opening **53** with the section of conduit **25** upstream of sensing member **30.** The peripheral clearance **54** permits only a relatively slow equalization of pressure between the pressure P_A in the upstream section of passage **25** and the pressure P_2 in the enclosed portion of damping chamber **52.** An elastic separating wall **55,** herein the form of a bellows, separates chamber **52** from the section of passage **25** downstream of plate **30.** Bellows **55** is highly yieldable in longitudinal direction. As long as the pressure P_1 is constant, in the steady-state, the pressures P_A and P_2 will remain equal; in the steady-state, damping plate **42** has no effect.

In the steady-state, the pressure P_1 will actually oscillate about a constant value, such oscillations constituting interference pressure pulsations superimposed upon the average value of pressure. These oscillations of P_1 are communicated to damping chamber **52** by way of readily yieldable bellows **55,** and the pressure P_2 will oscillate in the same manner as pressure P_1. Thus, in a manner similar to FIG. **3,** the very rapid pressure fluctuations of P_1 will have an effect on plate **30** which is counteracted by the effect on plate **42.** The dimensions of the plates **30, 42** can be so chosen as to make the arrangement almost completely immune to such rapid pressure fluctuations.

When throttle valve **28,** linked with gas pedal **27** (FIG. **1**) is opened to effect engine acceleration, the pressures P_1 and P_2 both decrease rapidly (suction increase) and, as just explained, this sudden change of pressure does not produce a net moment about axis **41.** However, as the pressure P_2 relatively slowly approaches the pressure P_A, by way of airflow through pressure-leakage opening **54**, a net moment can be exerted on plate **30.** Clearly, a damping of the response of plate **30** is effected also during ordinary acceleration. The magnitude of the damping depends on the rate of airflow through pressure-leaking opening **54** and can be adjusted to meet the empirically determined requirements of a particular engine design.

If it should be necessary to make the compensation for the pulsating pressure so great that the sensing plate **30** cannot quickly enough follow the transitional change of intake airflow, it is possible to provide two biased flutter valves on the damping plate **42** one of which is closed against the pressure P_2 and the other of which is closed against the pressure P_A.

A functionally equivalent arrangement is illustrated in FIG. **5.** Here, the transient damping force is applied to plate **30** not by a plate **42,** but rather by a lever **63** connected via linkage **62** with membrane **61.** A second membrane **65** has the same function as bellows **55** in FIG. **4.**

Membranes **61, 65** define between themselves a damping or dashpot chamber having a pressure-leakage opening **64.** In the steady-state, pressure P_2 is equal to atmospheric pressure. If pressure P_1 changes, pressure P_2 changes in like manner upon displacement of membrane **65.** The pressure P_2 will relatively slowly return to atmospheric pressure, thereby permitting a relatively slow response of sensing member **30** to the change of P_1. The rate of return of P_2 to atmospheric pressure depends on the size of pressure-leakage opening **64,** and can be so selected that, during a half-cycle of an interference pulsation of pressure P_1, no significant pressure equalization between P_2 and P_{atm} can occur. As with the previously described embodiment, and in addition to opening **64,** it is possible to provide two flutter valves on opposite sides of membrane **61,** and such valves can if desired have a temperature-dependent characteristic. Such temperature dependence can for instance be achieved by provision of bimetallic flat springs, which for example decrease the damping effect at lower temperatures. In this way it is possible to establish an enrichment of the fuel-air mixture at low running temperatures. As mentioned above, the interference pressure pulsations develop particularly at high loads, that is when the throttle valve **28** is fully or nearly fully open. In the embodiment of FIG. **6,** pneumatic damping is provided in dependence on the position of the throttle valve, and thereby on the load. This embodiment differs from that of FIG. **3** in the provision of an auxiliary air passage **71** communicating with damping chamber **45** and with the section of passage **25** downstream of throttle valve **28.** A flow-restricting opening **73** is provided at the juncture of chamber **45** and auxiliary air passage **71.** Ahead of the entrance of passage **71** into the downstream section of passage **25,** there is provided a pressure-responsive valve means **75** comprising a valve plate **76** upwardly biased by a tension spring **77.** Valve plate **76** blocks communication between passage **71** and the downstream section **72** of passage **25** when the pressure difference on opposite sides of plate **76** is below a predetermined threshold value.

The embodiment of FIG. **7** provides for the enrichment of the fuel-air mixture upon acceleration of the motor, and especially upon opening movement of the throttle valve **28** in response to depression of the gas pedal **27.** Specifically, when the valve **28** is opened suddenly, indicating that great acceleration is desired, the damping action is greatly decreased, so that the fuel injection time can be increased very quickly in response to the increased air-flow. A pressure chamber **81** communicates with damping chamber **45** via conduit **80.** Pressure chamber **81** is sealed at one end by an elastic wall or membrane **82.** In the center of the membrane **82** there is provided a force-transmitting plate **83** which is linked to one of the arms of lever **84.** The other arm of lever **84** is connected via mechanical linkage **85** with a throttle-follower member **86.** When to effect engine acceleration, the throttle **28** is opened in the direction of the arrow, members **26, 85, 84** and **83** effect displacement of membrane **82** in direction of the arrow C virtually immediately. The resulting underpressure in chamber **81** is quickly communicated to damping chamber **45,** and air flows from chamber **45** to chamber **81** very quickly. When the throttle **28** is quickly opened in this manner, the pressure to the right (in FIG. 7) of plate **42** quickly drops, and the slow follow-up by the pressure to the left (in FIG. 7) of plate **42** normally effects the damping action. However, because the sudden opening of valve **28** results in flow of air from chamber **45** to chamber **81,** the equalization of pressure to either side of plate **42** occurs far faster, and the damping is thus very greatly reduced. Indeed, the pressure will be equalized at a high rate relative to the increase of air flow, and counterclockwise displacement of sensing member **30** can even occur somewhat faster than actually corresponds to the increase in airflow, and the fuel-air mixture will thus be especially enriched at the time of such acceleration.

The provision of pressure-leakage opening **46** limits the duration of such enrichment. That is, the angular displacement of plate **30** will exceed that corresponding to the actual airflow only until the pressure on either side of plate **42** is equalized. At that time, any further changes in airflow will again be responded to with damping action, except for similar sudden opening motions of throttle **28.** The removal of damping action, it should be noted, occurs only in response to a sudden movement of throttle **28** in opening direction. When throttle **28** moves in opening direction the airflow is from chamber **45** to chamber **81,** and this is permitted by check valve **88.** However, if the throttle **28** moves suddenly in closing direction, the direction of airflow is from chamber **81** to chamber **45,** and such flow is greatly limited by check valve **88,** and occurs only through permanently open pressure-leakage opening **89,** whose flow area is relatively small.

FIG. **8** illustrates a modified version of FIG. **6** including temperature compensation. The auxiliary air passage **71** is again provided and leads into the valve chamber defined by valve body **91.** A tapered valve member **93** regulates the flow of air through passage **92.** Valve member **93** is biased towards closing position by bimetallic flat spring **94.** Valve member **93** is moved to open position only when the pressure difference between passage section **72** and the interior of valve body **91** has reached a certain threshold value. However, the use of a bimetallic flat spring **94** causes this threshold pressure difference to change with temperature in a manner corresponding to the desired temperature-dependent variations in the fuel-to-air ratio.

By suitable disposition of the juncture between auxiliary air passage **71** and damping chamber **45,** the response to airflow can be made to vary in a desired manner on the load. The advantage of such expedient is that the reduction of the damping action during acceleration can be accomplished solely by pneumatic action, and without the mechanical linkages used in the equivalent embodiment of FIG. 7.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in an arrangement for fuel-injection regulation, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications witout omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in appended claims.

1. A regulating arrangement which maintains proper fuel-air mixing ratios in a combustion engine by regulating the fuel-injection time as a function of the inflow rate of air through the air-intake passage, comprising an electrically controllable fuel-injection valve; adjustable timing means for opening said valve for an adjustable predetermined time; adjusting means for adjusting said predetermined time; an airflow sensing member operatively associated with said adjusting means and mounted in said air-intake passage for displacement by air flowing through said passage and impinging upon said member to any of a plurality of different positions respectively corresponding to different air inflow rates; and pneumatic damping means operative for opposing displacement of said sensing member in response to sudden and short-lasting changes in the air inflow rate, said pneumatic damping means comprising a dashpot arrangement having a first portion connected to said sensing member and sharing the movement thereof and a stationary second portion, the first and second portions of said dashpot arrangement together defining a dashpot chamber having an air leakage opening and being movable relative to each other in a first direction decreasing the volume of said dashpot chamber against the opposing damping force of air being compressed in said dashpot chamber and leaking out through said leakage opening, and movable relative to each other in opposite second direction increasing the volume of said dashpot chamber against the opposing damping force of the underpressure of air being sucked into said dashpot chamber through said leakage opening.

2. An arrangement as defined in claim **1,** wherein said sensing member comprises a first pivotable baffle plate, and wherein said first portion comprises a second baffle plate sharing the movement of said first plate and pivotably movable in said chamber and sharing the movement of said first plate.

3. An arrangement as defined in claim **2,** wherein said damping means includes an elastic separating wall separating the part of said dashpot chamber to one side of said second baffle plate from the section of said air-intake passage downstream of said first baffle plate, and wherein the part of said dashpot chamber to the other side of said second plate communicates freely with the section of said air-intake passage upstream of said first baffle plate.

4. An arrangement as defined in claim **3,** wherein said elastic separating wall comprises a bellows.

5. An arrangement as defined in claim **2,** wherein said first baffle plate has a major surface facing the section of said air-intake passage downstream thereof, and wherein said second baffle plate has a major surface also facing said section of said air-intake passage, and wherein said major surfaces are of approximately equal area.

6. An arrangement as defined in claim **1,** wherein said sensing member comprises a pivotable baffle plate, and wherein said portions comprise two elastically yieldable wall portions, and wherein one of said wall portions separates said chamber from the section of said air-intake passage downstream of said first baffle plate, and wherein said first portion further includes mechanical linkage means connecting the other of said wall portions with said first baffle plate in force-transmitting relationship therewith.

7. An arrangement as defined in claim **2,** wherein said damping means further includes an auxiliary air passage leading from said dashpot chamber to the section of said air-intake passage donwstream of said first baffle plate, and pressure-responsive valve means for restricting air flow through said auxiliary passage.

8. An arrangement as defined in claim **2,** said air-intake passage including a throttling valve linked to the gas pedal and located downstream of said first baffle plate, wherein said damping means further includes a pressure chamber communicating with said dashpot chamber, and means connected to said throttle valve for varying the volume of said pressure chamber as a function of the position of said throttle valve.

9. An arrangement as defined in claim **8,** wherein said damping means further defines a permanently open pressure-leakage opening between said pressure chamber and said dashpot chamber.

10. An arrangement as defined in claim **9,** wherein said damping means further includes check valve means for regulating the flow of air between said pressure chamber and said dashpot chamber.

11. An arrangement as defined in claim **7,** wherein said pressure-responsive valve means comprises a valve body and a helical biasing spring biasing said valve body in a predetermined direction.

12. A regulating arrangement which maintains proper fuel-air mixing ratios in a combustion engine by regulating the fuel-injection time as a function of airflow through the air-intake passage, comprising an electrically controllable fuel-injection valve; adjustable electric timing means for opening said valve for an adjustable predetermined time; adjusting means for adjusting said predetermined time; an airflow sensing member operatively associated with said adjusting means and mounted in said air-intake passage for displacement by air flowing through said passage to any of a plurality of different positions respectively corresponding to different airflow conditions; and pneumatic damping means, operative in response to airflow changes, for applying to said sensing member a damping force which decreases with time, whereby to oppose displacement of said sensing member in response to sudden and short-lasting changes in airflow conditions, wherein said sensing member comprises a first pivotable baffle plate, and wherein said damping means comprises a damping chamger and a second baffle plate sharing the movement of said first plate and pivotably movable in said damping chamber and wherein said damping means defines a pressure-leakage opening in said damping chamber, wherein the periphery of said second baffle plate defines with the inner periphery of said damping chamber a clearance constituting said pressure-leakage opening, and wherein said damping chamber communicates via said pressure-leakage opening with the section of said passage downstream of said first baffle plate.

13. A regulating arrangement which maintains proper fuel-air mixing ratios in a combustion engine by regulating the fuel-injection time as a function of airflow through the air-intake passage, comprising an electrically controllable fuel-injection valve; adjustable electric timing means for opening said valve for an adjustable predetermined time; adjusting means for adjusting said predetermined time; an airflow sensing member operatively associated with said adjusting means and mounted in said air-intake passage for displacement by air flowing through said passage to any of a plurality of different positions respectively corresponding to different airflow conditions; and pneumatic damping means, operative in response to airflow changes, for applying to said sensing member a damping force which decreases with time, whereby to oppose displacement of said sensing member in response to sudden and short-lasting changes in airflow conditions, wherein said sensing member comprises a first pivotable baffle plate, and wherein said damping means comprises a damping chamber and a second baffle plate sharing the movement of said first plate and pivotably movable in said damping chamber and wherein said damping means defines a pressure-leakage opening in said damping chamber, wherein said pressure-leakage opening is provided on said second baffle plate.

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