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(54) **Electromagnetic fuel metering and atomizing valve.**

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Description

The present invention relates to an electromagnetic fuel metering and atomizing valve for an internal combustion engine fuel supply device.

Known valves of the aforementioned type substantially comprise a cylindrical supporting body having a first axial cavity housing an electromagnet, and an axial hole communicating with said cavity and housing an axially-sliding anchor integral with a mobile plugging member. Said valves also comprise a nozzle secured to and projecting axially from the supporting body, and in which is formed a fuel outlet hole communicating with said axial cavity and controlled by said plugging member. This is designed to move, by virtue of said electromagnet, between a first closed position wherein it is pushed by a spring against a seat on the nozzle, thus closing the fuel outlet hole, and an open position wherein the fuel outlet hole is opened.

Said valves present a duct for feeding the fuel (piped to the valve) into a chamber communicating with said fuel outlet hole. Said fuel duct usually comprises an axial hole through the core and anchor on the valve, and further passages formed between further members and said supporting body and nozzle. On said valves, therefore, fuel is fed into said chamber along a duct orignating at the top end and extending along the entire axial length of the valve.

A major drawback of known valves of the aforementioned type is the formation of fuel vapours inside the fuel duct, which results in impaired operation of the valve in terms of metering and atomizing performance. This is particularly noticeable when operating with high-temperature fuel, as when the vehicle is left in the sun for prolonged periods of time.

Moreover, the pressure at which the fuel is fed into the chamber communicating with the fuel supply hole is not strictly constant, and rarely corresponds to the set pressure. As correct operation of the valve depends on the pressure of the fuel metered at each cycle being maintained strictly constant, the fuel supply circuit to the valve presents a pressure regulator for maintaining substantially constant fuel supply pressure. In the case of exceptionally long fuel ducts, however, between the upstream portion of the valve (controlled by said pressure regulator) and the chamber communicating with the fuel outlet hole, as on known valves of the aforementioned type, the pressure inside the chamber differs from that of said upstream portion due to the resistance encountered by the fuel in the duct portion formed inside the valve. Failure of such valves to provide for strictly constant fuel pressure, corresponding to the set pressure, immediately upstream from the fuel outlet hole, invariably results, as already state, in impaired metering and atomising performance. On certain known valves of the aforementioned type, the chamber formed inside the valve, immediately upstream from the fuel outlet hole, is supplied with fuel through holes formed inside a portion of the nozzle close to the chamber itself.

A valve of this type is described in JP-A-60/79154; this valve comprises a series of holes disposed in the lateral wall of the nozzle and designed to feed the fuel to the outlet hole of the valve and a series of holes disposed in the cylindrical body of the valve and designed to discharge the unemployed fuel and a small part of fuel vapours.

Though providing for substantially the same pressure inside the chamber and in the upstream portion of the valve (controlled by said pressure regulator) by reducing the length of the duct connecting the same, valves of the aforementioned type fail to provide a solution to the drawbacks caused by the formation of fuel vapours.

Moreover, valves of this sort featuring fuel outlet holes on the nozzle involve fairly complex machining operations, thus resulting in high manufacturing cost of the valve as a whole. The aim of the present invention is to provide an electromagnetic fuel metering and atomising valve for an internal combustion engine fuel supply device which includes a fuel supply duct, said valve comprising:

a substantially cylindrical supporting body having an external lateral surface, a first axial cavity, and a first axial hole, said first axial cavity being in communication with said first axial hole, said supporting body having an electromagnet and a core disposed within said first axial cavity, said supporting body having an armature partially disposed in said first axial hole and partially disposed in said first axial cavity; said core and said armature being substantially tubular in order to define respective cavities in which is housed a spring;

a nozzle secured to and projecting axially from said supporting body, said nozzle including a seat, an outlet hole in communication with said first axial cavity, a second axial hole, and a sliding rod with an integral mobile plugging member disposed if, said second axial hole, said sliding rod connected to said armature; and

a spacer disposed between said supporting body and said nozzle, said spacer supporting said nozzle and including a radial slot in communication with said first and second axial holes and said seat;

said plugging member being moved by means of said electromagnet between a first closed position, wherein said plugging member is pushed by said spring against said seat thereby closing said outlet hole, and a second open position wherein said outlet hole is open;

said supporting body including a series of radial holes disposed over said lateral surface and in communication with said first axial cavity thereby providing for a first fuel flow between said first axial cavity and the fuel supply duct;

characterized in the fact that said rod includes at least one hole connecting said cavity in said armature to said second axial hole; and said core includes at least one radial hole thereby providing for a second fuel flow coming from said series of radial holes passing through said radial hole, and said cavities defined within said armature and said core and going out said hole connecting said cavity in said armature to said second axial hole whereby said second flow scavenges any vapours from said cavity in said armature.

One embodiment of the valve according to the present invention will be described by way of example with reference to the accompanying drawing showing an axial section of the same.

The valve according to the present invention comprises a supporting body 1 defined by a substantially cylindrical lateral surface 2, and having a first axial cavity 3 housing an electromagnet 4, and an axial hole communicating with said cavity 3. Axial hole 6 on electromagnet 4 houses a core 7, while axial hole 5 houses an axially-sliding anchor 8 integral with a mobile plugging member 9. Supporting body 1 is fitted with a nozzle 12 in which is formed a fuel outlet hole 13 controlled by plugging member 9. In the embodiment shown, plugging member 9 is conveniently integral with a rod 14 sliding axially inside a cylindrical seat 15 on nozzle 12, and guided by a pair of annular projections 16 on which are formed flat portions 17, each defining a fuel passage together with the cylindrical surface of seat 15. A spacer 18 is fitted between nozzle 12 and body 1, and nozzle 12 is secured to body 1 by permanently deforming the annular end edge 19 of body 1.

Anchor 8 is substantially tubular and secured to rod 14, e.g. by permanently deforming the end of anchor 8. Inside anchor 8 and core 7, there is fitted a helical spring 20 having one end resting on a push rod 22 force-fitted inside an axial hole 23 on core 7, and designed to normally maintain plugging member 9 against a seat 24 upstream from fuel outlet hole 13.

According to the present invention, supporting body 1 presents a series of holes 25 designed to enable external communication of axial hole 5 through lateral surface 2 of body 1. As shown in the drawing, said holes 25 consist of radial holes coming out inside cavity 3 of body 1.

Spacer 18 presents a slot 30 for connecting axial hole 5 to seat 15 inside nozzle 12 and, consequently, to fuel outlet hole 13.

The end of rod 14 presents at least one hole 31 for connecting the hole in anchor 8 to seat 15 of nozzle 12.

As shown in the drawing, body 1 and part of nozzle 12 are conveniently covered by a plastic casing 35 having holes corresponding with holes 25. Between cover 35 and body 1, there is provided a mesh filter 36. The valve also comprises known electrical connecting members 38 for supplying electromagnet 4, a cap 39 for nozzle 12, and a sealing ring 40.

The valve according to the present invention operates as follows.

When connected to a fuel circuit of the type shown in the drawing, the valve according to the present invention is housed inside a substantially cylindrical seat 45 having a hole 46 communicating with the manifold supplying the mixture to the engine. As shown in the drawing, when the valve is housed and locked inside seat 45, e.g. by means of plate 47, pressure is exerted on the surface of hole 46 by sealing ring 40 which, together with a further sealing ring 48 between the valve and seat 45, seals the fuel inside seat 45. Fuel is fed into seat 45 along a duct 49 preferably located in line with holes 25, and is drained from seat 45 by a further duct 50.

The fuel supplied by duct 49 is maintained at a predetermined pressure by a pressure regulator (not shown) on the fuel circuit upstream from duct 49. The incoming fuel from duct 49 therefore fills seat 45 and enters the valve through holes 25, as shown by the black and white arrows in the drawing.

A first stream of fuel through holes 25 (shown by the black arrow) flows into cavity 3 and, through the hole in anchor 8 and the openings formed between anchor 8, core 7, body 1, spacer 18 and slot 30, into seat 15 on nozzle 12, and from there through the cavities formed between the flat portions of annular projections 16 and the surface of seat 15 to outlet hole 13.

A second stream of fuel through holes 25 flows into cavity 3 and, via the openings between core 7, anchor 8 and the surfaces of hole 5 in body 1 and hole 6 in electromagnet 4, flows over the outer surfaces of all the members inside cavity 3 and axial hole 5, and out along duct 50. The presence of radial hole 32 in core 7 facilitates said passage.

Said first stream of fuel therefore substantially supplies outlet hole 13 along said route inside the valve, the reduced length and, consequently, reduced resistance of which provide for minimal load losses, so that the fuel at outlet hole 13 presents substantially the same pressure as inside supply duct 49. Moreover, said second stream of fuel flows through all the openings and holes inside body 1, particularly those at the top of the valve,

thus providing for effective scavenging of any vapours formed inside the same.

The valve according to the present invention has been found to overcome the drawbacks typically associated with known substantially axial fuel feed type valves, wherein the metering and atomizing efficiency of the valve is seriously impaired by the formation of vapours particularly at the top of the valve. Moreover, metering and atomizing performance is improved by virtue of the high, substantially constant fuel pressure maintained immediately upstream from outlet hole 13.

When electromagnet 4 is energized, anchor 8 is drawn towards core 7 against the action of spring 20, thus detaching plugging member 9 from seat 24 of nozzle 12 and so allowing a given quantity of fuel to flow through outlet hole 13. When electromagnet 4 is de-energized, spring 20 restores plugging member 9 to the closed position shown in the drawing.

Claims

1. An electromagnetic fuel metering and atomizing valve for an internal combustion engine fuel supply device which includes a fuel supply duct (49), said valve comprising:

a substantially cylindrical supporting body (1) having an external lateral surface (2), a first axial cavity (3), and a first axial hole (5), said first axial cavity being in communication with said first axial hole, said supporting body having an electromagnet (4) and a core (7) disposed within said first axial cavity, said supporting body having an armature (8) partially disposed in said first axial hole and partially disposed in said first axial cavity (3); said core and said armature being substantially tubular in order to define respective cavities in which is housed a spring (20);

a nozzle (12) secured to and projecting axially from said supporting body, said nozzle including a seat (24), an outlet hole (9) in communication with said first axial cavity (3), a second axial hole (15), and a sliding rod (16) with an integral mobile plugging member disposed in said second axial hole (15), said sliding rod connected to said armature; and

a spacer (18) disposed between said supporting body and said nozzle, said spacer supporting said nozzle and including a radial slot (30) in communication with said first (5) and second (15) axial holes and said seat;

said plugging member being moved by means of said electromagnet between a first closed position, wherein said plugging member is pushed by said spring against said seat (24) thereby closing said outlet hole, and a second open position wherein said outlet hole is open;

said supporting body including a series of radial holes (25) disposed over said lateral surface and in communication with said first axial cavity (3) thereby providing for a first fuel flow between said first axial cavity (3) and the fuel supply duct (49);

characterized in the fact that said rod (16) includes at least one hole (31) connecting said cavity in said armature (8) to said second axial hole (15); and said core (7) includes at least one radial hole (32) thereby providing for a second fuel flow coming from said series of radial holes (25) passing through said radial hole (32), and said cavities defined within said armature (8) and said core (7) and going out said hole (31) connecting said cavity in said armature (8) to said second axial hole (15) whereby said second flow scavenges any vapours from said cavity in said armature (8).

Patentansprüche

1. Elektromagnetisches Kraftstoffdosier- und Kraftstoffzerstäubungsventil für die Kraftstoffzufuhrvorrichtung einer Brennkraftmaschine mit einem Kraftstoffzuleitungskanal (49), wobei das Ventil umfaßt:

einen im wesentlichen zylindrischen Trägerkörper (1) mit einer äußeren Seitenfläche (2), einem ersten axialen Hohlraum (3) und einem ersten axialen Loch (5), wobei der erste axiale Hohlraum mit dem ersten axialen Loch in Verbindung steht, wobei der Trägerkörper mit einem Elektromagnet (4) und einem innerhalb des ersten axialen Hohlraums angeordneten Kern (7) versehen ist, wobei der Trägerkörper einen teilweise in dem ersten axialen Loch und teilweise in dem ersten axialen Hohlraum (3) angeordneten Anker (8) aufweist, wobei der Kern und der Anker im wesentlichen rohrförmig sind, um jeweils Hohlräume zu bilden, in denen eine Feder (20) untergebracht ist;

eine Düse (12), die an dem Trägerkörper befestigt ist und axial von diesem absteht, wobei die Düse einen Sitz (24) ein mit dem ersten axialen Hohlraum (3) in Verbindung stehendes Auslaßloch (9), ein zweites axiales Loch (15) und eine Gleitstange (16) mit einem einstückig angeformten bewegten Verschlußglied in dem zweiten axialen Loch (15) enthält, wobei die Gleitstange mit dem Anker verbunden ist; und

ein Abstandsstück (18), das zwischen dem Trägerkörper und der Düse angeordnet ist, wobei das Abstandsstück die Düse trägt und einen radialen Schlitz (30) aufweist, der mit dem ersten (5) und dem Zweiten (15) axialen Loch und dem Sitz in Verbindung steht;

wobei das Verschlußglied mit Hilfe des Elektromagnets zwischen einer ersten geschlossenen Position, in der das Verschlußglied von der Feder gegen den Sitz (24) gestoßen wird und dadurch das Auslaßloch verschließt, und einer zweiten offenen Position, in der das Auslaßloch offen ist, bewegt wird;
wobei der Trägerkörper eine Reihe von radialen Löchern (25) enthält, die über der Seitenfläche angeordnet sind und mit dem ersten axialen Hohlraum (3) in Verbindung stehen, wodurch für einen ersten Kraftstoffffluß zwischen dem ersten axialen Hohlraum (3) und dem Kraftstoffzuleitungskanal (29) gesorgt wird;
gekennzeichnet durch die Tatsache, daß die Stange (16) wenigstens ein Loch (31) enthält, das den Hohlraum in dem Anker (8) mit dem zweiten axialen Loch (15) verbindet, und daß der Kern (7) wenigstens ein radiales Loch (32) aufweist, wodurch für einen zweiten Kraftstoffluß gesorgt wird, der von der Reihe von radialen Löchern (25) kommt und durch das radiale Loch (32) und die in dem Anker (8) gebildeten Hohlräume und dem Kern (7) verläuft und aus dem Loch (31) erfolgt, das den Hohlraum in dem Anker (8) mit dem zweiten axialen Loch (15) verbindet, wodurch der zweite Fluß Dämpfe aus dem Hohlraum in dem Anker (8) ausspült.

Revendications

1. Soupape électromagnétique de dosage et de pulvérisation pour un dispositif d'alimentation de carburant d'un moteur à combustion interne, incorporant une conduite d'alimentation de carburant (49), la soupape comprenant :

un corps de support sensiblement cylindrique (1) avec une surface latérale externe (2), une première cavité axiale (3), et un premier trou axial (5), la première cavité axiale étant en communication avec le premier trou axial, le corps de support comportant un électro-aimant (4) et un noyau (7) disposés à l'intérieur de la première cavité axiale, le corps de support ayant un induit (8) partiellement disposé dans le premier trou axial et partiellement disposé dans la première cavité axiale (3) ; le noyau et l'induit étant sensiblement tubulaires pour définir les cavités respectives dans lesquelles est logé un ressort (20);

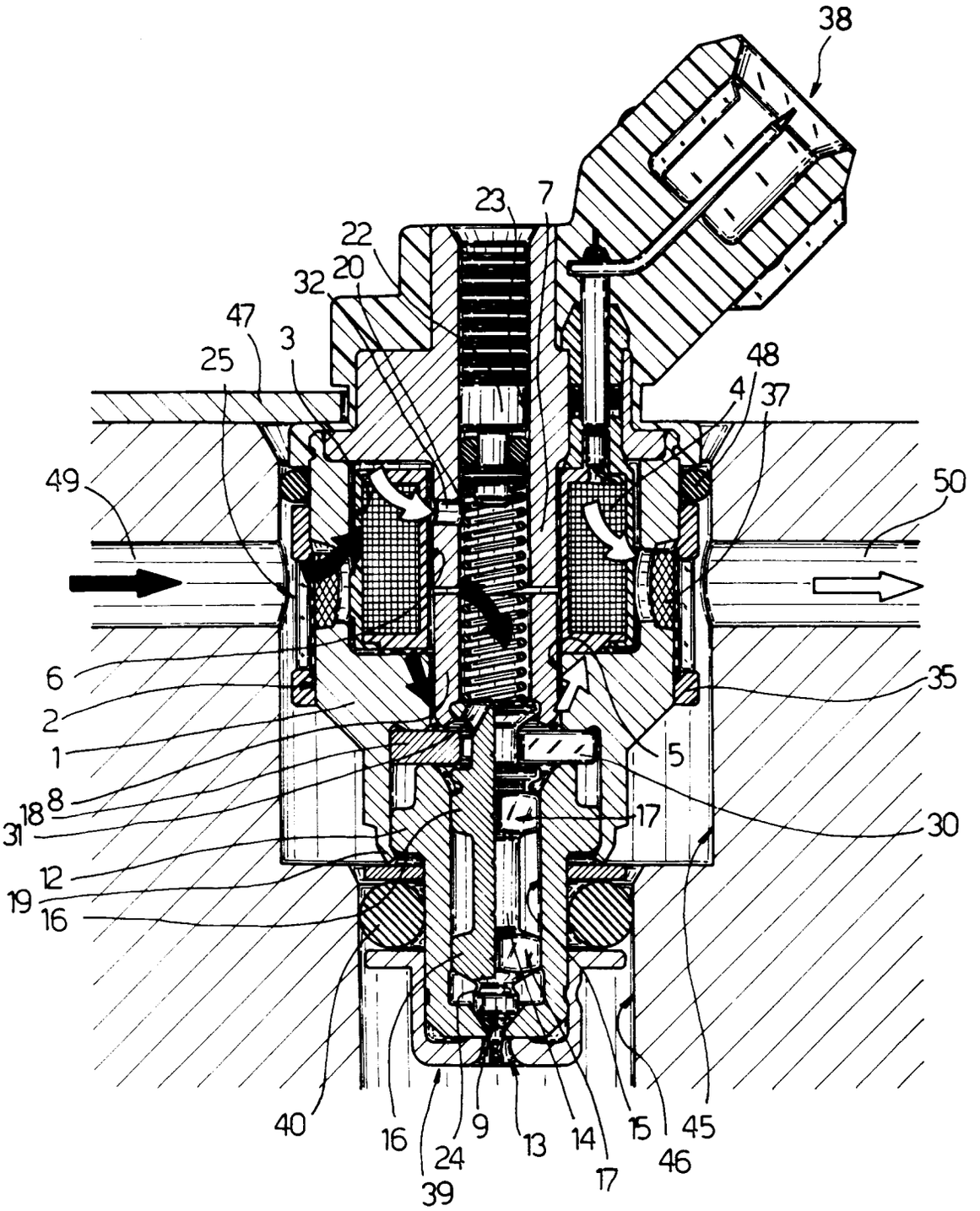
une tuyère (12) fixée et faisant saillie axialement sur le corps de support, cette tuyère comprenant un siège (24), un trou de sortie (9) en communication avec la première cavité axiale (3), un second trou axial (15), une tige coulissante (16) comportant un élément d'obturation mobile solidaire, disposée dans le second trou axial (15), la tige coulissante étant raccordée à l'induit ; et

une entretoise (18) disposée entre l'élément de support et la tuyère, cette entretoise supportant la tuyère et comportant une fente radiale (30) en communication avec les premier (5) et second (15) trous axiaux et le siège ;

l'élément d'obturation étant déplacé au moyen de l'électro-aimant entre une première position fermée, dans laquelle cet élément d'obturation est poussé par un ressort contre le siège (24), obturant ainsi le trou de sortie, et une seconde position ouverte dans laquelle le trou de sortie est ouvert ;

le corps de support comprenant une série de trous radiaux (25) disposés sur la surface latérale et en communication avec la première cavité axiale (3), assurant ainsi un premier écoulement de carburant entre la première cavité axiale (3) et la conduite d'alimentation de carburant (49);

caractérisée en ce que la tige (16) comprend au moins un trou (31) raccordant la cavité dans l'induit (8) au second trou axial (15) ; et le noyau (7) comprend au moins un trou radial (32) assurant ainsi un second écoulement de carburant en provenance de la série de trous radiaux (25) traversant le trou radial (32), et les cavités définies à l'intérieur de l'induit (8) et le noyau (7) et sortant de ce trou (31) raccordant la cavité dans l'induit (8) au second trou axial (15), de sorte que ce second écoulement balaie toutes les vapeurs provenant de la cavité dans l'induit (8).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