

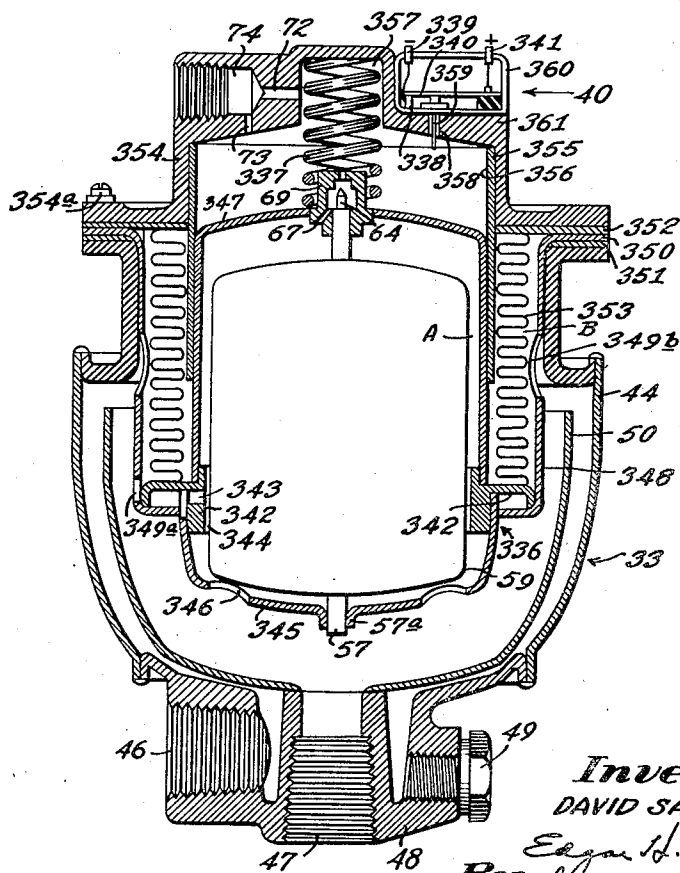
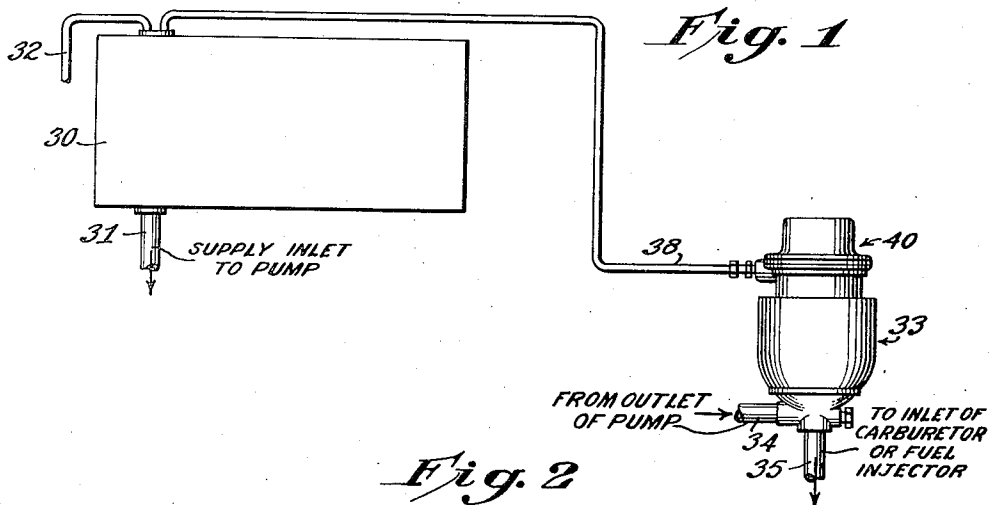
Jan. 23, 1945.

D. SAMIRAN

2,367,692

AIR ELIMINATOR

Original Filed May 16, 1940



Inventor
DAVID SAMIRAN
Edgar H. Sandgren and
By Wade Kooity
Attorneys

UNITED STATES PATENT OFFICE

2,367,692

AIR ELIMINATOR

David Samiran, Fairfield, Ohio

Original application May 16, 1940, Serial No. 335,646. Divided and this application June 11, 1942, Serial No. 446,618

3 Claims. (Cl. 158—46.5)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention is a division of my co-pending application Serial No. 335,646, filed May 16, 1940, now Patent No. 2,313,773, issued March 16, 1943, and relates in general to fuel feeding systems, such as employed in connection with airplanes, automobiles and Diesel engines. More particularly the present invention is directed to certain novel apparatus for use in conjunction with such systems.

The presence of air, fumes and vapor has long been a serious problem in fuel systems for internal combustion engines of airplanes or automobiles, and also Diesel engines, wherein such air, fumes or vapor enter, or is created in the fuel supply conduits and is subsequently fed into the carburetor or injector apparatus. This condition obviously is of more serious nature in connection with engines of airplanes, such as when the airplane approaches relatively high altitudes, under which condition the fuel in the system vaporizes to a much higher degree than at lower altitudes. As is well known, at certain altitudes the fuel in effect boils, thereby developing bubbles and air and vapor pockets in the fuel being fed through the system to the carburetor or injector apparatus. This condition results in varying the ratio of the fuel mixture, producing a lean mixture which causes faltering of the engine, with consequent reduction in speed and lack of power. Such effects upon the engine of an airplane are extremely serious and render the plane more difficult to maneuver and may result in serious mishaps. Moreover at high altitudes, in addition to the conditions above mentioned, the fuel in the supply system, in effect, becomes expanded or stretched, thus causing partial starving of the carburetor or injector, and thereby varying the ratio of fuel mixture entering the carburetor or injector apparatus. Such conditions also cause a reduction in speed and lack of power, with the attendant dangers above indicated.

As is well known, in airplane constructions at the present time, there is employed a plurality of fuel supply tanks and when one of the tanks is exhausted, another tank of fuel is connected into the fuel supply system. During this interval of switch-over there is a possibility of air and vapor getting into the system, which also produces the difficulties above mentioned.

While the present invention is adapted for use

in connection with internal combustion engines, such as in airplanes and automobiles, as well as Diesel engines, the following explanation of the construction and operation of the apparatus constituting this invention will be treated primarily in connection with problems resulting from such conditions of the fuel systems of airplanes.

One of the objects of this invention resides in the provision of novel apparatus adapted for constantly eliminating air, fumes and vapor from a fuel supply system, prior to the supplying of fuel to the carburetor or injector apparatus and also capable of functioning at various altitudes.

A further object is to provide a novel form of apparatus of the character indicated for constantly eliminating air, fumes and vapor from the fuel system, together with a vent conduit for carrying off said air, fumes and vapor for discharge thereof into the upper part of a fuel supply tank above the fuel therein, the space above the fuel in turning being vented to atmosphere.

Still another object is to provide a novel device of the character indicated, which is so constructed as to provide a small auxiliary reserve supply of fuel for the carburetor or injector apparatus, adapted to be utilized for maintaining operation of the engine for a short period of time after the main fuel source is exhausted during which time air is being pumped into the system, or when, for various reasons, the pump is unable to supply the requisite quantity of fuel to the carburetor or injector apparatus of the engine.

Other objects and advantages of this invention will be apparent from the following description, taken in connection with the accompanying drawing in which—

Figure 1 is a diagrammatic, fragmentary representation of certain elements of a fuel supply system, including the apparatus constituting the present invention;

Figure 2 is a cross sectional view of an embodiment of an air-vapor eliminator, especially adapted for use in connection with high pressure fuel systems, such as in connection with super-charged engines.

Referring now to Figure 1 of the drawing, I have shown a fuel supply or storage tank indicated at 30, having a supply outlet 31, adapted for connection to a fuel pump (not shown), the upper end of the tank being provided with a down-turned conduit 32 constituting the usual air vent. The novel air-vapor eliminator unit is indicated generally at 33, and has connected

thereto a fuel supply conduit 34, adapted to be connected to the pump, and also a fuel discharge conduit 35 adapted to be connected to a carburetor or fuel injector apparatus, (not shown).

The upper end of the air-vapor eliminator 33 is connected by a conduit 38 to the top of the fuel storage tank 30 and serves to constantly convey air, fumes, and vapor from the fuel system, for discharge into the top of the storage tank, and thereby precludes passage of any appreciable amount of air, fumes or vapor into the carburetor or injector apparatus. This arrangement thereby permits the escape of the air, through vent pipe 32 of the storage tank, and any of the vapors that again become condensed into liquid form within the tank are thereby salvaged.

It is to be understood that Figure 1 is merely a diagrammatic illustration, and any practical number of fuel supply tanks may be employed in connection with the fuel supply system, such as used in connection with airplanes.

The air-eliminator shown in Figure 2, and designated 33, and pressure switch 40, are especially adapted for use in high pressure fuel supply systems, such as in connection with a super-charged engine.

The essence of novelty in Figure 2, concerns slidable mounting of a float guide 336, which functions in a manner so that upon seating of the valve 64 in the valve seat 69, further increase in the liquid fuel level in the cup-shaped housing 44 will cause vertical bodily movement of said float guide 336, against the compressive restraint of a spring 337, to a level resulting in opening of a switch composed of a fixed contact 338 connected to a binding post 339 and a movable contact 340 connected to a binding post 341. Upon exhaustion of the fuel container 30, operably connected to the passageway 74 of the air-vapor eliminator 33 by the pipe 38, (see Figure 1), the reserve fuel contained in the cup-shaped housing 50 is pressure-fed through the outlet 47 by the spring 337, since continuing operation of the fuel pump prevents fuel escape from the inlet 46 of housing 44.

In the construction represented in Figure 2, parts employed include the slidable float guide 335 which consists of a ring 342 with vent holes 343 and 344, a lower housing 345 depending from said ring, and provided with vent holes 346, and an upper housing 347 fixed to the top surface of the ring 342. The bottom of the lower housing 345 is sleeved at 57a to form a journal guide for the tube 57 of the float 59. The valve seat 69 is fixed in an aperture provided in the top of the upper end of an inverted cup-shaped housing 347, so that it acts as a base guide for the spring 337. The outer diameter of the ring 342 is in turn guided by a cupped sleeve 348. Said sleeve is provided with vent holes 349a and 349b, and its upper end continues into an outwardly extending flange 350, supported on a mounting gasket 351, which in turn is seated upon the upper end of the housing 44. Immediately upon the top of the mounting flange 350 I place a thin annular disk 352 to the lower inner surface of which I fix the upper end of a flexible liquid sealing element or bellows portion 353. The lower end of the bellows portion 353 is also fixed to the top surface of the ring 342. The float carrier 347 thus becomes a vertically sliding partition which effectively seals the air space above it from the fuel space below it.

Mounted on the cup-shaped housing 44 is a cover plate-housing 354, secured thereto by con-

ventional screw-lockwasher means 354a. Formed in the housing 354 is a vertical cavity 355 in which is mounted a sleeve 356, adapted to act as a primary guide for the float guide 336. The top of the housing 354 includes a spring cavity 357; vent line passageways 72, 73 and 74, and a contactor pin hole 358. A contactor pin 359, of insulating material, is mounted for sliding guidance in said hole and has a major portion thereof depending from the bottom surface of a contactor housing 360. Upward movement of the pin 359 serves to "open the circuit" controlled by contacts 338 and 340, by engagement of said pin with the insulated movable contact 340, with respect to the grounded fixed contact 338. Obviously, the fixed contact 338 may be insulated from the housing 360, if desired. The contactor housing 360 can be fixed to a shelf 361 provided upon the top outer surface of the cover plate housing 354 by any of several well known conventional means.

The combined air-vapor eliminator 33 and pressure responsive switch 40 operate as follows: Assuming that the device has just been disconnected from an empty tank and connected to a full one, fuel from the fuel pump first enters the inlet 46, spills over the top of the deflector 50, and then rises in the latter until it flows through vent holes 345, 343, 344, 349a and 349b to an upward level approximating the middle of the last named vent hole. So far, air originally occupying the empty air-vapor eliminator 33 has found ready escape through the open valve seat 69 and vent passageways 67, 72, 73 and 74. Thereafter, further fuel flow divides itself in inner zone A and outer zone B. Due to air trap, the fuel in zone B does not usually progress to the top of the cup-shaped housing 44. In zone A, however, fuel ultimately and completely fills the upper part of housing 347. When fuel in the inner zone A reaches a point slightly above the buoyancy level of the float 59, the valve 64 closes the valve seat 69. Thereafter, pressure from the fuel pump must be relied upon, if further liquid rise is to be accomplished within zones A and B. Ingress of further fuel, under steadily increasing pump pressure, causes the spring 337 to steadily compress, permitting corresponding upward movement of the float guide 336 and associated elements, until its uppermost surface engages the pin 359. So long as the fuel pump continues normal functioning, the contacts 338 and 340 will remain in "open-circuit" condition and the engine fuel injector or carburetor connected with the outlet 47 of the housing 44 will continue to receive fuel under a predetermined pressure. During the time interval of "switch-over" between an exhausted fuel container and another container of fuel, the engine fuel injector or carburetor will continue to be fed reserve fuel under pressure from the cup-shaped housing 44 of the eliminator 33, the volume of which is effectively increased by the volume of fuel within the elevated housing 347. As the fuel passes out of the lower passageway 47, the housing 347 will be pressed downwardly by the spring 337 while the valve 64 remains closed and the pressure of the spring thus maintains pressure on the fuel itself. The quantity of fuel within the elevated housing 347 is thus moved bodily downward to supplement the supply within the reservoir cup 50 with the spring 337 furnishing pressure for the supplemental fuel. Finally, however, the level of the fuel recedes to such a point that the valve 64 opens and thereafter there can be only gravity

feed of the reserve fuel. Long prior to this however and, in fact, when the housing 347 starts to move downwardly, the switch 340 is closed for operating an indicator or means to supply further fuel to the eliminator.

Although I have herein shown and described a preferred form of my invention, manifestly it is capable of modification and rearrangement without departing from the spirit and scope thereof. I do not, therefore, wish to be understood as limiting this invention to the precise embodiments herein disclosed, except as I may be so limited by the appended claims.

I claim:

1. In an air eliminator for a fuel system, a closed housing having an air vent in the top and a fuel inlet in the bottom through which fuel under pressure is introduced, a reserve receptacle within the housing having an outlet opening in the bottom, a hollow float cage vertically slidable in a bearing in said housing, said cage having a top provided with a vent, said top being positioned to close off a space above said top within said housing, sealing means to prevent leakage between said closed off space and the remaining space within said housing except through said vent, a float having limited vertical movement within said cage, a valve on said float for controlling said vent, and means having a force less than the normal incoming pressure, urging said cage downwardly, thereby forcing fuel from the reserve supply within said receptacle through said outlet opening whenever the incoming pressure falls below that of the said force.

2. In an air eliminator for a fuel system, a closed housing having an air vent in the top, a fuel inlet opening in the bottom through which fuel under a preselected pressure is introduced, and a fuel outlet opening in the bottom through which fuel under said preselected pressure is discharged, a partitioning member supported within said housing for vertical sliding movement, an air chamber within said housing above said partitioning member and a fuel chamber within said housing below said partitioning member, sealing means between the housing and the partition-

ing member for sealing the air chamber above said partitioning member within said housing from the fuel chamber below said partitioning member within said housing, a valve opening in said partitioning member connecting the air space above said member to the fuel chamber below said member, a float carried by said partitioning member and adapted for vertical movement with respect to said partitioning member, a valve associated with said float and operable by vertical movement of said float with respect to said partitioning member to close said valve opening, and a resilient means under stress associated with said partitioning member having a force urging said partitioning member downwardly which is less than the upward force of said preselected fuel pressure, whereby fuel is stored in said housing whenever the fuel enters at the preselected pressure and moves said partitioning member upwardly against the resistance of said resilient means, and whereby reserve fuel is discharged by expansion of said resilient means whenever the incoming pressure falls below a predetermined value.

3. In an air eliminator of the character described, a closed housing having a fuel inlet and a fuel outlet in the bottom and an air vent in the top, a float carrier supported for vertical movement in said housing, means between said housing and said carrier for pressure sealing an air chamber above said carrier from a fuel chamber below said carrier, said carrier having a valve opening extending therethrough for connecting said chambers, a float supported by said carrier for vertical movement with respect thereto, a valve carried by said float and operable by vertical movement of said float to close said valve opening, and a resilient means urging said float carrier downward into said fuel chamber with a force less than the normal incoming pressure applies to said carrier to raise it, whereby said fuel is forced from said fuel outlet faster than it enters said fuel inlet, whenever said inlet pressure falls below said force.

DAVID SAMIRAN.