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CARBURETOR VAPOR VENTING DEVICE

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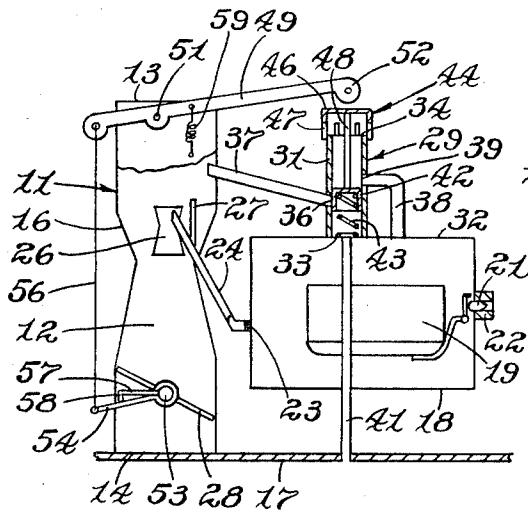


Fig. 1

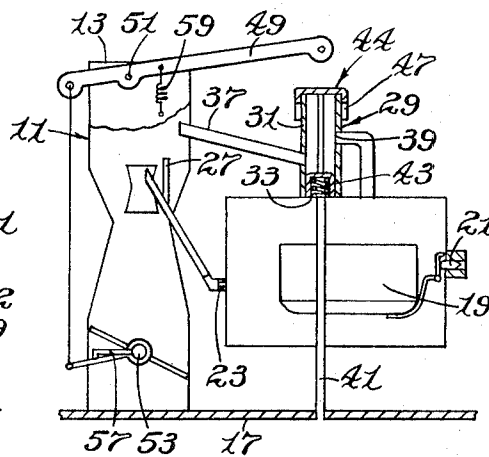


Fig. 2

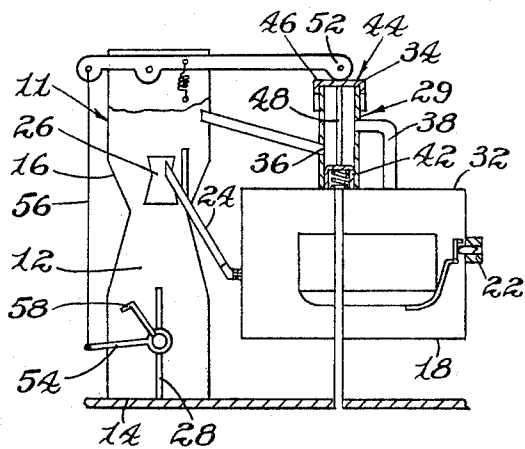


Fig. 3

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CARBURETOR VAPOR VENTING DEVICE

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This invention relates to a carburetor for an internal combustion engine and more particularly to an improved carburetor venting device for controllably releasing vapors formed in the fuel reservoir.

The gasoline in the fuel reservoir normally tends to give off vapors which create or generate an undesirable pressure which, if not relieved by venting, adversely affects normal fuel metering. The high ends or more volatile components of the gasoline are particularly susceptible to "boiling" and this boiling is particularly noticeable during idle or immediately after the engine has been stopped. Relief from the detrimental vapor pressure has been accomplished by venting the vapors externally to the atmosphere or internally into the carburetor mixture passage. Both methods of venting have inherent disadvantages. External venting loses the potential energy of the vaporized fuel, causes an objectionable gasoline smell to permeate the vehicle and/or the storage area and the vapors materially contribute to air pollution. Internal venting causes poor idling especially during hot weather driving and also creates an overly rich fuel-air mixture which makes it difficult to restart a hot engine. Various devices have been suggested to provide venting systems combining both the external and internal vents.

Ideally, carburetors should be designed and calibrated to function with the fuel reservoir normally internally vented during all phases of engine operation and externally vented only during periods of engine shutdown. It is desirable that the vents consistently assume an identical position during all phases of engine operation in order to assure properly calibrated and adjusted fuel metering means. A carburetor initially adjusted for internal venting would necessarily run rich if the external vent were opened just prior to or during those phases of engine operation when the main discharge jet is operative. The combination devices of the prior art have attempted to attain these ideals but in providing continuous fuel reservoir venting, these devices have been unable to definitely confine the external vent operation strictly to engine shutdown periods and to definitely confine internal vent operations only to periods of engine operation. These prior devices have allowed a detrimental overlap of external vent operations to occur during various engine operations and in so doing have caused improper fuel metering and inefficient engine operation. It is, therefore, an object of the present invention to provide a fuel reservoir vapor venting device which internally vents the fuel vapors to the carburetor mixture passage during all engine operations but which externally vents the fuel vapors during engine shutdown periods and accomplishes these functions without detrimental overlapping of the external and internal vent operations.

It is a further object of the present invention to provide a carburetor fuel reservoir vapor ventilating device which is simple, efficient, reliable and economical to manufacture and fabricate.

It is another object of the present invention to provide a carburetor fuel reservoir vapor venting device which is responsive to intake manifold vacuum and throttle valve movements.

It is still another object of the present invention to provide a carburetor fuel reservoir vapor venting device utilizing engine vacuum and including controlling means

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for insuring proper operation of the device when the engine vacuum is below a predetermined value.

It is still another object of the present invention to provide a carburetor fuel reservoir vapor venting device operatively utilizing engine vacuum and including throttle actuated control means operable when the throttle valve movements are outside a predetermined range of throttle operation and the vacuum is below a predetermined value so as to prevent the fuel vapor from being externally vented.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing which diagrammatically illustrates a single embodiment of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a diagrammatic view of a carburetor and a fuel system thereof showing the present invention incorporated therein and operative to open the external vent and close the internal vent when the utilizing engine is inoperative;

FIGURE 2 is a diagrammatic view similar to FIGURE 1 showing the fuel reservoir vapor venting device of the present invention in an operative condition responsive to communicated vacuum above a predetermined value, said vacuum being generated by the utilizing engine which is operating in an idle or off-idle range, whereby the external vent is closed and the fuel vapors are internally vented to the mixture passage; and

FIGURE 3 is a diagrammatic view similar to FIGURE 1 showing the fuel reservoir vapor venting device of the present invention controlled by throttle actuated control means when the utilizing engine is operating at full power or wide-open throttle range and the communicated vacuum is below a predetermined value and insufficient to actuate the piston means whereby the external vent is maintained in a closed position and the fuel vapors are internally vented to the mixture passage.

Referring now to the drawing wherein like reference characters designate like parts throughout the several views, in FIGURE 1 a carburetor of the downdraft type, generally designated 11, is shown comprising a mixture passage 12 including an air inlet 13 and a mixture outlet 14 and a main venturi 16. The mixture outlet is connected to the intake manifold 17 of an internal combustion engine.

Fuel is supplied to the mixture passage from a fuel reservoir 18 in which the fuel level is maintained at a given level in a conventional manner as determined by a float 19 which actuates a fuel valve 21 controlling the fuel inlet 22 leading from any suitable source (not shown). The fuel flows through a metering passage 23 to the main discharge nozzle 24 which discharges the fuel into an auxiliary venturi 26 in accordance with the air flow therethrough. A vent 27 provides an air bleed for the main discharge nozzle. An idle fuel passage (not shown) may lead from the main discharge nozzle structures to discharge fuel adjacent to the edge of the throttle valve 28 when the throttle valve is in the closed or off-idle positions. Suitable accelerator and economizer mechanisms which have not been illustrated may be provided in a manner well known in the art.

The fuel reservoir vapor venting device, generally designated 29, includes a hollow cylindrical housing 31 formed on a portion 32 of the carburetor body which overlies the fuel reservoir. The lower extremity 33 of the housing is closed while the opposite extremity 34 is open to provide a first port or external vent opening to the atmosphere. A second port 36 opens into the interior of the housing. A duct 37 communicates between the second port and the mixture passage to provide the internal vent means. A second duct 38 communicates

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fuel vapor from the fuel reservoir to orifice 39 opening into the interior of the housing intermediate the ports 34 and 36. A passage 41 communicates engine vacuum from a source posterior of the throttle valve herein illustrated as emanating from the intake manifold. A piston 42 slidably disposed in the housing is subject to the engine vacuum which tends to draw the piston downwardly against the bias asserted by the spring 43 compressively confined between the extremity 33 and the piston itself.

A valve member, generally designated 44, is supported by the housing and adapted to close the first port 34. The valve member comprises a cap-like member 46 having a plurality of slot-like openings 47 formed in the sidewall thereof. The valve slidably engages the exterior of the housing 31. When the valve is open (see FIGURE 1) the base of the cap member is spaced from the port 34 thereby allowing the slots to open into the interior of the housing. When the valve is closed (see FIGURES 2 and 3), the base of the cap abuts the adjacent extremity of the housing to close off port 34. A piston rod 48 is carried by the piston 42 and extends upwardly therefrom terminating in a connection with the base of the cap member 46. The piston rod dimensionally limits the separation occurring between the valve 44 and the piston 42 whereby the first port or external vent valve cannot be opened unless the piston concomitantly closes off the second port or internal vent.

Control means are provided to prevent valve 44 from opening when the communicated vacuum is below a predetermined value and insufficient to actuate the piston against the bias asserted by spring 43. The control means comprise a control arm 49 pivotally supported on the carburetor body as at 51, having free extremity 52 adjacent and overlying the valve member 44. The free extremity of the control arm is adapted to engage the external vent valve member. The throttle valve 28 is fixedly secured to a throttle shaft 53 journaled in the carburetor body. An overrunning member or loose lever 54 journaled on an extremity of the throttle shaft is connected by a linkage 56 to the control arm to translate rotational movements of the loose lever into rotational movements of the control arm. A pick-up lever 57 fixedly secured to the throttle shaft extremity in a definite relation to the throttle valve has a deformed extremity 58 adapted to engage portions of the loose lever when the throttle valve is actuated (by means not shown) through a predetermined range of throttle valve movements. Normally, the predetermined range of throttle valve movements will encompass movements in the idle and off-idle range. Biasing means 59 bias the control means in opposition to the force exerted by the rotating throttle shaft and the pick-up lever.

In operation, during engine shutdown (best illustrated in FIGURE 1) the throttle valve 28 will assume the closed position and the pickup-lever 57 will engage and rotate the loose lever 54 causing the rotary motion thereof to be transferred by linkage 56 to the control arm whereby the free extremity 52 thereof will be rotated clear of and out of contact with the external vent valve 44. Since the engine is inoperative, there will be no manifold vacuum to influence the piston 42. The piston will therefore be biased by spring 43 and cause piston rod 48 to axially displace the valve member 44 and expose the first port or external vent 34 to the atmosphere while concomitantly positioning the piston within the housing to effectively close off the second port or internal vent 36. Fuel vapor generated within the fuel reservoir 18 will flow through the duct 38 to the interior of the housing 31 and thence through port 34 and vent slots 47 of the valve member 44 to the atmosphere. Fuel vapors are prevented from reaching the mixture passage by the piston which effectively closes the internal vent thereby preventing overenrichment or loading of the carburetor.

When the engine becomes operative and operates in an idle or off-idle range (best illustrated in FIGURE 2), the

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throttle valve movements will be in the predetermined range of throttle valve movements thereby causing the control means to operate in the aforescribed fashion. However, the operation of the control means is wholly unnecessary since a high predetermined value of vacuum will exist at the source of vacuum 17 and this value of vacuum will be transferred by passage 41 to the closed extremity of the housing 31 to draw the piston downwardly into engagement with or adjacent to the lower extremity 33 of the housing 31. The piston rod 48 connected to the piston will cause the valve member 44 to move to a closed position and, of course, the piston 42 will no longer block or close off the second port 36. The fuel vapor will then be vented only through the internal vent 36 and duct 37 to the mixture passage 12 adjacent the air inlet 13.

During full power or wide-open throttle operation (best illustrated in FIGURE 3), the throttle valve movements will be outside the predetermined range of throttle valve movements. The pick-up lever 57 will rotate clear of the loose lever 54 allowing the spring 59 to pivotally bias the control arm causing its free extremity 52 to engage the external valve member 44 and maintain the valve in a closed condition. During this range of engine operation the value of vacuum in the source 17 will be below the predetermined value of vacuum required to actuate the piston. Normally, the piston biasing spring 43 would assert itself and actuate the piston to a position comparable to that illustrated in FIGURE 1, but the control arm's engagement with the valve member and the connection formed between the valve and the piston by the piston rod effectively prevents the piston from being displaced to thereby cause the fuel vapors to continue to be internally vented to the mixture passage.

From the foregoing description taken together with the accompanying drawing, it will be readily apparent that this invention provides a carburetor fuel reservoir vapor venting device which is controllably actuated by engine parameters and throttle valve movements. The device fulfills all the objects hereinbefore set forth.

I claim:

1. A carburetor for an internal combustion engine, comprising:
 - a mixture passage;
 - a fuel reservoir;
 - means for supplying fuel from the reservoir to the mixture passage in accordance with the quantity of air flow through the mixture passage;
 - a throttle valve in the mixture passage, said throttle valve adapted for movements between closed and opened positions for controlling the fuel-air mixture discharged from the mixture passage;
 - a source of vacuum;
 - a housing member;
 - a first port in the housing, including a valve member, communicating with the atmosphere;
 - a second port in the housing communicating with the mixture passage;
 - means for communicating between the reservoir and the housing;
 - a suction actuated member slidably supported in the housing, said suction actuated member adapted to open one of the ports and to concomitantly close the other of the ports;
 - means communicating vacuum from the source of vacuum to the housing with a predetermined value of communicated vacuum adapted to motivate the suction actuated member;
 - means for asserting a biasing force on the suction actuated member in opposition to the force exerted by the predetermined value of communicated vacuum whereby said member opens the first port and closes the second port; and,
 - throttle control means for overcoming the biasing force on the suction actuated member whereby said

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member closes the first port and opens the second port when the throttle valve is opened a predetermined amount and the vacuum from the source of vacuum is below the predetermined value and insufficient to motivate said member, said control means including a loose lever means and a pick-up lever means for engaging said loose lever means.

2. A carburetor for an internal combustion engine, comprising:

a mixture passage including an air intake and a mixture outlet;

a fuel reservoir;

means for supplying fuel from the reservoir to the mixture passage in accordance with the quantity of air flow through the mixture passage;

a throttle valve in the mixture passage, said throttle valve adapted for movements between closed and opened positions for controlling the fuel-air mixture discharged from the mixture outlet;

a source of vacuum, said source locating posterior of the throttle valve;

a hollow housing member;

a first port, including a valve member, communicating between the interior of the housing and the atmosphere;

a second port communicating between the interior of the housing and the mixture passage;

means for communicating between the interior of the housing and the reservoir;

means for communicating vacuum from the source of vacuum to the interior of the housing;

a suction actuated member slidably disposed in the housing adapted to be a responsive to a predetermined value of communicated vacuum to open one of the ports and to concomitantly close the other of the ports;

resiliently yieldable means operable when the communicated vacuum is below the predetermined value for biasing the suction actuated member to a position in which the first port is opened and the second port is closed; and,

throttle valve actuated control means for closing the first port valve member and actuating the suction actuated member to a position opening the second port when the throttle valve is opened a predetermined amount and the communicated vacuum is below the predetermined value and insufficient to actuate the suction member, said control means including a loose lever means and a pick-up lever means for engaging said loose lever means.

3. A carburetor for an internal combustion engine, comprising:

a mixture passage including an air intake and a mixture outlet;

a fuel reservoir;

means for supplying fuel from the reservoir to the mixture passage in accordance with the quantity of air flow through the mixture passage;

a throttle valve in the mixture passage adjacent the mixture outlet, said throttle valve adapted for movements between closed and opened positions for controlling the fuel-air mixture discharged from the mixture outlet to the engine;

a source of vacuum, said source locating posterior of the throttle valve;

a hollow housing member supported intermediate the reservoir and the air intake, said housing being closed at one extremity;

a first port at the opposite extremity of the housing communicating between the interior of the housing and the atmosphere;

a second port communicating between the interior of the housing and the air intake;

a passage communicating between the reservoir and the interior of the housing, said passage opening into

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the housing intermediate the first and second ports; means for communicating vacuum from the source of vacuum to the interior of the housing, said last named means opening into the closed extremity of the housing;

a valve member supported by the housing adjacent said opposite extremity, said valve member adapted to control the first port;

piston means slidably disposed in the interior of the housing adapted responsive to a predetermined value of communicated vacuum to open the second port and to concomitantly close the first port valve member whereby the fuel vapor in the reservoir is vented to the air intake;

biasing means positioned in the housing intermediate the closed extremity and the piston means for urging the piston means toward said opposite extremity when the communicated vacuum is below the predetermined value and for causing the piston means to open the first port valve member and to concomitantly close the second port whereby the fuel vapor in the reservoir is vented to the atmosphere; and,

throttle control means adapted to cooperate with the first port valve member and the piston means when the throttle valve is opened a predetermined amount and the communicated vacuum is below the predetermined value for closing the valve member and urging the piston means to a position intermediate the second port and the housing closed extremity whereby the fuel vapor in the reservoir is vented to the air intake, said control means including a loose lever means and a pick-up means for engaging said loose lever means.

4. A carburetor for an internal combustion engine, comprising:

a mixture passage including an air intake and a mixture outlet;

a fuel reservoir;

a means for supplying fuel from the reservoir to the mixture passage in accordance with the quantity of air flow through the mixture passage;

a throttle valve and shaft therefor rotatably supported in the mixture passage adjacent the mixture outlet, said throttle valve adapted for movements between closed and opened positions for controlling the fuel-air mixture discharged from the mixture outlet to the engine;

a source of vacuum, said source locating posterior of the throttle valve;

a hollow housing member;

a first port, including a valve member, communicating between the interior of the housing and the atmosphere;

a second port communicating between the interior of the housing and the mixture passage;

means for communicating between the interior of the housing and the reservoir;

means for communicating vacuum from the source of vacuum to the interior of the housing;

a suction actuated member slidably disposed in the housing adapted responsive to a predetermined value of communicated vacuum to open one of the ports and to concomitantly close the other of the ports;

means operable when the communicated vacuum is below the predetermined value for urging the suction actuated member to a position in which the first port is opened and the second port is closed;

a control arm pivotally supported and adapted to engage the valve member of the first port to urge the valve to a closed position;

a loose lever journaled on the throttle shaft;

a pick-up lever fixedly secured to the throttle shaft and adapted to engage and actuate the loose lever during

a predetermined range of throttle valve movements;
 linkage means interconnecting the control arm and the loose lever for actuating the control arm away from engagement with the valve member during throttle valve movements in the predetermined range; and,
 means for urging the control arm into engagement with the valve member when the throttle valve movements are outside the predetermined range. 5
 5. A carburetor for an internal combustion engine, comprising:
 a throttle passage including an air intake and a mixture outlet;
 a fuel reservoir;
 means for supplying fuel from the reservoir to the mixture passage in accordance with the quantity of air flow through the mixture passage;
 a throttle valve and shaft therefor rotatably supported in the mixture passage adjacent the mixture outlet, said throttle valve adapted for movements between closed and opened positions for controlling the fuel air mixture discharged from the mixture outlet to the engine;
 a source of vacuum, said source locating posterior of the throttle valve;
 a hollow housing member supported intermediate the reservoir and the air intake, said housing being closed at one extremity;
 a first port at the opposite extremity of the housing communicating between the interior of the housing and the atmosphere;
 a second port communicating between the interior of the housing and the air intake;
 a vent passage communicating between the reservoir and the interior of the housing, said vent passage opening into the housing interior intermediate the first and second ports;
 means for communicating vacuum from the source of vacuum to the interior of the housing, said last named means opening into the closed extremity of the housing;
 a valve member supported by the housing adjacent said opposite extremity, said valve member adapted to control the first port;
 piston means slidably disposed in the interior of the housing adapted responsive to a predetermined value of a communicated vacuum to open the second port and to concomitantly close the first port valve mem-

ber whereby the fuel vapor in the reservoir is vented to the air intake;
 means positioned in the housing intermediate the closed extremity and the piston means for urging the piston means toward said opposite extremity when the communicated vacuum is below the predetermined value and for causing the piston means to open the first port valve member and to concomitantly close the second port whereby the fuel vapor in the reservoir is vented to the atmosphere;
 a control arm pivotally supported exteriorly of the mixture passage adapted to engage the valve member of the first port to urge the valve member to a closed position;
 a loose lever journaled on the throttle shaft;
 a pick-up lever fixedly secured to the throttle shaft and adapted to engage and actuate the loose lever during a predetermined range of throttle valve movements;
 linkage means interconnecting the control arm and the loose lever for actuating the control arm; and,
 means for urging the control arm into engagement with the valve member when the throttle valve movements are outside the predetermined range, said valve member being adapted when in the closed position to limit movement of the piston means to a position intermediate the second port and the housing closed extremity whereby the fuel vapors in the reservoir are vented to the air intake notwithstanding that the communicated vacuum is below the predetermined value.

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