DEGASSER ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

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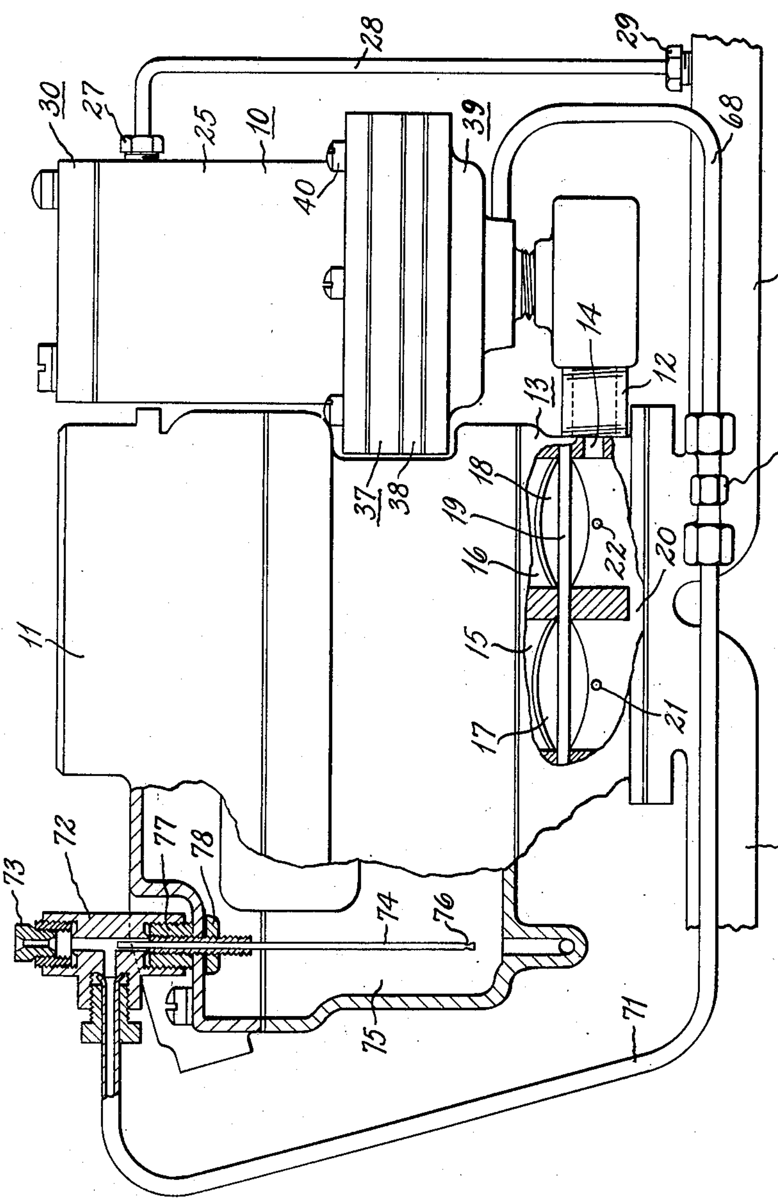

Fig. 1.

INVENTORS
JOHN M. BARR
BY HOWARD H. DIETRICH
Craig V. Morton
ATTORNEY

Feb. 25, 1958 H. H. DIETRICH ET AL 2,824,726

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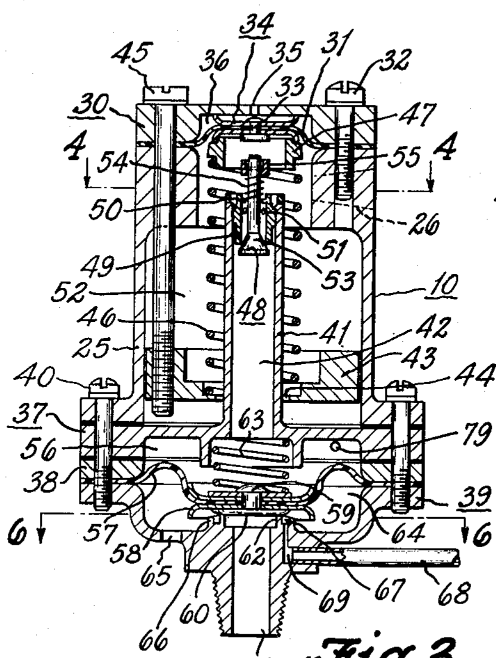

Fig. 3.

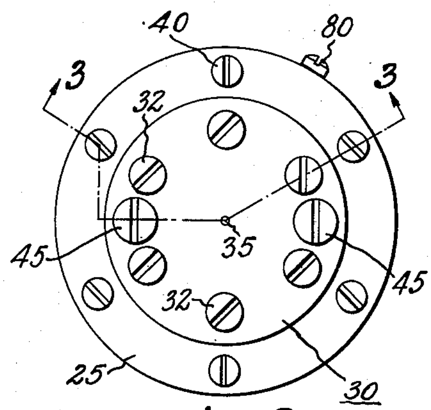

Fig. 2.

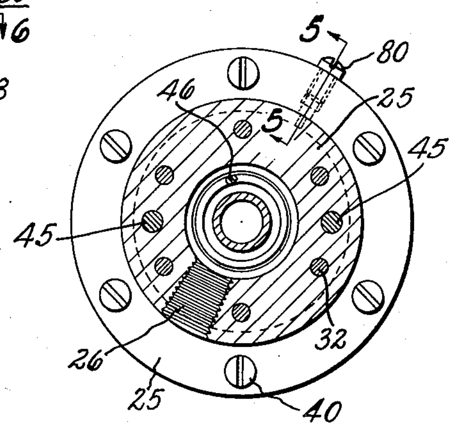

Fig. 4.

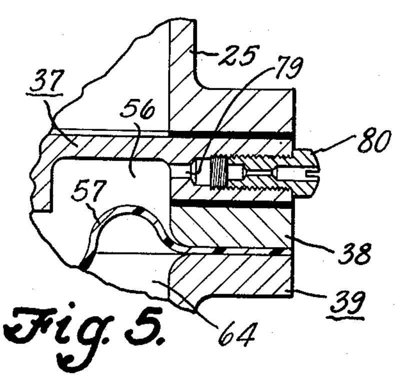

Fig. 5.

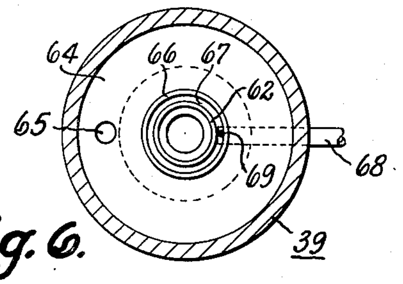

Fig. 6.

INVENTORS
JOHN M. BARR
BY HOWARD H. DIETRICH

Craig V. Morton
ATTORNEY

2,824,726

DEGASSER ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Howard H. Dietrich, Berkley, Mich., and John M. Barr, Rochester, N. Y., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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3 Claims. (Cl. 261—64)

This invention pertains to internal combustion engines, and particularly to a degasser attachment for such engines.

It has long been recognized that during deceleration of a vehicle powered by an internal combustion engine, with the throttle valve closed and the engine driven by the vehicle, the idle-air fuel mixture supplied to the engine is not completely burned due to a lack of sufficient air. Under these conditions, the products of incomplete combustion, including free hydrocarbons, are discharged with the exhaust and expelled to atmosphere. The present invention relates to means for supplying a combustible mixture to the engine during periods of deceleration with a closed throttle valve and, thus, substantially eliminate the discharge of unburned fuel with the exhaust gases. Accordingly, among our objects are the provision of means for regulating manifold vacuum during engine deceleration; the further provision of means for admitting additional air directly into the intake manifold during deceleration when manifold vacuum is above a predetermined value; and the still further provision of means for mixing the additional air with fuel to produce a combustible air fuel mixture which is supplied to the engine during vehicle deceleration with a closed throttle.

The aforementioned and other objects are accomplished in the present invention by incorporating a manifold pressure regulator and auxiliary fuel supply system in an attachment for an internal combustion engine. Specifically, the internal combustion engine includes a conventional, plain tube downdraft carburetor for supplying air-fuel mixture to an intake manifold which distributes the combustible mixture to the several engine cylinders. The speed of engine operation is controlled by throttle valve means which regulate the quantity of combustible mixture supplied to the engine. When the throttle valve is open, fuel is supplied through the main carburetor jets, and when the throttle valve is closed, fuel is supplied through the idling jets.

During vehicle deceleration with a closed throttle valve, the vehicle drives the engine and creates an abnormally high manifold vacuum. Moreover, the quantity of air which flows around the closed throttle valve is insufficient to clean out the exhaust gases from the cylinders, and consequently the air-fuel mixture supplied by the idling system will not burn. Thus, it becomes necessary to supply additional air to purge the cylinders of exhaust gases. However, in order to form a combustible mixture having an air-fuel ratio of between 12–14:1, additional fuel must also be supplied.

The degasser attachment of this invention is supported on the carburetor and includes a cylindrical housing having open ends, the interior of the housing being subjected to manifold vacuum through a conduit. The upper end of the cylindrical housing is closed by a diaphragm which is clamped between the upper end of the housing and a cap member having an atmospheric vent therein. The lower end of the cylindrical housing has attached thereto a stop member with a central aperture and an integral tube extending upwardly into the housing and forming a continuation of the central aperture. The tube constitutes a guide for a spring that normally urges the upper, or pilot diaphragm, against the upper cap. In addition, the upper end of the tube supports a pilot valve assembly capable of actuation by the pilot diaphragm so as to connect the interior of the tube with the interior of the housing.

A lower cap member is attached to the lower end of the housing, a second, or power diaphragm being disposed between the stop member and the lower cap. The lower cap member, likewise, has an atmospheric vent therein, a fuel chamber and a central outlet passage through which air-fuel mixture is supplied directly to the intake manifold. The vacuum chamber formed between the power diaphragm and the stop member has a calibrated atmospheric vent therein which prevents the trapping of vacuum in this chamber when the pilot valve is closed. The power diaphragm carries a valve disc and is spring urged to a position wherein the valve disc closes the outlet passage which is connected to the intake manifold. The fuel chamber is connected by a conduit to a fuel pick-up tube disposed in the fuel reservoir, or float chamber, of the carburetor. Since the chamber between the power diaphragm and the cap member is normally at atmospheric pressure due to the disc valve being closed, no fuel will be picked up by the auxiliary fuel tube under normal running conditions inasmuch as the float chamber of the carburetor is also vented to atmosphere.

During normal running operation of the engine, the air-fuel mixture is controlled by the carburetor throttle valve. Likewise, during normal idle operation of the engine, the fuel is supplied to the idling ports and mixed with the air passing around the periphery of the closed throttle valve. However, during deceleration of the engine with a closed throttle when the vehicle is driving the engine, the manifold vacuum increases appreciably above the manifold vacuum created during all normal running operation of the engine. When the manifold vacuum reaches a predetermined value, the pressure differential on opposite sides of the pilot diaphragm will be sufficient to overcome the restraining force of the spring and the pilot valve diaphragm will move downwardly to open the pilot valve. Upon opening of the pilot valve, the vacuum chamber of the lower diaphragm motor will be subjected to manifold vacuum, and the pressure differential on opposite sides of this diaphragm will effect movement of the diaphragm so as to open the outlet passage in the lower cap. When the outlet passage is open, the air flowing across the fuel passage creates a suction effect which causes a flow of fuel from the fuel reservoir and into the air stream which is being supplied to the intake manifold. Thus, the additional air is mixed with fuel, and the resulting air fuel mixture supplied from the idling jets and the air flow around the closed throttle valve plus the additional air and fuel supplied by the degasser attachment, is combustible.

The degasser attachment operates intermittently during deceleration with a closed throttle, since as soon as the outlet passage is opened, the manifold vacuum decreases, and as soon as the outlet passage is closed, the manifold vacuum immediately increases. The intermittent operation of the degasser attachment operates to regulate manifold vacuum during deceleration in addition to supplying additional air and fuel so as to produce a combustible air-fuel mixture. In this manner, the discharge of free hydrocarbons with the exhaust from the engine during deceleration is eliminated.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a fragmentary view, partly in section and partly in elevation, of a carburetor and intake manifold assembly having the degasser attachment of this invention.

Fig. 2 is a top view, in elevation, of the degasser attachment.

Fig. 3 is a sectional view taken along line 3—3 of Fig. 2.

Fig. 4 is a sectional view taken along line 4—4 of Fig. 3.

Fig. 5 is an enlarged fragmentary sectional view taken along line 5—5 of Fig. 4.

Fig. 6 is a sectional view taken along line 6—6 of Fig. 3.

Heretofore, it has been proposed to eliminate the discharge of unburned fuel with the exhaust gases during deceleration of a vehicle with a closed throttle, by admitting additional air either directly to the intake manifold or through the throttle valve by means of vacuum actuated poppet valves. While this arrangement appears to present a solution to the problem by leaning out the air fuel mixture supplied to and purging exhaust gases from the cylinders during deceleration, no means have been devised to control the supply of additional air so that the air-fuel mixture supplied to the cylinders is combustible. In other words, no one has been able to devise a device which will operate on all vehicle engines to prevent the discharge of unburned fuel with the exhaust during deceleration by merely admitting additional air to the intake manifold, since in some cases, the resultant air fuel mixture is too lean to be ignited in the cylinders, and in other instances the exhaust gases will not be sufficiently cleaned out of the cylinder combustion chambers to permit combustion of the mixture supplied. The present invention presents a satisfactory solution to the problem of degassing and operates satisfactorily on all engines since the additional air supplied during deceleration is mixed with fuel. The amount of fuel which must be added to the additional air to result in a completely combustible mixture being supplied to the engine during deceleration can be accurately calibrated. Thus, the amount of fuel supplied by the idling jets with a closed throttle can be accurately determined. Moreover, the amount of air flowing around the closed throttle valve can also be determined. With this information, it is a relatively simple matter to calibrate the additional fuel and air supplying system so as to supply a mixture withing the combustible portion range to the engine.

With particular reference to Fig. 1, the degasser attachment is indicated generally by the numeral **10**, the degasser attachment **10** being connected to a carburetor **11** by means of a pipe coupling **12**. The pipe coupling **12** actually communicates with the throttle body **13** of the carburetor, the throttle body **13** having a sidewall opening **14** communicating with the pipe **12**. By way of illustration, the carburetor **11** is of the dual barrel type and, thus, includes two induction passages **15** and **16**, the induction passages having butterfly type throttle valves **17** and **18** therein. The throttle valves **17** and **18** are attached to a common throttle actuating shaft **19**, which is connected by conventional linkage means, not shown, so as to be operated by the accelerator pedal, not shown, of the vehicle. It should be noted that the sidewall opening **14** in the throttle body **13** communicates with the induction passage **16** posterior to the throttle valve **18**. Moreover, in accordance with conventional practice, the two induction passages **15** and **16** are interconnected by a cross-over passage **20**.

In accordance with conventional practice, each induction passage is supplied with fuel through a main nozzle, not shown. When the throttle valves **17** and **18** are in the closed position, as depicted in Fig. 1, the idle-air fuel emulsion is supplied through idling ports **21** and **22**, respectively, located in the throttle body **13** posterior to the throttle valves. Air-fuel emulsion is drawn through the ports **21** and **22** from an idle well in the carburetor, not shown, due to the manifold vacuum existent in the induction passages **15** and **16** posterior to the throttle valves.

Induction passage **15** is connected to an engine intake manifold pipe **23**, while induction passage **16** is connected to intake manifold pipe **24**, as is conventional in the V–8 type engines. The two manifold pipes **23** and **24** are, likewise, interconnected by the cross-over **20** in the throttle body **13** so that the same absolute pressure exists in both manifold pipes **23** and **24** at all times.

With particular reference to Figs. 2 through 6, the structural details of the degasser attachment will be described. The degasser attachment **10** comprises a cylindrical housing **25** having open ends. As seen particularly in Fig. 4, the housing **25** has a threaded sidewall opening **26**, which, as depicted in Fig. 1, receives a coupling **27**, the coupling **27** being connected to a conduit **28**, which communicates with the intake manifold pipe **24** through a coupling **29**. The upper end of the housing **25** is closed by a cap member **30**, a suitable diaphragm **31** being interposed between the cap member **30** and the upper end of the housing **25**. The cap member **30** is attached to the housing **25** by a plurality of bolts **32**. The diaphragm **31** has attached thereto by means of a rivet **33**, a head assembly **34**. The cap **30** is formed with a central aperture **35** constituting an atmospheric vent for the chamber **36** formed between the upper surface of the diaphragm **31** and the inner surface of the cap **30**.

The lower end of the housing **25** has attached thereto a stop member **37**, a diaphragm ring **38**, and a lower cap **39**, these parts being maintained in assembled relation with the housing **25** by a plurality of bolts **40**. The stop member **37** includes an upwardly extending tubular member **41**, which communicates with a central aperture **42** in the stop member. An adjustable spring seat **43** is disposed within the housing **25** between the stop member **37** and the diaphragm **31**, the spring seat having a central aperture **44** through which a tubular projection **41** extends. The spring seat **43** is maintained in assembled relation with the housing **25** by means of a pair of bolts **45** supported on the cap member **30** and having threaded connection with the seat **43**. One end of a coiled compression spring **46** engages the seat **43**, the spring **46** encircling the tubular projection **41**, which acts as a spring guide therefor. The other end of the spring **46** engages a spring seat **47**, which is received by the lower disc of the disc assembly **34** attached to the center of the diaphragm **31**. The spring **46** normally maintains the diaphragm **31** in a position where the disc assembly **34** abuts the cover **30**, as depicted in Fig. 3. A pilot valve assembly generally depicted by the numeral **48** is supported by the upper end of the tubular projection **41**. The pilot valve assembly **48** comprises a valve cage **49**, which is snugly received in the tubular projection **41**, the valve cage having an internal shoulder **50** and a plurality of ports **51**, which interconnect the interior of the valve cage and the chamber **52** of the housing **25**. A valve element **53** is disposed within the valve cage and urged upwardly by a spring **54** so that the valve normally closes the open end of the cage **49**. The spring **54** reacts between the valve cage shoulder **50** and a seat **55** on the valve stem. When the chamber **52** is subjected to vacuum of a predetermined magnitude through the opening **26**, the pressure differential acting on opposite sides of the diaphragm **31** will be sufficient to overcome the resisting force of the calibrated spring **46** and, hence, the diaphragm will move downwardly, as viewed in Fig. 3, to a position where the rivet **33** engages the upper end of the stem of the valve **53** so as to open the valve and interconnect the interior of tubular projection **41** with the chamber **52**. Thus, the upper diaphragm **31** is termed the pilot diaphragm.

The tubular projection **41** communicates through the central aperture **42** in the stop member **37** with a vacuum chamber **56** for a power diaphragm **57**, which is flange mounted between the ring **38** and the cap member **39**. The diaphragm **57**, likewise, has attached thereto a disc assembly **58** by means of a rivet **59**, the lower surface of rivet **59** constituting a valve **60**. The valve **60** normally closes a centrally disposed outlet passage **61** in the lower cap member **39** by engaging an internal shoulder **62** circumscribing the passage **61**. The diaphragm **57** is normally maintained in position where the valve **60** closes the passage **61** by a coiled compression spring **63**, opposite ends of which engage the diaphragm disc assembly **58** and the stop member **37**.

As seen particularly in Figs. 3 and 6, the lower cap member **39** forms a chamber **64** with the diaphragm **57**, which is connected to atmosphere through an opening **65**. In addition, the annular shoulder **62** is radially spaced from a second annular shoulder **66** concentric with the shoulder **62** by an annular groove **67**. The annular groove **67** communicates with a fuel conduit **68** through a passage **69**. The fuel conduit **68** is connected by a union coupling assembly **70** to a conduit **71**, as seen in Fig. 1. The conduit **71** communicates with a fitting **72** mounted on the carburetor **11**. The fitting **72** is T-shaped and has attached thereto a calibrated air bleed **73** and an inlet fuel tube **74** which projects through the carburetor housing and into the fuel reservoir, or float chamber **75**. The tube **74** is open at the lower end, the lower end always being submerged within the fuel of the reservoir **75**. In addition, the tube **74** is formed with a calibrated restriction **76** adjacent the lower end thereof. The tube **74** is connected to the fitting **72** by a coupling **77** and is maintained in fixed relation relative to the carburetor by a nut **78**. Fuel cannot leak, or siphon, from the fuel reservoir **75** through the tubes **71** and **68** when the valve **60** is closed since opposite ends of the tubes are at atmospheric pressure.

With particular reference to Figs. 3 through 5, the stop member **37** has formed therein a radially extending bore **79**, which interconnects the chamber **56** with atmosphere through a calibrated bleed screw **80**. The calibrated air bleed for the chamber **56** prevents the trapping of vacuum in chamber **56** when the pilot valve **53** closes so that the diaphragm **57** will respond quickly and in a follow-up manner to the movements of the pilot diaphragm **31**. In other words, the chamber **56** is bled to atmosphere through the screw **80** so that unless the pilot valve **53** is open, the spring **63** will be operative to move the diaphragm **57** downwardly, as viewed in Fig. 3, and thereby position the valve **60** to close the outlet passage **61**.

Operation

During normal running operation of an engine equipped with a degasser attachment of this invention, fuel is supplied through either the main or idling jets of the carburetor in a conventional manner. Moreover, the air to fuel ratio during normal running operation is not in any way affected by the degasser attachment disclosed herein. However, during deceleration of the engine under conditions where the vehicle drives the engine, the intake manifold vacuum reaches an abnormally high value. In some cases manifold vacuum may reach a value as high as 26" of mercury. The resisting spring load on the pilot diaphragm **31** is adjusted so that this diaphragm is not actuated until manifold vacuum exceeds a value which is created during normal running operation, for instance, 23". When the manifold vacuum reaches a value of 23", the pilot valve diaphragm **31** will move downwardly due to the pressure differential on opposite sides thereof and the rivet **33** will open the pilot valve **53**. When the pilot valve **53** is open, manifold vacuum existent in chamber **52** of the housing **25** is communicated to chamber **56**. When the chamber **56** is subjected to manifold vacuum even of a relatively low value, the diaphragm **57** will move upwardly so as to displace valve **60** and open passage **61** to the chamber **64**, which is connected to atmosphere. Thus, air will flow across the annular groove, or fuel chamber, **67** between shoulders **62** and **66** and into the outlet passage **61**, which is connected by pipe **12** to the intake manifolds **23** and **24** through the throttle body **13**. Air flowing across the annular groove **67** creates an aspirating effect due to its high velocity so as to result in fuel being drawn from the reservoir **75** through the tube **74** and conduits **71** and **68** to passage **69** in the annular groove **67**. The fuel in annular groove **67** is mixed with air flowing thereacross to form an air-fuel emulsion which is supplied directly to the intake manifold of the engine. The air fuel mixture supplied by the degasser attachment mixes with the idle air fuel mixture supplied by the carburetor idle fuel supply system and forms a combustible mixture which is distributed by the intake manifold pipes **23** and **24** to the several engine cylinders and purges the exhaust gases therefrom. In this manner, the discharge of unburned fuel with the exhaust gases during deceleration is eliminated.

The degasser attachment operates intermittently during deceleration with closed throttle valves, since as soon as the manifold vacuum decreases below **23"**, the pilot valve diaphragm **31** moves upwardly and the pilot valve **53** closes. When this occurs, the chamber **56** quickly reaches an absolute pressure by reason of bleed screw **80**, which enables the spring **63** to move the diaphragm **57** downwardly so that valve **60** closes the outlet passage **61**. Thus, during vehicle deceleration with a closed throttle, the diaphragms **31** and **57** are intermittently actuated so as to maintain manifold vacuum substantially constant at 23". As soon as the speed of the engine reduces to a value wherein a manifold vacuum of 23" is not created, the degasser attachment is completely cut off.

From the aforegoing, it is apparent that the present invention provides a degasser attachment for internal combustion engines wherein the fuel and air supply is augmented during deceleration so as to produce a combustible mixture. Moreover, the degasser attachment does not in any way affect the normal running operation of the engine, and there will be no hesitation in engine operation after degassing since the carburetor idle fuel supply is not cut off during degassing.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A degasser attachment for an internal combustion engine having an intake manifold and a carburetor, including, a housing assembly having a chamber subjected to manifold vacuum and an outlet passage operatively connected to said intake manifold, first motor means in said housing assembly, second motor means in said housing assembly, a pilot valve in said housing assembly capable of actuation by said first motor means when the manifold vacuum in said chamber exceeds a predetermined value during engine deceleration to subject said second motor means to manifold vacuum, a valve for closing said outlet passage or opening said outlet passage to atmosphere and operatively connected to said second motor means, and fuel passage means located adjacent said outlet passage for supplying fuel to the air admitted to the intake manifold through said outlet passage when said valve is open.

2. A degasser attachment for an internal combustion engine having an intake manifold and a carburetor, including, a housing having a chamber subjected to manifold vacuum, means connected to said housing so as to form a second chamber, a pilot valve within said housing for interconnecting said first and second chambers, first motor means in said housing and responsive to manifold vacuum in excess of a predetermined value during engine deceleration for opening said pilot valve to subject

the second chamber to manifold vacuum, a member attached to said houing and having an outlet passage operatively connected to said intake manifold, a valve for closing said outlet passage or opening said outlet passage to atmosphere, second motor means responsive to vacuum in said second chamber for opening said valve when said second chamber is subjected to manifold vacuum, a fuel chamber in said member adjacent said outlet passage, and means for supplying fuel to said chamber so that said fuel will be mixed with the air flowing through said outlet passage to said intake manifold when said valve is open.

3. The degasser attachment set forth in claim 2 wherein said second chamber includes a calibrated bleed to

atmosphere to prevent the trapping of manifold vacuum therein when the pilot valve is closed.

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