July 11, 1961 J. DOLZA ET AL 2,991,776

FUEL INJECTION SYSTEM AND MANIFOLD

Filed Sept. 15, 1958

3 Sheets-Sheet 1

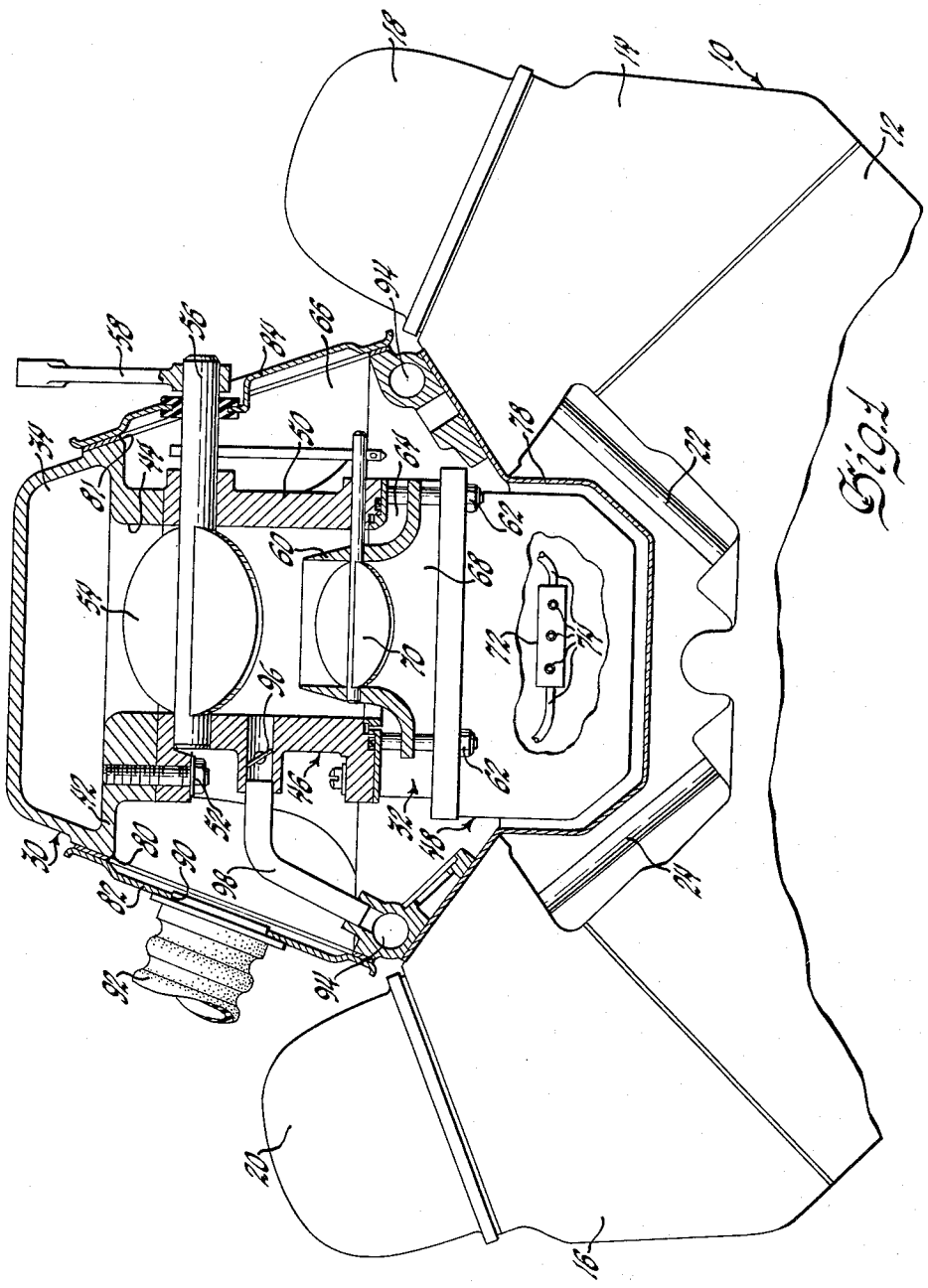


Fig. 1

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Filed Sept. 15, 1958 3 Sheets-Sheet 2

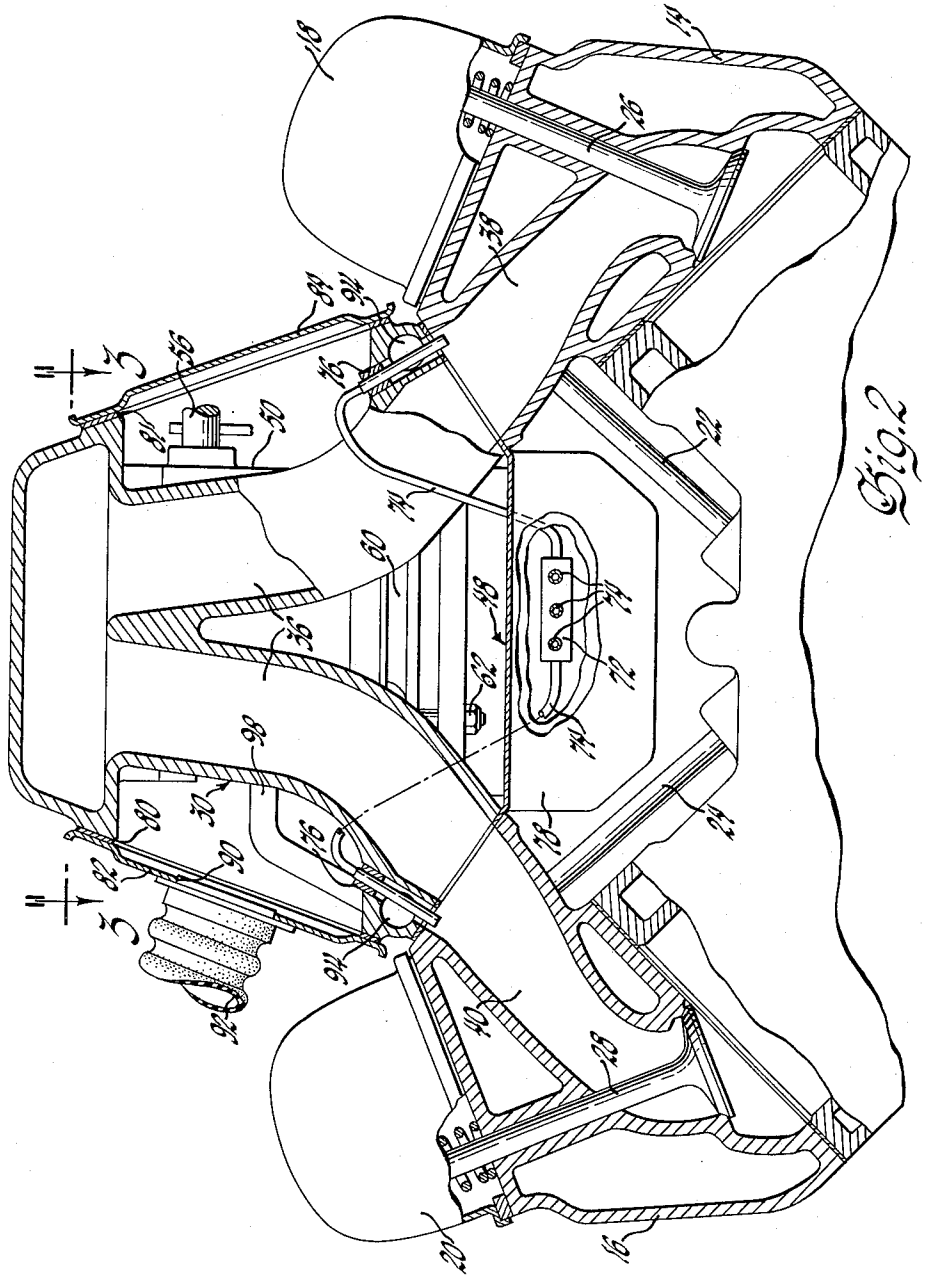


Fig. 2

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3 Sheets-Sheet 3

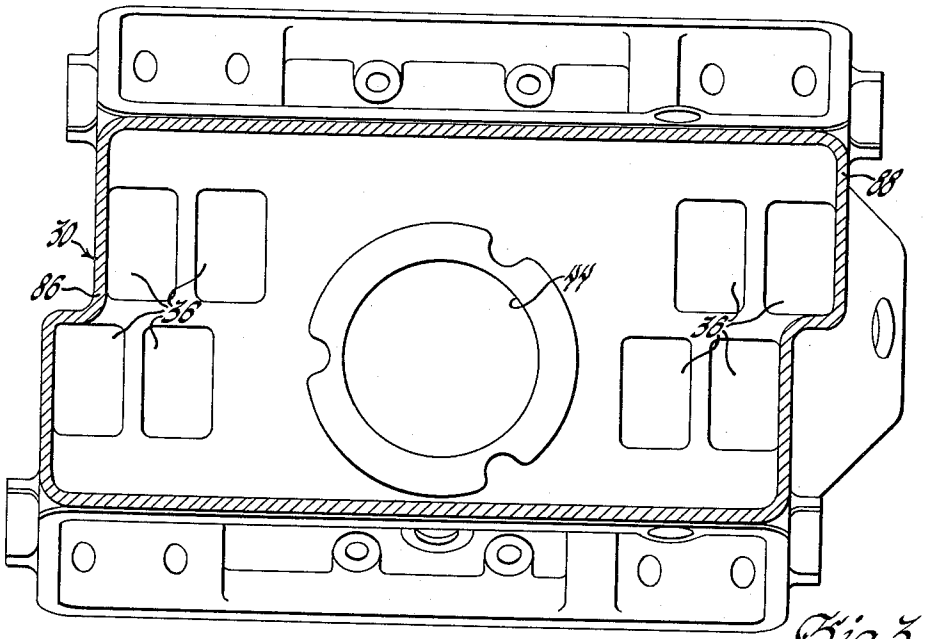



Fig. 3

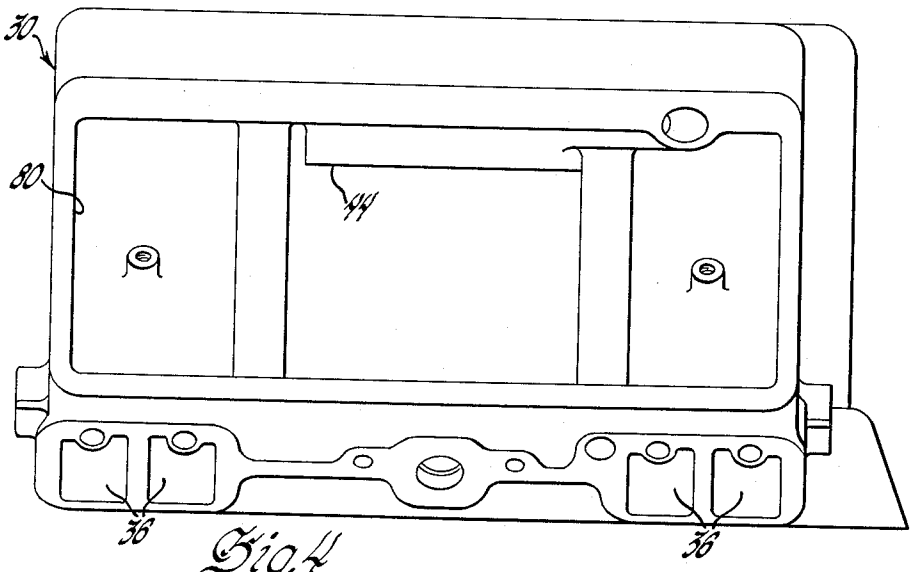



Fig. 4

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2,991,776

# FUEL INJECTION SYSTEM AND MANIFOLD

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7 Claims. (Cl. 123—119)

The present invention relates to an improved combination of a fuel injection system and manifold which coact in such a way as to greatly decrease the underhood space formerly occupied by such elements. The problem of underhood clearance has become a very serious one with the advent of the various accessory drive mechanisms which are now appended to an engine coupled with increasingly severe styling demands for lower hood lines.

As a consequence, engine and fuel systems designers are caught in a dimensional squeeze which has made necessary many engineering changes to accommodate the space squeeze. The present invention is directed to such a development as it pertains to the combinations and disposition of the manifold and fuel system in such a way that the cubic displacement of such combination is considerably reduced.

The present invention relates specifically to a V-type engine utilizing a fuel injection system of the general type shown and described in copending application S.N. 591,889, Dolza, filed June 18, 1956, and now Patent No. 2,957,464, issued October 25, 1960, and further which fuel injection system combined with a ram tube type manifold as shown in copending application S.N. 608,935, Dolza, filed September 10, 1956, now Patent No. 2,909,165, issued October 20, 1959.

In the present invention the ram tube type manifold is mounted upon the engine in the normal manner, however, the fuel metering system is dependingly supported from the manifold plenum chamber so as to at least partially extend within the V of the engine. The manifold and fuel metering mechanism are then enshrouded or encased in such a way as to isolate the fuel metering system from the engine proper. At the same time air is adapted to be supplied to the encased metering system from an intake preferably disposed at the forward part of the engine compartment. In this way, the fuel metering system is maintained in a relatively cool condition during engine operation.

Other objects and advantages of the present invention would be apparent from a perusal of the detailed description which follows.

In the drawings:

FIGURES 1 and 2 are partially sectioned front elevational views of the fuel metering system as mounted on a V-type engine;

FIGURE 3 is a detail view along line 3—3 of FIGURE 2; and

FIGURE 4 is a side elevation of the manifold.

In the drawings, a V-type engine is shown generally at **10** and includes a cylinder block **12**, cylinder heads **14** and **16**, and rocker arm covers **18** and **20**. Rocker arm push rods **22** and **24** are adapted to be operated off of a camshaft, not shown, and which rods in turn are adapted, through rocker arms, also not shown, to actuate inlet valves **26** and **28**.

A manifold **30** is of the ram tube type as generally shown and described in the aforenoted S.N. 608,935, Dolza application, now Patent No. 2,909,165, and does not, per se, constitute a part of the present invention save insofar as it is uniquely combined with the fuel metering mechanism indicated generally at **32**. Manifold **30** includes a plenum chamber **34** from which a plurality of ram tubes or pipes **36** lead to the respective cylinder intake passages **38** and **40** in cylinder heads **14** and **16**.



As best seen in FIGURES 1 and 3, the bottom wall **42** of plenum chamber **34** is provided with a flanged opening **44** upon which the fuel metering mechanism **32** is adapted to be dependingly supported.

Fuel metering mechanism **32** includes an air metering portion **46** and a fuel metering portion **48**. The air meter **46** includes an intake casing **50** suitably connected to plenum chamber **34** through stud means **52**. A throttle valve **54** is fixed to a shaft **56** rotatably supported in intake casing **50** and is adapted to be controlled by a suitable lever **58** fixed to shaft **56**.

As best seen in FIGURE 3, manifold air intake passages or ram pipes **36** are divided into two axially spaced sets with the air meter **46** mounted therebetween. The axial spacing is necessary to make room for the fuel metering mechanism **32** and by intermediately disposing the latter better charge distribution is possible.

Air meter **46** also includes a tapered adapter member **60** mounted on the lower end of intake casing **50**. Member **60** is axially spaced with respect to casing **50** by stud means **62** to provide a radially opening venturi air intake **64**.

Air intake **64** communicates with an air chamber **66**. Adapter member **60** has an axial passage **68** formed therethrough which at its lower end likewise radially communicates with chamber **66**, the air flow through which is controlled by a signal modifier valve **70**. As set forth in detail in copending application S.N. 658,091, Dolza et al., now Patent No. 2,914,051 issued November 24, 1959, signal modifier **70** is adapted to modify the vacuum signal transmitted to fuel metering mechanism **32** in accordance with certain engine operating conditions such as temperature.

Thus, under low air flow conditions, or when the engine is cold, the signal modifier valve will restrict the intake air flow to venturi passage **64** whereby a high air flow and consequently strong fuel metering vacuum signal will be maintained as described in the aforementioned application.

Studs **62** are also adapted to support fuel metering device **32** in axially spaced relation to adapter member **60**. Fuel metering device **32** is substantially the same as that shown and described in Patent No. 2,957,464 and therefore the same will only be described to the extent necessary to an understanding of the present invention.

In the illustrated embodiment of the present invention, fuel metering device **32** is adapted to supply fuel to a fuel distributor **72** in accordance with the mass of air flow through venturi intake **64**. A plurality of fuel conduits **74** lead from fuel distributor **72** and communicate at their opposite ends with fuel nozzles **76** disposed in manifold casing **30**. Nozzles **76** project with intake passages **38** and **40** and are adapted to project a stream of fuel against the backside of inlet valves **26** and **28**.

A casing member **78** is mounted between manifold casing **30** and cylinder heads **14** and **16** and is adapted to project within the V of engine **10**, so as to enclose and isolate fuel metering mechanism **48** from the engine.

Manifold casing **30** is provided with side openings **80** and **81** for permitting access to fuel metering mechanism **32** for servicing and adjusting purposes. The access openings **80** are adapted to be closed by cover plates **82** and **84**. Furthermore, the ends of manifold **30** are closed by casing wall sections **86** and **88**. Thus, manifold casing **30**, casing **78**, and plates **82** and **84**, encase fuel metering mechanism **32** within air chamber **66**.

Access opening cover **82** is provided with a suitable opening **90** therein with which a flexible air hose member **92** is adapted to cooperate to introduce air into chamber **66**. While not so shown, it is intended that the other or intake end of hose **92** will be disposed at the forward end of the engine compartment and will include

suitable filter or air cleaner means to introduce relatively cool air into chamber **66**. In thus providing a shrouded fuel injection system, as described, and introducing relatively cool air there into, a fuel metering system is provided in which vapor lock presents no additional problem notwithstanding the proximity of the system to the engine.

Nozzles **76** are of the atmospheric type as described in copending application S.N. 512,175, Homfeld, filed May 31, 1955, now abandoned, and as such include air galleries **94** which are adapted to introduce substantially atmospheric air into the nozzles at the point immediately anterior of where fuel is sprayed into intake passages **38** and **40**. In general, it is the purpose of the atmospheric nozzles to insure that the quantity of the fuel metered is insensitive to variations in manifold depression. However, as described in copending application S.N. 662,928, Dermond, filed May 31, 1957, now Patent No. 2,860,616 issued November 18, 1958, it is sometimes desirable to control the atmospheric air introduced into nozzles **76** for the purpose of providing fuel enrichment under cold starting and operating conditions. Accordingly, and as described in the Dermond application, a valve member **96** is adapted to be provided in a conduit **98** supplying atmospheric air to air galleries **94**. Valve **96** is temperature responsive such that under cold starting or running conditions the quantity of flow through conduit **98** is restricted until such time as the engine warms sufficiently. By thus restricting the air flow through conduit **98** manifold vacuum acting on the nozzles tends to increase the quantity of fuel flow and hence provide temporary fuel enrichment.

In the claims:

1. A charge forming device for an internal combustion engine of the V type which includes an air intake manifold, said manifold having a plenum chamber and a plurality of individual cylinder intake passages leading from said plenum chamber to the respective cylinders of the engine, a fuel and air metering mechanism dependingly supported from said plenum chamber and adapted to project within the V of said engine, casing means coacting with said manifold and said engine for completely encasing the fuel and air metering mechanism, and means for supplying air through said casing means to said mechanism.

2. A charge forming device for an internal combustion engine of the V type comprising an air manifold, said manifold having a plenum chamber, a plurality of intake passages communicating said plenum chamber with



the individual cylinders of the engine, an air meter dependingly supported from said plenum chamber, throttle means in said air meter for controlling the quantity of air flow therethrough, a fuel metering device supported from said air meter and projecting within the V of said engine, first casing means cooperating with said manifold and said engine to enclose said fuel metering device, second casing means cooperating with said manifold to enclose said air meter, said manifold and said first and second casing means defining an air chamber, and means for supplying air to said air chamber.

3. A charge forming device for an internal combustion engine of the V type comprising an air manifold, said manifold having a plenum chamber, a plurality of intake passages communicating said plenum chamber with the individual cylinders of the engine, an air meter dependingly supported from said plenum chamber, throttle means in said air meter for controlling the quantity of air flow therethrough, a fuel metering device supported from said air meter and projecting within the V of said engine, first and second casing means cooperating with said manifold and said engine to enclose said fuel metering device and said air meter, said manifold and said first and second casing means defining an air chamber, and means for supplying air to said air chamber.

4. A charge forming device as set forth in claim 3 in which the plurality of intake passages are divided into two sets of axially spaced passages and further in which said air meter is disposed intermediate said sets.

5. A charge forming device as set forth in claim 1 in which said manifold includes a pair of walls enclosing the respective ends of said manifold and a pair of side walls each having an access opening therein, said casing means including cover plates adapted to coact with said side wall openings.

6. A charge forming device as set forth in claim 5 in which said casing means includes a member mounted between the manifold and the engine for enclosing the bottom of the manifold.

7. A charge forming device as set forth in claim 5 in which said air supplying means is mounted on one of said cover plates.

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