Sept. 8, 1959 F. RIPPINGILLE 2,902,988

PROTECTIVE DEVICE FOR A CARBURETION SYSTEM

Filed Oct. 8, 1954

FIG. 1

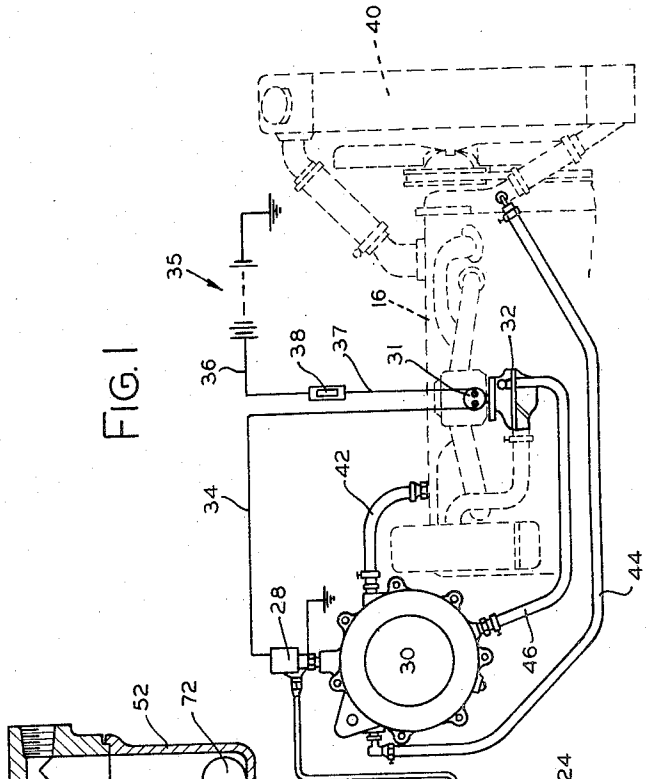


FIG. 3

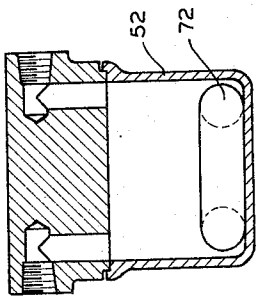
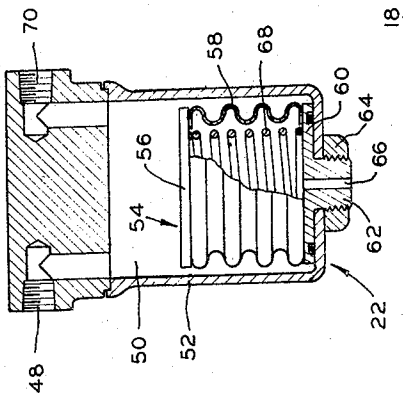


FIG. 2



INVENTOR.
FRANK RIPPINGILLE
BY J. Frederick Bechtel
ATTY.

United States Patent Office 2,902,988 Patented Sept. 8, 1959

2,902,988

PROTECTIVE DEVICE FOR A CARBURETION SYSTEM

Frank Rippingille, Niles, Mich., assignor to Clark Equipment Company, a corporation of Michigan

Application October 8, 1954, Serial No. 461,074

1 Claim. (Cl. 123—120)

This invention relates to protective devices for carburetion systems of internal combustion engines that employ liquefied petroleum gas as fuel. Such fuel, commonly known as LPG, frequently is a mixture of butane and propane, although other components may be present.

In an internal combustion engine that uses liquefied petroleum gas as a fuel it has been common practice to make use of a conventional vent type hydrostatic relief valve in the fuel flow system. A protective device to prevent excessive pressure is necessary in such a system because abnormal conditions, such as excessive temperature, may under some circumstances increase the system pressure sufficiently to endanger the vehicle or other machine in which the engine is located. In a conventional arrangement, when the pressure exceeds the relief valve setting, the valve opens and vents the fuel system to the atmosphere, thereby spilling liquefied petroleum gas on to the machine or elsewhere in the surrounding area. As the liquid is very volatile and inflammable this creates a hazardous condition.

The principal object of the present invention is to provide an improved protective device for carburetion systems of the liquefied petroleum gas type that safely limits the liquid pressure without creating any hazardous conditions.

A further object is to provide a simple, inexpensive, self-contained protective unit that is durable and not susceptible to damage.

In carrying out my invention in one form I provide a protective device comprising an enclosure connected in the fuel line between the source of supply of liquefied petroleum gas and the fuel regulator. This enclosure contains a collapsible device which collapses as the pressure increases, thus increasing the volume of the liquid and restricting the pressure increase. This protects against excessive pressure but at the same time allows no fuel to escape into the surrounding area to cause a hazardous condition.

For a clearer and more complete understanding of my invention reference should be had to the accompanying drawing illustrating certain preferred embodiments of the invention.

In the drawing:

Fig. 1 is a flow diagram of a typical liquefied petroleum gas carburetion system incorporating my invention, which may be used, for example, with an engine which propels a vehicle, and

Figs. 2 and 3 are enlarged sectional views showing certain forms of the protective device in more detail.

Referring to the drawing, the numeral **10** indicates a tank which contains liquefied petroleum gas **12**. This liquid may comprise the source of fuel for an internal combustion engine **16** which in turn may power a vehicle (not shown). The liquefied petroleum gas is kept in the liquid state by pressure. The pressure varies with the temperature and is equal to the highest vapor pressure of one of the components of the mixture. As an example, propane develops a pressure of approximately 190#/sq. in. at 100° Fahrenheit. Above the liquid in tank **10** is vapor **14**, made up of the petroleum gas components, which forces liquid **12** out of the tank **10** through a pipe **17** and shut-off valve **18**. The liquid then passes through fuel line **20** into the protective device **22**, described in detail hereinafter, which prevents the build-up of an excessive pressure in the carburetion system.

From protective device **22** the liquid **12** passes into a filter **24** which removes any foreign material which may be carried by the fuel. A fuel line **26** provides a connection from filter **24** to a solenoid valve **28** located in the system between filter **24** and vaporizer regulator **30**. The solenoid valve **28** is connected by an electrical conductor **34** to a vacuum switch **31** located on carburetor **32**. The vacuum switch **31** receives its electrical energy form a source, such as a battery, generally indicated by the numeral **35**. To complete the electrical circuit a line **36** connects battery **35** to a fuse **38** and a conductor **37** connects the fuse to the vacuum switch **31**. The vacuum switch **31** is closed only when there is a vacuum in the carburetor. Therefore, whenever the engine **16** stops, switch **31** opens the circuit to solenoid valve **28**. This deenergizes and closes the solenoid valve, which closes the fuel line **26** to the vaporizer regulator **30** and prevents any damage to the regulator due to excessive pressure.

When the liquid **12** enters the regulator **30** it expands and vaporizes. Hot water from the engine cooling system **40** is carried to and from the regulator **30** through water lines **42** and **44**. The hot water aids in vaporizing the liquid and eliminates any possibility of icing conditions that might develop because of drastic pressure change.

The resulting vapor passes from regulator **30** through a fuel line **46** to the carburetor **32**. The carburetor **32** mixes the fuel vapor with air and directs the dry gas to the combustion chamber where it is burned completely, which is one of the desirable features of this type fuel system. Other advantages of this type system are: no obnoxious fumes or smoke, no dilution of crankcase lubricant, simplicity of carburetor, elimination of fuel pump and no fuel spillage or evaporation as the entire system is under sealed pressure.

Refer now to Fig. 2 which is a section thru protective device **22** of Fig. 1 showing the protective device in greater detail.

An inlet **48** provides a passageway for liquefied petroleum gas into a chamber **50** provided in case **52**. Located in chamber **50** is a collapsible structure or bellows **54** which consists of a circular top plate **56** of rigid material which is suitably fastened and sealed to a cylindrically disposed convoluted resilient member **58**. A rigid bottom plate member **60** also is suitably fastened and sealed to resilient member **58**. Plate member **60** has an outwardly extending portion **62** which projects outwardly thru a hole in case **52** and is held in place by any convenient manner such as a nut **64** as shown. Plate member is sealed to the bottom surface of casing **52** in a suitable manner. In bottom plate member **60** and extending thru projecting portion **62** is passageway **66** which connects the interior of portion **54** to the outside atmosphere. Contained within capsule **54** is a second resilient member such as a coil spring **68** which helps return first resilient portion **58** to normal expanded position. In the upper portion of casing **52** and in communication with chamber **50** is an outlet **70**.

Next, I shall describe the operation of the protective device. Liquefied petroleum gas enters passageway **48** into chamber **50**. If the pressure exceeds a predetermined amount, dependent upon the characteristics of resilient portions **58** and **68**, the pressure causes the structure **54** to collapse, forcing the air contained within **54** out passageway **66**. As the structure **54** collapses it increases

the volume in chamber **50**, thus decreasing the pressure here and elsewhere in the carburetion system. When the pressure decreases again, the structure **54** returns to the expanded position, as shown, under the influence of resilient members **58** and **68**.

As the structure **54** is a sealed unit it is impossible for fuel to be spilled or released to the outside of the carburetion system, thus eliminating the hazardous or undesirable conditions which exist with many previous pressure relief devices.

It will be understood that the auxiliary spring **68** may be omitted from the structure **54** if the characteristics of the convoluted wall **58** alone can provide the necessary resiliency in the structure.

Another embodiment of my invention is the same as illustrated in Fig. 2 except that the passage **66** connecting the inside of structure **54** with the atmosphere is omitted. In this case, the structure **54** may float as a free unit within the chamber **50**, or it still may be secured to the bottom wall of the casing **22** if desired. In either event, the structure **54** is collapsed by compressing the air sealed within the structure **54**, thus increasing the effective volume of chamber **50** and relieving the pressure in the carburetion system in the manner previously described.

Another form of my invention is illustrated in Fig. 3 of the drawing. In this form, an annular or doughnut shaped member **72** of synthetic rubber or other suitable material is contained within casing **52**. The annular member **72** is filled with air or other suitable gas the same as structure **54** in Fig. 2 and collapses in the same manner as structure **54** to prevent excessive pressure in the carburetion system.

In all of the forms of my invention, excessive pressure in the carburetion system is prevented, without the necessity of venting the system to the atmosphere and permitting the escape of some of the fuel. Thus, my protective device avoids the hazards of other protective devices. Furthermore, my protective device is simpler and less expensive to construct than many previous protective devices because no valves or other parts requiring extremely close tolerances and extremely fine manufacturing operations are present.

While I have illustrated and described herein certain embodiments of my invention which include a collapsible structure within its own casing or enclosure in the carburetion system, it will be readily apparent that the surrounding casing or enclosure is not essential. The collapsible structure may, if desired, be located elsewhere in the system. As an example, it could be located in the same enclosure with the filter **24**.

Thus, while I have disclosed herein certain preferred

embodiments of my invention, it will be understood that modifications may be made by those familiar with protective devices of this type. Therefore, it should be understood that I intend to cover by the appended claim all such modifications which fall within the true scope and spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

In a liquefied petroleum gas carburetion system for internal combustion engines having a source of liquefied petroleum gas under super-atmospheric pressure, a first conduit connected to said source, a second conduit adapted to be connected to an engine and a vaporizer regulator for vaporizing the liquefied petroleum gas flowing through said second conduit; a protective device connecting said first and second conduits, said conduits being maintained substantially full of liquefied petroleum gas between said source and said regulator, and said protective device comprising a housing having a chamber therein in continuous communication with said first and second conduits and a collapsible bellows defining a variable volume cavity, said bellows being continuously submerged in the liquid in said chamber, being responsive to the liquid pressure in said chamber and being adapted to increase the volume of said chamber upon an increase in pressure of the liquid for maintaining the pressure of said liquid at or below a predetermined maximum value irrespective of variations in the temperature of the medium surrounding the source, and means controlling communication between said source and said regulator, said latter means having a solenoid valve located in said second conduit upstream of said regulator, a source of electrical energy connected to said solenoid valve and engine vacuum responsive switch means in said electrical connection for causing said solenoid valve to interrupt communication between said source and said regulator whenever an engine to which the switch means is adapted to be connected is in a non-operating condition and to permit such communication whenever such an engine is in an operating condition.

References Cited in the file of this patent

UNITED STATES PATENTS

651,617	Tilden	June 12, 1900
1,169,250	Fulton	Jan. 25, 1916
1,373,477	Angus	Apr. 5, 1921
2,341,177	Cope	Feb. 8, 1944
2,357,947	Gerson	Sept. 12, 1944
2,544,289	Andrews	Mar. 6, 1951
2,675,793	Ziege	Apr. 20, 1954
2,752,758	Tann	July 3, 1956