# United States Patent [19]

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## [54] HYDROCARBON VAPOR COLLECTING APPARATUS


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[52] **U.S. Cl.** ..... **141/93,** 141/392

[51] **Int. Cl.** ..... **B65b 1/28**

[58] **Field of Search** ....55/78, 179, 383, 387; 141/44, 141/59, 93, 285, 290, 312, 371, 376, 379, 392; 220/85 VR, 85 VS, DIG. 27; 222/530, 538, 539



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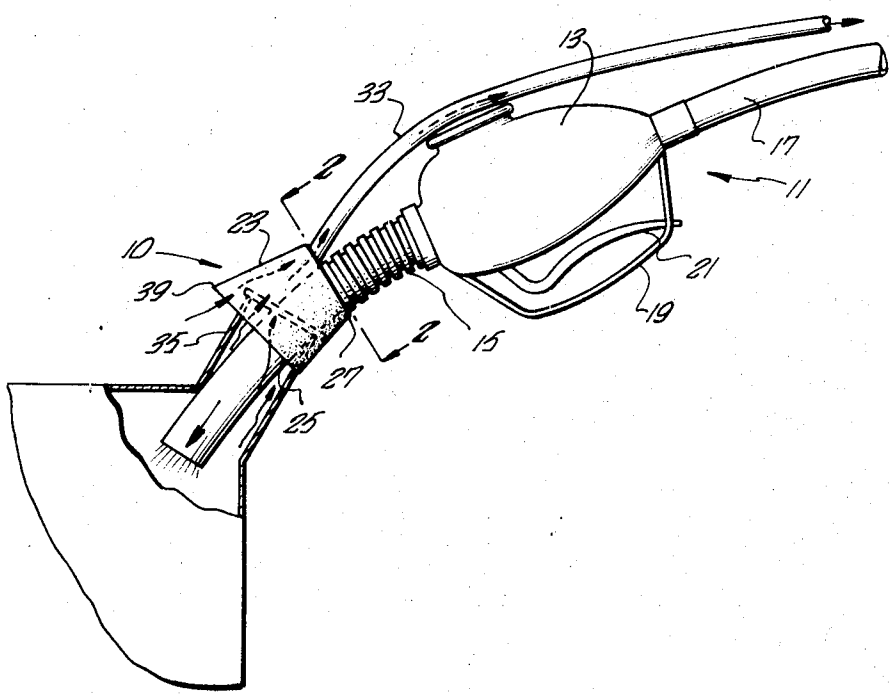


[57] **ABSTRACT**

A hydrocarbon vapor collecting system is disclosed having an attachment for a gasoline pump nozzle which includes a hood that is adapted to loosely fit over the mouth of an automobile tank filler tube as the nozzle is inserted therethrough. The hood is connected to a vapor hose which, in turn, communicates with a vapor absorbing device. A fan communicates with the vapor hose to create a suction at the mouth of the hood to concurrently draw in air from the atmosphere along with the hydrocarbon vapors from the tank as the nozzle is filling the tank with gasoline. A closed end tubular support having an open end for receiving the end of the pump nozzle extending through the hood is also provided. The cross section of the open end of the support is shaped and dimensioned to sealingly engage the interior of the hood to enable the hood to be sealed from the atmosphere while the pump is supported on the tubular support during non-use.

The system is also adaptable to the large storage tanks utilized by the service stations, whereby the hood of the vapor collecting apparatus is adapted for connection to the filling hatch of the tank with the fuel truck filler nozzle extending therethrough. In other embodiments the hood is attached to a vent pipe located adjacent the tank or remotely therefrom. The vapor hose utilized in these systems can be adapted for connection to a vapor absorbing device located at the service station or on the fuel tank truck. In all of the embodiments the fan is provided to create a suction through the vapor hose to draw all of the hydrocarbon vapors displaced by the gasoline tank and prevent any leakage of the vapors into the atmosphere.


**3 Claims, 7 Drawing Figures**



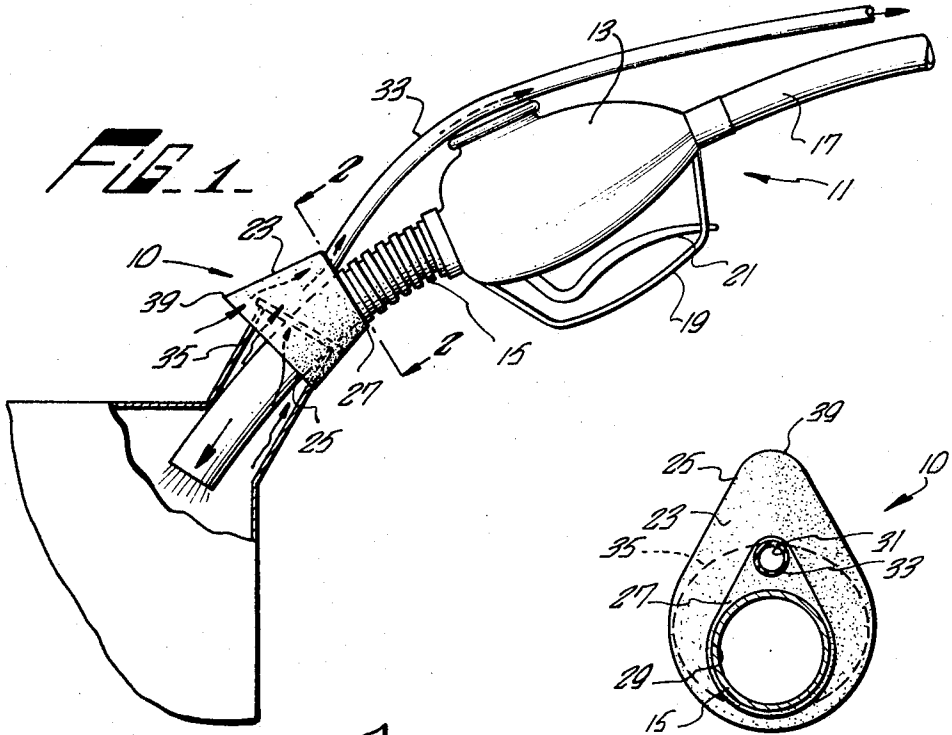



FIG. 1




FIG. 2

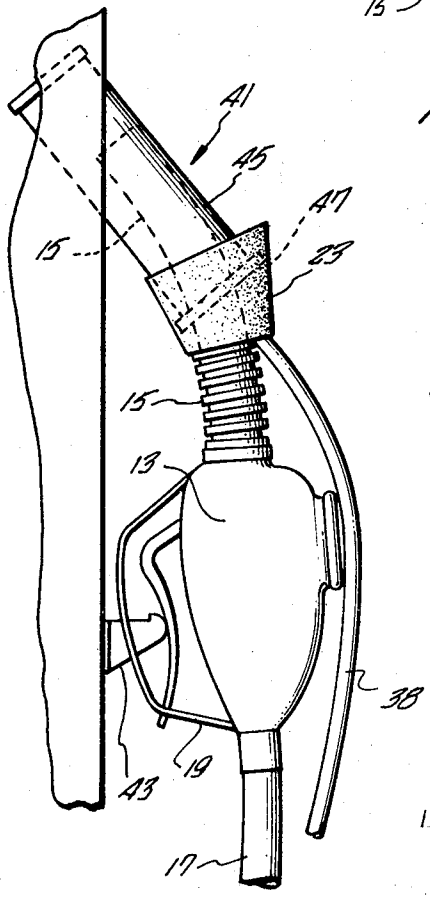



FIG. 3

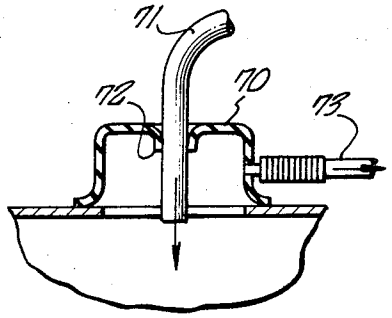



FIG. 5

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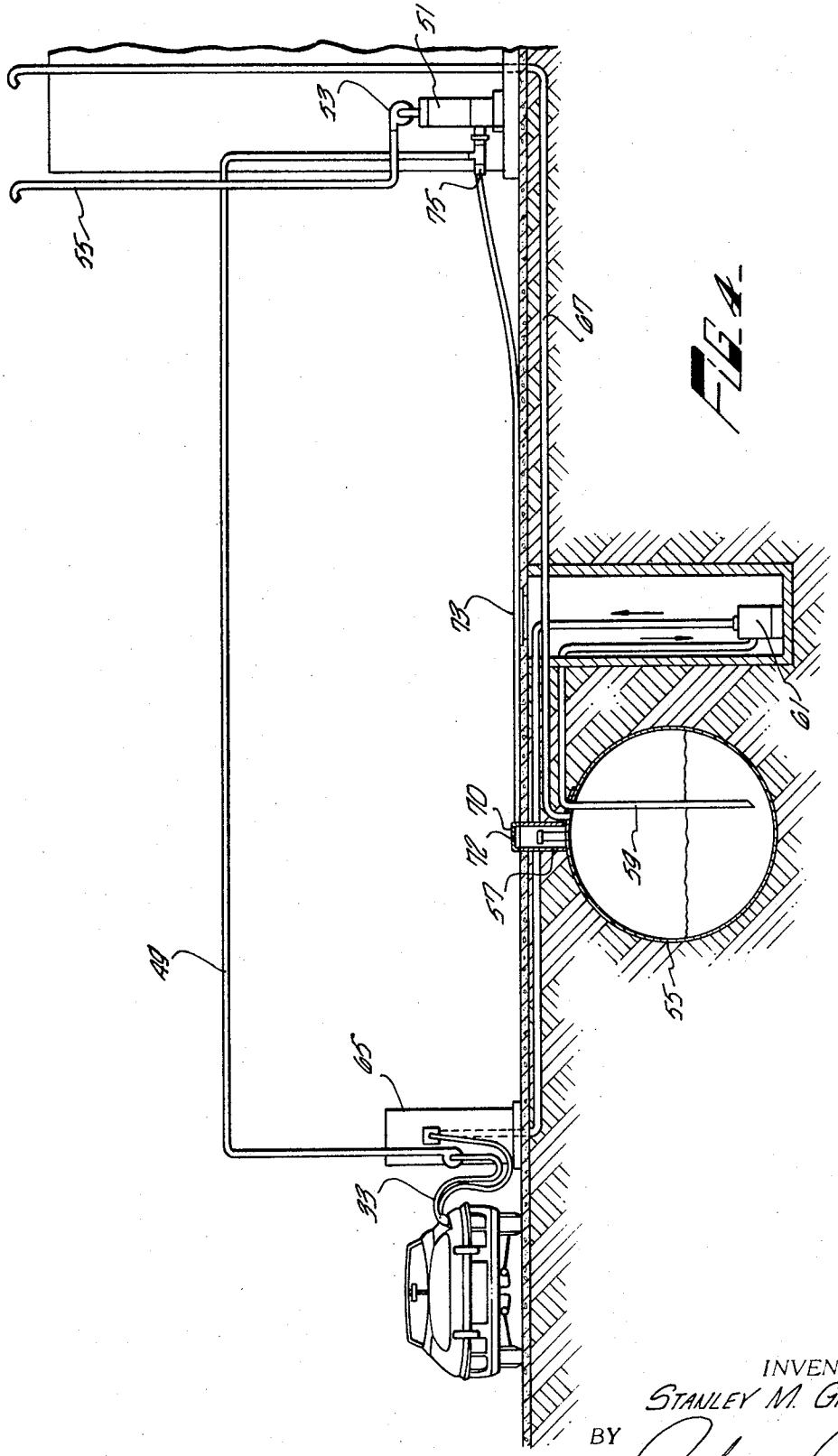



FIG 4

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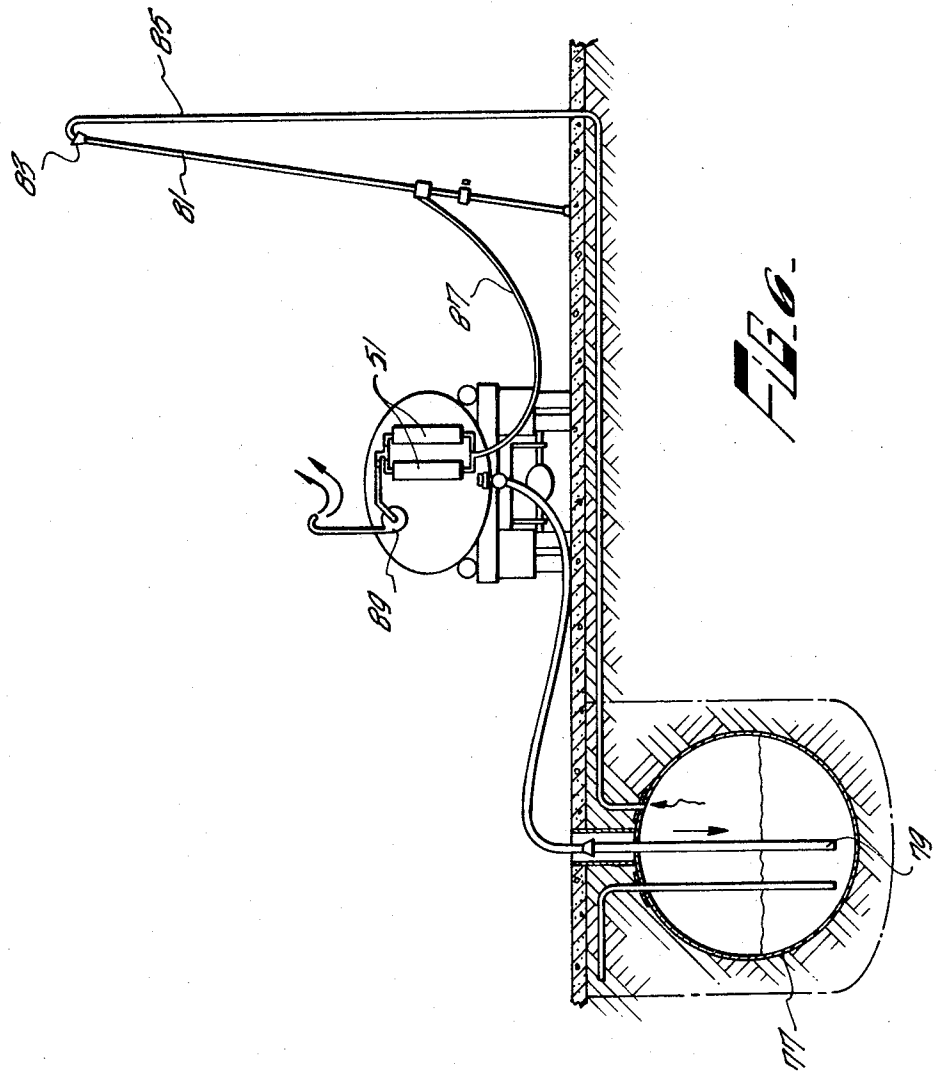



FIG. 6.

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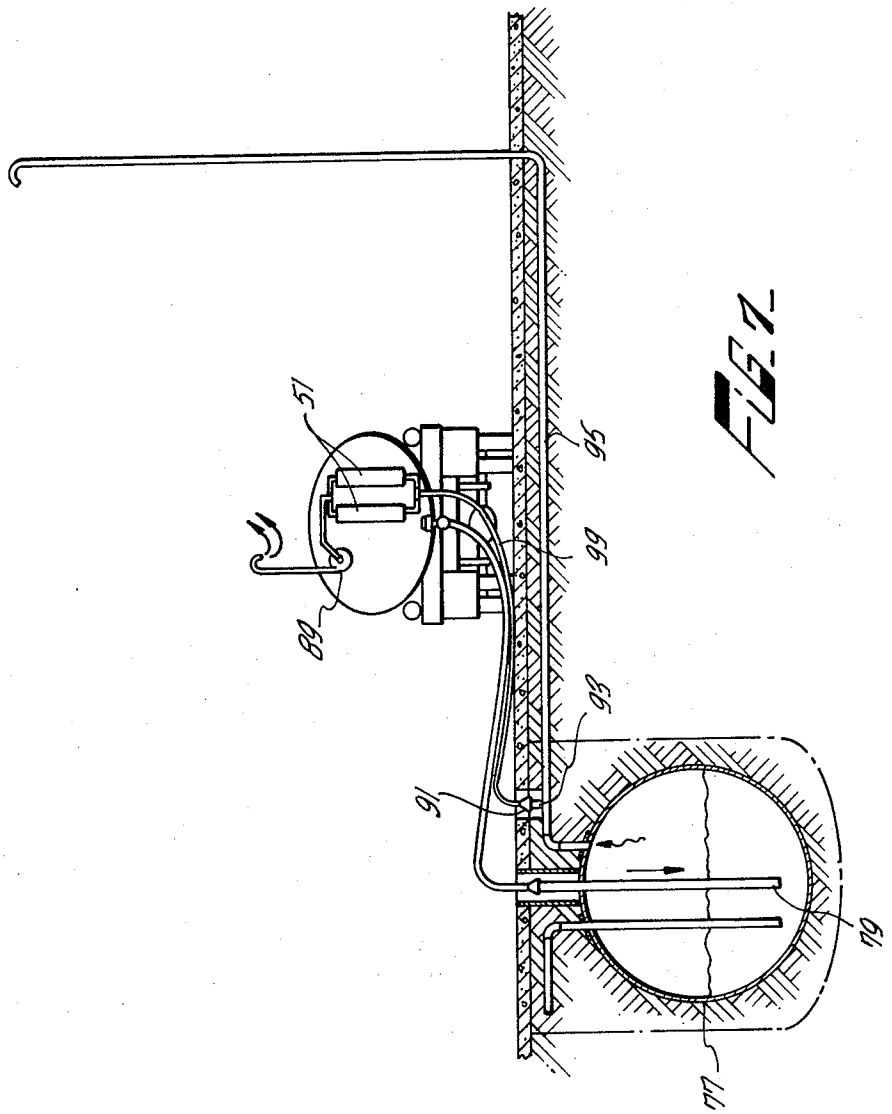



Fig 7

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# HYDROCARBON VAPOR COLLECTING APPARATUS

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a vapor recovery system and more particularly to a system for preventing the escape of hydrocarbon vapors from gasoline station areas.

2. Description of the Prior Art

There are, at the present time, conditions that prevail at gasoline stations that present hazards not only to the workmen and attendants, but also to the consumers and incidental personnel. These hazards are caused by hydrocarbon vapors escaping uncontrollably from the tanks of automobiles, and the main storage tanks, as they are being filled with gasoline.

Hydrocarbon vapors are created in these tanks because gasoline has a relatively high vapor pressure under normal temperature conditions and evaporates very readily, especially during agitation. Moreover, exceedingly high rates of vaporization occur when the liquid is introduced into the tank under conditions which cause it to splash either against walls of the tank or against the liquid level contained therein. Under these conditions of liquid transfer, the hazards that present themselves are (1) the possibility of fire and/or explosion, (2) the fume generation which is quite unpleasant to the entire surrounding area, and (3) the contribution to air pollution by the escaping vapors.

Precautions have been adopted in the nature of using rubber or plastic hoses to eliminate sparks that could occur, and additionally, prominent "No Smoking" signs are displayed in an effort to eliminate the hazard from cigarette sparks. Although these precautions do result in the reduction of damage both to installation and personnel, the other hazards of fume generation and air pollution still remain. Moreover, the "No Smoking" restriction around gasoline stations is inconvenient to many customers which, of course, is undesirable.

A few devices have been proposed in preventing the escape of hydrocarbon vapors from gasoline station areas; however, all of the proposals have various shortcomings which have prevented their widespread utilization.

One such proposal is described in U.S. Pat. No. 2,723,070, wherein an attachment is provided for a gasoline hose nozzle. The attachment includes a resilient body attached to the nozzle, the body having a vapor receiving chamber communicating with the filler pipe of a tank. The outside area of the body is adapted to be urged into contacting relationship with the filler pipe to form a vapor-tight seal. A vapor hose communicates with the vapor receiving chamber and is connected to a suitable vapor storage means.

In operation, as the gasoline is placed within the tank via the gasoline hose and the filler pipe, a positive pressure is applied to the vapors in the tank urging the latter outwardly through the filler pipe into the vapor receiving chamber, and ultimately through the vapor hose to a storage container.

A shortcoming involved with such a device is that because of the positive pressure exerted on the vapors, a vapor-tight seal is required at the mouth of the filler pipe in order to prevent any vapor from leaking to the atmosphere. Such a seal is undesirable because it requires the continuous attention of the operator. As a result, the operator is not free to attend to the other duties commonplace in servicing the automobile, such as cleaning the windshield, checking the oil level, battery water level and others. Because of such a shortcoming the device described in U.S. Pat. No. 2,723,070 has never been commercially acceptable.

A somewhat similar device is described in U.S. Pat. No. 2,803,269, except that this device is used in conjunction with storage tanks rather than automobile tanks. Besides the shortcomings previously mentioned, the system described in U.S. Pat. No. 2,803,269 is very complex and hence impractical.

Still another vapor recovery apparatus is disclosed in U.S. Pat. No. 2,908,299. In that device a very complex pump handle is provided with a first conduit connected to a source of compressed air for inflating a seal at the mouth of the filler pipe, a second conduit communicating with the interior of the filler pipe to carry out the vapors within the tank, and a third conduit functioning as the gasoline supply line. A cam mechanism is further provided to control the sequential operation of the three conduits. Because of the complexity and the expense involved in converting to such a system, the apparatus described in U.S. Pat. No. 2,908,299 also is not commercially acceptable.

U.S. Pat. No. 3,016,928 also describes a coupling attached to a supply hose having a fuel line and a vapor line enclosed therein. The coupling includes a pair of passageways connected to the respective lines with an impeller located within the fuel passageway. The impeller, in turn, is drivingly connected to a fan located within the vapor passageway. In operation, as the gasoline flows through the fuel line and coupling passageway, it acts on the impeller, causing it to rotate. The impeller, in turn, drives the fan in the vapor passageway, which creates a suction in the vapor line to draw the vapors from the tank into another container.

The main shortcoming with such a device is the costs involved in converting to such a system. Moreover, because of the low suction created by the fan, an airtight seal is also required at the filler pipe mouth. Furthermore, the system operates to remove the vapors from the automobile tank and the storage tank as these tanks are being filled by injecting the vapors into the truck tank as it is being emptied. Such a system has not found favor with the industry and is not used.

## SUMMARY OF THE INVENTION

The present invention obviates the above mentioned shortcomings by providing a new and improved system for collecting hydrocarbon vapors from automobile and service station tanks that is easily adapted to present installations at relatively little additional expense.

The above mentioned system comprises a vapor collecting attachment for a gasoline pump nozzle comprising a hood that is adapted to loosely fit over the mouth of an automobile tank filler tube as the nozzle is inserted therethrough. A vapor hose is connected at one end to the hood and the other end to a vapor absorbing device. A fan communicates with the vapor hose to create a large suction at the mouth of the hood.

Because of the loose fit of the hood, and the large suction created within the line, air from the atmosphere is drawn into the line along with the hydrocarbon vapors from the tank. As a result hydrocarbon vapors are prevented from leaking out into the atmosphere.

A closed end tubular support having an open end for receiving the end of the pump nozzle extending through the hood is also provided. The cross section of the open end of the support is shaped and dimensioned to sealingly engage the interior of the hood to enable the hood to be sealed from the atmosphere while the pump is supported on the tubular support during non-use.

The present invention is also adaptable to the large storage tanks utilized by the service stations. In one embodiment a vapor collecting hood is adapted for connection to the filling hatch of the tank, with the hood further having an aperture for receiving a pump nozzle. The vapor hose is connected to the vapor collecting hood with the other end connected to a vapor absorbing device located either at the service station, or preferably on the fuel truck used to fill the storage tank. In either mode, a fan is connected to the vapor line to provide a suction at the mouth of the filling hatch.

In another embodiment the vapor collecting hood is adapted to be connected to the vent pipe which is located either adjacent the tank or remotely therefrom. The vapor hose connected to the hood is again connected either to a vapor adsorbing device located at the service station or on the fuel truck. As in the above mentioned embodiments, a fan is connected to the vapor hose to create a suction therethrough to draw in atmospheric air through the loosely fitting hood and gas vapors from the storage tank.

A very important advantage of the hood attachment is that since a vapor seal is not created and the pumping rate is such to draw from both the tank and the atmosphere, the hydrocarbon vapor can not leak out into the atmosphere.

Moreover, the hood attachment is easily adapted to present day pump nozzles with absolutely no modification necessary to be done to the nozzle.

Another important advantage of the present invention is that constant attention need not be given the pumping operation since the attachment fits loosely over the tank cap. This enables the attendant to be free for other car servicing duties.

The present invention also has many advantages when being adapted to the large service station service tanks.

One very important advantage is that such a system can be installed in a station at an expense far less than previous proposals. This is because fewer modifications have to be made to the present gasoline installations.

Moreover, by having the vapor adsorbing devices mounted on the truck, the system does not have to depend on the service station attendants to maintain the devices in a working order and to change them as they reach capacity.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view, partly in section, of the hydrocarbon vapor collecting apparatus of the present invention;

FIG. 2 is an elevational view, partly in section, of the nozzle attachment, taken along lines 2—2 of FIG. 1;

FIG. 3 is an elevational view of the vapor collecting apparatus mounted on the gasoline pump mounting means;

FIG. 4 is a plan view of the vapor collecting system of the present invention;

FIG. 5 is a sectional view of the vapor collecting attachment of the system shown in FIG. 4;

FIG. 6 is a plan view of a second embodiment of the present invention in which a telescoping vapor pickup is utilized; and

FIG. 7 is a plan view of a third embodiment of the vapor collecting system of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIG. 1 shows a novel vapor collecting attachment, generally indicated by arrow **10**, mounted on a conventional gasoline pump nozzle assembly **11**. The pump nozzle assembly **11** conventionally comprises a main body portion **13** having a tubular nozzle **15** extending out of the one end thereof. The other end of the main body portion **13** communicates with a gasoline hose **17**. The main body portion **13** also includes a handle **19** and a trigger or shut off valve **21**, both of which function in a well known manner.

The vapor collecting attachment **10** comprises a truncated hood **23** having a large open end **25** and a smaller closed end **27**. The closed end **27** of the hood **23** includes an aperture **29** formed therein for receiving the pump nozzle **15** which extends entirely through the hood and substantially beyond. The closed end **27** of the hood **23** also includes a second aperture **31** formed therein for receiving the one end of a vapor hose **33**.

The pump nozzle **15**, along with the hood **23**, is shown in their operable position, with the nozzle **15** extending into a filler pipe **35**. In this position the hood **23** is mounted over the open end of the filler pipe **35**. The cross section of the conventional automobile filler pipe is usually circular. FIG. 2 shows the shape of the opening at the open end **25** with the interior wall section of the hood **37** becoming progressively smaller as it approaches the closed end **27**. In accordance with the present invention, the hood **23** is dimensioned to be substantially larger than the cross-section of the filler pipe **35**. Moreover, the top portion **39** of the hood **23** narrows to a point to ensure that no matter what orientation the hood **23** has with the filler pipe **35**, a seal is not created therebetween and an opening is always provided to the atmosphere. The operation of the apparatus **10** will be described in greater detail hereinafter.

FIG. 3 shows the pump nozzle assembly **13** and the vapor collecting apparatus **10** mounted on a conventional pump mounting **41** during non-use. The pump mounting **41** includes a lower projection **43** upon

which the handle 19 is supported. The projection 43 also extends through the handle 19 to engage the valve 21 to maintain it in a closed position. A tube 45 also extends from the pump and is adapted to receive the nozzle 15 with the hood 23 extending over it. Unlike the filler pipe 35, the tube 45 has a rim 47 which is shaped to engage the sidewalls of the hood 23 when the hood is mounted in the position shown in FIG. 3. As a result, a vapor tight seal is achieved therebetween.

FIG. 4 shows the vapor collecting system in which the vapor hose 33 is connected through an overhead vacuum line 49 to a vapor absorbing device 51. It should be noted that the vacuum line 49 can also be located beneath the surface of the ground.

The vapor absorbing device 51 can be of any conventional type with the activated charcoal cannister being preferred.

A vacuum pump 53 is positioned on the discharge side of the vapor absorbing device 51, with the outlet of the pump 53, in turn, discharging purified air from the vapor adsorbing device 51 to the atmosphere via a vent line 55.

In operation, while the gasoline is being pumped into the automobile gas tank, the pump 53 is functioning to create a suction in the vapor hose 33. Therefore, as the tank is being filled with gasoline, the hydrocarbon vapors are drawn out of the tank by the suction created in the vapor line. However, the pump 53 is designed to pump at a speed many times greater than is normally desired to evacuate the tank. As a result, because of the high pumping speed and the loose fit of the hood 23, air from the atmosphere is also drawn into the vapor hose 33. Accordingly, this direction of flow prevents any hydrocarbon vappors from leaking out into the atmosphere. Instead, all of the hydrocarbon vapors are drawn through the vacuum line to the vapor absorbing device 51 to be separated from the pure air.

It should be noted that the vapor seal created at the hood 23 when the apparatus is not in use, (see FIG. 3) prevents the pump 53 from drawing air therefrom which would tend to lower the suction rate for the other lines in the system which are in use.

FIG. 4 also shows the apparatus of the present invention being utilized to collect gas vapors from a service station fuel storage tank 55. The storage tank assembly 55 conventionally includes a fill hatch 57, an outlet pipe 59 leading to a fuel pump 61, and a feed pipe leading from the fuel pump 61 to the exterior pump structure 65. The storage tank assembly 55 also includes a vent pipe 67 leading to the atmosphere.

According to the present invention, a vapor collecting hood 70, more clearly shown in FIG. 5, is adapted to be positioned over the fill hatch 57 with the hood 70 having an aperture 72 formed therein for receiving the fuel truck fill nozzle 71.

A vapor hose 73 communicates at one end with the interior of the hood 70 while the other end is adapted to be connected to a hose wall fitting 75. The wall fitting 75, in turn, communicates with the vapor absorbing device 51 and the vacuum pump 53.

Similarly, as the gasoline is being pumped into the storage tank 55, the suction created in the vapor line draws the gas vapors from the tank, along with atmospheric air through the aperture 72.

Since the conventional vapor absorbing device 51 has a capacity for only one storage tank filling cycle, the present invention also calls for the vapor absorbing devices, utilized in the system, to be carried by the fuel trucks. Such systems are shown in FIGS. 6 and 7.

In FIGS. 6 and 7 a different type storage tank 77 is shown in which the fill pipe 79 extends nearly to the bottom of the tank 77 to prevent undue agitation of the gasoline splashing against the walls of the tank 77 or against the liquid level contained therein.

Although a hood similar to hood 70 could be utilized with such tanks, another embodiment of the present invention is shown in which a telescoping vapor pickup 81 has a suction inlet hood 83 which is adapted to extend over the conventional vent outlet 85 which communicates with the storage tank 77. A vapor hose 87 communicates at one end with the vapor pickup 81 while the other end communicates with either of two vapor absorbing devices 51.

A vacuum pump 89 is also mounted on the fuel truck and is powered by drive means located thereon.

The hood 83 and the pump 89 function in the same manner as the hood 23 and the pump 53. As a result, the pump 89 creates a suction in the line to draw in the gas vapors from the tank 77 and also air from the atmosphere through the loose fitting hood 83.

It should be noted that the vapor collecting system of the type shown in FIG. 6 requires no modification whatsoever to the existing service station structure.

The system shown in FIG. 7 requires only a slight modification to the existing service station structure. In this embodiment, a hood 91 is provided to be attached to a fitting 93 connected to the vent line 95 located underground adjacent the storage tank 77. A vapor hose 99 connects the hood 91 with the vapor absorbing devices 51 mounted on the fuel truck. The hood 91 is also loose fitting to function in a similar manner with the other hoods previously described.

As can be seen, a novel vapor collecting assembly is provided that ensures against any hydrocarbon vapors escaping to the atmosphere. Moreover, such a system can be easily adapted to present day service stations with little or no modification and at a minimum of expense.

It should be noted that various modifications can be made to the apparatus while still remaining within the purview of the following claims.

What is claimed is:

1. A gas vapor collecting system for collecting, from the gasoline tank of an automobile, gaseous vapors through a vapor hood and hose, said gasoline tank having a filler pipe and said system comprising:

a truncated hood comprising an elongated hollow body having a front open end and a closed back end, said closed back end having a first aperture means extending therethrough receiving the nozzle of any conventional hand-held gasoline pump in a vapor-tight seal attaching the hood to the nozzle and enabling the front open end of the nozzle to extend through the hood and out the front open end thereof;

said back closed end also having a second aperture means extending therethrough for connection to a vapor hose;

said truncated hood characterized in that the elongated hollow body comprising said hood includes a non-circular recessed interior surface means non-sealably engaging the rim of the gasoline filler pipe, said non-circular recessed interior surface of said hood extending forwardly beyond said rim and providing an air passageway between the outside of the filler pipe and the wall of the hood;

means including the interior surface of said hood defining a rim rest support holding the hood in place on said filler pipe with the air passageway continually leading to said second aperture; and

a vapor hose extending at one end through said second aperture formed at the back closed end of said hood for communicating with a vacuum pump creating a suction therein to draw in the gas vapors from the automobile gasoline tank and atmospheric air through the air passageways formed by said hood.

2. The invention of claim 1 further comprising means for sealingly supporting said nozzle and truncated hood during non-use to enable the hood to be sealed from the atmosphere while the pump nozzle is supported on the support means.

3. The invention of claim 2 wherein said support means comprises a closed tubular support having an open end for receiving the end of the pump nozzle extending through said hood, the cross section of the open end of said support being shaped and dimensioned to sealingly engage the interior of said hood to enable the hood to be sealed from the atmosphere while the pump nozzle is supported on the tubular support during non-use.

* * * * *