

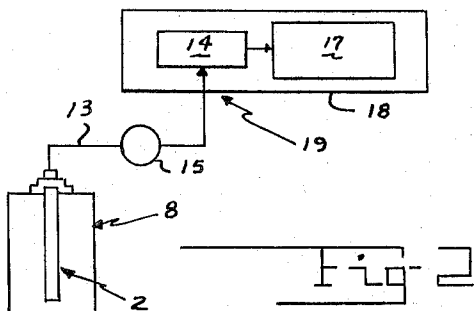
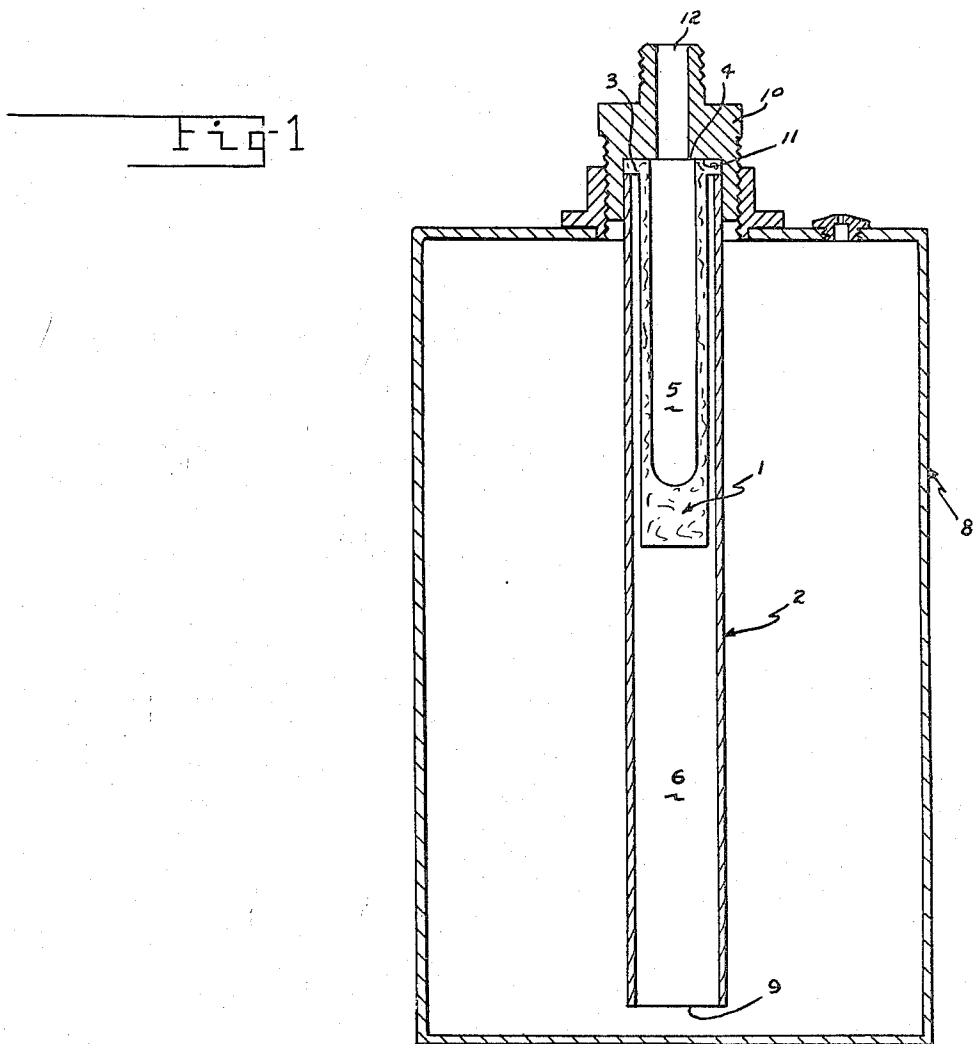
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FUEL SUPPLY SYSTEM

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FUEL SUPPLY SYSTEM

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7 Claims. (Cl. 158—36.3)

The present application is a continuation of applicant's prior co-pending application Serial No. 112,344, filed May 24, 1961, now abandoned.

This invention relates to a filter unit and, more particularly, to the improved fuel supply system which it enables for portable space heaters and like equipment.

A primary objective in constructing a space heater is to embody sufficient controls to insure safety in its use. For example, a space heater normally requires a fuel which, if not entirely consumed in a burning process, will leave dangerous and objectionable fumes in its combustion chamber. It has proven extremely difficult to avoid the occurrence of such fumes. However, the present invention does provide controls, the use of which obviates this problem. Moreover, in so doing it does in fact provide not only a safer but also a more efficient and effective space heater.

To further illustrate the problems which the invention solves, it must be understood that in the space heater of the prior art its fuel supply line normally incorporates a filter in its lower end which depends in and adjacent to the bottom of its fuel tank. In drawing fuel from the tank, under suction or pressure, the fuel passes through the filter from adjacent its bottom and upwardly through the fuel supply line to eventually pass to and from a burner head to a combustion chamber. The head normally provides a mixing or siphon type nozzle for mixing air with fuel and delivery thereof for ignition in the combustion chamber.

In the operation of such a space heater it has been found that when the heater has been left running and the level of fuel in the supply tank falls below the filter, rather than fuel flow terminating, a capillary attraction takes place between the filter and the fuel. This capillary action results in an intermittent pulsating flow of fuel from the bottom of the tank, under the influence of applied suction, for example. As a result, fuel is delivered to the burner in small amounts and in spurts, causing the burner unit to sputter and spit raw fuel into the combustion chamber. This not only creates dangerous fumes but results in incomplete combustion and leaves a dangerous combustible residue in the combustion chamber.

It has also been found to be a characteristic of prior art space heaters that when a heater is turned off with the level of fuel anywhere above the bottom of the fuel tank, fuel nevertheless still remains in the nozzle. This fuel eventually issues to the combustion chamber in liquid or fume form, leaving, in this instance also, dangerous fumes and residue. Moreover, using the prior art fuel supply systems and filters, the filters have a strong tendency to clog. This also interferes with proper fuel flow and produces, in the space heater, poor and incomplete combustion.

All of the above noted problems are obviated in the practice of the invention.

A preferred embodiment of the present invention enables a fuel supply system for space heaters and like equipment wherein the inherently vented fuel supply tank has its delivery opening bridged by a filter element, preferably of powdered metal or its equivalent. In conjunction therewith, a shield-like tubular housing is engaged about the filter to extend from the delivery opening of

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the tank and to depend and form an extended hollow chamber therebelow, in advance of the filter. It will be seen that this unit as applied in the fuel supply system of a space heater or similar equipment produces a novel function and significantly improved safety control features.

A primary object of the invention is to provide a novel fuel filter unit for a particularly advantageous incorporation in a fuel tank, which unit may be economically fabricated, more efficient and satisfactory in use, adaptable to a wide variety of applications and unlikely to create malfunctions in the fuel systems in which it is incorporated.

Another object of the invention is to provide a fuel filter unit particularly applicable to effect improvements in heating systems involving the supply of liquid combustibles.

A further object of the invention is to provide a novel filter unit applicable to the vented fuel supply tank of a space heater or like equipment to produce a fuel supply system which renders the space heater safer and more efficient in operation.

An additional object of the invention is to provide a novel filter unit, the proper application of which to the fuel supply tank of a space heater or the like will produce an automatic and complete cut-off of the fuel delivery therefrom on the fuel reaching a predetermined level in the tank.

Another object of the invention is to incorporate an improved filter unit in the supply system of a space heater or like equipment to produce thereby a substantial elimination of the possibility of any dangerous accumulation of fumes or combustible residue occurring in the combustion chamber of the space heater.

An additional object of the invention is to provide a space heater, such as one using a conventional siphon-type nozzle in its fuel supply system, with a filter so incorporated in its fuel supply line that on break of suction in the line a reverse flow of fuel takes place which inherently purges the nozzle and filter.

A further object of the invention is to provide in a space heater or like equipment a filter unit applied to the fuel delivery line interconnected in its fuel supply tank in a manner that enables it to operate to effectively purge the line and interrupt the operation of the heater when the fuel supply in the tank reaches a dangerously low level.

A further object of the invention is to provide a fuel filter unit possessing the advantageous structural features, the inherent meritorious characteristics and the mode of operation herein mentioned.

With the above and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawing wherein is shown one but obviously not necessarily the only form of embodiment of the invention,

FIG. 1 is a cross-sectional view of a fuel supply tank embodying a filter unit in accordance with the invention; and

FIG. 2 is a schematic showing of the application of the apparatus of FIG. 1 in a fuel supply system for a space heater, only so much of the heater apparatus being indicated as is necessary for the present disclosure.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings, the invention unit is shown to include a filter element 1 of powdered metal or material or equivalent characteristic. This element is appro-

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appropriately disposed to bridge the delivery opening from a fuel tank 8. The tank 8, being a fuel tank, is shown as conventionally vented, the vent being illustrated as incorporated in the cap for the tank filler opening.

The element 1 has a generally cylindrical configuration including a radially projected flange 3 at one end 4. The latter is shown in FIG. 1 of the drawings in a position external to the fuel tank proper. A cavity 5 is provided in the uppermost surface of the element 1, the cavity extending axially and substantially the length of the filter.

The filter unit is completed by a tubular housing 2. The housing 2 has an internal diameter greater than the external diameter of the filter element 1. As seen in FIG. 1, the body of the element 1 depends in the upper end of the housing in concentric spaced relation to its inner wall and has its flange 3 seated over such upper end and appropriately fixed thereto. The housing 2 has such an orientation and length to define an extended hollow chamber 6 below the filter 1.

In the embodiment illustrated the filter unit is fixed to depend vertically through the delivery opening in the fuel supply tank 8. As shown, the dependent extremity 9 of the housing 2 positions in adjacent spaced relation to the bottom of the tank. The uppermost end of the filter unit including the flange 3 is suitably seated in one end of a coupling 10, the flange 3 being positioned in abutment with a shoulder 11. The coupling 10 is of a tubular nature, the shoulder 11 being defined by a counterbore in its end most adjacent the fuel tank 8. Accordingly, the shoulder 11 rims a delivery passage 12 adapted to communicate this filter cavity 5 with a fuel supply line interconnected with the coupling 10.

The coupling 10 is externally threaded to one end to screw into the means defining the delivery opening in the tank 8 while its other end is reduced in external dimension and adapted for threaded engagement in the one end of the fuel supply line 13, the connection being schematically illustrated in FIG. 2 of the accompanying drawings. As seen in FIGURE 2 the fuel supply system of the invention provides that the line 13 is connected with a burner 14 through a suction means 15. The means 15 is conventionally operable to apply suction through the filter 1 to the fuel in the tank 8. As may be further observed in FIG. 2, the burner is arranged to discharge, in a conventional manner, such as through a siphon type nozzle, the fuel drawn from the tank 8 to a combustion chamber 17 within the housing 18 of a space heater 19. The burner will, of course, also be provided with suitable ignition means.

In the operation of the space heater 19 utilizing the filter unit of the invention in the manner as illustrated, the suction means 15 is energized to apply suction to the fuel in the tank 8 through the filter element 1 and housing 2. This produces a vacuum condition in the chamber 6 inducing a column of fuel within the chamber to flow upwardly to and through the filter 1 to the cavity 5 and therefrom to the line 13 by way of the delivery passage 12. The dependent extremity 9 of the housing 2 is, as illustrated, adjacent and spaced from the bottom of the tank. Therefore, as long as the fuel level in the tank is at or above the extremity 9 fuel will continue to pass upwardly through the chamber 6, line 13, burner 14 and be discharged from the burner into the combustion chamber 17 by way of a conventionally included nozzle. This flow of fuel will be smooth, even and continuous until the fuel level in the tank falls below the extremity 9 of the housing 2. The instant this happens, due to the fact the chamber is naturally vented, air enters the chamber 6 and there is a break in the existing vacuum. The end result of this is an immediate and automatic termination of the delivery of fuel to and from the burner 14.

It has been difficult to determine precisely what happens. However, it has been found that once air enters the chamber 6 and the vacuum is broken, there is fuel still in the upper portion of the housing 2, the filter and

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the supply line. The interruption of the vacuum causes this fuel to be drawn or to drop back through the filter 5, in the process of which it inherently purges the filter of all fuel and, in fact, the adjacent fuel supply line. The purged fuel falls the length of the chamber 6 and into the bottom of the fuel tank.

The entrance and existence of air which has occurred in the chamber 6 prevents the occurrence of a capillary type of attraction by the filter 1 for the fuel remaining in the tank as would normally occur were the filter 1 not substantially displaced from the fuel by the extended length of the chamber 6. Thus the filter remains dry and there is a block between the filter and the fuel.

It has been found that the break in the vacuum, as described, not only automatically terminates the delivery of fuel to the burner 14 but there no longer occurs any residual sputtering or spitting of raw fuel into the chamber 17. The net effect of this automatic cut-off is to eliminate the possibility of any dangerous residue being left in the space heater which could result in toxic fumes or a potentially explosive substance.

Thus the function of the invention as above described is highly important for adding safety and efficiency to the operation of space heaters and like equipment. Moreover, it may be readily seen therefrom that the invention filter may be equally advantageous in other similar applications involving the transmission of potentially dangerous fluids.

It should be noted that with the provision for the extended chamber 6 through the medium of the housing 2 and the purging operation that takes place in respect to the filter 1 when the level of fuel falls below the end 9 of the housing 2 the filter will not clog as would normally be the case if the filter were positioned in a conventional manner adjacent the bottom of the tank. This also means that further fuel may be introduced into the tank 8 and the filter will not interfere with a most effective operation of the fuel delivery system as illustrated in reference to the space heater.

The same safety conditions as above described would exist when a heater is cut off at any time when the fuel level in the tank is below the filter.

It should be recognized that while filters may have previously been used in the discharge opening from a sealed container of water or like substance to prevent undesirable foreign objects from passing from a container, no one heretofore has contemplated the use of a filter of a character described or in connection with a vented fuel tank in the supply system of a space heater as illustrated with the attendant significant results.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. In combination with a burner head of a space heater or like equipment having means in connection therewith for delivery thereto of fuel under the influence of suction means and therefrom to an attached combustion chamber, a fuel tank having a delivery opening at its top, adapter means in connection with said tank opening providing a delivery passage therefrom and means for inter-

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connection thereof with a supply line leading to said head and communicated with the aforementioned suction means, a filter fixed to said adapter to bridge said opening and to depend interiorly of said tank, said filter providing a cavity in free and unrestricted communication with said delivery passage, a tubular housing confined in said tank to depend vertically thereof to a point adjacent its bottom, the uppermost end of said tubular housing being bridged by said filter, the latter disposing in the path of fuel moving upward of said housing from adjacent the bottom of said tank under the influence of said suction means, said tubular housing forming an extended empty chamber in advance of said filter which, on level of fuel in said tank falling below said housing, receives air from said tank to break the vacuum produced by the suction on said housing, the result of which is to induce the fuel uppermost of said chamber to be drawn down in a reverse flow to the bottom of said tank, the effect of which is to positively clear the line in said filter and thereby produce a sharp and automatic interruption of the operation of said heater and inhibit after-flow.

2. In combination with a space heater including a burner head having a fuel supply line in connection therewith and means incorporated to draw fuel through said line under the influence of suction, a fuel supply system for connection with said line consisting of a fuel tank having means defining a delivery opening connected to said supply line, a vertical tube dependent from said opening substantially to the bottom of said tank, an elongated filter unit a portion of which covers the top of said tube and is confined thereto by said means defining a delivery opening and another portion of which smaller than said tube depends into the tank in the top portion of said tube, said tube depending beyond the lower end of said filter unit and forming an extended empty chamber of substantial volume and generally uniform cross-sectional dimension therebelow, the application of suction to said supply line producing a lift of fuel to exit from said tank through said tube and filter in the top portion of said tube, in the process of which a column of fuel is inherently maintained in said tube and the interconnected line, said extended chamber, as defined, functioning immediately on break of the vacuum produced in said tube by said suction means to provide the fuel in the filter will drop therefrom in a manner to purge said filter and thereby preclude the further discharge to said burner head of raw fuel.

3. In combination with a space heater including a burner head having a siphon nozzle, a fuel storage tank, a delivery line from said tank to said nozzle, said tank having a delivery opening in the upper part thereof, said delivery line being arranged in absence of suction to drain fuel from said nozzle back to said tank, a vertical tube confined within said tank to depend from said delivery opening adjacent to the bottom of said tank, the lower end of said tube being normally below the fuel level in said tank, the opposite ends of said tube being open, and a filter extending into the upper part of said tube having a cavity in free and open communication with said delivery line through said delivery opening and defining a chamber therebelow and means for creating a suction in said delivery line to draw fuel from said tank through said tube and said delivery line to said nozzle, discontinuance of said means allowing fuel in said delivery line and at said nozzle to drop back into said tank to and through said filter with resultant purging effect.

4. A fuel storage tank according to claim 3, characterized by means installed in the upper part of said tank having a through opening therein defining said delivery opening, said means being disposed to align said opening with the cavity in said filter as a continuation thereof, said opening being of a size freely to interconnect said cavity and said delivery line.

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5. In combination with a space heater, a fuel storage tank connected for fluid communication with said heater and having a delivery opening in its upper end, suction means in said fluid connection, closure means installed in said delivery opening and having a flow path therethrough having a diameter for a free and unrestricted withdrawal of fuel from the tank and draining thereof back to the tank, a vertical tube projecting downwardly from said closure means into the tank, the opposite ends of said tube being open, the upper end aligning with said flow path, and an elongated filter element extending into said tank and disposed lengthwise in said tube and having a head end secured in the upper end of said tube, said filter element having an axial cavity opening through the said head end, means locating said filter element with said head end at said closure means with said cavity in aligned unrestricted communication with said flow path, said filter element having an opposite end projecting toward the lower end of said tube but spaced therefrom a distance to leave in said tube between the lower end thereof and the said opposite end of said filter a chamber of extended length.

6. A fuel storage tank according to claim 5, characterized in that said means for locating said filter element includes a flange on said head end thereof overlying the upper end of said tube and held clamped thereto by said closure means.

7. In combination with a space heater including a burner head having a siphon nozzle, a fuel storage tank, a delivery line from said tank to said nozzle, said tank having a delivery opening in the upper part thereof, said delivery line being arranged in absence of suction to drain fuel from said nozzle back to said tank, a vertical tube dependent within said tank from said delivery opening and extending to near the bottom of said tank, the lower end of said tube being normally below the fuel level in said tank, the opposite ends of said tube being open, and a filter installed in the upper part of said tube having a cavity in free and open communication with said delivery line through said delivery opening and defining a chamber therebelow and means for creating a suction in said delivery line to draw fuel from said tank through said tube and said delivery line to said nozzle, discontinuance of said means allowing fuel in said delivery line and at said nozzle to drop back into said tank to and through said filter with resultant purging effect, said filter being a cylindrical element having a head end interengaged with the upper end of said tube and a body portion extending into said tank in spaced concentric relation to said tube, said filter element terminating at its end opposite said head end within the tube a substantial distance from the lower end thereof to define with the tube beneath the said opposite end of said filter element an open space of substantial volume, said cavity being in said body portion and opening through said head end.

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