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SHUT-OFF VALVE FOR FUSE FILTER

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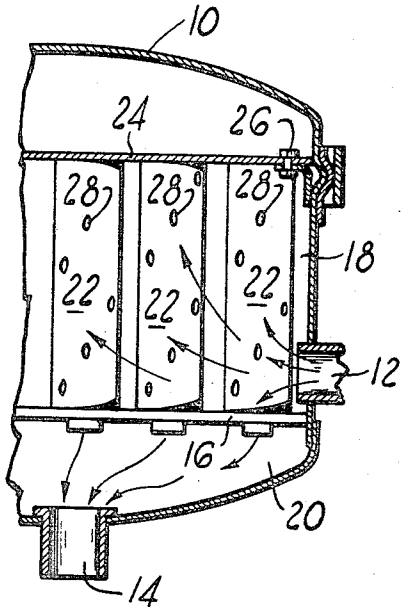


Fig. 1

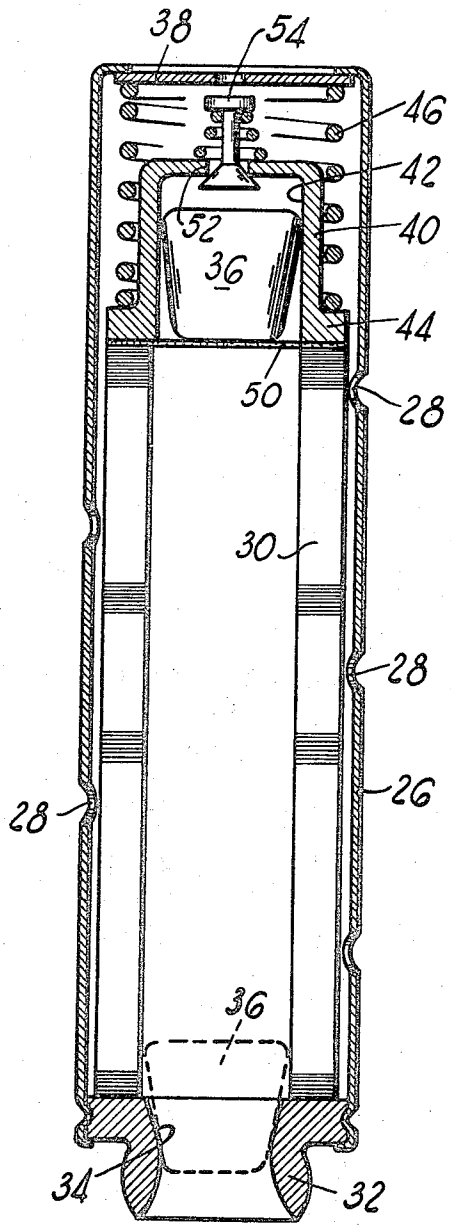


Fig. 2

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SHUT-OFF VALVE FOR FUSE FILTER

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ABSTRACT OF THE DISCLOSURE

A positive shut-off valve for interrupting the flow of fuel through a fuse filter element of a fuel monitoring device in the event such fuel contains free water. The shut-off valve member is confined at the end opposite the outlet port by a non-resilient thin disc-type shear diaphragm which ruptures when the pressure differential across the fuse element exceeds a predetermined value and is permitted to act on the diphragm. A poppet-type trigger valve prevents the full differential pressure from acting on the diaphragm until the predetermined value is exceeded.

Background of the invention

In most present day refueling installations fuel monitoring devices of the type described in my Patent No. 3,117,925 are located downstream of conventional filter water separators. In such installations, the fuel monitoring devices will normally operate for long periods of time without being exposed to large amounts of contamination. During such normal operations, the pressure drop through the fuel monitoring device will build up gradually, and the fuse elements will be replaced after a scheduled time interval, e.g., six months, or when the pressure differential across the fuse elements reaches a predetermined value, e.g., 15 to 20 p.s.i. Under such conditions, the fuse elements of the fuel monitoring device will retain all, or most all, of the solid and water contaminants in the fuel flowing therethrough.

More recently, in many installations fuel monitoring devices have been effectively utilized in place of filter water separators rather than in combination therewith. Even in such installations, if the fuel is of average quality, that is, contains only relatively small quantities of water and solid contamination, the fuse elements will have no difficulty in retaining or trapping the contamination. However, in such installations, certain operating conditions can occur which will cause small quantities of water to seep between the layers forming the edge-type fuse elements and flow to the outlet port of the fuel monitoring device. For example, if the fuel monitoring device is utilized in place of a filter water separator and the device is used at a fraction of its rated flow (25% or less), and if, in addition, the pumping system used to pump the fuel flowing therethrough is contaminated with a high operating pressure, then in those situations when the fuel flowing therethrough is contaminated with a high percentage of water, it will be possible for some of the water to seep through the fuse elements. The reason for this is that, under such conditions of limited flow and low pumping pressure, the piston in the fuse element cannot compress the edge-type filter element sufficiently to completely close off the pores between the layers and prevent further flow through the element. Thus, under such conditions water can in effect "seep" through the elements.

Summary of the invention

In view of the foregoing, it is an object of this invention to provide a fuel monitoring device which will function properly under all foreseeable operating conditions.

Another object of this invention is to provide a novel

fuse element construction which will prevent water seepage therethrough.

In other words, it is an object of this invention to provide a "seepage-proof" fuse element for use in a fuel monitoring device.

More specifically, it is an object of this invention to provide a tubular fuse element construction incorporating a releasable valve member which is releasably held at one end of the tubular fuse element by a non-resilient shear diaphragm which will rupture when a predetermined differential pressure acts thereacross and thereby permit movement of the valve member into the fuse outlet to prevent further flow therethrough.

The above and other objects and features of this invention will become apparent from the following description taken in connection with the accompanying drawings.

Brief description of the drawings

FIGURE 1 is a fragmentary view partially in section of a fuel monitoring device containing a plurality of filter units, each of which incorporates the invention;

FIGURE 2 is an enlarged sectional view of a filter or fuse unit incorporating the invention and showing the shut-off valve in various positions.

Description of the preferred embodiments

Referring to FIGURE 1 of the drawings, it will be seen that numeral **10** indicates a tank having a fuel inlet port **12** and fuel outlet port **14**. Suitably attached to the housing is a partition **16** which separates the interior of the housing into an inlet chamber **18** and an outlet chamber **20**. A plurality of filter or fuse units **22** (only three of which are shown) are suitably attached to partition **16** and are retained in position by a retainer plate **24** which is operatively connected to housing **10** by three bolts and nuts **26** (only one of which is shown). The direction of flow through the tank is indicated by the arrows.

Each filter or fuse assembly **22**, as shown in FIGURE 2, includes a metal tube **26** having a plurality of perforated inlet ports **28** surrounding a compressible porous tubular edge-type filter element **30** formed from a plurality of washers in registered face-to-face contact. The washers which are used in the filter may be formed from paper, cellulose, or other suitable fibrous or non-fibrous materials and are arranged so that flow through the filter element will be via the radially extending pores formed between the washers. The filter element may also be formed by utilizing a ribbon-like material wound edgewise. The method for winding and making the ribbon-type element is disclosed and claimed in my Patent No. 2,421,704. In the arrangement shown in FIGURE 1, flow will be from outside the filter element to inside the filter element. For additional details regarding this type of fuse assembly, reference may be made to my Patent No. 3,117,925 and Patent No. 3,151,071.

A nipple-like ferrule **32**, which is suitably connected to one end of the tube and is in abutment with one end of the filter element, is formed with a tapered valve seat **34** for receiving a valve member, indicated generally by the numeral **36**. A perforated retainer washer **38** is located at the other end of the tube, and a cup-shaped or thimble-shaped metal stamped endplate **40**, having a recess **42** therein and an outwardly extending flange **44** at the open end, is located at the other end of the filter element **30**. A preloaded spring **46** is located between the retainer washer **38** and the flange **44** of the endplate **40** for placing the edge-type filter element under the desired calibrated precompression. The valve member **36** is located within the endplate recess **42** and is confined therein by a substantially non-resilient shear diaphragm **50**, such

as a thin paper disc, which is sandwiched between the endplate and the tubular element. The closed end of the endplate **40** is formed with an orifice **52** in which a spring-loaded poppet valve **54** is located. This poppet valve functions as a pilot or trigger valve for causing release of the valve member **36**.

With the foregoing construction, it will be understood that the thin paper disc **50** will retain the valve member **36** within recess **42** as long as the pressure differential through the fuse element is below the opening pressure of the trigger valve **54**. As soon as this predetermined pressure differential is exceeded, the trigger valve will open and will permit the full differential pressure to act upon the exposed area of the paper disc. When this occurs the paper disc will rupture and valve member **36** will be propelled into the fuse outlet to prevent further flow therethrough.

Those acquainted with this art will readily understand that the invention set forth herein is not necessarily limited and restricted to the precise and exact details presented and that various changes and modifications may be resorted to without departing from the spirit of my invention. Accordingly, I do not desire to be limited to the specific details described herein primarily for purposes of illustration, but instead desire protection falling within the scope of the appended claims.

Having thus described the various features of the invention, what I claim as new and desire to secure by Letters Patent is:

1. A filter unit comprising a housing having a plurality of inlet ports and a single outlet port therein, a tubular filtering element located within said housing for permitting flow of fluid therethrough from the outside of the element to the inside of the element, said tubular element having one end thereof in abutment with said housing and in alignment with said outlet port, a cup-shaped endplate member in abutment with the other end of said tubular element, said endplate member having a recess therein and orifice means extending therethrough, pilot valve means operatively connected to said orifice means to permit flow therethrough and into said recess only when the pressure exerted thereagainst exceeds a predetermined value, a separate movable valve member slidable in said recess, substantially non-resilient shear diaphragm means located at said other end of said tubular element and

operatively connected to said endplate member to retain said valve member within said recess as long as said pilot valve means prevents flow through said orifice means, said diaphrgam means having one side thereof continually exposed to the fluid pressure inside the tubular element and the other side thereof exposed to the fluid pressure within said recess, said diaphragm means being structured to rupture and release said valve member when said pilot valve means opens and subjects the other side of said diaphragm means to the full fluid pressure outside the tubular element, said valve member coacting with said tubular element and said outlet port so that when the differential pressure acting on said diaphragm means ruptures said diaphragm means the valve member will be released and moved into said outlet port to prevent further flow therethrough.

2. A filter unit, as defined in claim **1**, wherein said diaphragm means is confined between said endplate member and said other end of the tubular element.

3. A filter unit, as defined in claim **2**, wherein said diaphragm means is a disc formed of thin paper.

4. A filter unit, as defined in claim **3**, wherein said orifice means comprises a single orifice.

5. A filter unit, as defined in claim **4**, wherein said pilot valve means comprises a spring-loaded poppet valve located in said orifice.

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