

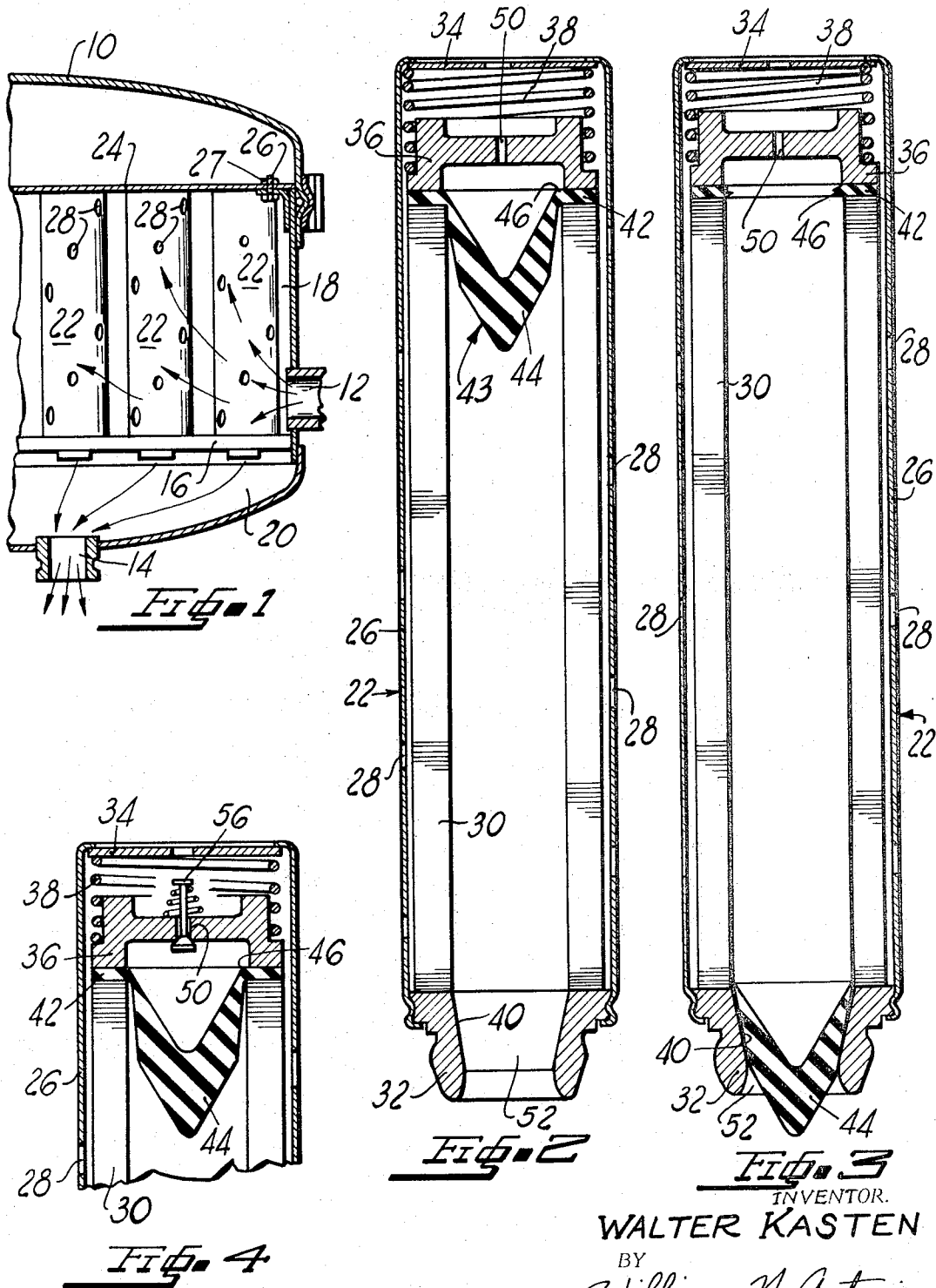
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W. KASTEN

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FRANGIBLE VALVE MEMBER FOR FUSE FILTER

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WALTER KASTEN

BY
William H. Antonis
ATTORNEY

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3,339,734 FRANGIBLE VALVE MEMBER FOR FUSE FILTER

Walter Kasten, Madison Heights, Mich., assignor to The Bendix Corporation, a corporation of Delaware
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This invention relates to a filter unit of the type which may be used as a fuel monitoring device and more particularly to improvements in a filter or fuse unit, of the type described in my Patent No. 3,117,925, wherein a shear plug valve is incorporated therein as a positive shut-off valve.

In most installations fuel monitoring devices of the type described in my above-referenced patent 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 trap and 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 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 through the device has only a rather limited low 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.

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 which incorporates a detachable valve member wherein one side thereof communicates with the fluid outside the fuse element and the other side thereof communicates with the fluid inside the fuse element so that when the differential pressure thereacross increases above a predetermined

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value the valve member will be detached from the fuse element and moved into the fuse outlet to prevent further flow therethrough.

A further object of this invention is to provide a fuse element construction having a shear plug valve wherein the frangible or shear section thereof is adapted to shear when the differential pressure thereacross increases above a predetermined value and the detached valve plug is then moved by the pressure exerted thereagainst into the fuse nipple outlet to prevent further flow therethrough.

A still further object of this invention is to provide a novel fuse element construction which incorporates a relatively inexpensive and simple positive shut-off valve therein.

The above and other objects and features of this invention will become apparent from the following description taken in connection with the accompanying drawings which form a part of this specification and in which:

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;

FIGURES 2 and 3 are enlarged sectional views of a filter or fuse unit with a shut-off valve therein shown in various positions; and

FIGURE 4 is a fragmentary sectional view of a filter or fuse unit showing a modification therein.

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 26 and nuts 27 (only one of which is shown).

Each filter or fuse assembly 22 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. A nipple-like ferrule 32 is suitably connected to one end of the tube and is in abutment with one end of the filter element. A retainer washer 34 is located at the other end of the tube and a movable piston-like endplate 36 is located within the tube and at the other end of the filter element. A preloaded piston spring 38 is located between the retainer washer 34 and the piston 36 for placing the edge-type filter element under the desired calibrated precompression. The washers which are used in the filter element 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 edge-wise. 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.

It will be seen from FIGURES 2 and 3 that the nipple-like ferrule 32 of each fuse element is formed with a tapered valve seat 40. A valve member, indicated generally by the numeral 43, is detachably connected to and closes off the upper end of the filter element 30. More specifically, the valve member includes a flange or rim 42 located between the piston 36 and the end of the filter element 30, and a tapered valve plug 44 located within the tubular filter element 30, said plug being attached

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to the flange 42 by a frangible section 46. This valve member can be made of plastic or any other suitable material. It will be noted that one side of the valve member communicates with the fluid outside the filter element 30 via restricted orifice 50 in piston 36 and the other side thereof communicates with the fluid inside the filter element 30.

The frangible section 46 is so proportioned that it will shear or rupture whenever the differential pressure or pressure drop between the outside and inside of the fuse element 30 increases above a predetermined value. This is usually about 25 p.s.i., but it can be calibrated to shear at any desired value. When the frangible section shears or ruptures, the valve plug 44 will be detached from the rim 42 which is retained between the piston and washer stack. After such detachment the higher pressure at the back of the valve plug will propel it towards the nipple-like ferrule 32 and cause it to be locked in the tapered seat 40, as shown in FIGURE 3. Obviously, further flow through the outlet port 52 will be prevented by the valve plug.

The foregoing fuse assembly construction having a shear plug valve therein normally will meet the average requirements of fuel pumping systems. However, if it is necessary to utilize a fuse element having trigger pressure limits which are more precise than those which are obtainable by the fuse construction shown in FIGURES 2 and 3, then a spring loaded poppet valve 56, as shown in FIGURE 4, can be mounted in the restrictor passage 50 of piston 36. Such a valve can be calibrated easily within plus or minus 1 p.s.i. With this construction, the shear plug valve 44 should be designed so that it will rupture below the minimum opening pressure of the spring loaded poppet valve 56. For example, if the spring loaded poppet valve is calibrated to open at 22 plus or minus 1 p.s.i., then the shear plug valve should be calibrated to rupture at 18 plus or minus 3 p.s.i. Thus, it will always rupture at the much more precise poppet valve opening pressure, and it will rupture as soon as the poppet valve opens.

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, and valve means in abutment with and closing the other end of said tubular

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element and including a detachable valve member, said valve member having one side thereof communicating with the fluid outside the tubular element and other side thereof communicating with the fluid inside the tubular element, said valve member co-acting with said tubular element and said outlet port so that when the differential pressure thereacross increases above a predetermined value the valve member will be detached and moved from the end of said tubular element into said outlet port to prevent further flow therethrough.

2. A filter unit, as defined in claim 1, wherein said valve means includes a flange in abutment with said other end of said tubular element and said valve member is a valve plug attached to said flange by a frangible section which is adapted to shear when the differential pressure thereacross increases above said predetermined value.

3. A filter unit, as defined in claim 2, wherein said housing includes a perforated tube.

4. A filter unit, as defined in claim 3, wherein said perforated tube includes a nipple-like ferrule at one end thereof for forming said outlet port.

5. A filter unit, as defined in claim 4, wherein a valve seat is formed within said ferrule for receiving and locking said valve plug in a closed position.

6. A filter unit, as defined in claim 5, which includes a piston member abutting the flange of said valve means, said piston member having a restricted orifice for communicating said one side of said valve member with the fluid outside the tubular element, and resilient means operatively connected to said housing and said piston member for urging said piston member against said tubular element.

7. A filter unit, as defined in claim 6, which includes second valve means operatively connected to said piston member for permitting flow therethrough only at pressures above a predetermined value.

8. A filter unit, as defined in claim 7, wherein said second valve means comprises a spring loaded poppet valve located in said restricted orifice.

9. A filter unit, as defined in claim 6, wherein said tubular element is a layered edge-type compressible tubular element.

10. A filter unit, as defined in claim 9, wherein said edge-type compressible tubular element is formed of a plurality of washers stacked in registered face-to-face contact.

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REUBEN FRIEDMAN, *Primary Examiner.*

W. S. BRADBURY, *Assistant Examiner.*