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FILTERING APPARATUS

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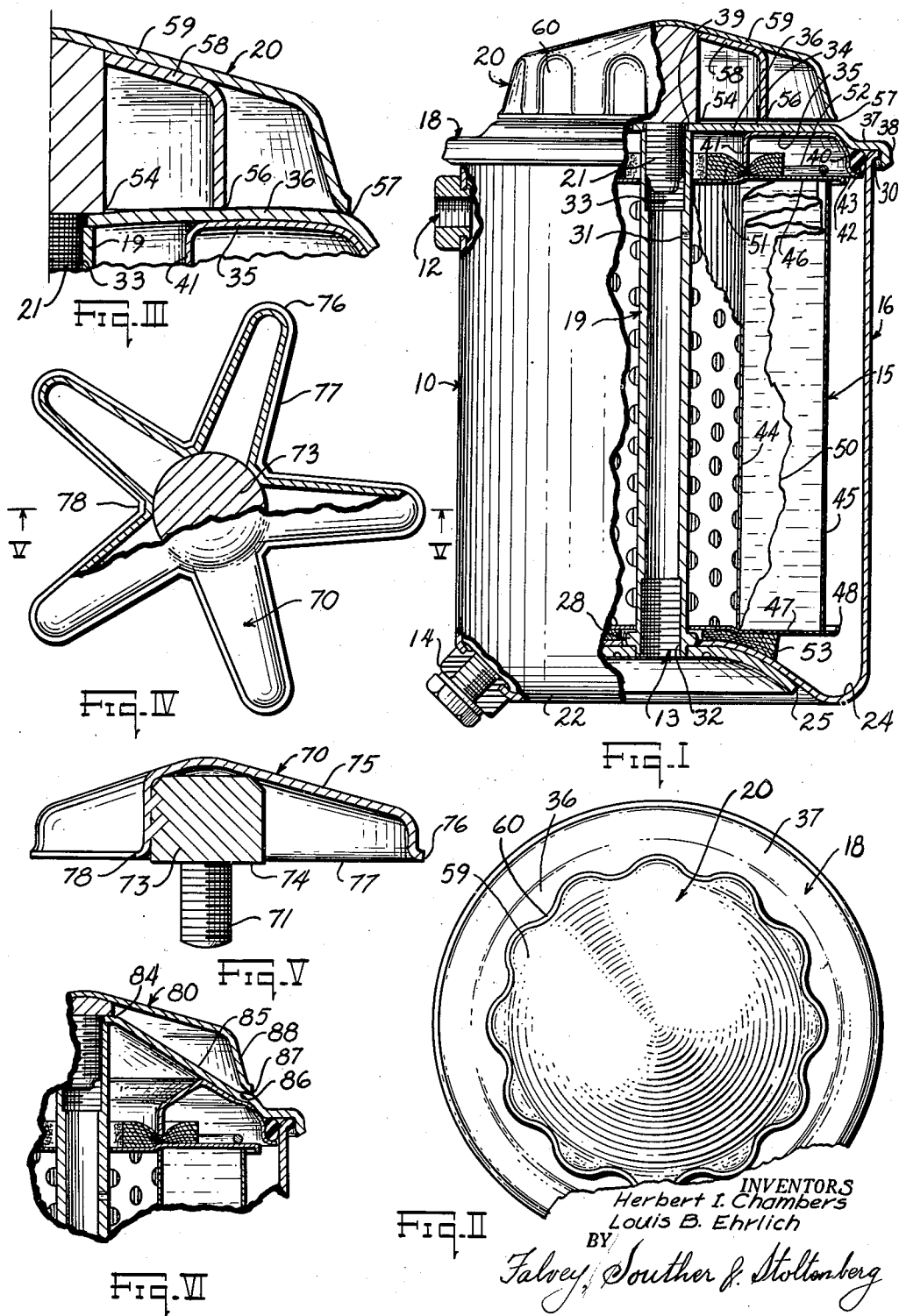


Fig. II

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FILTERING APPARATUS

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1

This invention relates to filtering apparatus for removing foreign particles from liquids and particularly to a filter adapted to be connected in the lubricating system of engines for self-propelled vehicles.

The invention comprehends a composite hermetically-sealed housing for liquids provided with novel clamping and sealing means for its component parts which produces a leak-proof enclosure capable of withstanding high internal pressures, severe shocks, and vibrations without impairment.

The invention embraces a filter assembly wherein the composite parts of the casing are manually drawn together with the minimum of effort, giving a direct indication when sufficient tightening is obtained, the arrangement being such that distortion of the parts does not take place when undue pressure is applied.

The invention contemplates the provision of a member for securing a cover to a container to form a leak-proof filter housing, the member having an enlarged section designed so that the effort required for tightening such member by hand is a minimum and which will remain in secure and fixed position regardless of vibration.

The invention comprises the provision of clamping means for a light-weight metallic container and cover to form a hermetically sealed filter housing, the clamping means providing large areas of contact when predetermined internal pressures are present to prevent distortion of the cover and housing as well as the possibility of rendering the hermetic seal ineffective.

The invention is inclusive of a light-weight composite casing including a cover and container for receiving and housing in predetermined fixed relation a filtering element and wherein not only an oil leak-proof sealed casing is obtained but its interior is effectively separated by the filtering element into two fluid chambers by the simple operation of manually turning a clamping or tension member which has a threaded connection with means carried by the container to draw cover and container together.

An object of the invention is to provide an economical and compact filtering device for the lubricating system of automotive engines that can be easily and quickly disassembled and assembled for service or replacement of the filtering element by any person without tools and without disturbing the connections of the filtering device with said system.

Another object of the invention resides in a liquid filtering assembly including a light sheet

2

metal container and cover for housing a filter cartridge wherein when the cover is drawn to close the container, a positive contact is provided so that a direct indication is given that sufficient tightening is obtained whereby any deformation of cover or container is avoided.

Another object of the invention is to provide in a two part housing a cover-securing member having an enlarged head having portions terminating in different planes whereby predetermined internal pressure increases the area of contact between cover and head, locking the cover and securing member in position, thereby eliminating accidental looseness between cover and the other part of the housing.

Another object of the invention resides in the production of a very simple and inexpensive casing for a filter cartridge, the casing being not only of extremely light weight, but capable of withstanding, without impairment, large internal and external stresses and severe shocks and vibrations and in which oil leakage is eliminated.

Another object of the invention is to provide an effective large filtration area in a comparatively small space which can be readily removed and replaced and held in fixed relation in a casing by its insertion therein forming the filtering unit which can be readily installed in many different ways by unskilled persons.

Other objects and advantages of this invention relating to the arrangement, operation and function of the related elements of the structure, to various details of construction, to combinations of parts and to economies of manufacture, will be apparent to those skilled in the art upon consideration of the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Referring to the drawings:

Fig. I is a view in elevation, partly in section, and with parts broken away of a filter according to the present invention;

Fig. II is a top plan view of the filter shown in Fig. I;

Fig. III is an enlarged sectional view showing the relationship of the cover and clamping means when predetermined internal pressures are present;

Fig. IV is a top plan view with parts broken away showing another form of the cover-clamping means of the invention;

3

Fig. V is a sectional view taken substantially in lines V—V of Fig. IV;

Fig. VI is a fragmentary sectional view of another embodiment of the invention.

The accompanying drawings show in detail certain illustrative embodiments of the invention, these being indicative of a few of the various ways in which the principles of the invention can be employed. In the drawings the invention is shown as embodied in a filter suitable for use in the lubricating system of engines of self-propelled vehicles. However, the invention is capable of receiving a variety of mechanical expressions. It is, therefore, expressly understood that we do not wish to limit the invention to the arrangement disclosed but we contemplate its utilization in any other arrangement, or other uses wherever the same may be found to be applicable.

Referring to the drawings in detail, and particularly to the form shown in Figs. I to III, numeral 10 designates a composite, fluid-tight casing of any suitable material made preferably of sheet metal. The casing 10 is provided with ports 12 and 13 adapted to receive suitable fittings for the admission and discharge of liquids from the casing, as well as with a drain plug fitting 14 for drawing off accumulated impurities that may be settled therein. The composite casing 10 is adapted to house a removable filter element 15 clamping the same in fixed relation therein, so that all the liquid admitted must pass through the element 15 before the same is discharged from the casing 10.

The casing 10 is preferably of cylindrical shape comprising a container part 16 and a closure or cover part 18 firmly held together in abutting and telescopic relation by inter-engaging clamping means inclusive of male and female members coacting with both parts to hold the same in fluid-tight relation. In the embodiments shown, the female member is in the form of a threaded hollow post or nut member 19 located within and fixed to the container 16 while the male member is in the form of a rotatable tension member or bolt 20 externally associated with the cover 18 having its threaded section 21 projecting there-through for engagement with the nut member 19.

The container part 16 is in the form of an elongated tubular member of cup-shape configuration with a reinforced closed end 22 centrally apertured and inwardly recessed forming a sediment-retaining pit or annular sump 24 provided with the drain plug 14. The end 22 is reinforced by welding or suitably fixing to its outer surface a curved metallic washer 25 on which is fixedly seated and, in turn, welded the lower end of the hollow post 19 with its enlarged section or shoulder 28 in positive contact with the inner surface of the washer 25, the arrangement forming a liquid-tight seal between the hollow post, washer, and container. The hollow post 19 is located centrally and extends longitudinally of the container 16 up to a point above the flanged rim or protruding lip 30 of the container's open end. The member 19 not only forms part of the clamping means but also acts as an outlet or liquid discharge tube by having its wall perforated between its ends as at 31 and its bore threaded at both ends as at 32 and 33. The lower threaded end 32 is adapted to accommodate a fitting for the discharge of liquid from the filter and its upper end 33 is adapted to receive the protruding threaded section 21 of the tension member 20, whereby the closure and container parts are clamped together.

The closure 18 is of a configuration adapted to

4

effectively seal the open end of the container 16 and is preferably made of relatively thin sheet metal, conveniently shaped by stamping operations to produce an assembly of two rigidly secured or spot welded concentric stampings 34 and 35. The stamping 34 of the closure assembly constitutes the main closing means which is adapted to resist the major reaction of internal liquid pressures within the casing, and is preferably of dish shape configuration. The stamping 34 is formed with an outward flat annular section 36 connected to a central planar section 37 by an angularly displaced portion. The annular section 36 terminates into a depending flange 38 which fits the exterior of the open end of the container whereby the protruding lip 30 of the container 16 is in abutting and telescopic relation with the annular section 36 and flange 38 of the closure part 18. The planar section of the stamping 34 is formed with the central aperture 39 for the passage of the threaded section 21 of the tensioning member 20 of the clamping means.

The stamping 35 is made from lighter gauge sheet metal of channel shape configuration having a planar section fixed to the planar section of stamping 34 with depending flanges 40 and 41. The outer flange 40 is substantially parallel to the container wall terminating into a curved portion 42 forming a groove which serves as means to retain a sealing gasket or ring 43 of relatively soft resilient material in proper position within the container in close proximity to the juncture of the container and closure parts.

The sealing ring 43 is normally of circular cross-section but when placed in operative position with the closure and container parts, the same is deformed, as shown in Fig. I, to provide a seal therebetween with the container and the closure parts. The sealing properties of the ring 43 are those usually found in the so-called "O-ring" which are enhanced by the action of pressure thereon, which sealing properties become more effective as the pressure of the liquid within the housing increases.

The inner flange 41 of the channel-shaped member 35 is vertically disposed to cooperate with the filtering cartridge 15 for clamping the same in the casing, holding its ends in liquid-tight relation between the cover and container parts when the parts are in closed relation, so that all liquid admitted must pass through the cartridge 15 before the liquid is discharged from the casing.

The filtering element 15 can be readily removed from the casing for service or replacement by only detaching the cover assembly 18 from the container part 16. The filtering cartridge 15 is in the form of a unitary or tubular cylindrical structure comprising two concentrically spaced, perforated, cylindrical walls 44 and 45, capped at their ends by annular, unperforated heads 46 and 47, the outer edges of which are flanged as at 48 to surround the ends of the outer cylindrical wall 45. Located between the cylindrical walls 44 and 45 is the filtering medium which is preferably in the form of a star-shaped or deep-pleated filter wall 50 having its ends bonded to the heads 46 and 47 respectively. I have found that the invention can be best fulfilled when the filter wall 50 is made of bonded cellulose material, so folded or pleated as to provide a very large area of filter medium in the comparatively small space provided between the cylindrical walls 44 and 45. However, other forms or types

of filtering medium, characterized by like properties, can be used.

The external surface of each of the filter heads 46 and 47 is provided with annular, resilient members, preferably in the form of felt washers 51 and 53, adapted to be engaged by the flange 41 of the cover 18 and the bottom of the container respectively whereby the filtering cartridge 15 is held in fixed and liquid-tight position within the casing, dividing the same into two separate liquid compartments. The central apertures of the end heads 46 and 47 are adapted to snugly fit the outer surface of the tubular nut member 19 and thereby act as guiding means for readily positioning, in spaced relation, the filtering wall 50 with respect to the container outer wall and discharge tube 19. A handle, preferably in the form of a wire loop 52, is suitably fixed to the upper end head 46 so that the filtering element can be readily lifted out of the casing without the necessity of the operator unduly soiling his hands after detaching the cover assembly from the container which is obtained by only turning the rotatable tensioning member 20 of the clamping means.

The top of the tensioning member 20, externally acting on the cover assembly, is in the form of an enlarged head having central and displaced or peripheral surfaces in offset relation. In the embodiments shown in Figs. I to V, the central surface is in a lower plane than that of the outer surface, while in the form shown in Fig. VI, the central surface is an upper plane. It can be seen by examination of the tension member shown in Figs. I to III that the central surface is formed by an annular shoulder 54 integral with the threaded shank 21 and the peripheral surfaces are formed by the ends 56 and 57 of the depending cylindrical flanges of the concentric sheet steel stampings 58 and 59 of dome-like configuration welded together and fixed to the upper end of the shank 21.

The depending flange of stamping 59 is formed with reentrant curved sections 60 to aid manual gripping as well as to enhance the locking effect between member 20 and cover 18 when a predetermined internal pressure occurs in the casing. The planar surface 54 of member 20 provides means to clamp the casing parts in abutting and telescopic relation drawing the cover inner surface adjacent to aperture 39 in positive contact with the end of member 19, thus giving direct indication that sufficient tightening has been obtained.

Due to the offset relation of the surface 54 with respect to the outer surfaces 56 and 57 of the member 20, it should be noted that while the central planar surface 54 clamps the central portion of the cover 18 to the nut member 19, a clearance is present between the cover and the end surfaces 56 and 57. This arrangement decreases the area of frictional contact between cover 18 and member 20 giving a sufficient leverage, so that the tension member can be tightened manually without tools. Moreover, a minimum gauge sheet material for the cover 18 can be used as the end surface 56 and 57 of member 20 act as cover reinforcing means as well as locking means therebetween, so that the cover can withstand abnormal pressures that may take place within the casing and resist vibration without impairing its hermetic seal.

It should be noted that to fulfill the objectives of the invention, there should be a correlation between the deflecting characteristics or gauge

of the sheet material of the cover with respect to the internal pressures that may take place within the casing, so that when a predetermined pressure takes place, the cover is deflected and urged into contact with the offset portions of the tension member.

The reinforcing and locking functions of member 20 with the cover 18 become effective when the predetermined internal pressure, for which the cover is designed, occurs because, due to such pressure, the cover outside surface is deflected into contact with the end surfaces 56 and 57 of member 20. After such contact takes place, the offset surfaces 56 and 57 arrest further distortion of the cover 18, taking any additional strains, providing, by such contact, effective locking means between cover and tension member to resist vibration and thus preventing accidental looseness between cover and container. The locking action is enhanced by the reentrant sections 60 as bulging of the cover at the reentrant areas positively opposes any turning of the tension member while pressure is maintained within the composite casing.

The two part tension member 70, illustrated in Figs. IV and V, has substantially the same functional characteristics described for tension member 20. The member 70 is in the form of a winged bolt having a threaded section 71 depending from the shoulder 74 of the cylindrical head 73 to which is welded a sheet metal stamping 75. The flange of the stamping 75 forms the offset or outer end surfaces 76 and is provided with indentations or reentrant sections 78 which inwardly project having its inner surfaces welded to the vertical wall of the head 73. Thus the tension member 70 takes the shape of a star or winged bolt having its central planar clamping section 74 in a plane lower than that of the outer surfaces 76 or the end surface 77 of the arms of the winged section. The clamping and indicating characteristics of the central section 74 are substantially the same as that of the central section 54 of tension member 20, while its offset surfaces 76 and 77 radially reinforce the cover at a plurality of spaced points and provide very effective radial locking means for the member 70 to resist vibration, maintaining a leak-proof seal.

In the form of the invention shown in Fig. VI, the planar section of the cover part of the filter casing is formed at the apex of a substantially conically-shaped stamping 85 which has an annular flat section 86 adapted to be deflected into contact with the end surface 87 of the depending peripheral flange of a tension member 80 when the internal pressure within the casing exceeds a predetermined amount. The depending flange of member 80 is preferably formed with depressions 88 to aid manual tightening and its end surface 87 is in a plane substantially lower than that of the central planar portion 84. As shown in Fig. VI, the structural relationship of other elements of the filter assembly are substantially the same as those shown in connection with Figs. I to III inclusive.

In use, the filter of the invention can be effectively connected by suitable fittings to the conduits of the lubricating systems of any type of engines. This can be accomplished by having the flow of the liquid to be filtered, such as oil entering at the port 12 of the composite filter casing, so that the oil will pass through the outer perforated wall 45 of the cartridge 15 and thereafter radially through the extended or pleated filter wall 50 wherein the filtering operation

takes place to be thereafter discharged from the cartridge by perforated wall 44. The filtered oil, after its discharge from the cartridge 15, fills the space about the central tube 19, which space is defined by the resilient seals of the end heads 45 and 47 with the container and cover parts, and thereafter flows through the openings 31 into the bore of the hollow post 19 and downwardly to the port 13 whereby the filtered oil can be conveyed by suitable conduit connections to the parts of the engines to be lubricated, or to the pump as the case may be when the filtering device of the invention is used as a by-pass filter.

When it is desirable to change or remove the filtering cartridge 15 from the composite filter casing 10, it will only be necessary for the operator to grip the enlarged head of tension member 20 and rotate the same, so that the threaded section 21 is disengaged from the nut member 12 to permit the removal of the cover assembly 18 from the container part 16. After removal of the cover, the filtering cartridge 15 can be lifted out of the container part 16 as a unit by the bail 52 without the operator unduly soiling his hands. The container part can be thoroughly cleaned and any sediment removed or drained out through the drain plug 14.

A new filtering element can be readily inserted in the container part 16 and held in its operative clamped position in the composite casing by placing the cover and tension member in cooperative engagement with the container and nut member, and thereafter manually turning the rotatable tension member 20 until the planar section 54 draws the cover into tight engagement with the upper end of nut member 12, giving a direct indication that sufficient tightening has been accomplished. The clamping operation of the cover by the tension member 20 not only holds the new filtering element in liquid-tight relation within the container but concurrently hermetically seals the container and cover parts.

It is to be understood that the above detailed description of the present invention is intended to disclose an embodiment thereof to those skilled in the art, but that the invention is not to be construed as limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of being practiced and carried out in various ways without departing from the spirit of the invention. The language used in the specification relating to the operation and function of the elements of the invention is employed for purposes of description and not of limitation, and it is not intended to limit the scope of the following claims beyond the requirements of the prior art.

What is claimed:

1. A filter comprising a tubular container having one of its ends open provided with ports for admitting and discharging liquids therefrom, a hollow post having its lower end attached to and projecting inwardly of said container from said outlet port, a filtering element adapted to be removably supported within said container being provided with perforated side walls and having imperforated annular end heads engaging said hollow post for retaining the filtering element in spaced relation with respect to said post and the walls of said container, resilient annular means carried by the outer surface of each of said annular end heads, a cover for the open section of said container, a depending flange carried by the under side of said cover, means for clamping said cover to

said container including a member projecting through said cover and having a threaded connection with the upper section of said hollow post, an enlarged head for manually turning said member and urging the inner surface of the cover into abutting engagement with the upper end of said hollow post whereby the filtering element is held in fixed relation within the casing separating the inlet and outlet ports through the engagement of the depending flange carried by the under side of said cover and bottom of the container with the resilient annular means carried by the end heads of the filtering element.

2. A filter structure comprising a casing composed of a container part and a closure part clamped together and provided with inlet and outlet ports, a hollow post extending inwardly in said container and attached at one end to an aperture forming the outlet port, a tubular filtering element having portions engaging said post for locating the same within said casing in spaced relation thereto, annular resilient means at the ends of said filtering element, the filtering element tightly held in said casing by the engagement of the resilient means with portions of the joined casing parts, a rotatable member having a portion projecting through an aperture provided in said closure part and having threaded engagement with said hollow post, a head of a larger area than the closure aperture forming another portion of said rotatable member for manually turning the same, the head of said member having a central section adapted to contact with the outer surface of said closure part adjacent its aperture for urging its inner surface into abutting contact with the end of said hollow post clamping closure and container parts together, the head portion of said rotatable member having another section in a plane offset from that of the central section whereby the area of contact between closure part and rotatable member is increased when a predetermined internal pressure is present within said casing.

3. A filter assembly comprising an elongated container having one of its ends open, said container provided with ports for admitting and discharging liquids therefrom, a hollow post fixed to and projecting inwardly of said casing from said outlet port, a removable filtering element having perforated side walls and being formed with imperforated annular end heads engaging said hollow post for retaining the filtering element in spaced relation within said container, annular resilient means carried by the outer surface of each of said annular end heads, a cover for the open end of said container, a projecting annular member located at the inner surface of said cover, a member having a section projecting through said cover threaded to the free end of said hollow post for clamping the cover to the container, an enlarged head for manually turning said member and urging the cover into abutting engagement with the free end of said hollow post whereby the filtering element is interposed between the inlet and outlet ports through the direct engagement of said projecting member and bottom of the container with the resilient means carried by the end heads of the filtering element.

4. A filter comprising a casing composed of a container part and a closure part clamped together provided with inlet and outlet ports, a hollow post projecting inwardly and being fixed to the aperture of said container forming

the outlet port, a tubular filtering element concentrically positioned within said casing around said post and held in fixed relation therein by the engagement of its respective ends with the closed end portions of the joined casing parts, and a rotatable member projecting through an aperture provided in said closure part and having threaded engagement with the upper end of said hollow post for clamping the cover and container parts together, said rotatable member having a head formed with a central section adapted to engage said closure adjacent said aperture for urging into abutting contact the inner surface of the closure with the end of said hollow post, the head of the rotatable member having another section terminating into a plane offset from that of said central section whereby the areas of contact between closure and rotatable member are increased when internal pressures are present within said casing, which exceed a predetermined amount.

5. A filter structure comprising a container having one of its ends open provided with ports for admitting and discharging liquids therefrom, a post secured to the container and projecting inwardly of said casing from said outlet port, a filtering element adapted to be removably supported around said post, the filtering element having a deep-pleated filtering wall capped at its ends by imperforated annular end heads engaging said hollow post for retaining the filtering wall in spaced relation within said container, annular resilient means carried by the outer surface of each of said annular heads, a cover for the open end of said container, a member projecting through said cover and having a threaded connection with said hollow post for clamping said cover to said container, an annular depending flange carried at the under side of said cover adapted to surround said hollow post, an enlarged head for manually turning said member and urging the inner surface of the cover into abutting engagement with the end of said post whereby the pleated filtering wall is held in fixed and liquid-tight relation within the casing between the inlet and outlet ports through the compression of the end heads annular resilient means by their engagement with the container and the annular depending flange carried by the under side of the cover.

6. A filter comprising a casing composed of a container part and a closure part clamped together provided with inlet and outlet ports, a post attached to said container part, a tubular filtering element positioned within said casing, annularly deformable means carried at the ends of said filtering element placed to be in spaced relation with respect to said post, a member having a section projecting through an aperture in said closure part in engagement with the end of said post, a downwardly projecting member surrounding said post in spaced relation therewith carried by the under side of said closure part, a head of a larger area than said aperture for manually turning said member, the central section of said head adapted to contact with the outer surface of said closure for urging into abutting engagement the inner surface of the closure with the end of said post causing the compression of said annularly deformable means by directly engaging the container part and said downwardly projecting member whereby the filtering element is held in liquid-tight relation between the inlet and outlet ports.

7. A liquid-tight casing composed of a first

part and a second part clamped together and having portions in telescopic relation, said casing provided with ports admitting and discharging liquids therefrom, a nut member rigidly attached to one of said parts, the other part provided with an aperture, a member having an enlarged section for manually rotating the same and having a portion projecting through said aperture for threaded engagement with said nut member, the enlarged section of said member provided with a portion of larger area than said aperture for urging into abutting engagement with inner surface of the part formed with the aperture with the end of the nut member for clamping the first and second parts of the casing together, the enlarged section of the rotatable member having a second section terminating in offset relation from its other section whereby the area of contacting engagement of the part provided with the aperture with the rotatable member is increased when internal pressures are present within said casing, which exceed a predetermined amount.

8. A liquid-tight casing for liquids composed of a container part and a closure part clamped together in abutting and telescopic relation and provided with ports for admitting and discharging liquids therefrom, a post attached to the container part projecting inwardly and terminating adjacent to the closure part, sealing means carried by the closure part and adapted to engage the inner surface of the container part including a member distortable by liquid pressure in said casing, a rotatable member having a portion projecting through an aperture provided in said closure part and having a threaded engagement with said post, a head of a larger area than said aperture forming another portion of said rotatable member for manually turning the same, the head portion of said member having a central section adapted to contact the closure part adjacent said aperture for urging into abutting engagement the inner surface of the closure part with the end of said post for clamping the closure and container parts together, the head portion of said rotatable member having another section terminating in offset relation with the central section whereby the area of contact between the closure part and the head portion of the rotatable member is increased when internal pressure is present within said casing, which exceeds a predetermined amount.

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