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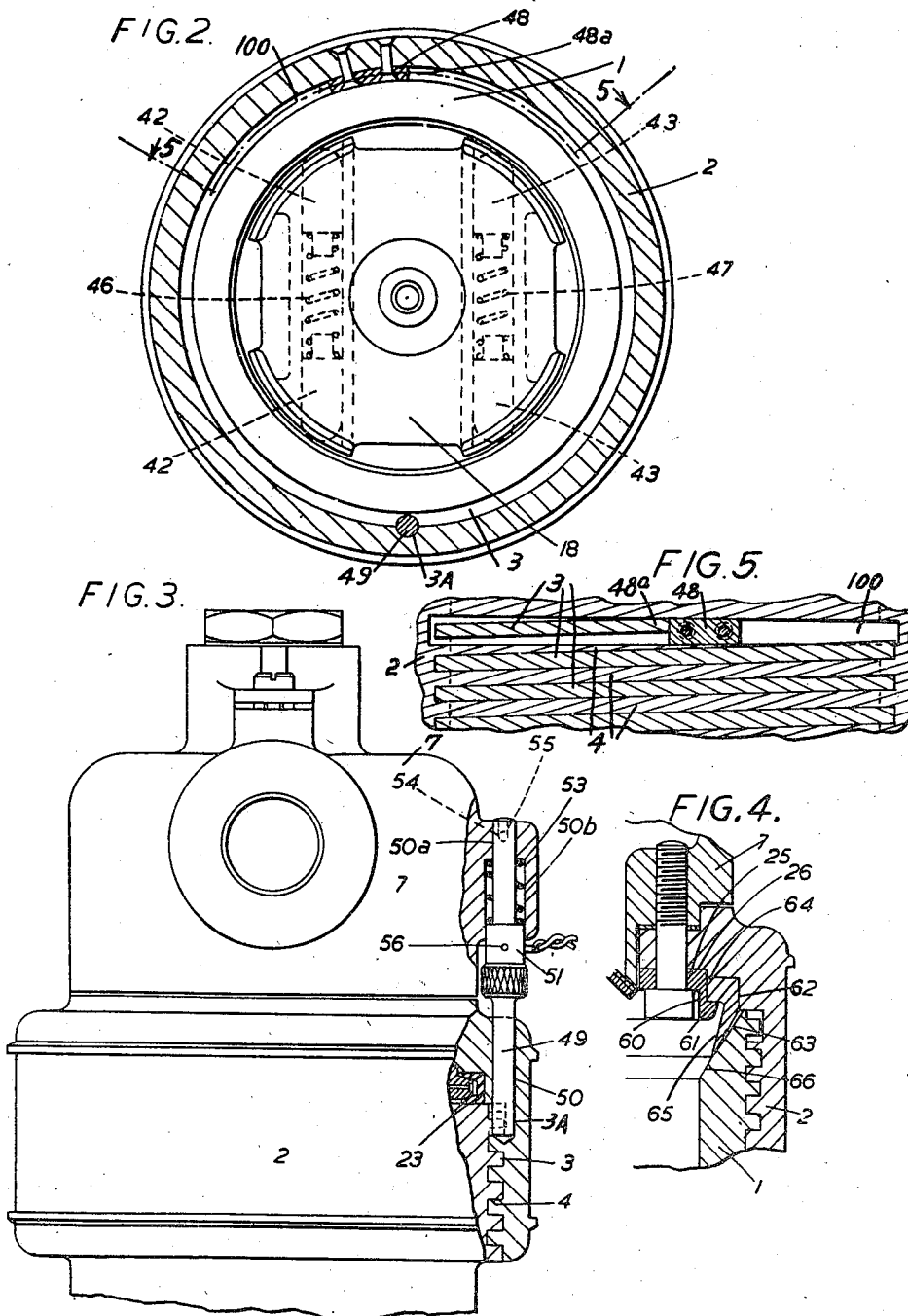
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OIL OR OTHER LIQUID FILTER OR CLEANER

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## UNITED STATES PATENT OFFICE

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## OIL OR OTHER LIQUID FILTER OR CLEANER

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1

This invention relates to oil or other liquid filters or cleaners, and particularly to such devices for use in cleaning high pressure liquids.

The principal object of this invention is the provision of an oil cleaner wherein novel means is utilized to prevent leakage.

Another object is the provision of a novel oil cleaner wherein the seal against leakage increases its effectiveness with the increase in oil pressure.

Another object is the provision of an oil cleaner having novel means for preventing leakage along the overlapping parts of the cleaner, such as the container and the head.

Another object is the provision of an improved oil cleaner having a novel arrangement of non-return valves in both the inlet and the outlet passages.

Another object is the provision of an oil cleaner having novel means for retaining the oil in the various parts of the cleaner when the apparatus is dismantled.

Another object is the provision of an improved oil cleaner having a novel venting arrangement for relieving entrapped air when the cleaner is dismantled and reassembled.

Another object is the provision of a novel oil cleaner which may be placed in a circulating system having parts at a higher level than the inlet and the outlet to the cleaner, and which has means to prevent undesirable oil flow through either the inlet or the outlet.

Another object is the provision of a novel oil cleaner which may be readily dismantled and assembled when necessary.

Another object of this invention is the provision of an improved oil cleaner wherein all of the parts are readily accessible.

Another object of this invention is the provision of a novel oil cleaner wherein the filter element may be replaced without disconnecting the device from the inlet and outlet conduits.

Other objects and advantages will become apparent from the following description.

One constructional form of the invention, applied to a high pressure oil cleaner, is hereinafter described, by way of example, with reference to the accompanying drawings, whereon:

Fig. 1 is a sectional elevation of the oil or other liquid cleaner;

Fig. 2 is cross section on the stepped line A-A-A in Fig. 1 with the filtering element removed;

Fig. 3 is a fragmentary view, partly in section, of the upper part of the cleaner and shows the

2

locking means for preventing the unauthorized separation of the head and container;

Fig. 4 is a fragmentary view showing a modified form of gland ring; and

Fig. 5 is a fragmentary cross-sectional view taken along the line 5-5 of Fig. 2.

Referring to the drawings:

The oil cleaner comprises a tubular container 1 fitted with a two-part cap-shaped head, the container being formed with an external square screw thread 3 cooperating with an internal thread 4 in the wall of the skirt of the lower part 2 of the head. The upper end of the lower part 2 of the head is formed with an opening 5, and the base 6 of the outer part of the head, which forms a head cover 7, is secured to the said end. The head cover 7 is formed with an outlet 8 and an inlet 9, outwardly directed opposite each other. The outlet 8 communicates with an outlet passage 10 formed substantially at right angles to the axis of the container in a transverse boss 11 projecting downwards from the inside of the top end of the head cover. A hollow tubular member 12, which is coaxial with the container and integral with the boss 11, provides a continuation 13 of the outlet passage which terminates in the top end of the container. A cylindrical neck 14 projects downwardly from the bottom of the head cover and is fitted into the hole 5 in the head.

The inlet 9 communicates with the space 15 in the head cover 7 and with the annular space 16 surrounding the tubular member 12. The hollow, corrugated filter element 17, which is of known construction and is made up of gauze and filter fabric, is held in position in the container between a bottom pressure plate 18 which is forced inwardly by means of a spring 19 and an upper pressure plate 20 which is slidably mounted on the tubular member 12 and sealed in light-tight engagement therewith by the felt washer 21 abutting stop means. When dismantled the plate 20 is prevented from becoming detached by the C-clip spring 22.

A gland ring 23, of channel section and made of synthetic rubber or other similar material, is held fairly loosely upon the peripheral flange 24 of an annular gland retainer 25 which is seated in a recess 26 in the head and is held therein by set screws 27 serving to fasten the head cover 7 to the lower part 2 of the head. The gland ring 23 and the flange 24 projecting therein are accommodated in an annular recess formed between the outer end of the container and a shoulder 28 in the part 2.

3

The inner end of the annular oil inlet space 16 surrounding the said tubular member 12 is arranged to be closed in certain circumstances by means of a mushroom-shaped non-return valve 29, which is slidably mounted upon the member. The valve is adapted to be pressed into sealing contact with the correspondingly-tapered end of the neck 14 by means of a coil spring 30 which is arranged around the tubular member. One end of the coil spring is lodged in a shoulder formed at the junction of the tapered skirt of the valve and a stem projecting therefrom, and the opposite end of the spring bears against a support 31 of angle section mounted on the tubular member and retained against axial movement by a C-spring clip 32.

Any pressure in the system due to a part thereof being at a higher level than the inlet 9, for example, will tend to open the valve 29, and, consequently, the spring 30 must be loaded sufficiently to overcome this tendency. When the device is properly adjusted only operating pressures will open the inlet valve.

The cleaner also comprises another non-return valve which consists of a hollow cylindrical member 33 slidably arranged in a passage 34 formed in the head cover co-axially with the bore 13 of the hollow tubular member 12. The top end of the passage 34 is closed by a screw plug 35. The bottom end of the non-return valve member 33 is tapered and is resiliently pressed into contact with a valve seat 36 formed at the junction of the transverse outlet passage 10 and the top of the bore of the tubular member by a coil spring 37 arranged in the valve and acting between the plug 35 and the inside of the tapered end of the valve.

Any back pressure in the system, due, for example, to parts thereof being at a higher level than the outlet 8, tends to hold the outlet valve closed, and, therefore, this valve need only be spring-loaded sufficiently to overcome its own friction and to maintain it closed except when the desired operating pressure is present in the system in which the cleaner is placed. When the oil cleaner is dismantled for any reason, such as the replacement of the filter element 17, the valves 29 and 33 prevent any oil in the head from spilling out and creating an undesirable mess. Also, these valves make it unnecessary to disconnect the conduits leading to the inlet and from the outlet of the cleaner. When the parts are reassembled it is difficult to prevent the entrapment of air in the container and in the passages 15 and 10. The means for relieving this entrapped air is described in the following paragraph.

The cleaner also comprises two air-vent valves 38 and 39, one of which (38) is arranged to vent the inlet passage 15 and the other (39) the outlet passage 10. The valves consist of screwed members formed at their outer ends with heads for the reception of a spanner, the other ends of the members being shaped respectively to form tapered valves 38A and 39A. The two valves are screwed into tapped holes which are formed in the top of the head cover and communicate respectively with the inlet and outlet passages 15 and 10 in the head cover through narrow ports 38B and 39B. Outlet passages 38C and 39C are also provided communicating with the atmosphere. The tapered ends of the valves are normally screwed down upon the valve seats formed at the top ends of the ports and they are only slackened back away from their seats

4

when it is desired to vent air from the said passages. Locking devices 40 and 41 are provided for preventing the air-vent valves working themselves open and for preventing them being opened inadvertently.

In operation, the oil flows into the container through the inlet 9, through the annular space 16 around the said tubular member 12 past the inlet non-return valve 29 and into the annular space between the filter element 17 and the wall of the container. Thereafter, the oil makes its way through the walls of the filter element into the interior of the latter, whence it flows to the outlet 8 through the passage 13 in the tubular member 12 and through the outlet passage 10.

The gland ring 23 is not, for the purpose of preventing oil leakage, clamped tightly between adjacent parts of the container and head. On the contrary, circumferential stop means are provided for preventing the container being screwed sufficiently tightly into the head to bring about such clamping action. Referring to Figs. 1 to 3 and 5, these means comprise a stop in the form of a small curved plate 48 which is fixed by rivets or screws in an annular groove 100 formed in the head part 2 at the inner end of the screw thread 4 and is arranged to contact the end 48a of the external thread 3 on the container 1. Thus, when the container and head have been screwed together to the predetermined extent, the end 48a of the thread 3 abuts against the plate 48, and further relative turning movement between the head and container is prevented. When this takes place, the head and container are so positioned that a locking device mounted in the head can engage the thread 3 at the inner end of the container.

The locking device comprises a pin 49 sliding at its lower end in a hole 50 in the part 2, and at its upper end in a hole 50a, in the head cover 7. A recess 3A is formed partly in the thread 3 of the container and partly in the inner surface of the part 2 of the head. The lower tip of the pin 49 in locking position rests in the recess 3A, engaging both the thread 3 of the container and the part 2 of the head and thereby locking the container and head against relative rotation. This pin is formed with a shoulder 51 at about its mid-length, the upper end of the said shoulder sliding in a hole of enlarged diameter 50b and in this enlarged hole is mounted a spring 53 which presses downwardly on the shoulder and urges the pin 49 into its lowest position where it engages in the recess 3A as aforesaid. The lower end of the shoulder is knurled to form a finger grip.

The upper end of the pin is fitted with a small cross pin 54, which can slide in the slot 55.

To unlock the container from the head the pin 49 is first raised by finger and thumb grip on the knurled part of the shoulder, until the lower end is out of engagement with the thread 3 and the cross pin is clear of the slot 55. The pin 49 is then rotated say through 90° and is thereby held in its raised and disengaged position by the cross pin 54 which cannot now enter the slot 55.

To relock the container and head, the pin 49 is rotated backwards until the cross pin 54 falls again into the slot 55. The spring 53 then once more presses it downwardly into engagement with the square thread 3.

A hole 56 is also provided through the shoulder through which a locking wire can be threaded to prevent unauthorized use.

When the container 1 is screwed home into the head 2, the inner and outer faces of the gland ring 23 are only slightly compressed. Consequently, oil under pressure makes its way between the lips of the gland ring and forces them outwardly. One of the lips is pressed against the end of the container and the other against the said shoulder 28 in the head, thus forming an effective oil-seal. Radial holes 52 are formed in the flange of the gland retainer to facilitate the entry of oil and thus ensure this result.

It is preferred to provide means for retaining the bottom pressure plate 18 within the container when the filter or cleaner is being dismantled. Such means may consist of two pairs of plungers 42 and 43, each pair being accommodated in a bore 44 and 45 formed in the pressure plate. Coil springs 46 and 47 are arranged between the two plungers of the respective pair of plungers and they act to press the outer ends of the plungers resiliently into contact with the wall of the container 1.

It will be understood that the seating with which the inlet non-return valve 29 forms sealing contact need not necessarily be arranged on the aforesaid neck 14. The valve seating could, for example, be provided on a part of the top of the head surrounding the tubular member 12.

The invention is not limited to a gland ring of channel section or to the use of a plurality of lips. The desired seal could be obtained by using the free flexible edge of a ring of resilient jointing material attached to either of the separable members and so positioned on either member that the flexible edge is favourably presented to the corresponding sealing surface on the complementary member.

A modification of this kind is shown in Fig. 4, in which it will be seen that the gland retainer 25 is formed with a neck 60 terminated by a flange 61. The gland ring 62, of synthetic rubber or like flexible material is formed with a downwardly depending tapered lip 63. The body part 64 of the gland ring is held between the flange 61 and the shoulder 26 in the head. The flexible sealing edge 65 of the gland ring bears upon the tapered or chamfered top edge 66 of the container and is forced into sealing contact therewith.

Throughout this specification and in the claims reference is made to an oil cleaner and to oil as the fluid or liquid being cleaned. This language is not intended to be limitative of the use to which the cleaner of this invention may be put; and while it is admirably suited for cleaning oil, any liquid or fluid may be cleaned or filtered therein. Also, the term "cleaner" might readily be replaced throughout by the word "filter" without changing the spirit or scope or intended use of the invention.

I claim:

1. A high pressure oil cleaner, comprising a tubular container, a head having an inlet passage and an outlet passage, a filter element enclosed in said container and positioned between said inlet and outlet passages, said head being detachably mounted upon the open end of said container by a detachable connection formed by an internal screw thread which is formed in a skirt part of said head and is adapted to cooperate with a screw thread formed on the outside of said container adjacent to the open end thereof, a gland ring for preventing leakage of oil from the interior to the exterior of the cleaner along the over-lapping parts of said container and said head, means retaining said gland ring in the in-

terior of the cleaner in an annular space between said container and said head, said gland ring being so shaped in cross section and so mounted in said annular space that the pressure of the oil being circulated through the cleaner forces the gland ring into sealing contact with said container and said head so as to form an effective oil seal between them, and circumferential stop means comprising a stop member positioned in said head near the inner end of the thread in said head and arranged to contact the inner end of the thread on said container when said container and said head have been screwed together to a predetermined extent to prevent clamping said gland ring between said container and said head.

2. The combination set forth in claim 1, wherein said gland ring consists of a flexible annular member having a generally channel shaped section, said gland ring being mounted in said annular space with its lips directed towards the center of the cleaner.

3. The combination set forth in class 1, wherein said gland ring consists of a flexible annular member having a generally channel shaped section, said gland ring being mounted in said annular space with its lips directed toward the center of the cleaner, and said retaining means consists of an annular retainer having its outer edge adapted to engage in the channel shaped section of said gland ring and being secured to said head.

4. The combination set forth in claim 1, wherein said gland ring consists of a flexible annular member having a generally channel shaped section, said gland ring being mounted in said annular space with its lips directed toward the center of the cleaner, and said retaining means consists of an annular retainer having its outer edge adapted to engage in the channel shaped section of said gland ring and being secured to said head, and a plurality of radial passageways formed in said annular retainer to pass the oil from said container to the interior of said channel shaped gland ring so as to insure an effective seal between said container and said head.

5. The combination set forth in claim 1, wherein said head comprises an outer part formed with a tubular portion projecting into said container, and an inner part surrounding the tubular portion and securing the outer part to said container, said outer part having said outlet passage formed partially in said tubular portion and connected to an outlet, and said inlet passage surrounding said tubular portion.

6. The combination set forth in claim 1, wherein said head comprises an outer part formed with a tubular portion projecting into said container and a depending skirt portion, an inner part surrounding said skirt portion and securing the outer part to said container, and means for resiliently mounting said filter element in said container comprising a top pressure plate arranged on said tubular portion, a bottom clamping plate, and spring means arranged between said clamping plate and the inner side of the bottom of said container.

7. The combination set forth in claim 1, wherein said gland ring is secured to said head and has a flexible lip in said annular space between said head and said container, the flexible sealing edge of said lip being forced by the pressure of the circulated oil into sealing contact with the wall of said space so as to form

7

an effective seal between said head and said container.

8. The combination set forth in claim 1, wherein said gland ring has a body part clamped between said retaining means and a shoulder on said head, and also has an integral lip which is tapered to provide a flexible sealing edge adapted to cooperate with the adjacent end of said container.

9. The combination set forth in claim 1, wherein said thread on the container has a recess therein at the inner end of the container, and including a locking device slidably mounted in said head and adapted to engage in said recess when said stop member is in contact with the end of the thread on said container.

10. An oil cleaner of the class described comprising a container, a head, an outlet passage in said head, an outlet in said head in communication with said outlet passage, a tubular portion projecting inwardly from said head and communicating with said outlet passage, an inlet passage formed in said head around said tubular portion, an inlet in said head communicating with said inlet passage, a tubular filter element enclosed in said container and surrounding the inner end of said tubular portion and connected in a fluid tight relationship with said tubular portion, said filter element being positioned between said inlet and outlet passages, a spring-urged inlet valve in said inlet passage for preventing the oil being spilled from said head through said passage when the cleaner is dismantled and reassembled and when the pressure in the circulating system in which the cleaner is placed does not exceed a predetermined value which is less than the operating pressure of the circulating system, said pressure being obtained when the circulating system is not operating, and a spring-urged outlet valve in said outlet passage for preventing the oil being spilled from said head through said outlet passage when the cleaner is dismantled and reassembled.

8

11. The combination set forth in claim 10, wherein said outlet valve is slidably mounted in said outlet passage coaxially with said tubular portion, a valve seat formed at the junction of said tubular portion and said outlet passage, spring means urging said valve toward closed position, said inlet valve is of ring shape and slidably mounted on said tubular portion, a valve seat formed on a shoulder portion within said head, and spring means urging said inlet valve toward closed position.

12. The combination set forth in claim 10, including means for venting air from said inlet and said outlet passages which is entrapped when the cleaner is dismantled and reassembled.

13. The combination set forth in claim 10, including means for venting air from said inlet and said outlet passages which is entrapped when the cleaner is dismantled and reassembled, said means comprising an air-vent valve in said head communicating with said inlet passage and a second air-vent valve in said head communicating with said outlet passage.

25 CAMILLE CLARE SPRANKLING LE CLAIR.

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