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FILTER

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Fig. 1.

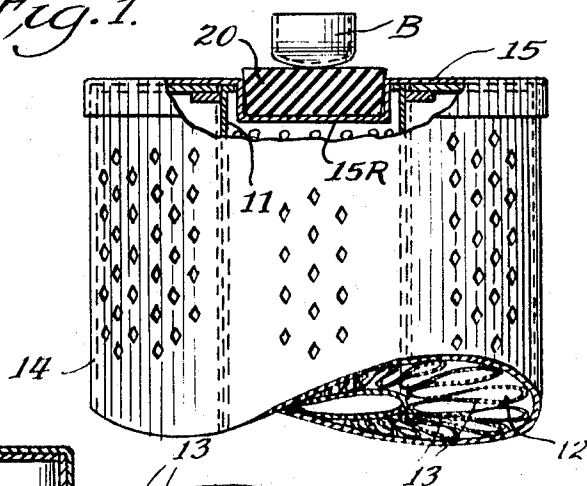


Fig. 2.

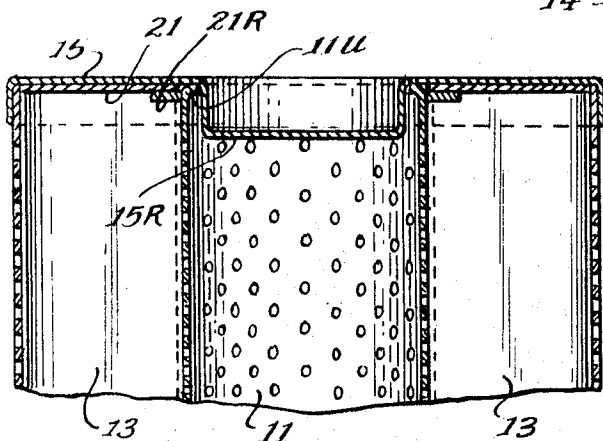
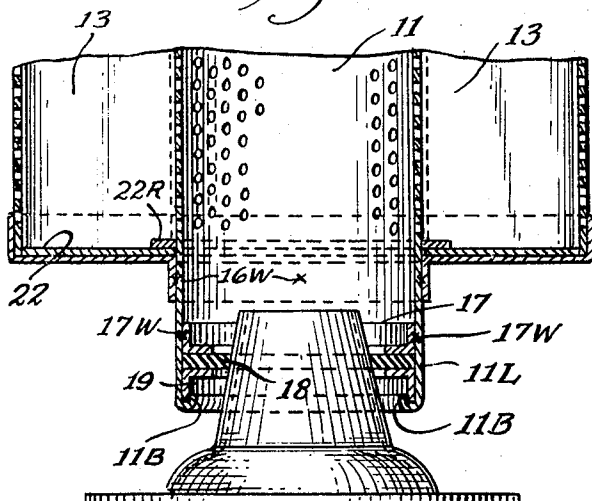
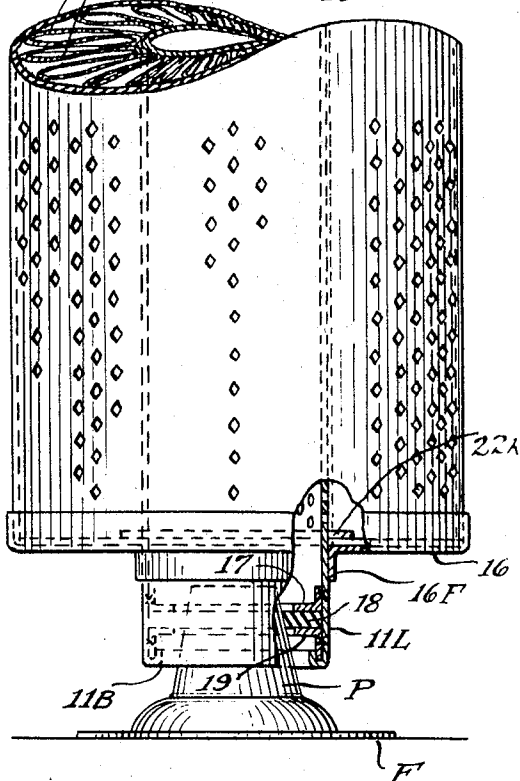


Fig. 3.



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1

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FILTER

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U.S. Cl. 210—351

5 Claims

ABSTRACT OF THE DISCLOSURE

A mechanically clamped filter mounting arrangement is disclosed for a locomotive lubrication system wherein a renewable filter is held down between a floor stub and a top pressure applying element, the filter being of a type having a perforate central core surrounded by an annular array of pleats that are sealed by top and bottom end caps. The top end cap receives the pressure element and abuts the core to load the core in compression, the core having an integral lower end projecting through the bottom end cap to seat upon the stub. This arrangement relieves the end caps of warping and prevents end leakage.

This application is a continuation of applicant's copending application Ser. No. 481,266 filed Aug. 20, 1965, and now abandoned.

This invention relates to filters, and, more particularly, to filters of the pleated paper type.

An important application for pleated paper filters exists in the high pressure lubrication system of railway diesel locomotives. Locomotive lubrication filter applications encounter extreme operating conditions including high system pressures and flows and startup surges. There is a mechanical requirement in such applications for a firm anchorage of the filter unit to prevent dislodgement of the unit in the presence of the system pressures and startup surges and it has been the practice to employ a hold down arrangement imposing high force loading to hold the filter unit against the floor of the mounting tank.

These pleated paper filters conventionally include a perforate core, a pleated paper element surrounding the core in an annular array and top and bottom end caps sealingly engaged to the ends of the core and pleats. In the prior art pleated paper filters, the hold down force is transmitted primarily through the pleats from the top to the bottom of the filter in a fashion which tends to produce warpage of the top end cap leading to impairment of the bond between the top end cap and the pleat ends. This bond is depended upon for insuring against end leakage of contaminated oil, a serious problem.

The present invention provides a filter of the pleated paper type wherein the hold down force can be transmitted directly through the core and not through the pleats. Accordingly, a filter construction is provided herein employing a throughcore having its upper end seated firmly against the top end cap and having its lower end extending through the bottom end cap and projecting externally thereof to directly engage the floor of the filter mounting tank. Thus, the exposed lower end of the core is fitted with a seal ring retained therein by a pair of insert rings, all secured by rolling in the lower end edge of the core.

This throughcore principle lends itself to a disposable cartridge type of filter construction. While pleated paper filters are substantially longer lived than the cotton waste filters, frequent replacement is still a maintenance problem. In the past, the entire pleated paper filter has been replaced and, where the core and end caps are of metal, disposal is a problem.

In the filter structure disclosed herein, it is feasible to employ a construction wherein the throughcore and end

2

caps are used over and over and only the pleated filter element and its outer cover wrap, which are handled as a cartridge, are replaced. This cartridge is entirely of combustible material and this facilitates disposal.

The cartridge construction utilizes closure rings sealed to the ends of the pleats and having interference fit with the core.

Other features and advantages of the invention will be apparent from the following description and claims, and are illustrated in the accompanying drawings which show an illustrative embodiment of the present invention.

In the accompanying drawings forming a part of the specification, and in which like numerals are employed to designate like parts throughout the same,

FIG. 1 is a side elevational view of a filter embodiment constructed in accordance with this invention, the filter being shown installed, with portions of the filter being broken out and shown in section to facilitate disclosure;

FIG. 2 is an enlarged transverse section through the top end of the filter; and

FIG. 3 is a corresponding enlarged transverse section through the bottom of the filter.

Referring now to the drawings, the invention as disclosed herein is illustrated in connection with pleated paper filters intended particularly for use in the engine lubrication systems of diesel locomotives. These filters are normally mounted in groups within the lubricant tank of a diesel locomotive. A portion of the floor of the lubricant tank is designated at F and includes a tubular open-ended plug P serving as a bottom mounting spud and constituting an outlet port for filtered oil after passage through the filter.

A typical filter construction is shown herein for purposes of illustrative disclosure as including a perforated cylindrical tube 11 serving as a core and an elongated permeable filter section 12 disposed in an annular array closely encircling the core and characterized by a series of circumferentially distributed pleats 13 that extend the full length of the core. The filter section is preferably of the type disclosed in copending application Ser. No. 448,427 filed Apr. 15, 1965, now U.S. Pat. No. 3,397,793, but the invention is applicable to other pleated filters known to those skilled in this art. An outer cover wrap 14 is shown closely encircling the pleated filter element and may also extend the full length to seat in upper and lower end caps 15 and 16, respectively. Each of the end caps spans the full diameter of the filter and each is arranged to seat against the corresponding ends of the filter element.

The throughcore 11 has its upper end butted flush against the main wall of the top end cap 15 and has its lower end extending through an external stub flange 16F on the bottom end cap 16. The lower end of the core projects beyond the bottom end cap to encircle the upstanding mounting spud P located on the tank floor F. The lower end 11L of the core is fitted with an inner retainer ring 17 of right angle section and welded in place as indicated at 17W, a loose rubber gasket ring 18 and an outer retainer ring 19 of right angle section. The outer ring 19 is inserted loose within the core end to be held in tight pinching engagement against the gasket ring by the rolled in bottom edge 11B of the core.

A snub-nosed hold down bracket B is shown in FIG. 1 applying hold down force to the top of the filter for forcibly seating the lower end of the core 11L and the gasket ring 18 against the floor mounted spud P. With the present construction, this hold down force is transmitted directly by the throughcore 11 and the filter element and end caps are relieved of any associated stresses and strains, such as might lead to buckling, rupture or impairment of adhesive bonds where these are employed. For purposes of disclosure, the hold down force is shown

3

being transmitted through a cushion 20 nested in a recessed center 15R provided in the top end cap 15. Such a top end cap arrangement has been found to be subject to warpage where the hold down force is passed through the pleats themselves. However, the throughcore structure of the present disclosure causes the hold down forces to be passed through the core and directly into the floor to avoid this warpage problem.

While the throughcore principle is applicable generally to pleated paper filter elements for the reasons already mentioned, it is disclosed herein in a particular filter embodiment utilizing a core and end cap construction that may be used over and over by replacement of a disposable cartridge which consists of the filter element 12 and outer cover wrap 14. In this particular embodiment, the ends of the pleated filter element 12 are sealed by closure rings 21 and 22 of paperboard, cardboard or other suitable material. These closure rings may be chosen of an elastomer material capable of presenting a resilient sealing contact with the core when disposed in an interference fit relation therewith or if of paperboard or cardboard may be equipped with an inner peripheral gasket ring 21R and 22R, each dimensioned to provide an interference fit to complete a seal at each end of the filter element. The expression interference fit used herein in its conventional sense in accordance with the usual dictionary definition that an interference fit involves contact so close as to produce deformation and stress. Thus, the replaceable cartridge consists of the pleated paper filter element 12, the outer cover wrap 14 and the end closure rings 21 and 22 and the entire cartridge may be selected of materials suitable for disposal by burning. Where scrap disposal of the cartridge elements is not a problem, the cover wrap 14 and the closure rings 21 and 22 may be of metal.

The reusable parts of the filter include the throughcore 11, the top end cap 15 and the bottom end cap 16. The bottom end cap 16 is permanently fixed to the lower end 11L of the core by spot welding as indicated at 16W, while the top end cap is merely removable.

In the normal use of pleated paper filter elements, periodic replacement is necessary and there is advantage in utilizing principal structural parts of permanent character. For this purpose, the throughcore is here constructed of 28 gauge tin plate steel giving it substantial strength and columnar stability and enabling it readily to transmit the hold down forces without distortion.

When a new cartridge is to be installed, the lower end of the cartridge is fed over the upper end of the core 11. A free sliding fit between these parts is preferably provided and the resultant close clearances present a problem in that the delicate pleated paper element may snag and rip as it is fed onto the upper end of the core. Accordingly, a rolled in upper edge 11U is provided on the core to present a gently tapering smoothly curved annular contact edge for snag free engagement with the filter paper. This end edge is slightly smaller in diameter than the core to also perform a guiding function on initial entry of the pleats over the core.

Thus, while preferred constructional features of the invention are embodied in the structure illustrated herein, it is to be understood that changes and variations may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a mechanically held down filter mounting combination that includes a renewable filter disposed between a bottom stub and a top pressure applying element vertically aligned therewith, said filter comprising a central perforated vertical tubular core of reusable material hav-

4

ing an externally projecting integrally depending lower end equipped with a gasket ring seating in force transmitting sealing relation upon said stub, a filter medium comprising a vertically elongated annular array of radiating pleats of disposable material loosely encircling and mechanically free of the length of the core above said externally projecting lower end, a top end cap of reusable material spanning the top ends of said pleats in loose closure relation thereto and loosely abutting the top end of said core to be contacted centrally by said pressure applying element and transmit compression load forces through said core to said stub, and a bottom end cap of reusable material encircling the lower end of said core and spanning the bottom ends of said pleats in loose closure relation.

2. In a filter mounting combination in accordance with claim 1 and wherein said core is metallic and said lower end has a fixed retainer ring and a loose retainer ring disposed in recessed relation therein, said lower end having a rolled edge engaging said loose ring to grip the gasket ring against the fixed ring.

3. In a mechanically held down filter mounting combination that includes a renewable filter disposed between a bottom stub and a top pressure applying element vertically aligned therewith, said filter comprising a central perforated vertical tubular core of high strength reusable material, a bottom end cap encircling and fixed on said core in offset relation from the lower end of the core to leave said lower end exposed, said lower end having means mounting a gasket ring in force transmitting seating relation upon said stub, a top end cap having a main wall in loose endwise abutment against the upper end of the core to transmit compression load forces through said core to said stub, and a replaceable cartridge comprising a paper filter medium having a vertically elongated annular array of radiating pleats endwise enterable over the upper end of the core to a position loosely abutting both the top end cap and the bottom end cap and bodily axially shiftably encircling the length of the core thereabove, a top closure ring sealingly spanning the top ends of the pleats to prevent end leakage thereat and a bottom closure ring sealingly spanning the bottom ends of the pleats to prevent end leakage thereat, said closure rings having inner peripheries in sealing relation with the core.

4. In a filter mounting combination in accordance with claim 3 and wherein said core has an upper end provided with a rolled in end edge presenting a smoothly contoured annular guide surface for reception of said cartridge.

5. In a filter mounting combination in accordance with claim 3 and wherein said core is metallic and said lower end has a fixed retainer ring and a loose retainer ring disposed in recessed relation therein, said lower end having a rolled edge engaging said loose ring to grip the gasket ring against the fixed ring.

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