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(54) A FILTER ELEMENT

(71) We, AB LECTROSTATIC, a Swedish Company of Kampagatan 5, S-532 00 Skara, Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a filter element and in particular to a filter element suitable for use at high, pulsating pressures of the kind comprising a bag or hose-like filter made of a fibrous material, to the interior of which in use, contaminated air is passed via an inlet and through the wall of which purified air departs.

Such filter elements, which are used in industrial vacuum cleaners and in hose filters, are subjected to very high strain owing to the differences in pressure which occur between the inner wall of the filter element and the outer wall thereof and due to the pulsations caused by these pressure differentials.

In the case of vacuum cleaners, an attempt has been made to solve this problem by bringing the bag-like filter element, which is normally made of paper, into contact with a surrounding wall made of perforated sheet metal or the like.

Even though a certain improvement has been obtained, insomuch as bursting of the bag can be prevented, there occurs a great deal of wear between the wall and the filter element, which results in small holes and cracks, the presence of such small holes and cracks greatly reducing the cleaning efficiency of the apparatus. Since the pressure differentials normally increase with increasing quantities of dust and other impurities taken up by the filter means, it is necessary to change the filter means relatively often in order to avoid interruptions.

In the case of co-called hose filters, in which the filter means comprises a hose-like bag open at both ends, which bag normally comprises a textile material, the pulsating load to which the filter is subjected causes still greater wear.

According to this invention, we propose a filter element including a bag or hose-like filter made of fibrous-material, to the interior of which, in use, is supplied, contaminated air via an inlet and through the wall of which purified air departs, wherein the filter is surrounded by resilient means comprising a net-like elastic bag or hose-like member and the length and the circumference of the filter in the expanded state respectively exceed the length and circumference of the resilient means whereby the filter is arranged in folds within the resilient means and is held compressed thereby. The filter element according to the present invention can be used at high pulsating pressure with substantially no risk of bursting or wear such as attends the convential filter elements referred to above. Also, the filter element according to this invention can be loaded with impurities to a much greater extent than was previously possible with known filter elements.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings of which:

Figure 1 is a simplified vertical cross-sectional view through an industrial vacuum cleaner having a filter element according to the invention,

Figure 2 is a sectional view taken along the line II—II in Figure 1,

Figure 3 is an enlarged view of the area III shown in Figure 2,

Figure 4 illustrates a detail of pressure-absorbing means, and

Figure 5 is a sectional view similar to that of Figure 3 but relating to a modified arrangement.

In the drawing there is shown a closed container or housing 1 containing a filter 2 manufactured from a fibrous, air-permeable material, such as paper or textile material. The container 1 has a circular cross-sectional area, although it will be understood that said container may have any suitable cross-sectional shape. This filter comprises a closed container having a bottom 3 which abuts a perforated bottom 4 of the hous-

ing 1. The closed container is placed in a net like bag 5 the upper edge of which, similar to the upper edge of the filter means 2, is securely and sealingly connected to plate 6 having an inlet opening 7 for contaminated air. As indicated by arrows, the contaminated air is sucked into the filter 2 and, subsequent to being freed from dust and other particles, departs through one or more outlets, for example the outlet 8. The suction fan, not shown, can be connected to the outlet 8 or may be located in a space 9 in the housing 1 beneath the plate 4.

Between the housing 1 and the described filter element there is a wall 10 which permits purified air to flow out through the filter and out of the outlet 8. This wall comprises a corrugated cylinder made, for example, of metal or a rigid plastic material, the corrugations of the cylinder extending from the inlet end of the filter down to the plate 4. The cross-sectional area of the filter in each plane parallel to the bottom 4 is greater than the corresponding area of the bag 5, and consequently the wall of the filter will be urged towards the wall of the bag 5 when a higher pressure prevails in the interior of the filter means than on the outside thereof.

The bag 5, which preferably comprises a network of a somewhat elastic material has in turn a larger cross-sectional area than the area defined by a circle through the crests of the corrugations, for example the crests 11 and 12, and will therefore, flex inwardly somewhat, as shown in Figure 3, between two mutually adjacent crests when the filter means is loaded. High frequency pressure pulsations occuring in the interior of the filter caused by the fan impellor, or low frequency pulsation caused by movement of a suction nozzle over a surface to be cleaned, will therefore only cause slight force variations in the area of the filter 2 lying above a valley 13 in the corrugated wall, these variations in pressure being taken up by the threads 14 of the bag 5, as shown in Figure 4. The elastic threads 14 of the network, delimit small areas, for example the area 15 shown in hatched lines, and corresponding areas of the filter will be subjected to only insignificant loads, which avoids the risk of bursting. Each mesh 15 of the net preferably has a largest dimension which is smaller than the perpendicular distance between two mutually adjacent crests 11, 12. Since the periphery of the bag 5 is smaller than the periphery of the filter and is at least sufficiently elastic to permit it to flex inwardly, when loaded, into the valleys or grooves 13 when the filter means is subjected to a rapid increase in pressure a resilient force will act against the wall of the filter, thereby eliminating the risk of wear. The amount of wear will be minimal since the wall of the filter medium and the wall of the bag 5 execute practically the same expansion and contraction movements.

The filter means 2 has a length which is much greater than the length of the elastic net-like bag 5, whereby the filter will form a large number of folds 16 (Figure 1), so presenting an increased through-flow area and therewith a smaller load of dust etc. per unit of surface area at a given size for the bag 5.

The net-like bag 5 may be made from a flexible, and optionally an elastic plastics material or optionally from metal wire.

Figure 5 is a sectional view similar to that of Figure 3 but of a modified filter element, particularly intended for filter bags of relatively small volume, for example 20 to 50 litres. In this embodiment, the bag 5 lies directly against the wall of the housing 1^1 and encloses a corrugated cylinder 10^1 made of corrugated cardboard or a slightly resilient plastics material. Arranged in the interior space of the cylinder as a bag 2^1 or the like made of a fibrous, air-permeable material, for example paper or a textile material. The length of the bag 2^1 exceeds the length of the net-like bag 5^1 and has a circumference which is larger than the circumference of the bag 5^1. The function of this filter element is the same as that of the filter element described with reference to Figures 1 to 4.

Even though the invention has been described with reference to a filter element of the closed-bag type it can also be applied to so-called hose filters. The air-conducting wall 10, 10^1 may comprise a perforated cylinder of metal or plastics material or some other suitable material, although the described corrugated wall is to be preferred and can have the form of a lose insert of metal, plastics or optionally fibrous material. The wall 10, 10^1 can be omitted, since the filter bag or filter hose 2 2^1 forms a large number of folds on the outer surface thereof, these folds permitted purified air to pass out through the wall of the filter, although the provision of flow passages by means of the wall 10, 10^1 is to be preferred if the highest posible efficiency is to be obtained.

WHAT WE CLAIM IS:—

1. A filter element including a bag or hose-like filter made of fibrous-material, to the interior of which, in use, is supplied, contaminated air via an inlet and through the wall of which purified air departs, wherein the filter is surrounded by resilient means comprising a net-like elastic bag or hose-like member and the length and the circumference of the filter in the expanded state respectively exceed the length and circumference of the resilient means where-

by the filter is arranged in folds within the resilient means and is held compressed thereby.

2. A filter element according to claim 1, wherein the filter has a bottom remote from the inlet; and the elastic bag or hose-like member has a bottom abutting the bottom of the filter.

3. A filter element according to claim 1 or claim 2 wherein the filter is disposed within the net-like elastic bag or hose-like member the exterior of which abuts a corrugated wall, the corrugations of which wall extend in the longitudinal direction of the filter.

4. A filter element according to claim 1 or claim 2 wherein the outer surface of the filter abuts a resilient corrugated wall which is contained within the elastic net-like bag or hose-like member whereby the filter is held compressed, the corrugations of which wall extend in the longitudinal direction of the filter.

5. A filter element according to any one of claims 1 to 4 wherein the filter comprises paper.

6. A filter element according to any one of claims 1 to 4 wherein the filter comprises a textile material.

7. A filter element constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

Fig. 1

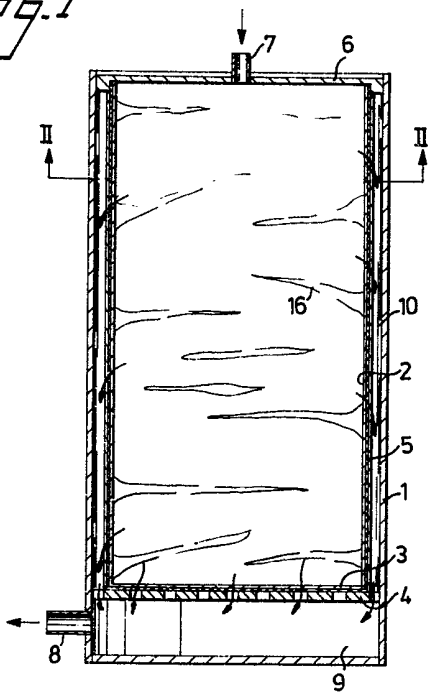

Fig. 2

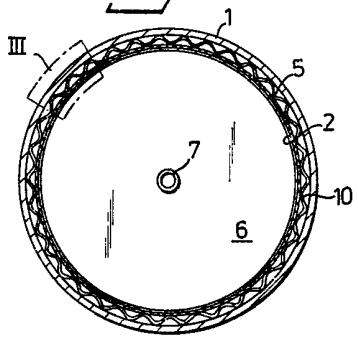

Fig. 3

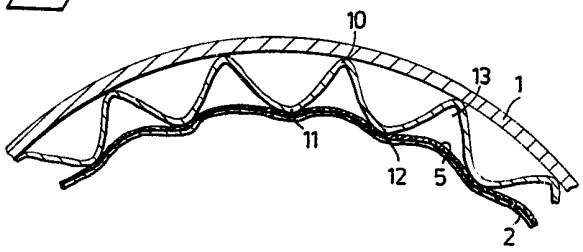

Fig. 4

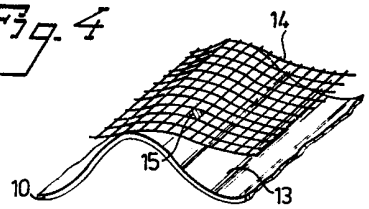

Fig. 5