Sept. 21, 1971 D. A. PETERSON 3,606,739

AIR FILTER

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FIG. 1.

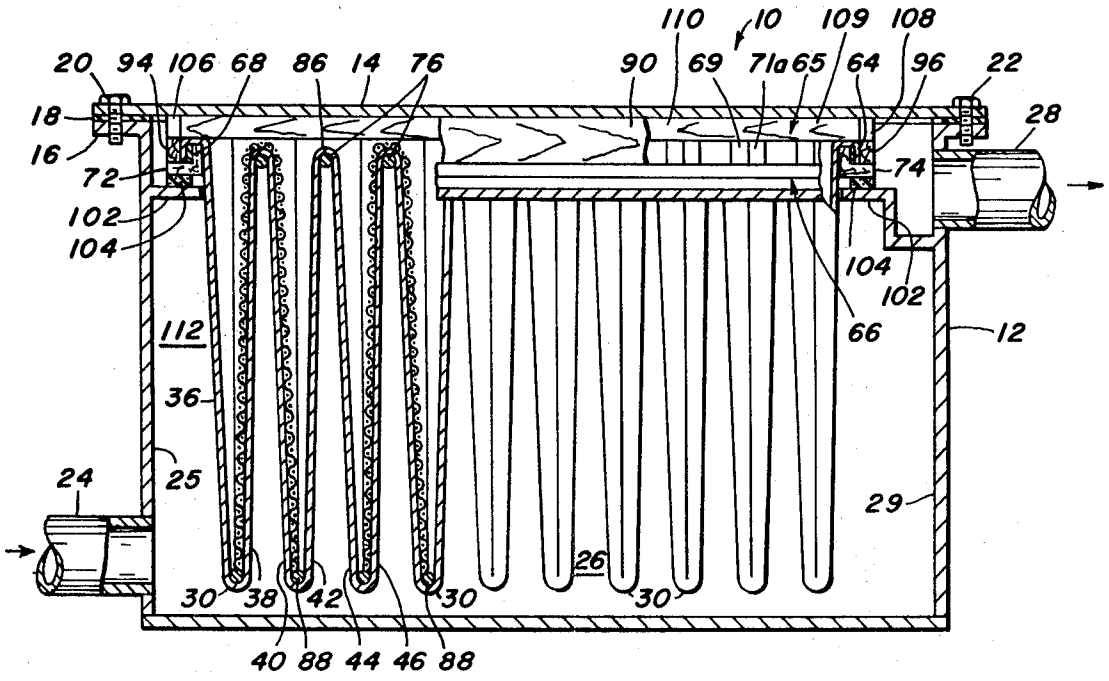


FIG. 3.

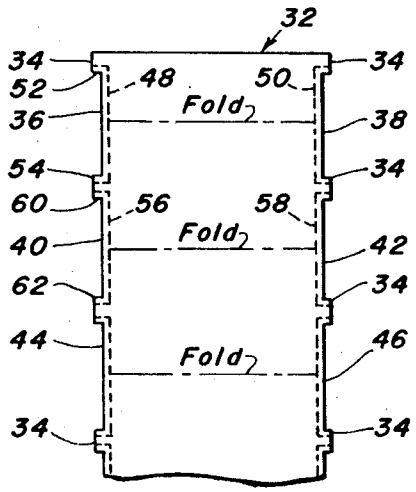
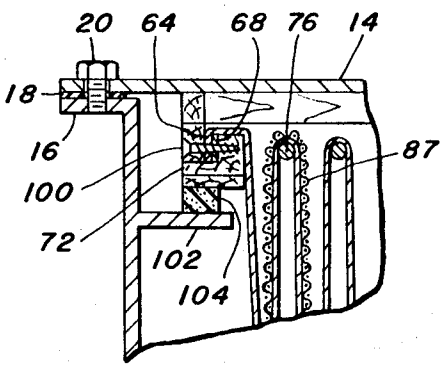


FIG. 4.



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FIG. 2.

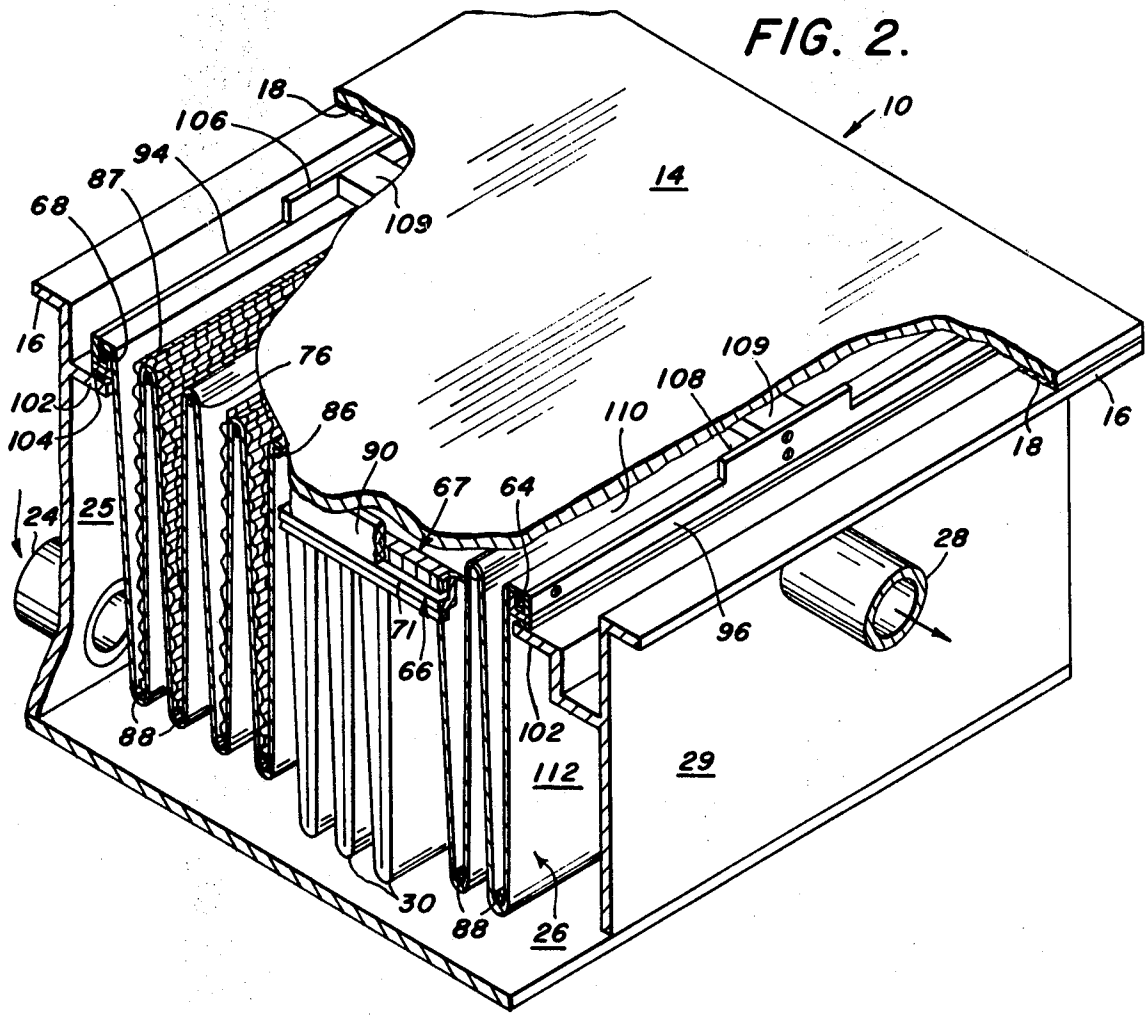
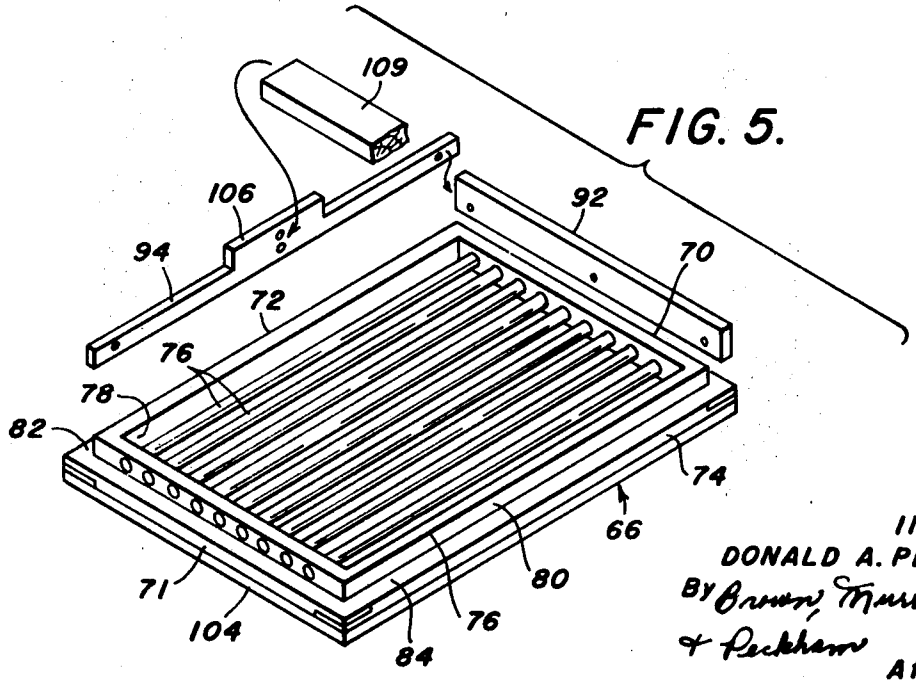


FIG. 5.



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AIR FILTER

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U.S. Cl. 55—484 8 Claims

ABSTRACT OF THE DISCLOSURE

An air filter comprising a housing having a removable lid and an inlet opening and an outlet opening. A unitary filtering medium comprising a single length of material formed into a plurality of individual bags is supported within the housing of the filter between the inlet opening and the outlet opening. The unitary filtering medium is secured to and supported by an integral frame member which is, in turn, supported by portions of the housing and maintained in position within the housing by the cooperative arrangement of the lid of the housing and members disposed between the lid and peripheral portions of the frame member.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention relates to filters and more particularly to an air filter wherein a particle laden air stream is drawn into the filter through an inlet opening and is caused to pass through a filtering medium which traps the particles while letting the air stream pass therethrough for discharge through an outlet opening to the surrounding atmosphere.

(2) Description of the prior art

In the past, the filters with which the present invention relates have been constructed of a housing having an inlet opening and an outlet opening. A filtering medium consisting of a plurality of discrete individual bags were placed between the inlet opening and outlet opening with the surfaces of each bag providing filtering areas. Each discrete bag comprised a strip of material of flannel, for example, folded upon itself with its edges joined together to form a bag having an open top and closed bottom. A rigid steel band encircling the bag at the top portion thereof was provided and a portion of the top of the bag was folded over to form a cuff which was secured to the rigid steel band. A section of mesh screen was placed within the bag for stiffening it, and a weight was provided in the bag to maintain the bag in a substantially vertical position within the housing of the filter.

In order to support these discrete bags within the housing, a flange or ledge was provided within the housing between the inlet and outlet openings. The discrete bags were placed within the housing with the rigid steel bands at the tops of the bags resting on the ledge. No problem was encountered in placing the initial bags on the ledge, however, as the last of these bags was to be placed on the ledge, great difficulty arose due to the rigidity of the steel band.

As is evident to those skilled in the art, in order to provide an efficient filtering medium between the inlet opening and outlet opening, the discrete bags must be in contact with one another at their top portions, and the portions of the bags adjacent the housing must be in contact therewith. Otherwise, the particle laden air stream will pass between adjacent bags and between the housing and bags in an unfiltered state, thereby defeating the purpose of the filter. Accordingly, to prevent air leakage and because the filtering medium consists of a plurality of discrete bags which are maintained in contact with each other at their top portions solely by the walls of the housing, the last few bags must be stuffed into the housing. The rigid steel band at the tops of the bags renders this stuffing burdensome and time consuming. This problem of stuffing the last of the bags into the housing occurs in the filter's initial construction and subsequently upon the replacement of the filtering medium of the filter.

SUMMARY OF THE INVENTION

Briefly, the present invention is directed to a filter comprising a housing having a removable lid and an inlet opening and an outlet opening. A filtering medium comprising a single length of material formed into a plurality of individual bags is provided within the housing. A cuff portion which encircles the single length of material is provided for securing it to an integral frame. A support means is associated with the housing which is adapted to be engaged by the frame member for supporting the single length of material between the inlet opening and outlet opening. Finally, means are provided which are cooperatively arranged in surrounding relation to the cuff portion and disposed between the undersurface of the lid of the housing and peripheral portions of the frame member for maintaining the frame member in position between the inlet and outlet openings and in engagement with the support means.

The present invention, therefore, provides a single length of material formed into a plurality of individual bags which present a number of filtering surfaces to the air to be filtered and which are secured to an integral frame. The integral frame supports the filtering medium within the housing and permits the unitary filtering medium to be easily inserted into the filter's housing, thereby eliminating the need of stuffing the individual bags into the housing of the filter.

Accordingly, a primary object of the present invention is to provide a filter having a unitary filtering medium consisting of a plurality of individual bags linked together which obviates the need for stuffing the individual bags within the housing of the filter.

Another object of the invention is to provide a filter including a unitary filtering medium which may be easily removed and replaced, thereby facilitating the changing of the filtering medium of the filter.

Still another object of the invention is to provide means cooperatively arranged between the lid of the housing and peripheral portions of the integral frame member for maintaining the frame member, and thus the unitary filtering medium, in position within the housing.

These and other objects of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevation of the filter of the present invention, with some of the parts being broken away;

FIG. 2 is a partial perspective view of the filter of the present invention with one of the sides thereof removed and parts broken away to further illustrate the interior of the filter;

FIG. 3 is a plan view of a portion of the strip of material from which the unitary filtering medium of the present invention is fashioned;

FIG. 4 is a fragmentary view in section showing details

of the unitary filtering medium of the present invention as secured to the frame member; and

FIG. 5 is a perspective view of the frame member of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and particularly to FIG. 1, a filter is shown generally at **10**. The filter **10** comprises a rectangular box or housing **12** having a removable top or lid **14** which is received by a flange or seat portion **16** which extends laterally outwardly adjacent the top edges of the walls of housing **12**. A seal **18** is provided between seat portion **16** and lid **14** to prevent the leakage of air between them. Lid **14** is secured to seat **16** by a plurality of threaded bolts such as those shown at **20** and **22**. An air inlet opening **24** is provided in side wall **25** of housing **12** through which a particle laden air stream is drawn into the filter **10**. The particle laden air stream introduced into housing **12** through air inlet opening **24** is caused to pass through a unitary filtering medium shown generally at **26**. After passing through unitary filtering medium **26** which traps the particles contained therein, the now filtered air stream is discharged through air outlet opening **28** provided in the side wall **29** of housing **12**.

The unitary filtering medium **26** comprises of a plurality of bags **30** which are integrally linked together. The bags **30** are fashioned from a single strip of material such as that shown generally at **32** (FIG. 3). The strip of material **32** consists of a continuous strip of flannel, for example, and is provided with outwardly extending opposite tabs **34** positioned along its length. Only a portion of strip **32** has been shown which represents the first three bags **30** of the left side of filtering medium **26** as viewed in FIGS. 1 and 2. The strip of material is creased or folded along the lines indicated in FIG. 3 to fold like an accordion. The folding along the lines indicated results in an accordion strip of material having a plurality of pairs of adjacent sections **36, 38**; **40, 42**; **44, 46** (see first three bags **30** of the left side of unitary filtering element **26** in FIG. 1). Selected pairs of the adjacent sections are joined together, thereby forming the bags **30**. For instance, section **36** when folded as above indicated overlies section **38** with the tab portion **34** of section **36** overlying the tab portion **34** of section **38**. The overlying sections **36, 38** are sewn together along their opposite edges as indicated by the dotted lines **48** and **50**. Tabs **34** of adjacent sections **36, 38** are also sewn together, the bottom portion **52** of tab portion **34** associated with section **36** being sewn to the top portion **54** of tab portion **34** associated with section **38**. Likewise, section **40** when folded as above indicated overlies section **42** with the tab portion **34** of section **40** overlying the tab portion **34** of the portion **42**. These overlying sections **40, 42** are also sewn together along their opposite edges as indicated by the dotted lines **56, 58**. The tabs **34** of these adjacent sections **40, 42** are also sewn together, the bottom portion **60** of the tab portion **34** associated with section **40** being sewn to the top portion **62** of tab portion **34** associated with section **42**.

It will be noted that adjacent sections of the strip of material **32** each share one-half of the tab portion **34** associated therewith when the adjacent sections are joined together. The remainder of bags **30** contained in the unitary filtering medium **26** are fashioned in a like manner. After the joining of selected pairs of the adjacent sections together in the manner indicated, the bags **30** are turned inside out, thereby forming the unitary filtering medium **26**. The resulting unitary filtering medium **26** has a lip portion extending upwardly above the open tops of the bags **30** which encircles the bags **30** taken as a whole. This lip portion results from the joining of the bags **30** together in the manner indicated and the subsequent turning of the bags **30** inside out. This lip portion is then folded over to form a cuff **64** (see FIGS. 1, 2 and 4) which extends around the unitary filtering medium **26** at the top thereof; and its purpose is to secure the filtering medium **26** to an integral rectangular frame member **66** of L-shaped cross section (see FIG. 5).

In its folded position, lip or cuff **64** has the tab portions **34** of the strip of material **32** facing outwardly as indicated in FIGS. 1 and 2 generally at **65** and **67**, respectively. Each half of the tab portions **34** extends along the length of the strip of material **32** that has been joined to another half of an adjacent tab **34** and is opened and folded flat as indicated at **69** and **71***a*. Prior to folding the lip portion or cuff **64**, a sealing band **68** of felt, for example, is affixed to the cuff **64** for aiding in sealing the unitary filtering medium **26** to the frame member **66**.

As best seen in FIG. 5, frame member **66** comprises a rectangular member having a first pair of opposite sides extending along the width of the unitary filtering medium **26**. The rear side **70** of this first pair of opposite sides is shown in FIG. 5; and the front side **71** is shown in FIGS. 1 and 2. A second pair of opposite sides **72** and **74** extend along the length of the unitary filtering medium **26**. A plurality of cross members **76** span between the first pair of opposite sides **70, 71** and are parallel to the sides **72** and **74**. Each of the first pair of opposites sides **70, 71** and each of the second pair of opposite sides **72, 74** have an L-shaped cross section. For example, sides **72** and **74** consists of vertical portion **78** and **80**, respectively, and horizontal portions **82** and **84**, respectively.

In assembling the unitary filtering medium, the bags **30** are positioned between the spanning members **76** with the integral portions **86** linking the bags **30** together supported by the spanning members **76**. As was stated above, the lip or cuff portion **64** is secured to the frame member **66**. The cuff portion **64** together with the band **68** are positioned in overlapping relation to the vertical portions of the sides making up the frame member **66** and are glued or stapled to these vertical portions. The unitary filtering medium **26** is accordingly supported by the frame member **66** along the length thereof and across the width thereof by the sides **70, 71, 72** and **74**. In this respect, the cuff portion is folded over the top and vertical portions of the sides making up the frame member in a generally inverted U-shaped configuration.

In order to stiffen and maintain the adjacent sections of the bags **30** apart, a U-shaped wire screen **87** is positioned within adjacent pairs of the bags **30**. This screen also serves as a spacer to maintain the opposite side walls of each bag separated. Also, to maintain the bags **30** in a substantially vertical position within the housing **12**, a weight member **88** is placed in the bottoms of the bags **30**.

To further secure the unitary filtering medium **26** to the integral frame member **66**, a pair of first strip members **90** and **92**, respectively, and a pair of second strip members **94** and **96**, respectively, are provided which are arranged in substantially surrounding relation to the cuff portion **64**. The members **90** and **92** extend along the width of the filtering medium **26** with member **90** being secured to the vertical portion of side **71** and with member **92** being secured to the vertical portion of side **70**. Preferably, the members **90** and **92** are secured to the vertical portions of the sides **70** and **71** as by fastening elements such as screws (not shown) which pass through the cuff portion **64**.

The members **94** and **96** extend along the length of the filtering medium **26** with member **94** being secured to the vertical portion of side **72** and with member **96** being secured to the vertical portion of side **74**. The members **94** and **96** are also preferably secured to the vertical portions of the sides **72, 74** as by screws **100** which pass through the cuff portion **64**.

In addition to aiding in the securement of the cuff portion **64** to the vertical portions of the frame member **66**, the members **90, 92, 94** and **96** serve another function as will appear more fully hereinafter.

A flange means or seat portion **102**, spaced from and located below the top of the housing **12**, is provided around the inside of the walls of the housing **12** for supporting frame member **66** within housing **12**. The horizontal portions of the sides making up frame member **66** are received on the seat portion **102** when the frame member together with its associated parts is inserted into the housing **12**. A flexible seal **104** is provided between seat portion **102** and the horizontal portions of the sides **70**, **71**, **72** and **74** to prevent leakage of air between them. Preferably, the seal **104** is glued, for example, to the undersurfaces of the horizontal portions of the frame member **66** and forms a part thereof.

It will be noted that the lower edge portions of each of the members **90**, **92**, **94** and **96** are in abutment with the upper surfaces of the horizontal portions of the frame member **66** and that the upper edges of the members **90** and **92** are in abutment throughout their lengths with the undersurface of the lid **14** when the lid **14** is secured to the housing **12**. It will be also noted that the members **94** and **96** each has a centrally disposed upstanding portion **106** and **108**, respectively, extending from the upper edges thereof which are also in abutment with the undersurface of the lid **14** when the lid is secured to the housing **12**. A centrally disposed cross member **109** is positioned between the portions **106** and **108** and is secured to these latter portions at its opposite ends as by screws. The undersurface of cross member **109** is in abutment with the uppermost surfaces of filtering medium **26** which it overlies and the upper surface of member **109** is in abutment with lid **14** when the lid **14** is secured to housing **12**.

The vertical dimensions of the members **90**, **92** and the vertical dimensions of the portions **94** and **96** at the upstanding central portions **106** and **108**, respectively, are chosen such that the upper terminal edges or portions of these members and the upper surface of cross member **109**, lie in a horizontal plane disposed above the top of the cuff portion **64**. The vertical dimension of the flexible seal **104** is chosen such that, when the frame member **66** together with its associated parts is positioned on the flange means **102** and prior to the lid **14** being secured to the housing **12**, the horizontal plane in which the upper terminal edges of the members **90–96** lie is disposed above the top edges of the housing **12**. Accordingly, when the lid **14** is secured to the housing **12**, the frame member **66** is forced downwardly into the housing compressing flexible seal **104** to assure a positive air tight seal between the flange means **102** and the horizontal portions of the frame member **66**. Also, by reason of this arrangement, the frame member **66** is maintained in position on the flange means **102** between the air inlet and outlet openings **24** and **28**, respectively.

With the unitary filtering medium **26** and integral frame member **66** together with its associated parts positioned within the housing **12** as indicated, the housing **12** is divided into two compartments **110** and **112**. The particle laden air stream entering compartment **112** must pass through the unitary filtering medium **26** to compartment **110**. From compartment **110**, the air stream exits through outlet **28**. Leakage of air between the unitary filtering medium **26** and the integral frame **66** is prevented by the cuff portion **64** together with its sealing band **68** being held positively in contact with the vertical portions of the frame **66** by the members **92–96**. Leakage of air between the frame member **66** and seat portion **102** is prevented by the seal **104**. Accordingly, the construction and the arrangement of the parts of the present invention provide a filter wherein the particle laden air stream cannot pass between the adjacent bags or between the bags and the housing in an unfiltered state as was possible when individual discrete bags made up the filtering medium of the filter. Because the bags **30** making up the filtering medium of the present invention are linked together and are secured to frame member **66** as a unit, the need of stuffing discrete bags into the housing is thereby eliminated. Furthermore, because of the arrangement of the members **90–96** in substantially surrounding relation to the cuff portion **64** and their being disposed between the undersurface of the lid **14** and the peripheral portions of the frame member **66**, as indicated above, the frame member is maintained in engagement with the flange means **102** without the need of screws or other type fasteners thereby greatly facilitating insertion and removal of the filter medium from the housing **12**. While the members **90–96** have been illustrated and described as being secured to the frame member **66**, it will be evident that these members may be secured to the undersurface of the lid **14** and form an integral part thereof.

An important aspect of the invention is that the integral frame member **66** and the members **90–96** are preferably constructed of wood rather than heavy metal stock as was the case in prior filter constructions of this type. This wooden construction permits ready assembly of the filter, which assembly is accomplished merely by the drilling of holes in the members **90–96** at the required locations and thereafter securing the various associated parts with screws as above described. The screws will easily pass through the cuff portion **64** and be received in the vertical portions of the frame member **66** without the necessity of previously drilling holes in the vertical portions of the frame member. Accordingly, the need for a rigid steel band encircling the cuff portion **64** to secure the unitary filtering medium to the frame member **66** is no longer required as in prior constructions of filters of the type with which the present invention is concerned.

By reason of the wooden construction of the frame member **66** and members **90–96**, there is thus provided by the present invention a relatively inexpensive, light weight disposable filter which is easily assembled in its initial fabrication and one which is easily inserted and removed from the housing in which it is designed to be used.

Although the invention has been shown in connection with certain specific embodiments, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

I claim:

1. In a filter comprising an enclosed housing having side walls, a bottom wall and a removable lid, a generally rectangular flange projecting inwardly from the side walls of said housing beneath said lid and lying in a plane extending generally parallel to said lid, an inlet opening in said housing beneath said flange, an outlet opening above said flange, and a bag filter supported on said flange and interposed between said inlet and outlet openings; the improvement in said filter comprising:

a generally rectangular frame member seated on said flange and extending across the housing,

a plurality of spaced straight parallel spanning cross members extending between two of the opposite sides of said frame member,

a plurality of parallel hanging filter bags formed from a sheet of filtering material and disposed side-by-side with their open ends connected to one another by portions of said sheet of filtering material which overlie said spanning members whereby said filter bags hang downwardly between adjacent ones of said spanning members with the outer bags hanging downwardly between a spanning member and a side of the frame,

a cuff portion extending around the top of said filter and connecting the upper edge of said bag filter to said frame member,

said frame member having a lower horizontal surface resting on said flange and an upper horizontal surface formed by opposed vertical walls with said upper horizontal surface and vertical walls extending around said frame member,

said cuff portion being wrapped around said vertical walls and said upper horizontal surface to form a generally inverted U-shaped cross-sectional configuration with one outer leg of the U-shaped configuration terminating at the lower edges of said vertical walls which face the walls of said enclosed housing,

strip members extending along and in abutment and surrounding relation with the sides of said one outer leg of the U-shaped cross-sectional configuration of said cuff portion,

fastening elements passing through said strip members and said cuff portion and extending into said vertical walls of the frame member facing the walls of the enclosed housing to hold said cuff portion in place on said frame member, and

means in abutment with said lid for holding said frame member in abutment with said flange.

2. The improvement of claim 1 wherein said frame member has a generally L-shaped crosss-sectional configuration with vertical leg portions and horizontal leg portions which extend toward the walls of the enclosed housing, said upper horizontal surface and vertical walls being on said vertical leg portion.

3. The improvement of claim 1 wherein said strip members each have an upper edge in abutment with the undersurface of said lid and a lower edge in abutment with a surface of said frame member, whereby the frame member is held in snug abutting relationship with said flange when said lid is secured to the top of said enclosed housing.

4. The improvement of claim 1 including a flexible sealing means disposed between the lower horizontal surface of said frame member and said flange.

5. The improvement of claim 1 including a plurality of wire mesh screens disposed within said plurality of filter bags to stiffen the same.

6. The improvement of claim 1 wherein said frame member and said strip members are formed from wood

and wherein said fastening elements comprise screws which extend through openings in said strip members and are screwed into a vertical wall of the frame member.

7. The improvement of claim 1 including a strip of sealing material interposed between said one leg of the U-shaped configuration and said one of the vertical walls facing the wall of said enclosed housing.

8. The improvement of claim 1 wherein two of said strip members on opposite sides of said frame member are of constant height and are interposed between said lid and said frame member to hold the frame member in snug abutting relationship with said flange, the other two of said strip members on the other two opposite sides of said frame member having raised central portions which abut said lid member to hold said latter-mentioned strip members in snug abutting relationship with said frame member and force it against said flange, and a centrally disposed cross member positioned between and connected to said raised central portions.

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U.S. Cl. X.R.

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