

[54] HIGH PERFORMANCE FILTER ASSEMBLY

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55/521

[51] Int. Cl. B01d 46/52

[58] Field of Search 55/478, 480, 481, 490, 495,
55/496, 497, 500, 502, 509, 521

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Primary Examiner—Dennis E. Talbert, Jr.

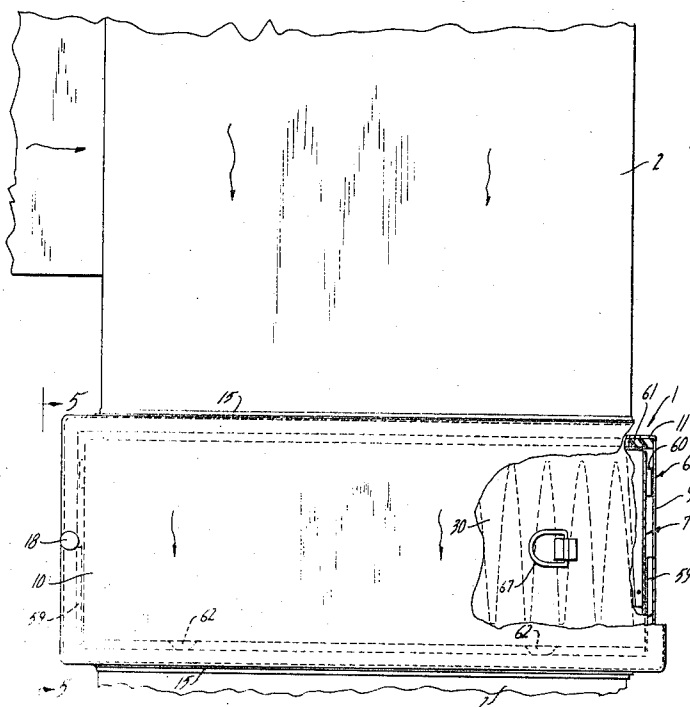
Attorney, Agent, or Firm—Andrus, Scales, Starke &
Sawall

[57]

ABSTRACT

A high performance filter assembly includes an outer casing adapted for insertion in the ductwork or plenum of an air treating system. A drawer is removably secured within the casing and contains an improved pleated filter media of the high efficiency type. The upstream portion of the drawer is sealed to the casing by a cam arrangement, and double blankets are disposed at the drawer ends and casing ends to further prevent air leakage. The pleated filter itself is collapsible for easy storage, and expands to a fixed position when installed. Reinforcements on the outermost walls of the pleated filter prevent possible tearing of the filter during its installation and also support said walls during filter expansion. The elongated filter edges are sealed to the drawer by a member which also functions to secure a plurality of filter-supporting fingers.

22 Claims, 19 Drawing Figures



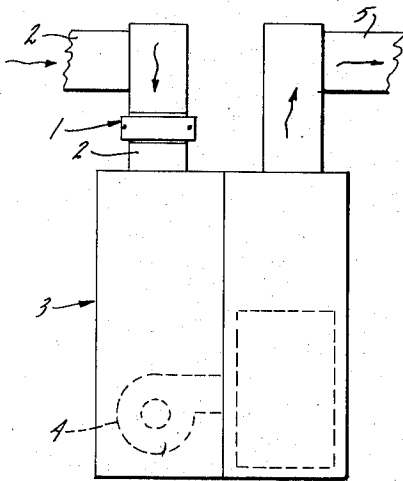


FIG. 1

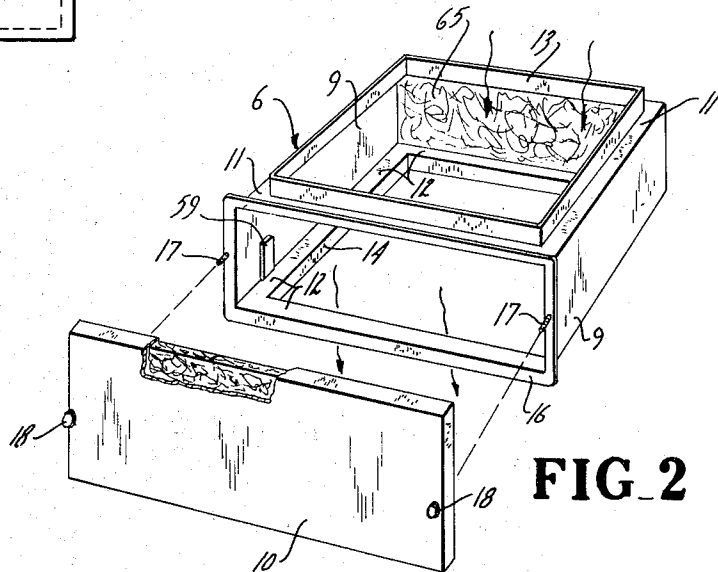


FIG. 2

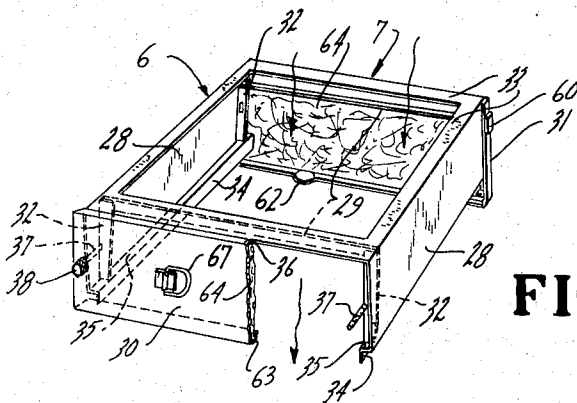


FIG. 3

FIG 4

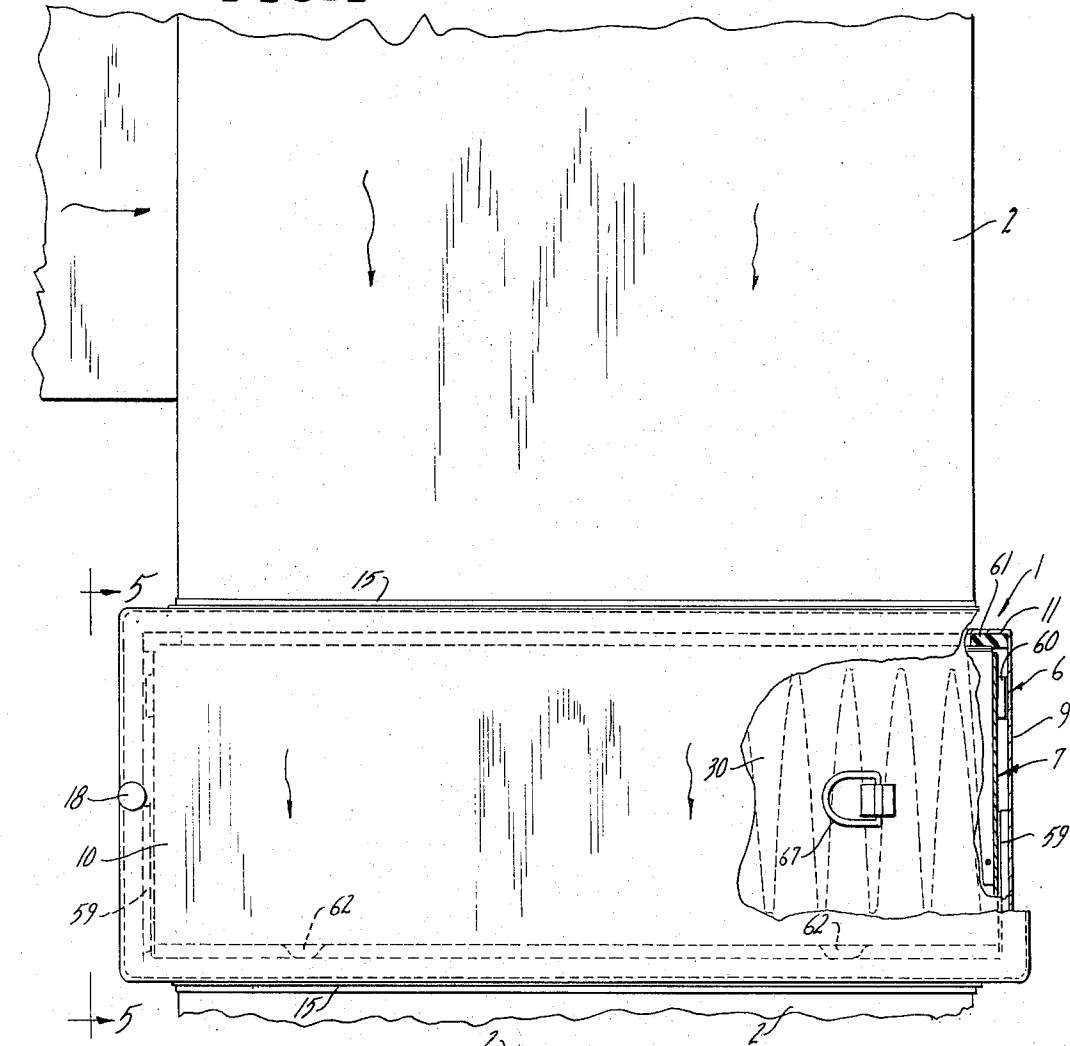


FIG 5

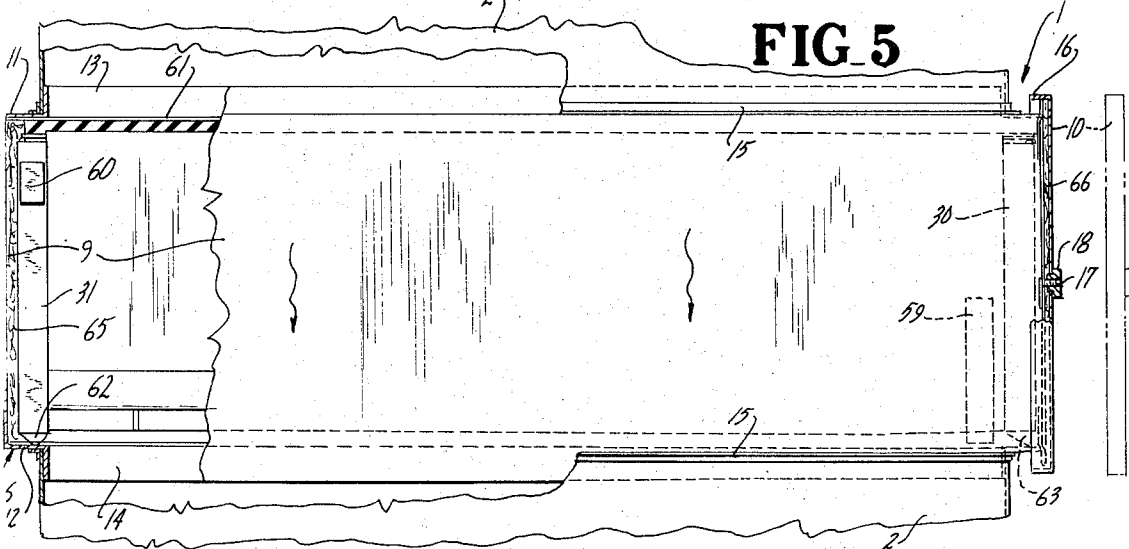


FIG 6

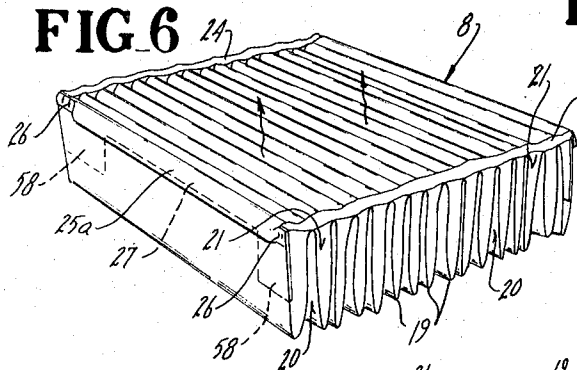


FIG 8

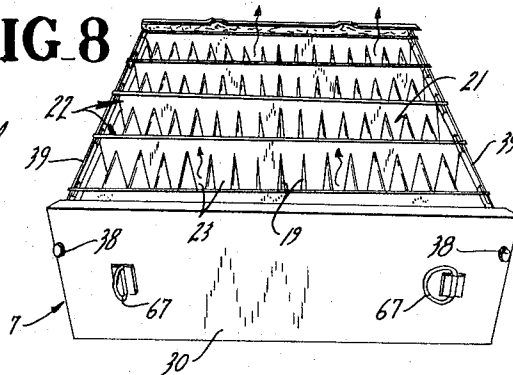


FIG 7

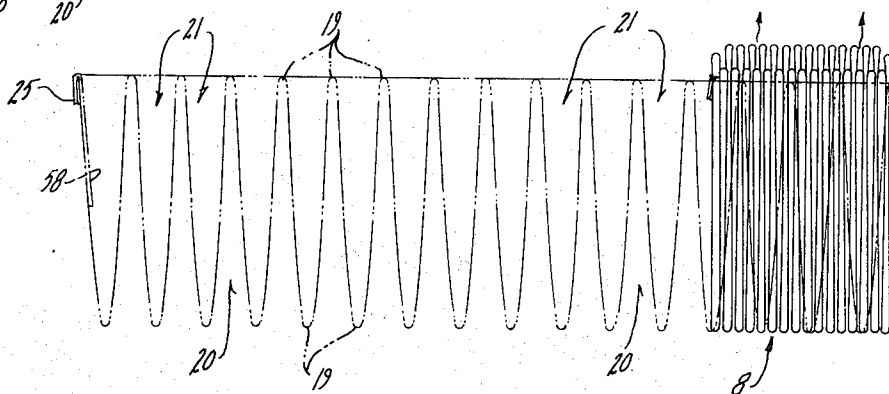


FIG 9

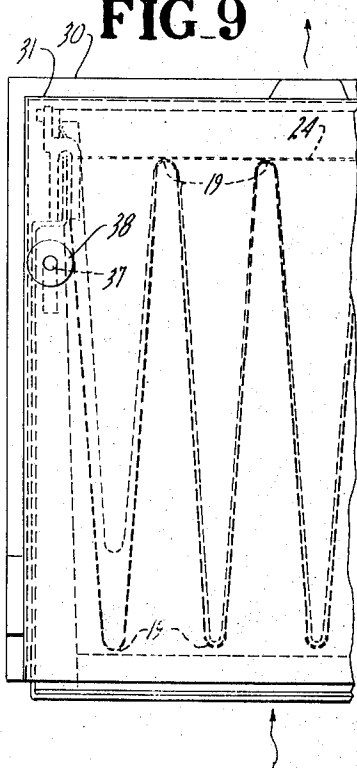
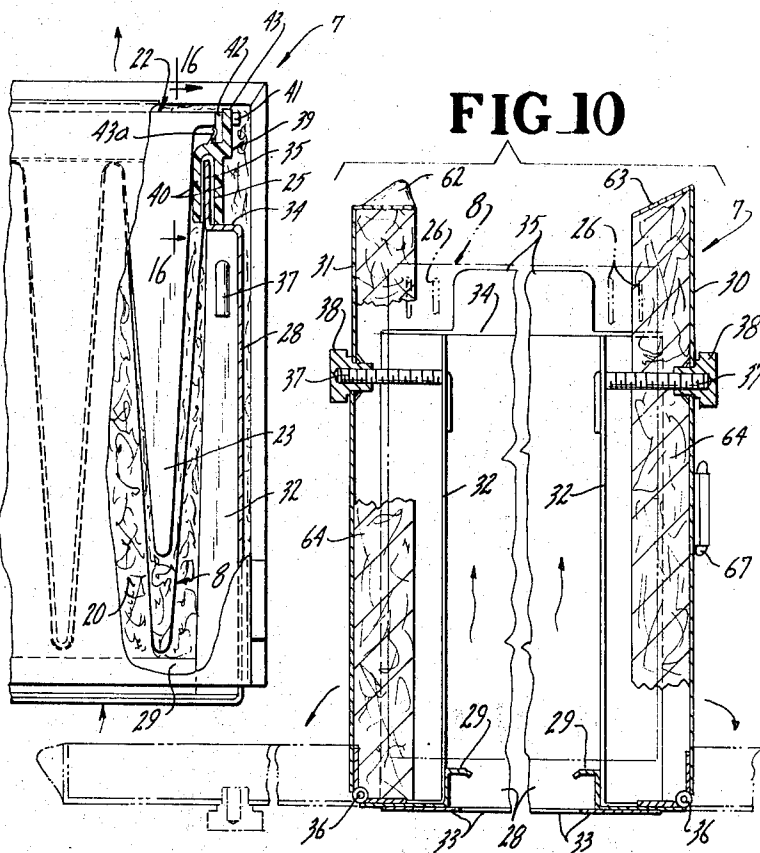
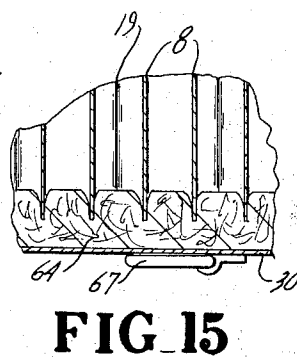
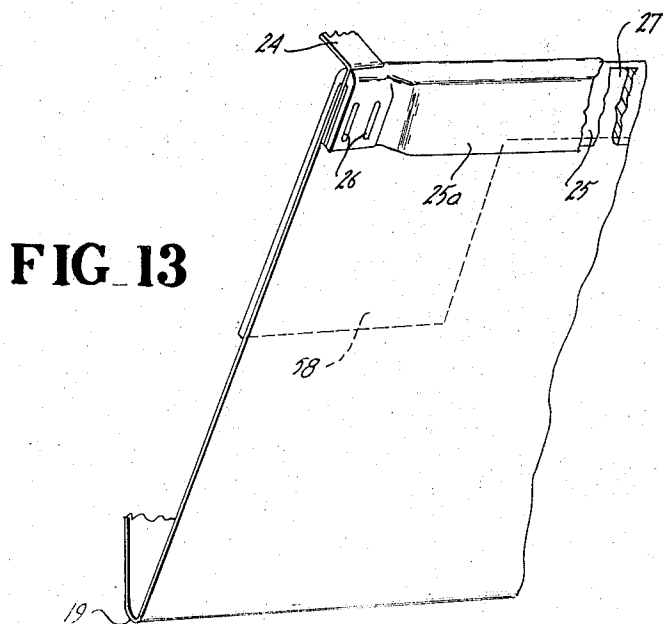
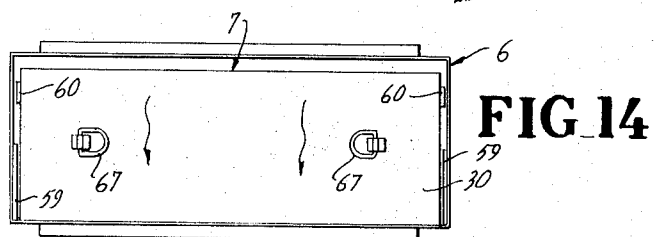
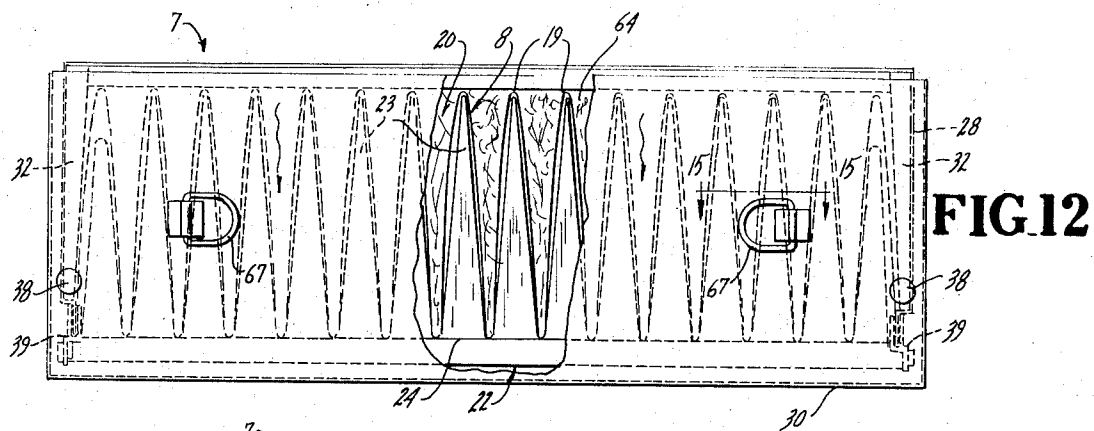
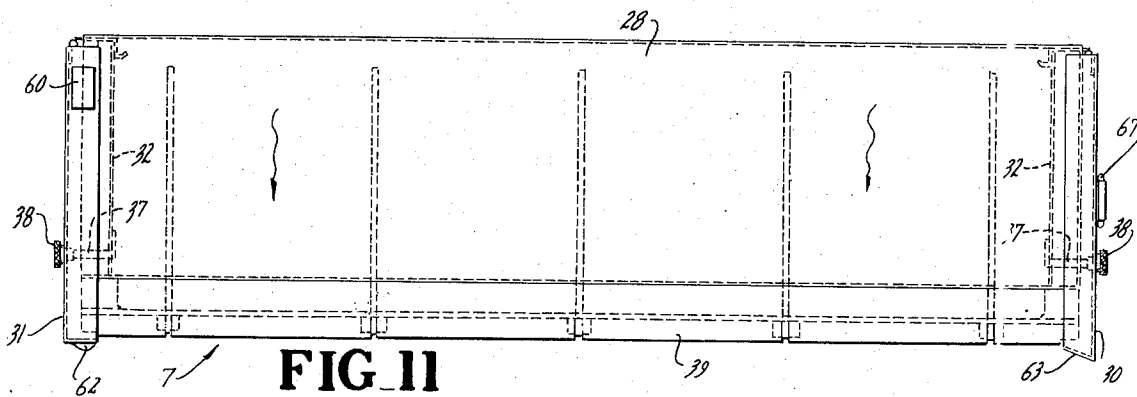


FIG 10





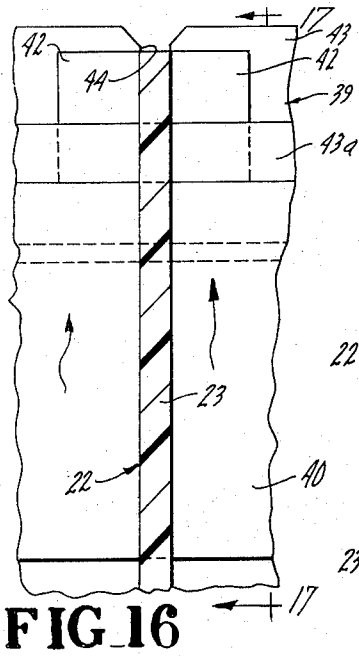


FIG. 16

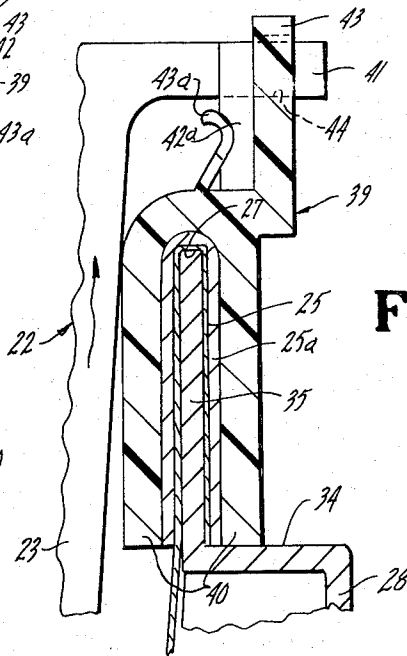


FIG. 17

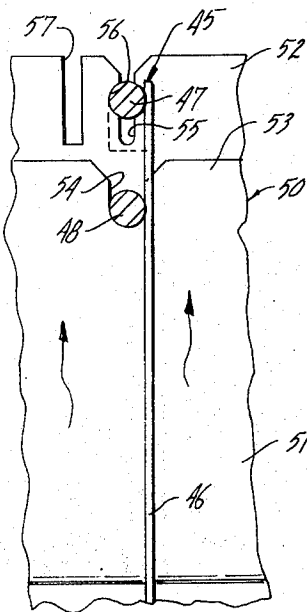


FIG. 18

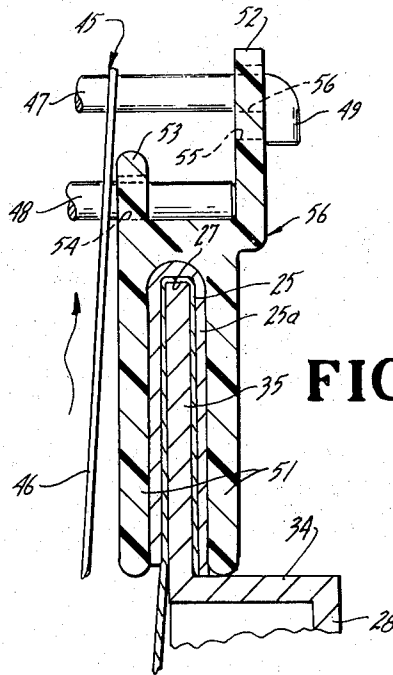


FIG. 19

HIGH PERFORMANCE FILTER ASSEMBLY

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a high performance filter assembly.

Most forced air furnaces are provided with a filter for removing dust and impurities from the air to assist in cleaning the environment. Such filters are usually relatively inexpensive and may comprise a thin panel of loose mesh fiber glass or the like which is mounted adjacent the furnace blower. Such filters have an efficiency of about 15 percent, based on the "dust spot" method of testing, and are not adequate to give any noticeable relief to those who suffer from certain allergic conditions.

For some time, high efficiency filter media has been available. However, to the knowledge of the inventors, no way has previously been found to mount such a filter in an air treating system at relatively low initial cost and wherein bypassing of the filter by any undesirable dust-laden air is virtually prevented.

The present invention is directed to a filtering assembly for mounting in furnace duct work, and wherein untreated air cannot by-pass the high efficiency filter, thus taking advantage of the approximately 70 percent efficiency of such a filter. With certain particles, the efficiency may be even more. Furthermore, the assembly is relatively low in cost and is relatively easy to maintain. The relief provided allergy sufferers has been found to be dramatic.

In accordance with the invention, the assembly comprises an outer casing adapted for insertion in the duct-work or plenum of an air treating system. A drawer is removably secured within the casing and contains an improved pleated filter body of the high efficiency type. The upstream portion of the drawer is sealed to the casing by a cam arrangement, and double seals are disposed at the drawer ends and casing ends to further prevent air leakage. The pleated filter itself is collapsible for easy storage, and expands to a fixed position when installed. Reinforcements on the outermost walls of the pleated filter prevent possible tearing of the filter during its installation, and also support said walls during filter expansion. The elongated filter edges are sealed to the drawer by a member which also functions to secure a plurality of filter-supporting fingers.

While the concepts of the invention are particularly applicable to forced air furnaces of the residential type (with or without an air conditioning feature), the assembly may also find use in commercial, industrial and other non-residential buildings.

DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the best mode presently contemplated by the inventors for carrying out the invention.

Arrows on the drawing figures denote the direction of air movement.

In the drawings:

FIG. 1 is a front elevation of a forced air furnace and accompanying duct work incorporating the assembly of the invention;

FIG. 2 is a perspective view of the assembly casing, with front end cover removed;

FIG. 3 is a perspective view of the drawer framework, with parts broken away;

FIG. 4 is an enlarged front elevation of the assembly shown in FIG. 1, with parts broken away and in section;

FIG. 5 is a left side elevation of the assembly taken on line 5—5 of FIG. 4 and with parts broken away and in section;

FIG. 6 is a perspective view of the pleated high efficiency filter used in the assembly, and in inverted position;

FIG. 7 is an end view of the inverted high efficiency filter media, showing both the collapsed and expanded positions;

FIG. 8 is a perspective view of the filter-holding drawer sub-assembly in inverted position;

FIG. 9 is a broken rear end elevation of the inverted drawer, with parts broken away and in section;

FIG. 10 is a broken left side elevation of the inverted drawer, with parts broken away and in section;

FIG. 11 is a left side elevation of the drawer;

FIG. 12 is a front elevation of the drawer, with parts broken away and in section;

FIG. 13 is a fragmentary perspective view of a corner of the filter;

FIG. 14 is a schematic front view of the assembly showing the means for preventing incorrect installation of the drawer;

FIG. 15 is a fragmentary sectional view of a drawer door taken on line 15—15 of FIG. 12;

FIG. 16 is an enlarged fragmentary view taken on line 16—16 of FIG. 9 and showing a portion of the comb assembly and retainer means;

FIG. 17 is an end view taken on line 17—17 of FIG. 16;

FIG. 18 is a view similar to FIG. 16 of another embodiment; and

FIG. 19 is an end view similar to FIG. 17 of the second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown generally in FIGS. 1—5 of the drawings, the concepts of the invention are embodied in a high performance filter assembly 1 mounted in the air return duct 2 of an air treating apparatus, such as a furnace 3 having an air blower 4 and hot air discharge duct 5. Assembly 1 broadly comprises a generally rectangular outer casing 6, a generally rectangular inner drawer 7 and a high efficiency filter 8.

Outer casing 6 includes a rectangular generally U-shaped wall 9 having an open front end which is adapted to be closed by a removable cap-like cover 10. The upstream and downstream peripheral edges of wall 9 are flanged inwardly, as at 11 and 12 respectively, with the latter merging into further perpendicular flanges 13 and 14 respectively. The latter flanges 13, 14 are adapted to tightly telescope onto the spaced open ends of air return duct 2, with the duct ends sealingly abutting flanges 11 and 12 around the entire casing. To further complete the seal, tape 15 or other suitable sealing means may be applied to the casing-duct joint. This is particularly important on the downstream side. The upstream and downstream sides of casing 6 are open to permit the passage of air therethrough.

As best shown in FIG. 2, the front end edges of casing 6 are flanged outwardly, as at 16 to form a frame-like

peripheral support for cover 10. For securement purposes, a pair of forwardly extending screws 17 are secured to flange 16 and are adapted to receive cover 10 thereover so that the cover completely overlaps the flange. Suitable threaded tightening nuts 18 hold the cover in place.

Drawer 7 is adapted to be slidably received within casing 6, and contains the primary filter 8. Referring now to FIGS. 6-9, which shows the structures inverted from their usual position within the system, filter 8 is of the high efficiency self-supporting type, and comprises a body which is usually of paper or other fibrous non-woven filter media. The filter is open-ended and provides an extended filtering surface by virtue of the fact that it is reverse folded as at 19, into a collapsible expandible elongated accordian-like member which forms generally V-shaped upstream and downstream facing spaces, referred to hereinafter as pockets 20, 21 respectively.

As shown in full lines in FIG. 7, filter 8 may be collapsed into a small volume for ease of shipping and disposal. Furthermore, and as will be more fully described hereinafter, the filter is mounted in fully expanded position in drawer 7. See FIG. 8. A plurality of comb-like assemblies 22 having generally pointed fingers 23, corresponding in spacing to that of pockets 21, are then mounted to the drawer so that the fingers are disposed within the downstream pockets 21. Fingers 23 hold the pocket walls against collapse. In accordance with one aspect of the invention, means are provided to equalize the pleat spacing of an expanded filter 8 so that the entrances to pockets 21 coincide with the positions of fingers 23. For this purpose, a flexible narrow strip 24 of cloth or the like extends transversely and completely across each end portion of the downstream side of filter 8, with strips 24 being secured to the filter so that its downstream folds 19 will be equally spaced. In the embodiment shown in the drawings, strips 24 are secured to folds 19 themselves and limit the pocket expansion to a uniform width. In addition, since filter 8 is completely self-supporting, strips 24 are made of very flimsy light-weight non self-supporting material.

As best shown in FIGS. 6 and 13, the downstream edge portion of each outermost filter pleat is folded over to form a narrow lip 25, which is reinforced by a folded over strip 25a of cardboard or the like. These members are secured at their ends to the adjacent pocket wall, as by staples 26. This, in effect, forms an upstream facing shallow envelope-like pocket 27, for purposes to be described.

Turning now to the detail structure of drawer 7, reference is made to FIGS. 3 and 8-10 of the drawings. FIGS. 8-10 show the drawer in inverted position; as when filter 8 is serviced. Drawer 7 is open on its upstream and downstream portions and includes a housing 28 having suitable generally Z-shaped transverse braces 29. In the embodiment shown, both ends of the drawer are open, but are adapted to be closed by front and rear doors 30, 31. For strengthening and other purposes, a gusset plate 32 is disposed within each corner of the drawer, and attached to housing 28 and brace 29. Plates 32 are tapered to avoid interference with the outer tapered pocket walls of filter 8.

The upstream edge of housing 28 is provided with a peripheral inwardly extending flange 33; while the downstream portion of the housing is provided with opposed inwardly extending flanges 34. Each down-

stream flange 34 merges into an elongated filter supporting lip 35 which is shorter than flange 34 and of the same length as envelope-like pocket 27 on filter 8.

Doors 30, 31 are cap-like and are hinged to braces 29 along their upstream edges, as at 36 so they can be removed outwardly from the respective drawer opening. See FIG. 10 which shows the open and closed position thereof. Each door is locked in closed position, overlapping housing walls 28, by a pair of screws 37 which are secured at their inner ends to supporting gusset plates 32. Screws 37 extend through openings in each door, and suitable tightening nuts 38 hold the doors in place.

Filter 8 is inserted or removed from the drawer when doors 30, 31 are in their downwardly hinged open position. The installation is accomplished by placing one envelope-like pocket 27 of a collapsed filter over a lip 35 and then manually expanding the filter until the other pocket 27 can be placed over the opposite lip 35. At this point, the filter fold spacing is equalized, as described previously.

In accordance with one aspect of the invention, means are provided to tightly and sealingly close each envelope pocket 27 onto its lip 35, with said means also supporting and stabilizing comb-like finger assemblies 22. For this purpose, and as shown in the embodiment of FIGS. 9, 16 and 17, an elongated channel-like retainer 39 is provided with upstream facing legs 40 which are tightly press fit over strip 25a, pocket 27 and lip 35. In this embodiment, comb assembly 22 is relatively rigid and flat, and may be made of plastic or the like. Assembly 22 is provided with rectangular end extensions 41 having transverse lugs 42. Each lug 42 is provided with an indented groove 42a on its inner upstream surface portion. Retainer 39 includes a pair of laterally spaced downstream facing outer and inner flanges 43, 43a. Outer flange 43 is provided with longitudinally spaced rectangular slots 44 therein. Slots 44 in opposite retainers 39 are in alignment. Inner flange 43a is inclined toward outer flange 43 and is curved inwardly along its edge. Thus, lugs 42 can be snapped into the retainer with flange 43a engaging the respective groove 42a. By using rectangular extensions 41 and slots 44, each comb assembly 22 is maintained in perpendicular transverse position and cannot tilt.

In a second embodiment, shown in FIGS. 18 and 19, the comb assembly 45 is constructed of rigid wire having fingers 46 and a pair of parallel spaced supporting rods 47, 48 disposed along the fingers' base. End rod 47 is longer than adjacent rod 48 and has bent ends 49. In this instance, the channel-like retainer 50 also has upstream facing parallel legs 51 which are press fit over pocket 27 and lip 35. Each retainer 50 has a pair of laterally spaced downstream extending outer and inner flanges 52, 53 respectively. Inner flange 53 is narrower than flange 52 has a plurality of spaced slots 54 for receiving rod 48. Outer flange 52 also has a plurality of spaced slots 55, each of which has an enlarged central portion 56. Slots 55 are adapted to receive end rod 47 by a snap fit into portion 56. A relief groove 57 spaced slightly from each slot 55 permits give of the retainer material during the snap-in operation.

When installing assembly 45, rods 47 and 48 are positioned at the guideway entrance to respective slots 52 and 53, and the retainer pressed downwardly. The dual hanging support prevents pivoting of assembly 45 out of perpendicular position.

In both embodiments, it is important to have enough spaced comb-like assemblies installed in drawer 7 to prevent collapse, of the filter pocket walls between the supporting fingers, due to the air pressure differential within the assembly. In a device for use with ductwork having normal residential air velocities and pressures, five such assemblies have been found to be adequate.

It has been found that when filter 8 is manually expanded, the outermost wall being pulled may tend to flex unduly. This flexing problem is partially reduced by the use of previously described reinforcing strip 25a. In addition, and as best shown in FIGS. 6 and 13, a relatively narrow reinforcing tab or tongue 58 is disposed at each end of the inner wall of each outermost pocket 21. Tongues 58 are shown as integral with cardboard strip 25a and extend upstream to the central portion of the filter wall. The tongue-strip member forms a frame-like element which spreads the pulling forces onto the wall. In addition, strip 25a strengthens the filter media to prevent tearing thereof when retainers 39 or 50 are pressed thereover.

Once filter 8 and the appropriate comb assemblies 22 or 45 are installed, doors 30 and 31 are closed, drawer 7 is turned over to its right-side-up position, and inserted into casing 6, where it will slide inwardly along side casing flanges 12.

Since it might be possible for a novice to attempt to install drawer 7 backwards or in inverted position, means are provided to prevent insertion of drawer 7 into the casing unless it is oriented properly. For this purpose, and as best shown in FIGS. 2-5 and 14, a pair of opposed vertical stop bars 59 are secured to the inner surface of casing side wall 9 adjacent the front end casing opening. Bars 59 extend from approximately flange 12 to midway of the wall. In addition, a pair of short outwardly extending lugs 60 are secured adjacent the rear ends of drawer side walls 28 and are positioned so they will by-pass stop bars 59 if the drawer is inserted correctly, but will engage the bars if the drawer is inverted at the time. Furthermore, front drawer door 30 is wider than rear door 31 and the main drawer body, and will stoppingly engage casing stop bars 59 if it is attempted to insert the drawer in reverse.

To assure relatively easy entry and sliding of drawer 7 into casing 6, there must be a certain amount of dimensional tolerance therebetween. However, since the major purpose of the unit is to filter out substantially all undesirable matter in the air in duct 2, it is essential that no unfiltered air leaks through the unit. For this reason, cooperative camming means are provided to shift drawer 7 in an upstream direction and into tight sealing engagement with the upstream casing portion only at the end of the drawer's inward travel. For this purpose, and as best shown in FIGS. 4 and 5, a sealing gasket 61 is secured beneath the entire periphery of casing flange 11. In addition, a plurality of projection-like cams 62 are secured to the downstream edge of rear drawer door 31, and are disposed generally centrally thereof so that they will not interfere with the sides of casing 6 during sliding drawer movement. Furthermore, at least the downstream edge of front drawer door 30 is bevelled outwardly to provide a cam surface 63. (The side edges of door 30 are also shown as bevelled to provide a relatively snug fit to the casing.) As drawer 7 reaches the innermost end portion of its slid-

ing travel, cams 62 will ride up and be supported on the transverse rear end portion of casing flange 12 and door cam 63 will simultaneously ride up and be supported on the transverse front end portion of flange 12, to raise the drawer off the flange and so that peripheral drawer flange 33 tightly seals against gasket 61 on the co-extensive flange 11.

A further very important aspect of the invention contemplates sealing means embedding the end edges of filter 8 to prevent any possible leakage of unfiltered air thereby within drawer 7; as well as sealing means disposed at the rear and front ends of casing 6 to prevent any possible leakage of unfiltered air around drawer 7. Thus, a double seal is provided at both ends.

In accordance with the invention, and as shown in FIGS. 3, 10, 12 and 15, the first-named sealing means comprises a mat or blanket 64 of soft material disposed within and substantially filling the recessed interiors of both front and rear drawer doors 30 and 31 and extending inwardly beyond the doors. Thus, when the doors are hinged closed, the edges of filter 8 will depress and be embedded in the blankets.

It has been found that a suitable blanket comprises a resilient planular felt-like filter produced from a blend of fiber glass and micro fibers or the like. The blanket may contain a flexible binder to impart resistance to failure due to flexing. The binder may also provide wet strength and water repellency.

The relative stiffness of filter 8 and blankets 64 is such that, when the doors 30, 31 are closed, the filter edges will not bend but will flex blankets inwardly, as shown. Furthermore, the filtering characteristics of blankets 64 are such as to provide greater resistance to the flow of air therethrough than the resistance of filter 8, thus tending to force air back through filter 8. However, in the event air does pass planularly through blankets 64, it will still be filtered.

Further in accordance with the invention, and as shown in FIGS. 2 and 5, the second named sealing means comprises a blanket 65 secured within the rear end of casing 6 and mounted to the rear portion of casing wall 9. Blanket 65 is sealingly engaged by rear drawer door 31 which, in effect, is embedded therein. In addition, a blanket 66 of substantial thickness is mounted within the cap-shaped front casing cover 10. When cover 10 is mounted to the casing, the front casing peripheral flange 16 is embedded into the edge of blanket 66, while the front drawer door 30 is also embedded therein.

Blankets 65 and 66 are preferably of the same material and are adapted to function in the same general manner as blankets 64.

The high performance filter assembly of the invention may be installed in any desired position; that is: horizontally as shown, vertically or even angularly.

Removal of drawer 7, as by door handles 67, for servicing of the unit is an easy task. Furthermore, when replacing a filter 8, only the downstream clean side of the dirty filter need be handled, thus making the job more pleasant.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. A high performance filter assembly for connection to a duct of an air treating system wherein air flows from upstream to downstream, said assembly comprising, in combination:
 - a. a generally rectangular casing for mounting to the said duct, said casing being open on its upstream and downstream portions as well as on its front end,
 - b. a generally rectangular drawer disposed within said casing and adapted for sliding insertion and removal through said casing's open front end, said drawer being open on its upstream and downstream portion as well as on at least its front end portion,
 - c. a high efficiency filter body disposed in said drawer for filtering air passing through the assembly from the upstream to the downstream portions thereof, said filter body being pleated and expandible from side to side of said drawer and having front and rear end edges,
 - d. closure means for said open ends of said casing and drawer,
 - e. and means to prevent leakage of unfiltered air through said assembly.
2. The filter assembly of claim 1 wherein said leakage preventing means comprises:
 - a. first sealing means to seal the upstream portions of said drawer and casing together when said drawer is in its innermost position,
 - b. second sealing means to prevent by-passing of unfiltered air around the front and rear end edges of said filter body within said drawer,
 - c. and third sealing means to prevent by-passing of unfiltered air between the respective ends of said drawer and casing.
3. The filter assembly of claim 1 in which said leakage preventing means includes sealing means to seal the upstream portions of said drawer and casing together when said drawer is in its innermost position, said sealing means comprising:
 - a. generally co-extensive inwardly extending peripheral flanges on the upstream portion of said casing and said drawer,
 - b. a peripheral gasket disposed on at least one of said flanges,
 - c. and cooperative camming means between said casing and said drawer to cause said drawer to shift upstream only at the innermost portion of rearward sliding travel of said drawer to seal said flanges and gasket together.
4. The filter assembly of claim 3 in which said cooperative camming means comprises:
 - a. front and rear transversely extending support members disposed respectively adjacent the open front end of said casing and the rear end thereof, said support members being disposed in the downstream portion,
 - b. and downstream facing cam means disposed on the front and rear end portions of said drawer with said cam means being disposed to ride onto said support members when said drawer reaches its innermost portion of sliding travel.
5. The filter assembly of claim 4 in which said downstream facing cam means comprises:
 - a. projection means on the inner drawer end,
 - b. and a beveled surface on the edge of the said front drawer door.

6. The filter assembly of claim 1:
 - a. in which said drawer is open on both its front and rear end portions,
 - b. and said closure means comprises:
 1. a cap-like cover removably secured to said casing's open front end,
 2. and a cap-like door removably secured to each of said drawer's front and rear open end portions.
7. The filter assembly of claim 6 wherein said leakage preventing means comprises:
 - a. first sealing means to seal the upstream portions of said drawer and casing together when said drawer is in its innermost position, said first sealing means comprising:
 1. generally co-extensive inwardly extending peripheral flanges on the upstream portions of said casing and said drawer,
 2. a peripheral gasket disposed on at least one of said flanges,
 3. and cooperative camming means between said casing and said drawer to cause said drawer to shift upstream only at the innermost portion of rearward sliding travel of said drawer to seal said flanges and gasket together,
 - b. second sealing means to prevent by-passing of unfiltered air around the front and rear end edges of said filter body within said drawer, said second sealing means comprising:
 1. a planular blanket of resilient filter material disposed within both said cap-like drawer doors and extending inwardly therefrom,
 2. the end edges of said filter body being embedded into said blankets,
 - c. and third sealing means to prevent by-passing of unfiltered air between the respective ends of said drawer and casing, said third sealing means comprising:
 1. a first planular blanket of resilient filter material disposed at the rear end of said casing and with the rear end of said drawer embedded thereinto,
 2. and a second planular blanket of resilient filter material disposed within said front casing cover and with the front end of said drawer embedded thereinto,
 - d. all of said blankets having a greater resistance to air flow than said filter body.
8. The filter assembly of claim 6 in which said leakage preventing means includes sealing means to prevent by-passing of unfiltered air around the front and rear end edges of said filter body, said sealing means comprising:
 - a. a planular blanket of resilient material disposed within both said cap-like drawer doors and extending inwardly therefrom,
 - b. the end edges of said filter body being embedded into said blankets.
9. The filter assembly of claim 8 in which said blankets are of filter material having a greater resistance to air flow than said filter body.
10. The filter assembly of claim 1 in which said leakage preventing means includes sealing means to prevent by-passing of unfiltered air between the respective ends of said drawer and casing, said sealing means comprising:

- a. a first planular blanket of resilient material disposed at the rear end of said casing and with the rear end of said drawer embedded therein,
- b. and a second planular blanket of resilient material disposed within said front casing cover and with the front end of said drawer embedded therein.

11. The filter assembly of claim 10 in which said blankets are of filter material having a greater resistance to air flow than said filter body.

12. The filter assembly of claim 1:

- a. wherein said pleated filter body is self supporting and, when expanded, forms a plurality of equally spaced downstream facing generally V-shaped pockets,
- b. which includes a plurality of elongated comb-like members with said members having a plurality of fingers corresponding in spacing to said V-shaped pockets of the expanded filter body,
- c. and means disposed on said filter body to limit the expansion thereof during installation of said body in said drawer so that the entrances to said pockets will coincide with the positions of said fingers.

13. The filter assembly of claim 12 in which said expansion limiting means comprises a narrow flexible strip of flimsy non self-supporting material extending transversely across each downstream side of said filter body and secured to the latter so that a plurality of its said pockets, when fully expanded, are equally spaced.

14. The filter assembly of claim 12 which includes: means to support each said comb-like member so that the fingers thereof are disposed within said pockets for supporting the pocket walls against collapse due to the air pressure.

15. The filter assembly of claim 1:

- a. wherein said pleated filter body forms a plurality of spaced upstream and downstream facing generally V-shaped pockets,
- b. and which includes means disposed within each outermost downstream facing filter body pocket to support the outermost wall of said filter body pocket during expansion of said body.

16. The filter assembly of claim 15 wherein each said wall supporting means comprises a reinforcing tongue secured to each end portion of the outermost wall of said filter body pocket.

17. The filter assembly of claim 15 wherein each said wall supporting means comprises a frame-like element having:

- a. a reinforcing strip disposed along the downstream edge portion of each outermost wall of said filter body,
- b. and a tongue extending upstream from each end portion of said strip within the said outermost downstream facing filter body pocket.

18. The filter assembly of claim 1 which includes:

- a. a pair of oppositely disposed elongated downstream extending lips disposed on said drawer,
- b. a shallow upstream facing envelope-like pocket formed in the downstream edge portion of each outermost filter body pleat wall,
- c. each said pocket being supportingly disposed over the respective lip,
- d. a frame-like element disposed to support each said outermost filter body pleat wall during expansion of said body,

e. and means to secure the ends of said envelope-like pocket and said frame-like element together.

19. The filter assembly of claim 1 which includes:

- a. a pair of oppositely disposed downstream extending elongated lips disposed on said drawer,
- b. a shallow upstream facing envelope-like pocket formed in the downstream edge portion of each outermost filter body pleat wall,
- c. each said pocket being supportingly disposed over the respective lip,
- d. and means to sealingly close each said pocket onto its respective lip.

20. The filter assembly of claim 19:

- a. wherein said pleated filter body forms a plurality of spaced downstream facing generally V-shaped pockets,
- b. which includes a plurality of elongated comb-like members with each member having a plurality of spaced fingers disposed within said V-shaped pockets for supporting the pocket walls against collapse due to the air pressure differential within the assembly,
- c. and wherein said closing means for said envelope-like pockets also forms means for supporting said comb-like members.

21. The filter assembly of claim 20:

- a. in which each said comb-like member includes:
 - 1. generally rectangular end extensions,
 - 2. and a transverse lug on each said extension,
 - 3. each said lug having an indented groove on its inner upstream surface portion;
- b. and wherein each said combined closing and supporting means comprises:
 - 1. an elongated channel-like retainer having upstream facing legs fit over the respective said envelope-like pocket and lip,
 - 2. and a pair of spaced downstream extending outer and inner elongated flanges,
 - 3. said outer flange having a generally rectangular slot which receives a said extension so that said cam-like member is stabilized,
 - 4. said inner flange being inclined toward said outer flange so that said lug snaps into the space between said flanges whereby said inner flange engages said groove.

22. The filter assembly of claim 20:

- a. in which each said comb-like member includes a pair of spaced inner and outer parallel rods disposed along the base of said fingers, and with the outer rod being longer than the adjacent inwardly disposed rod,
- b. and wherein each said combined closing and supporting means comprises:
 - 1. an elongated channel-like retainer having upstream facing legs fit over the respective said envelope-like pocket and lip,
 - 2. a pair of elongated flanges extending downstream from said retainer with the innermost flange being narrower than the outermost flange,
 - 3. first slot means disposed in said innermost flange and receiving the end of said inner rod,
 - 4. and second slot means disposed in said outermost flange and receiving the end of said outer rod by a snap fit.
 - 5. the central portion of said second slot means being enlarged to receive the said outermost rod in the installed position of said comb-like member.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,789,589 Dated February 5, 1974

Inventor(s) John J. Delany and John M. Liebmann

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 57, after "stream" insert "casing"

Signed and sealed this 30th day of July 1974.

(SEAL)

Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents