A pocket filter of V-shaped cross-section has, to define the pocket opening, two end plates and two side members, each of the side members having outwardly bent outer edges as a connecting piece for assembly with adjacent pocket filters; V-shaped clamps fit within the pockets to hold a strip of filter material in place.
POCKET FILTER FOR AIR AND GAS PURIFICATION

My present invention relates to a pocket filter for air and gas purification. A known pocket filter utilizes large-surface-area multiple-sack pockets arranged in a reception housing of suitable shape. The manufacture of these sack pockets, which one also closed at the sides, and the joining of several sack pockets by sewing or gluing the outer edges to adjacent pockets is very expensive and accordingly uneconomical, since the air-filter sacks are mostly throw-away articles.

To some extent there has come into use, for pocket filters of this type, a dry filter material in strip form. In these devices, zig-zag wire grids are welded between upright sheet walls to receive a V-shape strip material, consisting of glass wool, cotton wool or textile thread, held in place by resilient removable frames. With these pocket filters there is the disadvantage that the filter material cannot be satisfactorily sealed against the sheet wall since, on welding in the zig-zag wire grid, the sheet walls are subject to deformation. If several pocket filters of this type arranged one above the other should be held in the form-built-in filter walls satisfactory sealing between individual, upright adjacent sheets of the housing is not obtainable at a high rate of dust removal. These known filters are accordingly usable only for coarse filtering; however, the cost of equipment in relation to the degree of dust removal is very high.

Other known pocket filters comprise individual housings in which lateral sheets, i.e. end plates, bracket V-shaped, grid-like support members wherein the strip-shaped filter medium is placed. Clamp frames which may be hinged spread apart are provided for holding the filter material, these clamp frames being inserted in the plug-in opening of the housing. In this known construction the housings have a surrounding rim at the air-inlet side. When a number of individual housings are assembled to form a built-in unit, again the problem arises of reliable sealing against outside air, as regards both the individual housings in relation to each other and the filter medium in relation to the housing. The sealing necessary for fine filtering is very expensive and absolutely satisfactory seals can be obtained only at a great outlay of material and work. Accordingly, these known pocket filters also are used mainly for coarse filtering unless additional sealing measures are carried out.

The present invention has for its object to provide a pocket filter which affords a good seal between the individual housings and between the filter medium and the individual housings. It should be suitable for selective installation in filter ducting or in brickwork openings.

According to one aspect of the invention, I provide a plurality of juxtaposed filtering units each comprising at least one housing with two end plates, a support grid of generally V-shaped cross-section bracketed by the two end plates to define a pair of apertured, rearwardly converging walls of a cell or pocket, and two parallel side members also extending between the end plates to define a pair of longitudinal edges for the rectangular insertion end of the pocket; each side member has an outer edge bent forward to constitute a connecting member or rib for attachment to a similar adjacent housing.

Usually, each end plate is of a V-shape conforming to the cross-section of the support grid and has inwardly bent edge portions to which the support grid is secured. At least one end plate, and preferably both, may be bent back out of its plane at right angles to provide a cross-wall coplanar with the adjoining side members defining therewith a rectangular peripheral flange which frames the insertion end of the pocket.

A preferred special configuration of side member, designed to provide both easy interconnection between housings and good sealing within the housing, is a strip bent along three longitudinal fold lines, i.e. (a) orthogonally forwardly at a first line near one edge of the insertion end to define the connecting rib; (b) backwardly along a second, intermediate, line through 360° to form a doubled-over portion; and (c) outwardly through less than 90° along a third line from the back of this doubled-over portion so as to extend backwardly, at an acute angle to that portion the inwardly projecting doubled-over portion constitutes a shoulder for retaining an internal filter clamp within the housing, whereas the backwardly extending portion forms a sealing strip to which the support grid is connected. Of course, this backwardly extending portion will conveniently be so oriented as to be in line with the arms of the V-shaped grid defining the apertured walls of the housing.

Usually each side member extends beyond the end plate, by a distance corresponding to the height of the cross-wall, and is recessed beyond the end plate by removing the doubled-over portion to accommodate the cross-wall, the side members and cross-wall being joined together by welding to form the peripheral flange.

For ease in fabrication the edges of the support grid may be bent over to form hook-like flanges, or cuffs complementary cuffs being provided on the side members and/or the end plates to fasten the support grid. Such cuffs may of course be located on the end of the backwardly extending portion of the side member, and/or on the bottom of the inwardly bent portions of the end plate.

If desired, the side members may span two or more like housings of a filtering unit separated by internal partitions which will not normally possess bent-cover edges and which can be lodged face-to-face in slits of suitable thickness in these side members. When the side member has the preferred folded-strip configuration referred to above, the slits may correspond in depth to the width of the remaining doubled-over portion.

According to a further aspect of the invention, the clamp consists of two similar, generally planar wire frames interconnected at the free edges of the V by a spring member and at the apex of the V by welding or hinging.

To facilitate insertion and removal of the clamp, its free edges, only have projections extending from the filter pocket.

The spring may be a leaf spring; by using a generally inwardly convex leaf spring provided with outwardly projecting bent portions, which can be manually compressed to facilitate insertion and removal of the clamp, it is possible to dispense with projections on the frame for this purpose. The same advantage applies to the use of a generally outwardly convex wound wire spring, whose limbs can be pressed inward manually.
According a further important aspect of the invention provide a mounting unit wherein a plurality of filter unit as described above lie side-by-side with their connecting members joined together. Such a frame may have a rectangular central aperture, surrounded by rim internally projecting web, in which the housings can be mounted and fixedly attached by their peripheral flanges to the web.

Such mounting units are preferably assembled first by welding together the individual housings and subsequently by wetting the resulting assembly to the mounting frame; in each instance the welding is best carried out as spot-welding using point welding paste.

A filter assembly according to my invention may consist of two or more of such mounting units of generally rectangular shape mounted side-by-side.

A mounting unit can be disposed in an air duct and be provided with a sealing member (endless rubber tube, or plastic caulking compound) in the peripheral groove; additional sealing devices can be provided if necessary.

The accompanying drawing shows embodiments of the invention by way of example in the drawing:

FIG. 1 is a perspective exploded representation of a mounting unit according to my invention;

FIG. 2 is an illustration similar to FIG. 1 showing the filter material and an associated clamp;

FIG. 3 is a fragmentary perspective of two individual housings joined together;

FIGS. 4 to 6 are cross-sections of joined housings with differently constructed spring members;

FIG. 7 is a fragmentary perspective view of a modified embodiment of a mounting unit; and

FIG. 8 is a similar view of two mounting units set in a masonry opening.

The Figures show a housing assembly 1 carried in a mounting frame 3 and constituting it a mounting unit, the assembly 1 consisting of seven individual housings 2 arranged alongside. Each individual housing 2 has a support member 4 formed of a wire grid. FIG. 2 shows a filter mat or strip 5, bent in a V-shape, which is inserted in the individual housing 2 and held by a clamp 6. As can be seen in particular from FIGS. 1, 3 and 4 to 6, the individual housing 2 consists of an upper and a lower end plate 7 between which the support grid 4 is mounted. The insertion opening of the housing 2 is surrounded by a peripheral flange 8 including two longitudinal side members 9 which have upright forwardly bent portions or ribs 10. The ribs 10 of two adjacent side members 9 are sealingly interconnected by step-point welding. As FIGS. 4 to 6 show, the side member 9 has a blocking strip or abutment means formed by a fold or doubled-over portion 11, projection into the insertion opening, joined to an inwardly bent resilient sealing strip 12 to which the support grid 4 is attached. An outwardly bent transverse edge of each end plate 7 forms a cross-wall 13 constituting one of the minor sides of the rectangular peripheral flange 8. On assembly of the individual housing from the side members and end plates, the cross-walls 13 are placed in cutouts 14 of the longitudinal side members coplanar therewith, the depth of each cutout being equal to the width of the folded strip portion 11.

A continuous housing edge is formed by the completed flange 8 upon welding the cross-walls 13 to the side members 9.

Cuffs flanging 15 are provided on the edge of the sealing strip 12 for receiving the support grid 4. The free edges of the end plates 7 have orthogonally bent back portions 16, which are also provided with cuffs 17. As FIG. 1 shows, the support grids 4 have complementary inwardly directed cuffs 18 at their free edges. For fixing the support grid 4 to the housing, the cuffs 19 of the support grid 4 are engaged with the cuffs 15, 17 and secured thereto by a flanging tool. Of course, the support grids 4 may for instance also be connected to the individual housing 2 by spot welding or in some other manner.

A mounting frame 3 has a peripheral edge 19 and an inwardly projecting web 20 which forms an opening 21 corresponding to the total cross-section of the housing assembly 1. As FIGS. 1 and 2 show, the mounting frame 3 is pushed from the rear over the assembly 1 so that the cross-walls 13 come to rest on the web 20. They are then connected to the web by spot point welding. The same thing takes place with the outermost side members 9 of the assembly 1 so that an assembly 1 is obtained which is sealed off completely against air leakage and seated in the mounting frame 3.

As FIG. 2 shows, a mat of filter material 5, folded in a V-shape, is placed in each individual housing followed by clamp 6 which is pushed into the opening. The clamp 6 is a flexible structure of generally trapezoidal cross-section, converging rearwardly like the plates 7 and the grid 4, and consists of two individual frames 22, provided with reinforcing wires 23. The frames 22 consist of a suitably thick wire and at the apex end of the V form a pair of rear legs 24 integral with transverse legs 25 and front legs 26. Projections 27, through which the two individual frames 22 are welded or held together by eyes not shown, are offset from the legs 24. Between the legs 26 lies a resilient spring member 28. To insert the clamp 6, the free front legs 26 are pressed together and the clamp 6 is thrust into the opening of the housing. As FIGS. 4 to 6 show, when this takes place the legs 26 of the clamp 6 press outwardly against the sealing strip 12 of the housing. The sealing strips 11 prevent the clamp 6 from undergoing any unintended change of position, so that satisfactory sealing of the filter mat 5 into the individual housing 2 is maintained.

FIG. 5 shows a spring member in the form of an inwardly curved leaf spring 28 which has eye-like outwardly projecting bent-back portions 29, its ends being fixed to the clamp legs 26.

FIG. 4 shows a modified embodiment, in which legs 26 of clamp 6 are bent outwardly at 30 to facilitate compression of the clamp frame and wherein the spring member is an outwardly curved leaf spring 31 fastened to the legs 26. FIG. 6 shows a further modification in which an outwardly curved wire spring 32, having two turns and leg portions 33 which can be gripped for the compression of the clamp 6, is fixed to the legs 26 as the resilient clamp spreader.

The periphery 19 of the mounting frame 3 has a peripheral stiffening groove 34 in which, as FIG. 8 shows, a seal 35 is placed when two or more mounting frames 3 are connected to one another by screws passing through bores 36.

FIG. 7 shows a modified embodiment in which there are continuous side members 37 extending over the height of several individual housings 2 forming part of a
plurality of juxtaposed filtering units. The outermost end plates 7 of the stack of individual housings 2 are each equipped in the aforesaid way with the cross-wall 13, but the intermediate partitions 39 parallel to and coextensive with these end plates do not possess such cross-walls 13. Members 37 have notches 38 extending over the width of the doubled-over blocking strip 11 and having a depth amounting to double the wall thickness of the end plates 39 which can therefore be held in pairs in the notches 38, and welded and sealed to each other and (at the notches 38) to the longitudinal side members 37. When this assembly is mounted in the frame 3, it is necessary to weld the outermost side members 37 and the outermost cross-walls 13 to the web 20.

When an assembly 1 according to the invention, carried in the mounting frame 3, is to be mounted in a duct housing, a surrounding sealing lip is provided at the front edge of the rim 19 of the frame 3.

I claim:
1. A filter comprising:
   a plurality of juxtaposed filtering units each including at least one housing with an insertion opening framed by a rectangular planar flange, two parallel end plates extending rearwardly from the minor sides of the rectangular flange and terminating in the plane of the flange in two outwardly bent edges defining said minor sides, and a pair of apertured sidewalls extending rearwardly from the major sides of the rectangular flange to define a unitary grid in engagement with said end plates, the major sides of said rectangular flange being defined by a pair of parallel strips coplanar with said outwardly bent edges, said strips being orthogonally bent forwardly from said major sides beyond said sidewalls to form a pair of ribs transverse to said end plates, said ribs being bonded in fluidtight manner to corresponding neighboring ribs of adjacent housings;
   a sheet of filter material in each housing overlying said sidewalls thereof;
   clamping means in each housing removably retaining said sheet of filter material therein in contact with said sidewalls, said strips having portions projecting inwardly past said sidewalls to form a pair of shoulders holding said clamping means in position within each housing; and
   a mounting frame embracing said housings in fluidtight contact with at least said outwardly bent edges of said rectangular flange of each housing, the sidewalls of adjacent housings being spaced apart to define a fluid passage.
2. A filter assembly as defined in claim 1 wherein said mounting frame is provided with peripherally spaced holes for fastening same to a substantially identical mounting frame of an adjoining assembly.
3. A filter assembly as defined in claim 1 wherein said strips extend beyond said perpendicular planes whereas said inwardly projecting portions thereof terminate at said planes, thereby forming cutouts accommodating respective corners of said end plates together with parts of said outwardly bent edges complementary to said cutouts.
4. A filter assembly as defined in claim 1 wherein said mounting frame has an inner peripheral web of rectangular configuration abutting said outwardly bent edges in bonded relationship therewith.
5. A filter assembly as defined in claim 1 wherein said strips are folded back upon themselves along said projecting portions and are thence extended rearwardly in line with said sidewalls and in positive engagement therewith.
6. A filter assembly as defined in claim 5 wherein said strips are provided at their rear edges with cuffs hooking onto complementary cuffs on said sidewalls.
7. A filter assembly as defined in claim 1 wherein each of said units comprises a plurality of stacked housings bracketed by said end plates, said strips being common to all the housings of a unit.
8. A filter assembly as defined in claim 7 wherein said stacked housings are separated by partitions parallel to said end plates and substantially coextensive therewith.
9. A filter assembly as defined in claim 8 wherein said strips are provided with slits in said inwardly projecting portions receiving said partitions.
10. A filter assembly as defined in claim 9 wherein said partitions are duplicated on adjoining housings of a unit and are jointly inserted into said slits.
11. A filter assembly as defined in claim 1 wherein said clamping means comprises a wire structure with separable halves and resilient means urging said halves apart toward said sidewalls.
12. A filter assembly as defined in claim 11 wherein said halves have front legs located behind said shoulders, said resilient means being looped forwardly between said shoulders for manipulation to extract said structure from the housing.
13. A filter assembly as defined in claim 12 wherein said front legs are provided with gripping formations extending forwardly between said shoulders.