

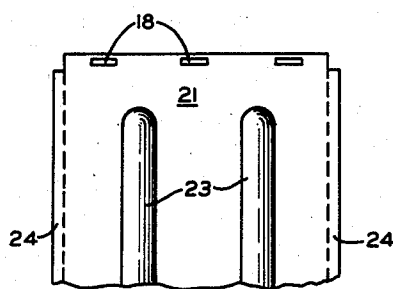
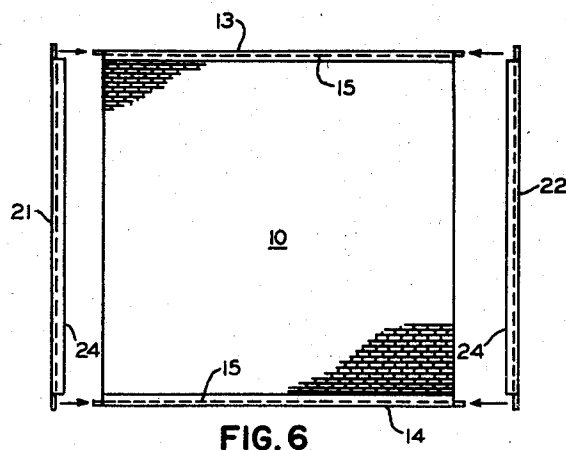
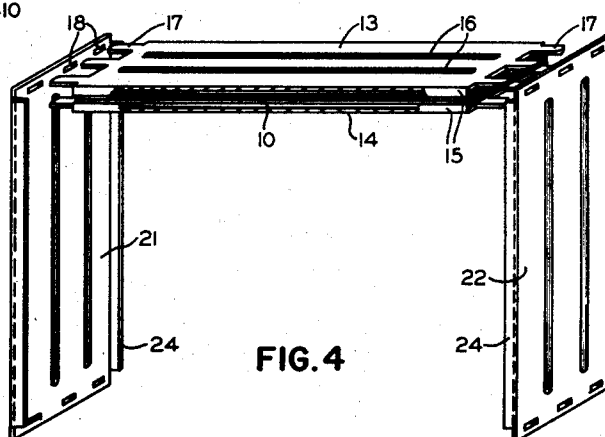
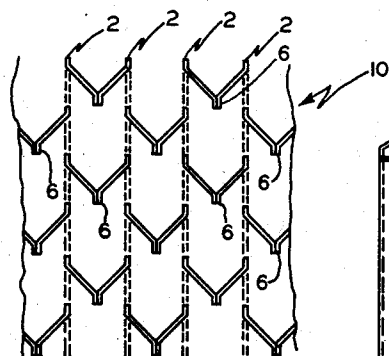
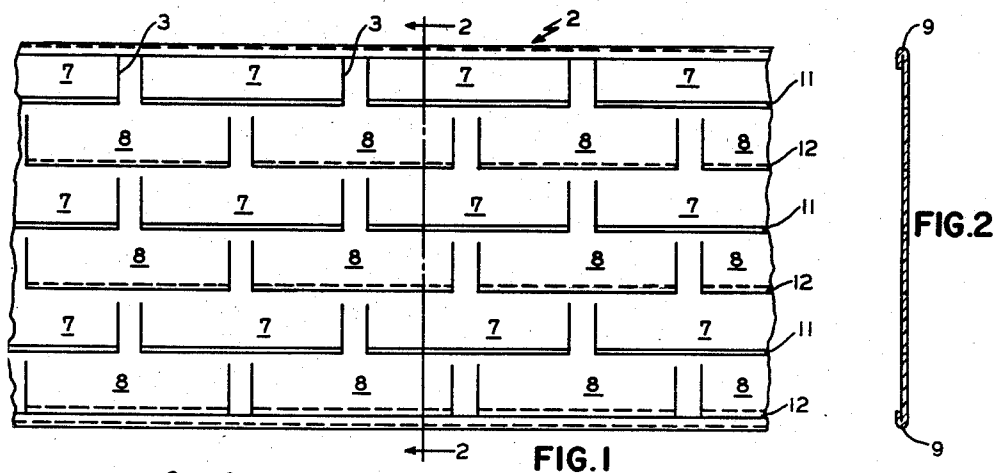
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FILTER APPARATUS

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FILTER APPARATUS

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The present invention relates to a new and improved type of filter for the removal of solid particles from fluid streams and more particularly to a new and improved type of filter which presents a filter maze to the fluid stream to be filtered.

In order to filter suspended particles efficiently from a fluid stream such as air, it has been found desirable that a filter arrangement be used which provides a filter medium presenting a large surface area to such fluid stream, but which medium, at the same time, is light in weight, high in flow properties and occupies a relatively small space. The present invention provides a filter arrangement which includes a medium having these desirable features and which can be made from readily available materials in a straightforward and inexpensive manner. In addition, the present invention provides a filter arrangement which can be shipped to a user in collapsed condition so as to occupy a minimum of shipping space and which can be readily assembled by the user in a matter of minutes with the performance of a few, straightforward assembling operations.

Various other features of the present invention will become obvious to one skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides a filter structure comprising at least two sheets of material in faced relationship, each of the sheets of material including a plurality of spaced tab portions secured thereto so that each tab portion has a free end pivotally movable from the sheet to which the tab portion is secured, each of the tab portions of one sheet substantially facing a corresponding tab portion of a facing sheet to form a plurality of pairs of facing tab portions, means to join the free ends of each of the pairs of facing tab portions together, and means to hold the facing sheets of material in spaced relationship to form a plurality of spaced bridges by the joined pairs of tab portions and provide a filter maze between said faced sheets of material.

It is to be understood that various changes can be made by one skilled in the art in the arrangement, form and construction of the structure disclosed hereinafter without departing from the scope or spirit of this invention.

Referring to the drawings which disclose one advantageous embodiment of the present invention:

Figure 1 is a plan view of one sheet of the thin, lightweight material which forms the inventive filter medium, disclosing a plurality of slits therein to form sets of tab portions;

Figure 2 is a side view of the sheet of Figure 1, taken in a plane passing through line 2—2 of Figure 1 and disclosing the sheet as having its edges folded for strength purposes;

Figure 3 is a cross section of a portion of a number of sheets which form the expanded filter medium, disclosing corresponding tab portion of faced sheets joined together to form a plurality of spaced bridges;

Figure 4 is an exploded perspective view of the filter assembly showing two peripheral frame members attached

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in faced relation to the end sheets of the stacked sheets of material which form the filter medium, the medium being in sandwiched or collapsed condition and interposed between two other peripheral frame members which can be connected to the first two members to form the overall structure;

Figure 5 is an enlarged plan view of a portion of one of the frame members of Figure 4;

Figure 6 is an exploded plan view of the filter assembly of Figure 4 with the filter medium in expanded condition for filtering purposes and the peripheral frame members ready to be connected to each other to form the assembled filter unit.

Referring to Figure 1 of the drawings, a sheet 2 which forms part of the filter medium is disclosed. The sheet can be made from any one of a number of types of thin, lightweight but substantial materials such as an aluminum foil or a treated filter paper. Sheet 2 is provided with a plurality of slits 3 which can be cut into the sheet by any one of a number of conventional slitting machines. In the advantageous embodiment disclosed in Figure 1, slits 3 are U-shaped and are arranged to provide a plurality of spaced rectangular tab portions integrally secured to sheet 2, each tab portion having a free end 6 pivotally movable from sheet 2 to which it is secured (Figure 3). It is to be noted in Figure 1, that the tab portions are so arranged as to provide on sheet 2 tab portion sets 7 and 8, the sets 7 and 8 including spaced rows of tab portions with the rows of set 7 alternating with the rows of set 8 and each of the tab portions in a row of set 7 being offset from the tab portions in an adjacent row of tab portions of set 8. In this connection, it is to be understood that various arrangements and shapes of tab portions can be provided in the stacked sheets of material in accordance with the particular results which might be desired. As can be seen in Figure 2, each of sheets 2 has its edges folded over as at 9 in order to increase the strength of the sheet when it is assembled as a part of the filter medium 10 (Figure 3).

Again referring to Figure 1, it can be seen that the tab portions of sets 7 and 8 are each provided with an adhesive strip 11 and 12 respectively on the free end 6 thereof. In this connection, it is to be noted that in the embodiment disclosed the adhesive strips 11 on the set of tab portions 7 are applied to the faces of the tab portions which are included in that side of sheet material 2 opposite to the side of the sheet material which includes the faces on which adhesive strips 12 are applied to the set of tab portions 8. Accordingly, when sheets of material 2 are stacked in face-to-face relationship to form filter medium 10 (Figure 3) with corresponding tab portions of corresponding sets also being in faced relationship to form pairs of facing tab portions, such pairs of facing tab portions can be readily glued together.

Referring to Figure 3 of the drawings, it can be seen that, when the sheets of material 2 are so glued, the joined pairs of tab portions serve to present a plurality of spaced bridges when the sheets are held in spaced relationship. Thus, a filter maze is provided by these joined tab portions and by the apertures which are created in the sheets of material when the tab portions are glued together and the free ends moved away from the sides of the sheet material with which they are integral.

Referring to Figure 4, the filter medium 10 is disclosed in collapsed condition, it being understood that the medium includes stacked filter sheets 2 having set of tab portions 7 and 8 arranged and joined together as described above. Medium 10 is sandwiched between peripheral frame members 13 and 14, which members can be made from any one of a number of thin firm, light weight materials including metals or woods. The member 13 faces the end sheet of one end of filter medium 10 and mem-

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ber 14 faces the end sheet at the other end of filter medium 10. Advantageously, the end sheets can be fastened to their respective frame members by gluing, although it is to be understood that other types of fastening arrangements can be provided if so desired. Frame members 13 and 14, which are substantially identical in form, size and shape, are provided with flange portions 15 to assure retention of filter medium 10 when the overall unit is in assembled position and these frame members can be embossed so as to have raised ribs 16 to increase the strength of the members. In addition, either end of each frame member is provided with a plurality of aligned tongues 17, spaced from each other and arranged to engage in aligned and spaced slots 18 of peripheral frame members 21 and 22. The members 21 and 22, like members 13 and 14 are also substantially identical to each other in size, shape and form, each being embossed so as to have spaced ribs 23 for strength and each having at its opposite ends the aforementioned aligned and spaced slots 18. As can be seen in Figures 4 and 5, each of members 21 and 22 is also provided with flange portions 24 which serve to insure further the retention of the filter medium 10 when the overall unit is in assembled position.

From the foregoing description it will be obvious that the overall filter assembly can be shipped to a user in a collapsed state (Figure 4) with filter medium 10 in collapsed state between members 13 and 14 and accompanied by members 21 and 22. Upon arrival at the destination, it is only necessary for the user to spread frame members 13 and 14 apart to expand the filter medium 10. Then the user can insert frame members 21 and 22 between the spaced frame members 13 and 14 with tongues 17 of members 13 and 14 engaging in slots 18 of members 21 and 22. By merely bending the tongues through a 90° angle, the frame members are firmly fastened together to provide a complete filter assembly ready for immediate use.

The invention claimed is:

1. A collapsible filter medium comprising at least two sheets of material in faced relationship, each of said sheets of material including a plurality of spaced tab portions extending along the length and breadth thereof and pivotally secured thereto so that each tab portion has a free end movable from the sheet to which said tab portion is secured, each of said tab portions of one sheet substantially facing a corresponding tab portion of a facing sheet to form a plurality of pairs of facing tab portions, and means to join the free ends of each of said pairs of facing tab portions together so that upon a spacing of said facing sheets of material a plurality of spaced bridges are formed by the joined pairs of tab portions to present a filter maze between said faced sheets of material.

2. A collapsible filter medium comprising at least two sheets of material in faced relationship, each of said sheets of material including a plurality of spaced slits therein extending along the length and breadth thereof to form a plurality of spaced tab portions integrally and pivotally secured to said sheet so that each tab portion has a free end movable from the sheet to which said tab portion is secured, each of said tab portions of one sheet substantially facing a corresponding tab portion of said facing sheet to form a plurality of pairs of facing tab portions, and means to join the free ends of each of said pairs of facing tab portions together so that upon spacing said facing sheets of material a plurality of spaced bridges are formed by the joined pairs of tab portions to present a filter maze between said faced sheets of material.

3. A collapsible filter medium comprising a plurality of sheets of material in faced substantially parallel relationship, each of said sheets of material including a plurality of spaced slits therein to form sets of spaced tab portions extending along the length and breadth thereof, said tab portions being integrally and pivotally secured to said sheet so that each tab portion has a free end mov-

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able from the sheet to which said tab portion is secured, each of said tab portions of one set of tab portions on a first sheet of material substantially facing a corresponding tab portion of a corresponding set of tab portions on a second sheet of material which second sheet faces said first sheet on one side of said first sheet and each of said tab portions of another set of tab portions on said first sheet of material substantially facing a corresponding tab portion of a corresponding set of tab portions on a third sheet of material which third sheet faces said first sheet on the other side of said first sheet, and means to join the free ends of said facing tab portions of said corresponding sets of tab portions so that upon a spacing of said facing sheets of material, a plurality of spaced bridges are formed by the joined tab portions to present a filter maze between said faced sheets of material.

4. A collapsible filter medium comprising at least two sheets of material in faced relationship, each of said sheets of material including a plurality of spaced tab portions extending along the length and breadth thereof and pivotally secured thereto so that each tab portion has a free end movable from the sheet to which said tab portion is secured, each of said tab portions of one sheet substantially facing a corresponding tab portion of a facing sheet to form a plurality of pairs of facing tab portions, and an adhesive coating applied along the free ends of said pairs of facing tab portions to join the free ends of said pairs of facing tab portions together so that upon a spacing of said facing sheets of material a plurality of spaced bridges are formed by the joined pairs of tab portions to present a filter maze between said faced sheets of material.

5. A collapsible filter medium comprising at least two sheets of material in faced relationship, each of said sheets of material including a plurality of spaced U-shaped slits therein extending along the length and breadth thereof to form spaced substantially rectangular tab portions, each tab portion having one side integrally secured to said sheet so that each tab portion has a free side opposite said integral side pivotally movable from the sheet to which said tab portion is secured, each of said tab portions of one sheet substantially facing a corresponding tab portion of said facing sheet to form a plurality of pairs of facing tab portions, and an adhesive coating applied along the free ends of said pairs of facing tab portions to join the free ends of said pairs of facing tab portions together so that upon a spacing of said facing sheets of material a plurality of spaced bridges are formed by the joined pairs of tab portions to present a filter maze between said faced sheets of material.

6. A collapsible filter medium comprising a plurality of sheets of material in faced substantially parallel relationship, each of said sheets of material including a plurality of spaced slits therein extending along the length and breadth thereof to form sets of spaced tab portions integrally and pivotally secured to said sheet so that each tab portion has a free end movable from the sheet to which said tab portion is secured, said sets of spaced tab portions including spaced rows of tab portions with the rows of one set alternating with the rows of another set and each of the tab portions in one row being offset from each of the tab portions in an adjacent row, each of said tab portions of one set of tab portions on a first sheet of material facing a corresponding set of tab portions on a second sheet of material which second sheet faces said first sheet on one side of said first sheet and each of said tab portions of another set of tab portions on said first sheet of material facing a corresponding tab portion of a corresponding set of tab portions on a third sheet of material which third sheet faces said first sheet on the other side of said first sheet, and means to join the free ends of said facing tab portions of said corresponding sets so that upon a spacing of said facing sheets of material, a plurality of spaced bridges are formed by the joined tab por-

tions to present a filter maze between said faced sheets of material.

7. The filter medium of claim 6, said slits in said sheets of material being of U-shape to form sets of rectangular-shaped tab portions, each having one end integral with its sheet and a free end opposite thereto pivotally movable from said sheet.

8. The filter medium of claim 7, said free ends of said tab portions having an adhesive coating applied therealong to join said free ends of facing tab portions together.

9. A filter structure comprising at least two sheets of material in faced relationship, each of said sheets of material including a plurality of spaced tab portions extending along the length and breadth thereof and pivotally secured thereto so that each tab portion has a free end pivotally movable from the sheet to which said tab portion is secured, each of said tab portions of one sheet substantially facing a corresponding tab portion of a facing sheet to form a plurality of pairs of facing tab portions, means to join the free ends of each of said pairs of facing tab portions together, and means to hold said facing sheets of material in spaced relationship to form a plurality of spaced bridges by the joined pairs of tab portions to present a filter maze between said faced spaced sheets of material.

10. A filter structure comprising a plurality of sheets of material in stacked, faced relationship, each of said sheets of material including a plurality of spaced tab portions extending along the length and breadth thereof and pivotally secured thereto so that each tab portion has a free end movable from the sheet to which said tab portion is secured, each of said tab portions of one sheet substantially facing a corresponding tab portion of a facing sheet to form a plurality of pairs of facing tab portions, frame members connected to the end sheets of said stacked sheets of material, and spacing members to hold said frame members in spaced relationship and thus hold said faced sheets of material in spaced relationship to form a plurality of spaced bridges by the joined pairs of tab portions which present a filter maze between said faced spaced sheets of material.

11. A filter structure comprising a plurality of sheets of material in stacked, faced relationship, each of said sheets of material including a plurality of spaced tab portions extending along the length and breadth thereof and pivotally secured thereto so that each tab portion has a free end movable from the sheet to which said tab portion is secured, each of said tab portions of one sheet substantially facing a corresponding tab portion of a facing sheet to form a plurality of pairs of facing tab portions, first frame members connected to the end sheets of said stacked

sheets of material, and second frame members intermediate said first frame members and removably connected thereto to hold said first frame members in spaced relationship and thus hold said faced sheets of material in spaced relationship to form a plurality of spaced bridges by the joined pairs of tab portions which present a filter maze between said spaced facing sheets of material.

12. The filter structure of claim 11, said first and second frame members having a tongue and slot arrangement integral therewith to effect the removable connection thereof.

13. A filter structure comprising a plurality of sheets of material in faced substantially parallel relationship, each of said sheets of material including a plurality of spaced U-shaped slits therein extending along the length and breadth thereof to form sets of rectangular spaced tab portions pivotally secured to said sheet with each tab portion having a free end movable from the sheet to which it is secured, said sets of spaced tab portion in each sheet of material including spaced rows of tab portions with the rows of one set alternating with the rows of another set and each of the tab portions in one row being offset from each of the tab portions in an adjacent row, each of said tab portions of one set of tab portions on a first sheet of material facing a corresponding tab portion of a corresponding set of tab portions on a second sheet of material which second sheets faces said first sheet on one side of said first sheet and each of said tab portions of another set of tab portions on said first sheet of material facing a corresponding tab portion of a corresponding set of tab portions on a third sheet of material which third sheet faces said first sheet on the other side of said first sheet, said free ends of said facing tab portions having an adhesive coating applied therealong to join said ends together, first frame members connected to the end sheets of said stacked sheets of material, and second frame members removably connected intermediate said first frame members by a slot and tongue arrangement integral therewith to hold said first frame members in spaced relationship and to hold said faced sheets of material in spaced relationship thus forming a plurality of spaced bridges by the joined pairs of tab portions which present a filter maze between said spaced faced sheets of material.

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