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F. EILHAUER

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FILTER AND METHOD OF MAKING SAME

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Fig. 1.

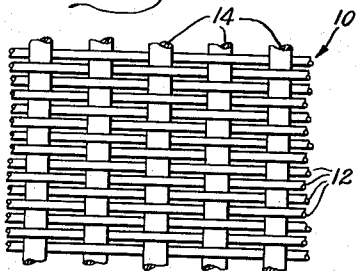


Fig. 4.

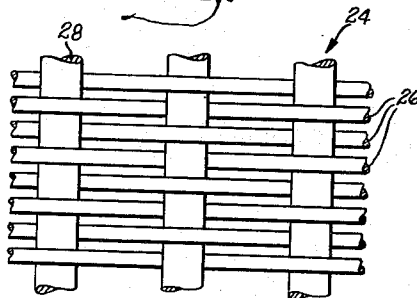


Fig. 2.

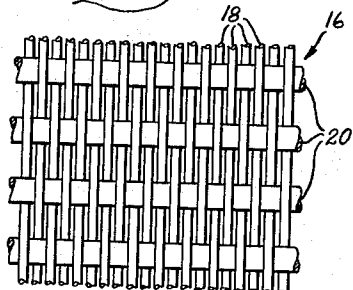


Fig. 5.

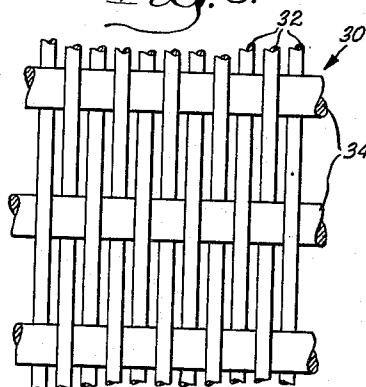


Fig. 3.

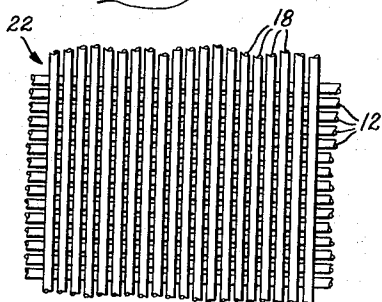
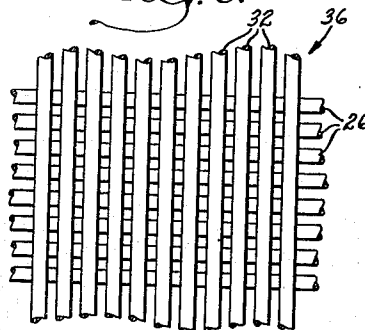


Fig. 6.



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FILTER AND METHOD OF MAKING SAME

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This invention relates to a method for making filters by combining two (or more) woven wire cloths, each of which includes a set of warp wires or filaments of one material and a set of weft wires or filaments of a different material. More specifically, the invention relates to a method comprising superimposing two such wire cloths one over the other and joining them together, after which two sets of filaments are removed from the resulting combined body, one set from each fabric. The remaining sets of wires or filaments, usually perpendicular to one another, form a filter having a plurality of substantially square or rectangular apertures.

The term "wire" as used herein is not intended to denote a metal or any particular material since various metallic or plastic materials may be used for the warp and weft wires in the woven fabrics employed to make the filters, it being necessary only that the warp wires in a particular fabric layer be of a different material from the weft wires therein to permit removal by chemical or physical procedures of one of the two sets of wires or filaments from each fabric. The two sets of wires, one in each of the two fabrics to be combined, which are to form the filter may be of the same material. Similarly, the two sets of wires to be removed may be of the same material.

According to my invention, filters of unusual fineness and accuracy of meshes and with substantial rigidity can be processed, not feasible by any other method known hitherto. The finest wire meshes known count 50,000 mesh openings per square centimeter and have square mesh openings of about 20 to 25 microns.

The method of my invention permits the production of fabrics having a multifarious number of meshes coupled with a fineness practically unlimited. Moreover, the exactitude and regularity of the meshes is increased, due to the use of a simple weaving process as one step in the preparation of a filter in accordance with my method. Since the meshes of the filter so obtained are independent of the wire gauge, micro filters of a sufficient rigidity can be obtained.

Filters composed of two or more wire fabrics placed atop one another to form a sieve unit are known. A kind of porous sheet having openings of varied sizes and structures ensues by such methods, since both the warp and the weft wires of the combined fabrics are preserved.

These drawbacks of irregularity of filters are redressed by filters processed in conformity with my method. According to this process fabrics may be made, for instance, having a greater number of weft wires per unit of length than there are warp wires. Moreover, the weft wires consist of different substances than the warp wires. The latter may be of bronze metal, while the weft wires may consist of stainless steel. If two such textures or fabrics are combined, one being superimposed upon another with the warp wires of one fabric at an angle of 90° with respect to the warp wires of the other, and the stainless steel wires are joined together by a sintering process, substantially square meshes are formed. The bronze metal warp wires will melt during the sintering operation and can subsequently be dissolved by known chemical processes. It may be found expedient, in some cases, to have this process followed by a separate sintering and rolling operation.

One object of the present invention is to provide a filter having a plurality of unusually small apertures and

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possessing great uniformity of structure and configuration.

Another object is to provide such a filter having, where desired, a great number of apertures per unit of area so as to provide substantial permeability.

A further object of the invention is to provide a relatively simple and inexpensive method for making such filters, which method may, if desired, be employed to produce a filter having unusually small apertures on the order of a few microns and also possessing substantial stability and rigidity, such filters being useful where maximum permeability is not essential.

These and other objects and advantages of the invention will be apparent from the following description thereof.

Now in order to acquaint those skilled in the art with the manner of utilizing and practicing my invention, I shall describe, in conjunction with the accompanying drawings, certain preferred embodiments of my invention.

In the drawings:

FIGURE 1 is a view of a typical first portion of cloth which may serve as one component in practicing my invention;

FIGURE 2 is a view of a typical second portion of cloth which may serve as a second component for use with the component of FIGURE 1 in practicing my invention;

FIGURE 3 is a view of a filtering medium according to the method of my invention by employing the cloth components of FIGURES 1 and 2;

FIGURE 4 is a view of a modified form of first portion of cloth which may serve as one component in practicing my invention;

FIGURE 5 is a view of a modified form of second portion of cloth which may serve as a second component for use with the component of FIGURE 4 in practicing my invention; and

FIGURE 6 is a view of a filtering medium according to the process of my invention employing the cloth components of FIGURES 4 and 5.

Referring now to the drawings, FIGURE 1 shows a first woven fabric 10 composed of a set of narrow warp filaments 12 and a set of weft filaments 14. In this example, the weft filaments 14 are made of a relatively destructible material so that they may be removed during the process. FIGURE 2 shows a second woven fabric 16 comprising a set of narrow weft filaments 18 and a set of warp filaments 20, in this case the latter being made of a relatively destructible material. The fabrics 10 and 16 may be combined to manufacture a filter by superimposing one upon the other with the warp filaments 12 in alignment with the warp filaments 20, and joining the two fabrics together by a sintering operation or other suitable joining operation, after which the weft filaments 14 from the first fabric 10 and the warp filaments 20 from the second fabric 16 are removed such as by melting, dissolution or other suitable means.

The product resulting from the above process comprises a filter 22 as shown in FIGURE 3 which is composed of a first set of closely spaced parallel coplanar filaments, i.e., the warp wires 12 from the first fabric 10, and a second set of closely spaced parallel coplanar filaments, i.e., the weft wires 18 from the second fabric 16, which overlie the first set and are substantially perpendicular thereto, the filaments 18 being joined to the filaments 12 where they intersect to define a plurality of substantially rectangular apertures. The method illustrated in FIGURES 1-3 may be carried out as a continuous process since the longitudinal warp wires of the two fabrics are aligned when joining the fabrics together, permitting lengths of the two fabrics to be joined while being conveyed through a processing area.

FIGURES 4 to 6 illustrate an alternative embodiment

of the method of the present invention. FIGURE 4 shows a first woven fabric 24 composed of a set of narrow weft filaments 26 and a set of warp filaments 28. In this instance, the warp filaments 28 are made of a relatively destructible material to permit their subsequent removal. FIGURE 5 shows a second woven fabric 30 composed of a set of narrow weft filaments 32 and a set of warp filaments 34, the latter being made of a material to permit removal by melting, dissolution or other suitable means. It will be noted that the weft filaments 26 of the fabric 24 are shown perpendicular to the weft filaments 32 of the fabric 30, indicating that according to this embodiment one of the fabrics to be joined is rotated 90 degrees in its own plane with respect to the second fabric to which it is joined. In other words, the warp filaments of one of the fabrics are aligned with the weft filaments of the other fabric. The fabrics 24 and 30 are then combined by superimposing one over the other and joining them together, after which the warp filaments 28 from the first fabric 24 and the warp filaments 34 from the second fabric 30 are removed.

The resulting product comprises a filter 36 shown in FIGURE 6 composed of a first set of closely spaced parallel coplanar filaments, i.e., the weft wires 26 from the fabric 24, and a second set of closely spaced parallel coplanar filaments, i.e., the weft wires 32 from the second fabric 30, which overlie the first set and are substantially perpendicular thereto, the filaments 32 being joined to the filaments 26 where they intersect to define a plurality of substantially rectangular apertures. While the filter 36 in FIGURE 6 is illustrated as having a smaller number of apertures per unit of area than the filter 22 of FIGURE 3, yet in fact the method of FIGURES 4-6 is suited to produce an even finer filter having a larger number of mesh openings per unit of area than the method of FIGURES 1-3, as will be more fully explained hereinafter.

As one example of my method, a pair of woven textures or fabrics may be used each having 100 bronze metal wires of 0.03 mm. gauge per centimeter warp and 400 stainless steel wires of 0.02 mm. gauge per centimeter weft thus providing an opening of 5 microns between each weft wire or filament. By superimposing and joining two such fabrics a filter of 400×400 wires per centimeter or 160,000 apertures per square centimeter may be formed after the sintering operation and the dissolution of the bronze metal wires, each aperture being of 5 microns on each side. The sizes of the meshes as well as the number of meshes per square centimeter can be adjusted at will by altering the wire gauge or the distances of the wires one from the other. Since filters having apertures of a given size can be produced with varying gauges of wires, the aperture size being controlled by the spacing between the edges of the wires rather than their diameter, one can select a gauge of wire which satisfies the rigidity requirements for the filter being produced. Of course, where relatively large gauge wires are selected to provide increased rigidity, the resulting filter will have a smaller number of apertures per unit of area, and thus will be of a lower permeability.

The chemical industry is in urgent need of micro filters of infinite uniformity of meshes for the specific purpose of filtering high grade power fuels. In order to produce extended lengths by continuous operations it is desirable to use one woven texture or fabric having narrow weft meshes, and a second woven fabric having narrow warp meshes, both of the same wire material. Such woven textures of any desired lengths can be superimposed one upon the other and joined by a sintering operation, after which the combined layers of fabric may be immersed in a chemical bath for dissolving the other (auxiliary) wire material, and if desirable, further improving upon the quality by a second sintering process.

A filter with substantially rectangular apertures will be produced if the metal wires intended to form the filter

are of varying gauges or have varying distances one from another. Where the permanent wires are uniformly spaced and of uniform gauge, the apertures will be substantially square in configuration.

Joining of the two lengths or sectors of woven fabrics is effected by known methods, i.e., by sintering, soldering or brazing, melting, gluing or by cold welding (recrystallization, high frequency) or welding. The second wire material must, however, be of such a nature that it will not become involved by any of these operations, making it possible to remove it by chemical or physical processing.

Where desired, my method may be used to produce filters of a relatively high permeability, i.e., with a great number of mesh-openings. Owing to the very fine wire gauges which must be used, such filters offer less resistance to mechanical influences. On the other hand, my method can be employed to produce filters of equally fine mesh openings per area, formed by higher gauged wires, thus affording greater stability and mechanical resistance.

For filters produced according to my invention by continuous working methods, extreme fineness of meshes is limited by the dimensions of the reeds in looms presently available. The thickness of the bars forming the reed or comb determines the minimum distance of the warp wires of the woven fabrics used for the filter. Since the continuous operating method shown in FIGURES 1-3 makes it imperative that at least one of the sets of warp wires remains to form a part of the filter, the number of the producible square sieve openings is governed by the lowest possible distance of such warp wires, at present possible up to 200 to 250 wires per centimeter.

This limitation, applicable for continuous operation only, is not conclusive for obtaining the finest sieve meshes according to the method illustrated in FIGURES 4-6 where processing is done by the non-continuous method comprising placing the woven wire fabrics one atop the other at an angle of 90°. It will then be possible for both woven fabrics placed one atop the other to have weft wires of a material ultimately to remain to form the filter. Their density can easily be intensified almost without reaching a limit. A density of 1,000 wires per centimeter is obtainable.

It will be understood that various modifications and re-arrangements may be made in the embodiments selected for disclosing my invention without departing from the spirit and scope of the invention.

I claim:

1. An assembly of fabrics for making a filter comprising a first fabric and a second fabric each of which is composed of a plurality of first and second filaments in crossing relation with respect to each other, said first filaments being of material relatively more easily destructible than the material of said second filaments, said fabrics being arranged in superimposed relation with respect to each other with said first and second filaments of said first and second fabrics in crossing relation with respect to each other, respectively, and said second filaments of said first and second fabrics being joined to each other at their crossing portions.

2. An assembly of fabrics for making a filter comprising a first fabric and a second fabric each of which is composed of a first set of substantially parallel first filaments and a second set of substantially parallel second filaments extending transversely of said first filaments, said first filaments being of material relatively more easily destructible than the material of said second filaments, said fabrics being arranged in superimposed relation with respect to each other with said first and second filaments of said first and second fabrics in crossing relation with respect to each other, respectively, and said second filaments of said first and second fabrics being joined to each other at their crossing portions.

3. An assembly of fabrics for making a filter compris-

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ing a first fabric and a second fabric each of which is composed of a first set of substantially parallel first filaments and a second set of substantially parallel second filaments extending transversely of said first filaments, the number of said filaments in said first and second sets being different, said first filaments being of material relatively more easily destructible than the material of said second filaments, said fabrics being arranged in superimposed relation with respect to each other with said first and second filaments of said first and second fabrics in crossing relation with respect to each other, respectively, and said second filaments of said first and second fabrics being joined to each other at their crossing portions.

4. A method of making a filter from a first fabric and a second fabric each of which is composed of a plurality of first and second filaments arranged in crossing relation with respect to each other, the first of said filaments being of material relatively more easily destructible than the material of said second filaments, superimposing said first and second fabrics one over the other with said second filaments of said first and second fabrics in crossing relation, joining the crossing portions of said second filaments of said first and second fabrics to each other, and destroying said first filaments of each of said first and second fabrics.

5. The method of making a filter from a first fabric and a second fabric each of which is composed of a first set of substantially parallel filaments and a second set of substantially parallel filaments extending transversely of the filaments of said first set, the filaments of said first sets being of material relatively more easily destructible than the material of the filaments of said second sets, superimposing said first and second fabrics one over the other with the filaments of said second sets in crossing relation, joining the crossing portions of the filaments of said second sets of said first and second fabrics to each other, and destroying the filaments of said first sets of said first and second fabrics.

6. The method of making a filter from a first fabric and a second fabric each of which is composed of a first set of substantially parallel filaments, and a second set of substantially parallel filaments extending transversely of the filaments of said first set, the number of said filaments in said first and second sets being different, the filaments of said first sets being of material relatively more easily destructible than the material of said filaments of said second sets, superimposing said first and second fabrics one over the other with the filaments of said second sets of said first and second fabrics in crossing relation, joining the crossing portions of the filaments of said second sets of said first and second fabrics to each other, and destroying the filaments said first sets of said first and second fabrics.

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7. The method of making a filter from a first fabric and a second fabric each of which is composed of a first set of substantially parallel filaments, and a second set of substantially parallel filaments extending transversely of the filaments of said first set, the number of said filaments in said first and second sets being different, the filaments of said first set being of the same material and the filaments of said second set being of the same material, the material of said filaments of said first set being relatively more easily destructible than the material of said filaments of said second sets, superimposing said first and second fabrics one over the other with the filaments of said second sets of said first and second fabrics in crossing relation, joining the crossing portions of the filaments of said second sets of said first and second fabrics to each other, and destroying the filaments of said first sets of said first and second fabrics.

8. A method of making a filter from a first fabric and a second fabric each of which is composed of a plurality of first and second filaments arranged in crossing relation with respect to each other, the first of said filaments being of material relatively more easily destructible than the material of said second filaments, superimposing said first and second fabrics one over the other with said second filaments of said first and second fabrics in crossing relation, joining the crossing portions of said second filaments of said first and second fabrics to each other, destroying said first filaments of each of said first and second fabrics, and further joining the crossing portions of said second filaments of said first and second fabrics to each other.

9. A method of making a filter from a first fabric and a second fabric each of which is composed of a plurality of first and second filaments arranged in crossing relation with respect to each other, the first of said filaments being of material relatively more easily destructible than the material of said second filaments, superimposing said first and second fabrics one over the other with said second filaments of said first and second fabrics in crossing relation, joining the crossing portions of said second filaments of said first and second fabrics to each other by sintering, destroying said first filaments of each of said first and second fabrics leaving an assembly composed of said second filaments of said first and second fabrics, and sintering and rolling said assembly.

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