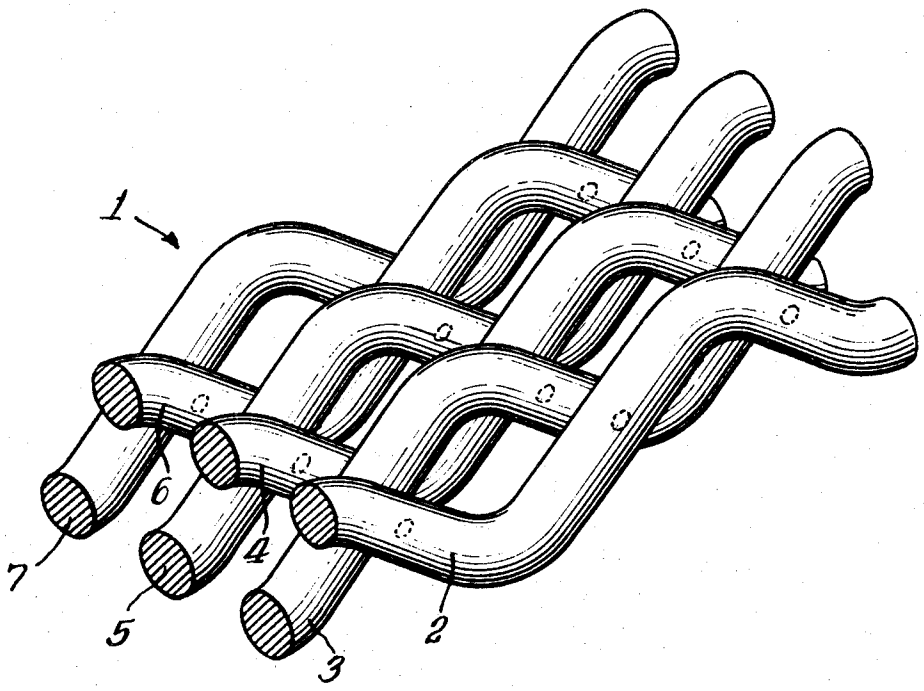
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METHOD OF MAKING FILTER MEDIA

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METHOD OF MAKING FILTER MEDIA

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ABSTRACT OF THE DISCLOSURE

Method of making filter media from a fabric having first and second sets of crossing filaments in which adjacent filaments of one set of filaments are joined at contacting portions thereof, and in which the filaments of the other set of filaments are removed from the fabric.

The present application is a division of my application Ser. No. 437,452, filed Mar. 5, 1965.

The present invention relates to method of making filter media.

It is known that a filter media may be made by combining two or more fabrics as, for example, first and second fabrics, 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 the first sets, and of which the filaments of the first sets are more easily destructible than the filaments of the second sets. Such first and second fabrics may be disposed in superimposed relation with their second sets of filaments in crossing relation, the crossing portions joined to each other, as by sintering, and then destroying the first sets of filaments of the first and second fabrics to thus provide a filter media composed of the filaments of the second sets in crossing and joined relation providing mesh openings therebetween.

A filter media fabricated as aforenoted is satisfactory for many filtering purposes but has some limitations in that regard in that the mesh openings are normal to the axes of the weft or filler filaments and elongated small diameter foreign material and particles by impact against the surface of the filter media may frequently pass therethrough. Also such known filter media are expensive to fabricate by reason of the need of at least two fabrics with filaments of each thereof being destroyed to provide the end filter media.

An object of the present invention is to provide a method of making a filter media from a single fabric component.

The foregoing object may be achieved by forming a fabric of first and second sets of filaments extending in crossing relation with respect to each other, such as a plurality of weft or filler filaments arranged in contacting relation in their lengthwise direction, and a plurality of warp filaments. The weft or filler filaments may then be joined at their contacting portions, for example, by presently known expedients such as by adhesives, sintering, brazing, or welding. Thereafter, the warp filaments may be removed such as by dissolving, vaporizing or melting the same, or removing them by mechanical means to provide a filter media composed of the joined weft or filler filaments. Thereafter, if desired, the filter media thus

formed may be calendered or otherwise flattened by further sintering or bonding to reduce the size of opening and create a stronger bond at the joined portions of the weft or filler filaments.

The above and other objects and advantages of the invention will appear from the following detailed description of a preferred embodiment of the invention.

Now in order to acquaint those skilled in the art with the manner of practicing the present invention, there is described below a preferred embodiment of the invention.

The single figure of the drawing shows a filter media on a greatly enlarged scale of and constructed in accordance with the present invention.

In accordance with the present invention it is proposed to form a filter media from a fabric defined by a first set or plurality of first filaments extending in the same lengthwise direction, such as weft or filler filaments, in which the successive or adjacent filaments of the first set have portions thereof in contacting relation, such as by abutting each other at portions of the lengths thereof and/or being disposed in laterally overlapping relation, and a second set or plurality of second filaments extending in the same lengthwise direction in spaced apart relation with respect to each other, such as warp filaments, and with the warp and weft filaments being in crossing relation. Typically, in the art a Dutch weave, either plain or twilled, may be suitably employed in the present invention although it will be understood that the weft or filler filaments and warp filaments need not necessarily be woven, it being suitable for the present invention to have first and second sets of such filaments in crossing relation.

A typical plain Dutch weave cloth suitable for practicing the present invention may, by way of example, be of 100 x 700 mesh embodying .004 inch diameter patented or annealed carbon steel warp wires, and .0016 inch diameter type 304 stainless steel weft or filler wires. Such fabric may then be sintered to join the contacting portions of successive or adjacent weft or filler wires to each other and to join the crossing portion of the weft or filler wires and the warp wires. Thereafter, the warp wires may be removed, as by leaching, leaving an assembly or filter media composed of the weft or filler wires in joined relation with mesh openings therebetween. If desired, the assembly thus formed may again be sintered to increase the bond strength between the joined weft or filler wires.

More specifically, in carrying out the method of the present invention, a fabric as above described and in preparation for sintering of the assembly, is preferably cleaned and placed in a muffle of a sintering furnace. The fabric may then be sintered at 1900° F. for 2 hours in the environment of a reducing atmosphere of dried hydrogen maintained in the muffle of the sintering furnace. Such a muffle may, for example, be made of Inconel and in that event the fabric may be supported on prefired fire brick to prevent its sintering to the muffle. After sintering as above described, the fabric may then be positioned in a section of the muffle extending from the furnace and cooled in the hydrogen atmosphere to prevent scaling on removing of the fabric into room air. Thereafter, the warp wires may be removed by leaching in the typical example above noted in a 30% nitric acid solution at 170° F. for about 1 minute or until all the warp wires are dissolved. Preferably, and again after

rinsing and drying, the assembly of the joined weft or filler elements may again be placed in a sintering furnace and heated for 2 hours at 2200° F. This second sintering step increases the bond strength between the weft or filler wires by increasing the diffusion of the contacting portions of the wires with each other. It should be observed that the second higher sintering temperature should not be used in the first sintering step as it may well cause undesirable diffusion between the warp and weft or filler wires. Again, after the second sintering step and cooling in the manner above described, a completed filter media according to the invention is provided.

In the above specific example, the filter media thus formed retained 92% of particles in a range of 45–50 microns contained in the fluid passed through the filter as determined by a Coulter Particle Counter. Substantially the same values apply to filtering characteristics of Dutch weave fabric as above described and prior to processing in accordance with the method of the invention. However, and as established in comparative tests between an unprocessed Dutch weave fabric, namely one which was subjected to the first described sintering operation but unleached, and a second processed sample of such Dutch weave fabric which was sintered and leached in accordance with the above described method of the invention, it was found in filtering fluid media containing particles as small as 15 microns that in the unprocessed fabric there is a decrease in the number of particles in the filtrate in the size range of 15 microns whereas in the processed fabric there is no decrease in particle size between 30–35 microns. Thus particles in a range of 15 microns are retained in the unprocessed fabric which in short time would impede filtering of fluid passing therethrough. In the processed fabric more uniform mesh opening is provided as illustrated by the foregoing comparative tests.

In further comparative tests of the foregoing processed and unprocessed Dutch weave fabrics the flow rate of the processed fabric was considerably enhanced. At a pressure drop of .15 p.s.i. the flow rate of the processed fabric ran 350 gallons per minute as against 180 gallons per minute for the unprocessed fabric. At 1 p.s.i. differential the flow rate for the processed fabric was 1000 gallons per minute against 650 gallons per minute for the unprocessed fabric. Thus, at a pressure drop of .15 p.s.i. the flow rate is increased 85% and at a pressure drop of 1 p.s.i. the flow rate improves by 54%.

From the foregoing it was observed that the particle retention characteristics of the processed fabric has not been altered to any great extent by removal of the warp wires but rather, in fact, had resulted in improvement because of the smaller range of particle size retention. Further, by reason of the decrease in pressure drop of the processed fabric the filter media may be used for a longer period of time or the filter media may be made of smaller area for miniaturization of a filtering system as well as providing a highly efficient filter media at less cost. In filter media made according to the method of the present invention the mesh openings are not normal to the axes of the weft or filler wires and hence are effective in retaining elongated small diameter foreign material from passing through the filter media as well as retaining particles which would normally pass through the filter media by impact.

Also, in practicing the aforedescribed process embodying the second sintering step, the filler or weft wires are pressed together into substantially a common plane thus decreasing the size of opening and in one instance was instrumental in reducing the particle size retention from 40 microns to 20 microns.

In addition to the foregoing and after the above discussed second sintering step the joined weft or filler filaments, if desired, may be calendered or pressed, and then sintered for a third time for purposes of increasing the strength of the filter media by providing more and larger areas of contact of the weft or filler filaments.

Referring to the drawing, there is shown somewhat diagrammatically and on a greatly enlarged scale a filter media made in accordance with the method of the present invention. The filter media indicated at 1 is defined essentially by a plurality of filler or weft wires 2 through 7 lying in successive adjoining parallel planes perpendicular to the face of the filter media and extending in the lengthwise directions of the wires. Each of the wires 2 through 7 are of substantially sinusoidal or serpentine configuration in their lengthwise directions. Alternate wires, such as wires 2, 4 and 6, are positioned 180° out of phase with the wires 3, 5 and 7 and adjacent wires at their crossing contacting portions or nodes, as indicated at 0, are fused or joined to each other to provide an integrated filter media of the several wires 1 through 7 forming mesh openings as aforedescribed.

It will be understood that the foregoing described method concerns one preferred embodiment of the invention but it will be understood that the filler or weft wires could be secured to each other in other ways than sintering such as by adhesives, brazing or welding and that the warp wires could be removed by vaporizing, melting or by mechanical means rather than by dissolving as above specifically described. Further, the materials used for the warp and weft or filler filaments may be selected compatible with the steps employed for bonding the weft or filler filaments and for the selective removal of the warp filaments as may be dictated by the chemical and physical characteristics desired in the finished filter media. Thus, the warp and weft and filler filaments could include any of many metals, plastics, textile fibers or fiber glass or other suitable materials capable of being arranged to form a fabric of the nature above described.

While there has been disclosed a preferred embodiment of the invention, it will be understood that various modifications and rearrangements may be made therein without departing from the spirit and scope of the invention.

The invention claimed is:

1. The method of making a filter media having parallel weft filaments only consisting essentially of the steps of forming a single fabric of a plurality of first weft filaments extending in the same lengthwise direction and arranged with portions thereof in contacting relation, and a plurality of second warp filaments extending in the same lengthwise direction and in crossing relation with respect to said first weft filaments, joining said first weft filaments at the contacting portions thereof, and removing said second warp filaments.

2. The method of claim 1 in which said warp filaments are of material more easily destructible than the material of said weft filaments.

3. The method of claim 2 in which the contacting portions of said weft filaments are joined by sintering, and again sintering said weft filaments following removal of said warp filament.

4. The method of claim 2 in which said wefts are of stainless steel, and said warps are of carbon steel, and in which said wefts are joined at their contacting portions by sintering.

5. The method of claim 4 in which said warps are removed by leaching.

6. The method of claim 5 in which said wefts are sintered.

7. The method of claim 5 in which said sintering is carried out at 1900° F. for two hours in a reducing atmosphere, and said leaching is effected in a 30% nitric acid solution at 170° F.

8. The method of claim 7 in which said joined weft filaments are sintered at 2200° F. for two hours.

9. The method of making a filter media having parallel weft filaments only consisting essentially of the steps of forming a single fabric of a plurality of metallic weft

filaments in successive contacting relation at portions of the lengths thereof, and a plurality of metallic warp filaments disposed in spaced apart relation with respect to each other, said warp filaments being of metal more easily destructible than the metal of said weft filaments, joining the contacting portions of said weft filaments by sintering, destroying said warp filaments leaving an assembly composed of said joined weft filaments, again sintering said assembly, calendering said assembly, and again sintering said assembly.

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