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FILTER PACKS AND METHODS OF MANUFACTURE

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The present invention concerns certain features of novelty and betterment in filter-packs and their modes of production, each such pack consisting of, or comprising, a series of relatively-thin discs stacked together face-to-face in a pile or group, and usually apertured in registration, whereby the filtering action may take place through the shallow spaces between the discs or sheets rather than through the material of the discs themselves.

Heretofore, such packs have ordinarily been made of paper discs impregnated with a suitable material, which has been heated at a suitable temperature, to assure that such material, and the substance of the treated discs themselves, will not be detrimentally affected by whatever medium, and its polluting contaminants, is to undergo the filtering action.

According to prior practice, the discs have been punched out of a plurality, for instance four, of superposed sheets of paper resting on one another and charged with a phenolic-resin, such as "Beckaphene," whereupon a group of such discs has been more or less loosely mounted on a rod, and heat treated in an oven to modify or polymerize the Beckaphene, and, thereafter, subsequent to pressing and holding the discs together, as an assembly, the exterior cylindrical surface of the group or row of discs has been ground and polished to provide a smooth outer surface to preclude an undue amount of solid particles filtered out from adhering to such surface, the filtering action occurring ordinarily inwardly, but not necessarily inwardly, of the pack between the discs.

It has been discovered, however, that such procedure and the resulting pack are subject to substantial improvements in that the method may be simplified, the grinding and polishing step may be omitted in some cases, the pack may be more easily handled, the filtering action may take place at a lesser pressure on the material undergoing filtration than has heretofore been permissible, the filtration occurs with greater uniformity, and cleaning of the pack is required less frequently.

To obtain these and other desirable objects and aims, the following alternative procedures have been invented.

When, in following the earlier process, the discs have been punched out of a plurality of sheets of paper resting on one another in a punch-press, it has been discovered that the edges of the discs, or at least of a sufficient number of them, have been slightly rough and/or rounded transversely, but enough to require the final polishing action referred to.

It has been determined that to avoid the presence of such objectionable type of edges, the discs may be punched out of a single sheet of paper, so that all discs are provided by direct cooperation of the sharp edges of the punch and die with merely a single sheet of paper or equivalent or comparable material between them, that is, by avoidance of a plurality of superimposed paper sheets between them.

Any other appropriate manner, if there be such, of providing sharp, smooth-edged discs may be used to attain the required stated result.

According to the prior art outlined above, when the discs were loosely mounted on the rod, to allow the heated air to reach them easily, extended through their aligned or registered apertures, some of the discs, in fact a substantial percentage of them, in some cases, become more or less miscellaneously turned angularly around their axis so that the substantially-parallel ridges or rugosities of the crepe-paper of which they were made become disposed in a number of different angular relations with the surface ribs or rugosities of their companion discs on opposite sides thereof with the result that, in the final complete pack, the spaces between the surfaces of contacting discs were not exactly uniform, their detrimental deviation therefrom depending, in substantial measure, upon the angular relation of the discs with one another.

To obtain greater uniformity in the thickness of the shallow filtering gaps between the discs, in carrying out the new method, the discs of the pack are mounted on the rod, not in the specified loose hit or miss condition, but held pressed together lengthwise the pack, with maintenance of the angular relation of all of the discs substantially the same, that is to say, with their surface ridges or ribs practically parallel to one another, and the heat treatment is applied to the discs while retained in this pressure contact relation.

The result is that the impregnating material, "Beckaphene" (40% to 60%) from which the alcohol has evaporated, undergoing the heat polymerization cements or adheres the discs together more or less at the points where the ridges of one face contact with those of the adjacent face of the next disc, and thus all of the discs become adhered together forming a single unit, stack or assemblage of the numerous discs.

It is to be noted that such adherence takes place only between parts of the ribs, leaving the channels between such ribs open to allow the

filtering flow or passage therethrough of the medium, liquid or gaseous, undergoing purification by the filtration.

Under such heat-treatment, which may be from about 325° F. to about 450° F. for approximately six hours to approximately ten minutes, respectively, the phenolic-resin becomes modified or polymerized and the paper may also undergo substantial change, and, in fact, if the heating is continued long enough and at a suitable temperature, the paper may be disintegrated or converted into carbon leaving the resin with which it was charged with suitable interstices through which the liquid or gas being filtered finds its way from without the pack into its internal passage formed by the registered apertures of the original paper-discs.

Thus the final filter-pack has an outer surface, in many cases, adequately smooth so as not inevitably to need the former polishing action, the pack may possess sufficient lengthwise elasticity, inherent in the ridges of the discs, so that, in some cases, no supplemental pressure-applying-means, such as a spring or terminal rubber washer, or other resilient or elastic means, is required, the pressure imposed before the heat treatment being still present in the pack, this resiliency being provided by that of the numerous rugosities which are only in part cemented together.

In addition, the thus adhered finished discs now constitute a unitary member which may be easily handled, as contrasted with a pack of loose uncemented discs, for mounting in a filter-housing, and for replacement by a new pack when necessary.

It should be clear that the discs may be of any suitable size and appropriate shape, that the original discs may be of paper or other befitting material, and that the impregnating or conditioning agent may be any which will perform the essential functions.

It is not to be understood that the surface ribs or ridges of each disc are necessarily all parallel to one another, because the invention is also applicable to discs having roughnesses of various and miscellaneous kinds.

Where crepe-paper discs, having the ribs or ridges of each substantially parallel, are used, the ribs of contacting discs need not be absolutely parallel to one another, since a slight progressive deviation therefrom produces results practically the same as when precise parallelism is present, so that in such a non-parallel pack the ribs or ridges of the two terminal discs may be even at right-angles to one another or at some intermediate angular relation.

As an alternative or supplementary procedure, which in many cases is preferable, after providing the stack of treated, registered discs held pressed together on the rod, or its equivalent, and prior to the heat polymerizing treatment, the stack is painted with, sprayed with, or dipped into a dilute solution of the Beckaphene, such as approximately 5% Beckaphene and 95% alcohol, and, thereafter, the stack is subjected to the heat treatment to polymerize the Beckaphene, thus rendering the pack immune to the action of the fluid to be filtered and also exempt from any detrimental effect thereon by the one or more contaminants in such fluid.

After such polymerization, the exterior of the pack is smoothed and polished to a high degree of uniformity and evenness, thus, in substantial measure, reducing the tendency of the filtered-out particles to cling or adhere to such surface.

The specified thin Beckaphene solution does not fill up or seal the interstices of the pack, but it does something to the material of the pack which enables it to take on a high polish.

Why such application of this solution to the pack does not close its cavities and passages and why it permits the pack to be polished to the high degree which it does, is not fully known at the present time.

As will be readily understood, the shape of the pack may be anything desirable; it need not be cylindrical.

Those acquainted with this art will readily understand that the invention herein set forth is not necessarily limited and restricted to the precise and exact details presented and that various changes and modifications may be resorted to without departure from the invention as defined by the appended claims and without the loss or sacrifice of any of its material benefits and advantages.

I claim:

1. In a known type of edge-filtration filter-pack composed of a series of registered face-to-face contacting layers of an uneven-surface material, the pores of which material are closed by an impregnating-agent unaffected by the medium to be filtered or by any of its contaminants, the novel improvement of a cementitious-medium adhering the contacting surfaces of said layers together sufficiently to constitute a unit, yet permitting the filtrate to pass between such surfaces during the edge-filtration.

2. The novel improvement in a filter-pack as set forth in claim 1, in which said impregnating-agent is also the cementitious-medium which adheres said layers together.

3. The novel improvement in a filter-pack as set forth in claim 1, in which said material is crepe-paper.

4. The novel improvement in a filter-pack as set forth in claim 1, in which said material is crepe-paper and in which the impregnating-agent is also the cementitious-medium which adheres said layers together.

5. The novel improvement in a filter-pack as set forth in claim 1, including the additional novel feature that the exterior surface of said pack is polished.

6. The novel improvement in an edge-filtration filter-pack as set forth in claim 1, in which said material is crepe-paper with substantially-parallel surface rugosities, and in which the rugosities of the several layers are substantially-parallel.

7. The novel improvement in an edge-filtration filter-pack as set forth in claim 1, in which said material is crepe-paper with substantially-parallel surface-rugosities, in which the rugosities of the several layers are substantially-parallel, and in which said impregnating-agent is also the cementitious-medium which adheres the layers together.

8. In the known process of making an edge-filtration filter-pack including the registering of a series of layers of an uneven-surface material in face-to-face contact with one another, the pores of said material being closed by a polymerizable impregnating-agent which, when polymerized, is unaffected by the medium to be filtered or by any of its contaminants, and then polymerizing said agent, the novel improvement of holding said impregnated layers pressed together face-to-face during such polymerization to cause sufficient adhesion of said layers to-

gether by the polymerized-agent to constitute a unit while at the same time leaving spaces enough between the adhered surfaces to allow the filtrate to flow therethrough during the edge-filtration.

9. The novel improvement in the process of making an edge-filtration filter-pack as set forth in claim 8, including the additional combination of novel improvements of coating the surface of said pack before the polymerizing step with an agent having comparable properties, and polishing such coated surface after said polymerizing step.

10. The novel improvement in the process of making an edge-filtration filter-pack as set forth in claim 8, in which said material is crepe-paper with substantially-parallel surface-rugosities, and in which the rugosities of the several layers are substantially-parallel during the polymerization.

11. The novel improvement in the process of making an edge-filtration filter-pack as set forth in claim 8, in which said material is paper with surface-ribs, and in which said ribs are not completely flattened out while the layers are held pressed together during the polymerization.

12. In the known process of making an edge-filtration filter-pack including the mounting of a series of layers of uneven-surface material in register with, and in face-to-face contact with, one another, said layers being impregnated with a modifiable-agent not detrimentally affected in the final filter-pack by the medium to be filtered by the pack or by its one or more contaminants, and then modifying said agent to give it the specified property of non-affectability, the novel improvement of pressing said layers together face-to-face sufficiently during such modification to cause the adherence of said layers with one another during such modification of and by such agent and without entirely closing the spaces between said layers.

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