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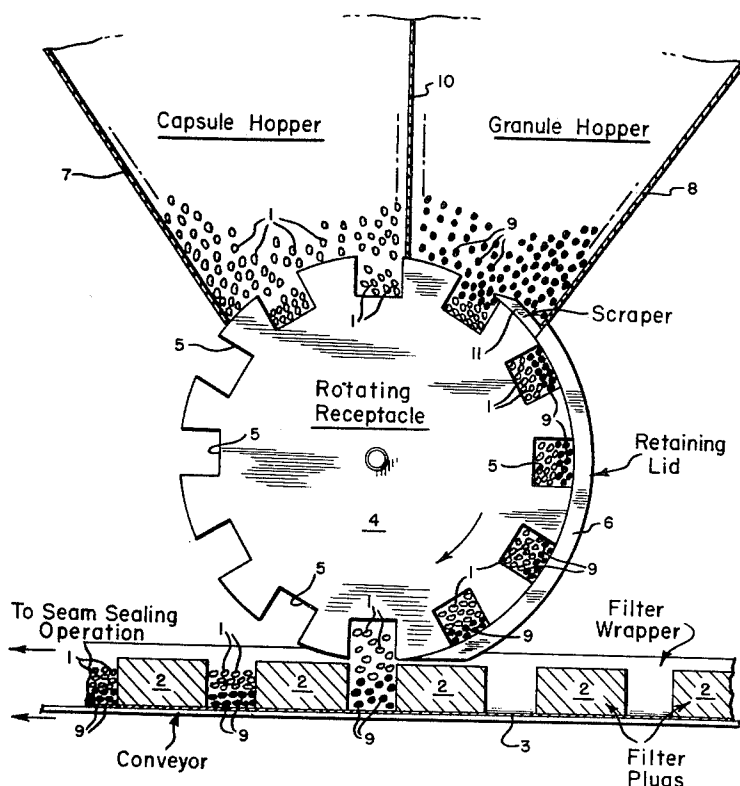
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[54] **METHOD OF MAKING A COMPOSITE FILTER**
5 Claims, 1 Drawing Fig.

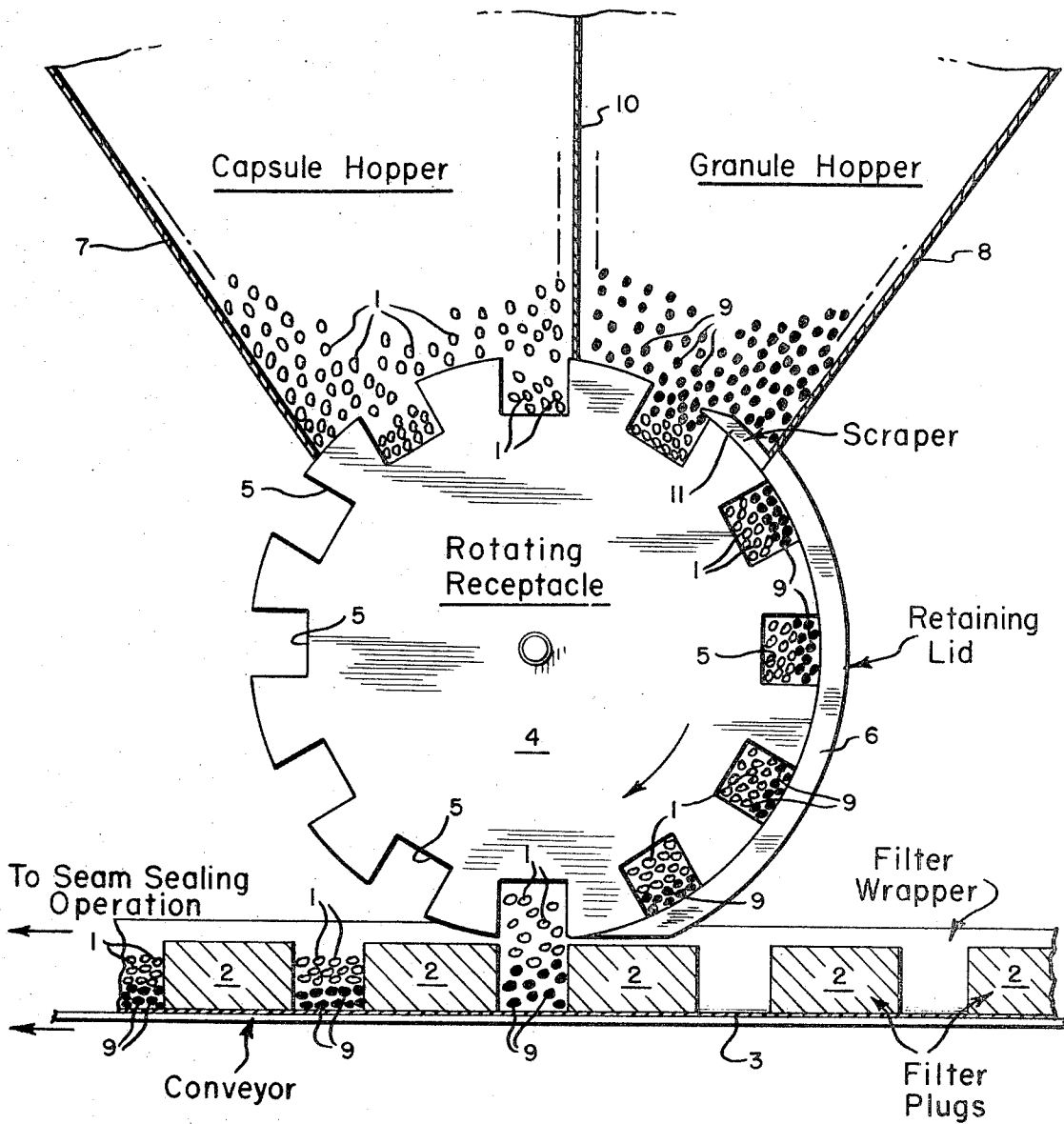
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ABSTRACT: In the making of a composite filter for tobacco smoke wherein a multiplicity of frangible capsules filled with a tobacco smoke treating agent is charged to a moving receptacle cavity at the top of its circular path of travel and is thereafter discharged from the cavity to a filter pocket at the bottom of the path, the danger of rupturing the capsules by frictional contact with a stationary retaining surface as the cavity moves between the charging and the discharging stages is avoided by only partially filling each cavity with the capsules and then substantially filling the remainder of each cavity with granules of other solid material before the mouth of the cavity is moved under the retaining surface.



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METHOD OF MAKING A COMPOSITE FILTER

This invention relates to composite filters for tobacco smoke and, more particularly, to the production of such composite filters wherein pockets between spaced filter plugs are filled with a multiplicity of frangible capsules containing a smoke-treating agent.

In making composite cigarette filters and the like wherein the spaces between filter plugs contain a granular filtering material such as granules of active carbon, the general procedure is to deposit the filter plug material at spaced intervals along the center line of a strip of paper wrapper, then fold the sides of the strip upwardly to form pockets between the spaced plugs, fill the pockets with carbon granules and finally fold the tops of the strip wall inwardly to complete the tubular wrapper around the plugs and granules. In order to fill the filter pockets with granules, a charging wheel or drum is used which has peripheral surface cavities, a cavity being filled with granules at the top of its path of travel and being emptied directly into the filter pocket at the bottom of its path while the charge of granules is retained in the cavity by a stationary retaining surface positioned between the filling and emptying stages. This same procedure has been used to make a composite filter wherein the spaces between plugs are filled with a multiplicity of frangible capsules containing a smoke-treating agent, but it has been found that the frictional contact between the top layer of capsules and the retaining surface tends to rupture the capsules. Where the capsules contain a liquid treating agent, the liquid tends to foul the charging operation, and where the agent is a solid its efficacy is often lost by its premature exposure to moisture and to filter-filament plasticizer vapors working their way into the filter pocket, or its efficacy can be lost by evaporation of the treating agent itself.

We have now discovered that the premature breaking of the capsules during manufacture of such composite filters can be avoided by providing each capsule-containing cavity of the rotating charging receptacle with a top layer of granules of solid material which can absorb the frictional contact between the moving cavity charge and the stationary retaining surface during the filter-charging operation. Thus, the method of the present invention for protecting the charge of capsules against rupture as a result of this frictional contact comprises controlling the charging of the capsules to the cavity of the rotating charge-carrying receptacle as it moves through its charging stage so as to only partially fill the cavity, and then substantially filling the remaining upper portion of the cavity with a charge of a multiplicity of granules of solid material prior to movement of the cavity charge into frictional contact with the aforementioned stationary retaining surface.

These and other novel features of the invention will be readily understood from the following description taken in conjunction with the accompanying drawing in which the single FIG. is a side elevation in cross section of apparatus for carrying out the method of the invention.

As shown in the drawing, the apparatus is used to supply a charge of treating agent-filled capsules 1 to each pocket formed by axially spaced filter plugs 2 secured to the inside of a channel-shaped strip of wrapping material 3 prior to the upper edges of the wrapping strip being folded in over the top of the channel to form a filter rod composed of alternate plugs and masses of the capsules.

The capsules are fed to the pockets between filter plugs by a rotating wheel or drum 4 provided around its periphery with surface cavities 5. The volume of each cavity is such as to deliver the desired volume of material to the filter rod pockets. The periphery of the rotating wheel between the cavity-filling stage at the top and the discharge stage at the bottom is covered with a conventional retaining lid 6 to prevent the charge falling out of the cavity before it is intentionally discharged into the filter rod pocket.

Pursuant to the practice of the invention, the charging stage includes a hopper 7 for the treating agent-filled capsules 1 and a hopper 8 for the granules of solid material 9. The width of the open bottom of the capsule-containing hopper is such, in

relation to the flow rate of the capsules and the speed of a cavity therepast, that the cavity is only partially filled with capsules. A numerical value for the extent of this filling is not as significant as the prescription that the remaining empty space at the top of the capsule-containing cavity be sufficient to accommodate a layer of the granules thick enough to protect the capsules from significant frictional contact with the adjacent surface of the retaining lid 6 as the filled cavity advances to the discharge stage. The desired filling rate is advantageously obtained by making the partition 10 between the capsule hopper 7 and the granule hopper 8 movable laterally so as to be able to vary the size of the bottom opening of the capsule hopper. As the partially filled cavity passes from under the capsule hopper 7 to a path under the open bottom of the granule hopper 8, the unfilled top portion of the cavity is substantially filled with granules of the solid material. The thus-filled cavity then passes advantageously under a scraper blade 11 which smooths off the top layer of granules so that the lower-positioned charge of capsules will not be crushed as the filled cavity moves under the retaining lid 6. When the cavity reaches the discharge stage in alignment with a filter rod pocket, the cavity has moved beyond the extremity of the retaining lid 6 and its charge falls freely and completely into the rod pocket.

The treating agent-containing capsules to be positioned within the pocket portion of the filter element advantageously range in diameter between about 0.001 and 0.12 inch. These miniature capsules can be made by a coacervation process or by a liquid-solid exchange process. Suitable microcapsules can also be produced mechanically with a single or multiorifice encapsulating device which forces drops of a liquid to be encapsulated through a thin film of coating-forming material. Centrifugal devices can also be used in a similar fashion. Some of these and other microencapsulating procedures are described in U.S. Pat. Nos. 2,800,457, 2,800,458, 2,969,330, 2,969,331, 3,015,128 and 3,041,289, in an article by H. W. Mattson entitled "Miniature Capsules," published in the April, 1965, issue of International Science and Technology (New York, N.Y.) pages 66 et seq., and in "Microencapsulation" by C. E. Anderson et al., Management Reports, (American Management Association), pp.1-103, 1963.

The capsules comprise an outer frangible sheath enclosing the smoke-treating agent and consist of a material which is not reacted upon or dissolved by the agent. The sheath advantageously is composed of a thermoplastic or thermosetting resin such as vinylidene chloride copolymers, polyethylene, polypropylene ethylene-vinylacetate copolymers, polyesters, phenol-formaldehyde and urea-formaldehyde resins, or of polyvinylalcohol, sodium alginate, gelatin, or the like. There is no limitation on the composition of the sheath material other than its ability to form and maintain an encapsulating but frangible sheath about the treating liquid and the requirement that is not be a tacky material which would clog the capsule handling and feeding equipment.

The smoke-treating agent within the capsule can be any liquid or solid which imparts to the smoke a favorable change in its physical or chemical condition or alters its taste, or the like. Menthol, advantageously in the form of an alcoholic solution, is a presently preferred liquid component, although water can be used, or a solution of another flavoring agent or of a treating agent including iron salts can be the liquid component. Moreover, capsules of different liquid contents can be mixed, and the liquid in any capsule can further contain a solid such as finely divided active carbon, silica gel, or other useful solid components for a tobacco smoke filter. The smoke-treating agent can be entirely of solid material such as active carbon, silica gel, activated alumina, diatomaceous earth, and the like, or grains of iron salts and the like having a beneficial action on tobacco smoke passed in contact therewith.

The granules which are charged on top of the capsules in each pocket of the filter can be of virtually any solid material whether it contributes to, or is inert with respect to, the filtering of the smoke. Its primary purpose is to form a protective

layer over the capsules in the filling cavities. Thus, the granules can consist of carbon, either in active or common form, plastic, glass, detergent, or the like. The granules are advantageously nonporous in order not to entrap or otherwise sequester the smoke-treating liquid when it is released from a ruptured capsule, but when made of plastic or glass, or the like, the granules are advantageously provided with a rough surface in order to offer an extended surface for exposure of the released liquid to contact with the smoke. When the granules are composed of detergent prills, the surface-active nature of the detergent aids the liquid released from the capsules in penetrating the filter plugs for greater contact with the smoke. The granules may be structurally weak or strong; when they are weak their fragility offers a buffer to frictional action of the retaining surface against the filled cavities, but when they are strong their tendency to pack somewhat offers the equivalent amount of protection to the capsules below them in the cavities.

The wrapper strip for the composite filter can be of any conventional type used for making filters and filter rods. Generally it is paper, although other strip material such as plastic film or fibrous sheet can be used. In spite of the fact that the wrapper will enclose liquid-containing capsules, the wrapper strip need not have high wet strength because the method of the invention avoids rupture of the capsules and permits the composite filter rod to remain dry.

The filter plugs which are positioned at spaced intervals along the length of the strip can be of any of those plug-forming materials which have been proposed heretofore as filter elements. They can be composed of rolled paper, cellulosic fibers in the form of cellulose acetate tow, tobacco components, inorganic fibers, or discs, in short, any material, or combination of materials, which effects a filtering or treating action on tobacco smoke passing therethrough or therepast and, at the same time, serves as a retaining wall for the liquid-containing capsules.

The following is an illustrative example of the practice of the invention:

In producing 100 mm. filter rods at a rate of 400 rods per minute, the linear speed of the conveyor carrying the filter segments was 131 feet per minute. The receptacle 4 was 6.58 inches in diameter, contained 21 cavities, and was rotated at 76 revolutions per minute to obtain a peripheral speed of 131 feet per minute. Capsules containing an alcoholic solution of menthol was fed to hopper 7 by a vibrating feeder at a controlled rate to prevent excessive buildup of capsules in the hopper. The depth of capsules in the hopper 7 was maintained at approximately one-half inch so as not to restrict the movement of capsules into the receptacle cavities 5 and thus prevent breakage against the separating partition 11 between the hoppers 7 and 8, whereas the granule hopper 8 could be

filled to any depth desired. The cavities of the rotating receptacle, which were 9 mm. deep by 5.5 mm. wide and 4.5 mm. long, passed under the capsule hopper 7 and received a charge of capsules. The capsules ranged in size from 800 to 2,000 microns and filled approximately 60 percent of the cavity. The cavity then passed under hopper 8 where its remaining volume was filled with carbon granules which had a particle size of 12 to 30 mesh (Tyler Standard). The cavity contents were leveled as each cavity passed under the scraper 11. The pocket formed by the spacing between successive filter plugs and the upstanding walls of the paper wrapper were 5 mm. long, approximately 7.5 mm. wide and 7.5 mm. deep. After the charge in each receptacle cavity had been dropped in its respective pocket, the paper wrapper was closed over the plug and the capsule-granule charge to complete the filter assembly. There was no observable breakage of any of the capsules during the entire operation.

We claim:

1. In the method of making a composite cigarette filter wherein a charge of a multiplicity of frangible capsules filled with a tobacco smoke treating agent is delivered to a peripheral cavity of a rotating charge-carrying receptacle at a charging stage at the top of its circular path of travel and then at a discharging stage at the bottom of said path the charge is emptied into a pocket formed between two axially spaced filter plugs and a partially closed tubular wrapper therefor, the charge of capsules being retained in the receptacle cavity during its travel in said path by maintaining a stationary retaining surface adjacent the mouth of the cavity between the charging and discharging stages, the improvement which comprises protecting the charge of capsules against rupture as a result of frictional contact with the retaining surface as the charge is moved between said stages by controlling the charging of the capsules to the cavity as it moves through the charging stage so as to only partially fill the cavity, and then substantially filling the remaining upper portion of the cavity with a charge of a multiplicity of granules of solid material prior to movement of the cavity charge into frictional contact with said retaining surface.

2. The method according to claim 1 in which the charge of capsules to the receptacle cavity fills only about 60 percent of the volume of the cavity.

3. The method according to claim 1 in which the capsules contain a menthol solution.

4. The method according to claim 1 in which the granules are composed essentially of carbon.

5. The method according to claim 1 in which the surface of the charge of granules in each receptacle cavity is scraped to level the surface before it passes under the stationary retaining surface.

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