CONTINUOUS MANUFACTURE OF A MULTIPLE FILTER ROD HAVING SPACED POCKETS CONTAINING PARTICULATE MATERIAL

Inventor: John H. Sexstone, Middletown, Ky.
Assignee: Brown & Williamson Tobacco Corporation, Louisville, Ky.

Filed: May 7, 1973
Appl. No.: 358,126

A filter rod making machine is modified to include a hopper for granular or particulate material, and an applicator wheel driven in timed relationship with the rod cut-off unit. The selected filter material for forming the rod is formed into a substantially U-shaped configuration. The applicator wheel is provided with spaced pockets extending circumferentially about the wheel periphery. The applicator wheel runs continuously with the pockets filling with the granular material while passing under the hopper. A guide around the surface of the wheel holds the particulate material in the pockets and permits their release at the appropriate moment when the pockets containing the granules are at the bottom part of the traverse of the wheel. The granules from the individual pocket are deposited into the interior of the U-shaped filter material, shortly after the shaping of the filter material into this configuration. Immediately after the application of the granules, the tongue of the garniture closes the top of the U and anchors the granules in position, in the center of the cylindrically shaped endless rod. Accordingly, the granules will be restricted to spaced pockets along the length of the rod. The cut-off unit cuts the endless rod between pockets into the desired lengths for banding in filter tip attachment machinery. This machinery cuts the lengths intermediate the particulate sections to form plugs each having at least one of the granule pockets intermediate its ends.

References Cited
UNITED STATES PATENTS
2,145,528 1/1939 Ruau........................................ 93/1 C
2,423,554 7/1947 Davidson.................................. 93/1 C
3,312,151 4/1967 Molins.................................. 93/1 C
3,357,321 12/1967 Hall................................... 93/77 FT
3,625,118 12/1971 Jackson................................ 93/1 C

OTHER PUBLICATIONS
Defensive Publication 775, 576 (T 860013), March 25, 1969, Hawkins et al.

Primary Examiner—Roy Lake
Assistant Examiner—James F. Coan
Attorney, Agent, or Firm—Vance A. Smith

11 Claims, 7 Drawing Figures
CONTINUOUS MANUFACTURE OF A MULTIPLE FILTER ROD HAVING SPACED POCKETS CONTAINING PARTICULATE MATERIAL

BACKGROUND OF THE INVENTION

In an effort to improve the absorbent properties of tobacco smoke filters, various additives in the form of particulate or granule material have been incorporated. Towards this end, finely divided charcoal, silica gel, volcanic salts, ion exchange resins, clays and the like as well as other absorbents and adsorbents have been introduced. This introduction has been by dusting, spraying, slurrying, or otherwise incorporating the additives into the material which forms the major part of the filter structure. This fibrous material may be paper, bulked yarn, filamentary tow or any other material known to the art. When the granular additives are introduced to the fibers or interspersed therein, there is a tendency for them to sift out or migrate during the filter forming operation or while the filter element is in use. In addition, the sifting out of the particulate material would prove distasteful particularly when the migration resulted in granules finding their way into the mouth of the smoker. In this connection, attempts to introduce adhesives to fix the location of the additives has not proved successful because such adhesives would generally deactivate the absorbent properties of the additives.

Another method of manufacturing multiple filters with granule or particulate additive material involved the handling of short filter segments of selected material and arranging them in spaced relationship and thereafter incorporating the additives between segments to provide a multiple filter rod having a loose granule section. The filter rod is eventually cut to provide multiple filters having an intermediate granule section. This technique, although effectual, does involve expense which is increased significantly with cost of the particulate material introduced. Furthermore, the handling of short filter plug lengths and introduction of the particulate material in the contemplated manner, particularly on high speed machinery incurs many difficulties including wastage and “down-time” of the production machinery.

As a rule, a tremendous “house-cleaning” problem ensues with most of the heretofore employed or contemplated techniques and methods. As a result rather large and expensive equipment has been incorporated which also adds to the overall cost of the finished filter rods.

Several processes and apparatus have been proposed for obviating the disadvantages of the prior art. For example U.S. Pat. No. 3,371,000 and Defensive Publication 775,576 disclose techniques for introducing the granular additive material at spaced intervals in continuously moving filter material. Eventually a filter rod is formed having spaced sections containing granular material.

Based on the teachings of U.S. Pat. No. 3,371,000 problems still exist with migration of the granular material. This patent is directed to a process in which it is difficult to control the dispensing of granules as well as their location within the formed cigarette rod so that the rod may be cut between the granular zones thereby preventing granules from being exposed to the lips of the smoker.

Another difficulty with the introduction of particulate material in continuously moving tow is the contamination of the cutting areas and consequently tobacco as a result of the migration. Furthermore, this situation is aggravated because of triangulation of the spaced particulate pattern whereby the pattern is not evenly or concentrically arranged with respect to the rod axis. This is caused by the surging pressure on the side of the tow by the rod forming machine which results in spiraling of the spaced pattern in the finished rod.

Based on current and direct knowledge, neither of these patented approaches have resulted in a commercial application; and it is towards this end, that the present invention is dedicated.

SUMMARY OF THE INVENTION

The present invention relates to the manufacture of a continuous filter rod having at spaced intervals pockets containing a selected additive in particulate or granular form with registry of the pockets being assured and migration of granules eliminated.

Another object is to provide multiple filters having an intermediate pocket of a granular additive of reduced pressure drop for assuring the direction of the tobacco smoke to this zone in order that the smoke may be treated as desired.

A further object is to provide for the manufacture of a multiple filter rod of this type in an efficient manner and on a commercial scale without any of the disadvantages of the aforesaid prior art techniques.

Still another object is to provide for the manufacture of a multiple filter rod of the foregoing type in which more accurate metered amounts of the granule material are introduced into the pockets of the filter material thereby restricting the location of the granules to the center rather than migrating throughout the cross-sectional area of the rod.

Other objects and advantages will become apparent from the following detailed description which is to be taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is an elevational view of a continuous filter rod forming machine incorporating the teachings of this invention;

FIG. 2 is a length of filter rod formed by the machine of FIG. 1 with certain parts broken away and removed showing pockets at spaced intervals in the tow, containing a selected additive in particulate or granule form;

FIG. 3 is a cross-sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary and partially sectional view showing the metering wheel applicator associated with a granule hopper and componentry at the inlet and outlet of this station;

FIG. 5 is a fragmentary cross-sectional view taken along the line 5—5 of FIG. 4 showing the formation of the filter material into the U-shaped configuration;

FIG. 6 is a fragmentary sectional view taken along the line 6—6 of FIG. 4 showing the association of the base of the wheel with the U-shaped filter material and release of the granules from the metering wheel; and

FIG. 7 is a fragmentary sectional view taken along the line 7—7 of FIG. 4 showing the filter material about
to be formed over the granules to form a continuous rod having spaced pockets containing this material.

**DETAILED DESCRIPTION**

Referring initially to FIG. 1, apparatus 10 is provided for continuously forming a multiple filter rod having spaced pockets containing a finely divided additive in particular or granular form. Lengths of this continuous rod are cut by apparatus 10 and suitably removed at the discharge end thereof. An exemplary rod length 12 formed by such apparatus is illustrated in FIG. 2. In forming this length 12 of multiple filter rod, a filter material such as fibrous cellulose acetate tow 14 may be utilized. In lieu of cellulose acetate the filter material may be paper, bulked yarn or other filamentary tow well known to the art. The spaced pockets 16 may contain an additive 18 having the desired absorbative or adsorbative properties either in particulate or granular form. The granules 18 may be finely divided charcoal, silica gel, volcanic salts, ion exchange resins, clays and the like. A particular additive contemplated by this invention is the ion exchange resin "Duolite" which may be of the type disclosed in commonly assigned U.S. Pat. No. 3,716,500 granted Feb. 13, 1973.

The continuous cellulose acetate tow is drawn from the usual storage bail into a tow opening unit 20 which spreads or blooms the tow in a manner well known to the art of filter manufacture. The opened or spread tow 22 passes through a conventional plasticizer applicator 24. The plasticizer for cellulose acetate tow that is usually employed is triacetin. The tow with plasticizer is transferred to the nip of delivery roll 26 and roll 28. The continuously delivered tow then passes into the trumpet 32 located at the inlet end of the granular applicator station 34. The trumpet 32 and rib 32a are designed to place the flattened tow 22 into an essentially U-shaped configuration as shown in FIG. 5. Preparatory to receipt of the spaced charges of granular material 18. As best seen in FIG. 4, the tow is constrained to move into and pass through the trumpet 32 and over rib 32a, which supplies a U-shaped cross-section to trumpet 32. The tow begins to assume the U-shaped configuration and then is compressed on both its interior and exterior surfaces by rib 32a and the sides of trumpet 32 upon entering the narrower cross-section of trumpet 32, thereby providing shape and increased integrity to the U-shaped web. The shaped web of tow 22 then is fed into station 34 along with the web 36 of the selected paper or wrapper leading from the supply roll 38. A driven tube belt 40 cooperates in driving the wrapper 36 through the cigarette plug making machine 10 along with the tow 22. The wrapper eventually encases the tow and cooperates in defining the desired substantially cylindrical configuration of the filter rod.

The wheel applicator station 34 is shown in detail in FIGS. 4 and 6 and operates to deposit metered amounts of the selected granular material at spaced intervals within the base of the U-shaped web 22 leading from the trumpet 22, the granular material 18 is gravity fed from hopper 42 for filling the cavities, recesses or pockets 44 appearing at predetermined spaced intervals along the periphery of the metering wheel 46. Suction may be applied internally of wheel 46 to assist the feeding of the granules into the pockets. Once the pockets are filled, the granular material is retained therein during the rotational movement of the wheel 46 by means of the retaining shoe 48, or by the mainte-

nance of the above suction, until such time as the filled cavities reach the lowermost point of travel of the wheel 46 where the material is then deposited onto the travelling U-shaped web 22 of tow. Suction may be applied at this location beneath the tow by a vacuum source 50 to expedite this transfer. The operation of the applicator wheel 46 is synchronized with the tube belt 40 preferably in a 1 : 1 ratio in order that the peripheral speed of the wheel 46 approximates that of the wrapper web 36 as well as the tow 22.

The U-shaped tow 22 with the spaced charges of selected granular material 18 pass into a garniture 57 immediately after the wheel applicator station 34. The rod former and guide unit operates to gather the legs of the U-shaped tow 22 and gather them about the spaced granular material 18. The essentially cylindrical tow with spaced pockets of granular material 18 together with the wrapper 36 pass into the garniture tongue as is conventionally done in filter rod making machinery. Then one of the marginal side edges of the wrapper 36 is exposed to the glue applicator 54. Thereafter the rod passes through the paste applicator station 54 where glue is applied to one of the marginal side edges of the wrapper 36. Thereafter folder 55 engages this edge and folds it into contact with the other with the applied glue in between for purposes of sealing the wrapper about the tow. The wrapped tow is fed through heater 56 and subsequently into the cut-off station 58 at which the wrapped rod is cut into lengths 12 (see FIG. 2). The cutting of the rod is synchronized with the rotation of the wheel 46. A registration device 60 operates to register the peripheral movement of the wheel with the cut to assume cutting midway between pockets 16.

When the individual plugs of rod length 12 are cut as indicated in FIG. 2 and applied to the butt end of a cigarette, the smoke of the lit cigarette when puffed by the smoker, is assured exposure to the pocket 16 and consequently the granular material therein as result of this zone of reduced pressure drop. In this manner the smoke will be conditioned to the desired extent by the selected granular material 18.

The broken lines 14 indicate where cuts may be made by the cutter 58 of the plug maker 10 in order to provide quadruple length dual filter rods of the type shown in FIG. 2. These quadruple length rods are supplied to a filter tip attachment machine which cuts each quadruple length rod in half to form two dual length dual filter rods which are each assembled in axial alignment and in endwise abutting relationship with two tabacco rods with a wrapper. A final cut is made along the center line of the dual length cut rod to form two dual filter cigarettes.

Of course, separate and different additives may be mixed and placed in the individual pockets 16. For that matter, more than one pocket 16 with the same or different additives 18 may be located in each individual filter segment for incorporation on the butt end of a cigarette to attain the desired smoke treatment.

Thus the several aforementioned objects and advantages are most effectively attained. Although a single somewhat preferred embodiment of the invention has been disclosed and described in detail herein it should be understood that this invention is in no sense limited thereby and its scope is to be determined by that of the appended claims.

I claim:
1. A method of manufacturing multiple tobacco smoke filters comprising the steps of:
   a. providing a web of filter material, said web having an enlarged axis and being continuous in the direction of said axis;
   b. continuously feeding the web in the direction of said axis;
   c. flattening said web into a predetermined width;
   d. forming the flattened web into a substantially U-shaped configuration by passing the flattened web into a member having a U-shaped cross-section and shaping the web by compressing both the interior and exterior surfaces of the web against the surfaces of the member;
   e. feeding a continuous wrapper into contact with the underneath surface of the U-shaped web;
   f. providing a supply of particulate material;
   g. receiving a metered amount of the particulate material from its source of supply continuously and at spaced intervals;
   h. delivering the spaced metered amounts of particulate material to the web immediately after it is formed into its U-shaped configuration;
   i. depositing the spaced metered amounts of the delivered particulate material into the interior of the web and at the base of the U and between the legs of the U whereby metered amounts of the particulate material will be located on the web at predetermined spaced intervals;
   j. closing the legs of the web about the spaced amount of particulate material substantially immediately after the particulate material is deposited and forming it into a cylindrical rod;
   k. applying the wrapper about the cylindrical rod; and
   l. transversely cutting the wrapper rod into lengths each having at least one intermediate portion containing a pocket with the particulate material within the web of selected filter material.

2. The invention in accordance with claim 1, wherein the supply of particulate material is in a hopper, feeding the particulate material from the hopper and thereafter receiving metered amounts of the particulate material from this hopper to the web.

3. The invention in accordance with claim 2 wherein a metering applicator wheel receives the particulate material from the hopper and delivers it to the web, the metering wheel having spaced pockets of predetermined size along its periphery for accommodating the metered amounts of the particulate material and continuously rotating the metering wheel and delivering the metered amounts of particulate material from the hopper to the web at spaced intervals.

4. The invention in accordance with claim 3, wherein the metered amounts of particulate material in the pockets along the periphery of the wheel are retained in the pockets by a retaining shoe, during rotation until deposited onto the web.

5. The invention in accordance with claim 3, wherein the rotation of the wheel and the feed of the wrapper and tow are synchronized such that the peripheral speed of the wheel is approximately equal to the rate of travel of the wrapper and tow.

6. The invention in accordance with claim 3, wherein suction is applied to facilitate transfer of the particulate material into the web.

7. Apparatus for manufacturing multiple tobacco smoke filters comprising:
   a. filter material supply means for supplying a web of filter material, said web having an elongated axis and being continuous in the direction of said axis;
   b. feed means for continuously feeding the web in the direction of said axis;
   c. shaping means having walls converging in the direction of web movement and a U-shaped internal configuration for forming and compressing the web into a substantially U-shaped configuration;
   d. hopper means for supplying a particulate material;
   e. metering wheel means associated with said hopper means and having spaced pockets along its periphery for receiving predetermined amounts of particulate material and transferring it to a discharge location;
   f. retaining means including a retaining shoe positioned about the spaced pockets on one side of the metering wheels for maintaining the particulate material in the pockets during this transfer;
   g. discharge means for permitting the discharge of the particulate material in the pockets onto the U-shaped web immediately after the trumpet means, the discharged particulate material being located at the base of the wheel between the legs of the U and at predetermined spaced intervals;
   h. wrapper feeding and moving means for continuously feeding a wrapper in contact with and beneath the web after the web has been formed into the substantially U-shaped configuration and before the discharge of the particulate material into the web;
   i. garniture means immediately adjacent the wheel means for enclosing the web about the particulate material immediately after the particulate material is deposited on the web and forming the web into a rod;
   j. wrapping means for enclosing a wrapper around the rod; and
   k. cutting means for cutting the wrapped rod into lengths each having at least one intermediate portion containing a pocket with the particulate material within the web of selected filter material.

8. The invention in accordance with claim 7, wherein suction means expedites the transfer of the particulate material from the pockets of the wheel to the web.

9. The invention in accordance with claim 7, wherein synchronization means synchronizes the peripheral speed of the wheel with the travel of the web.

10. The invention in accordance with claim 7, wherein registration means registers the location of the pockets with the cut by the cutting means.

11. The apparatus of claim 7 wherein the shaping means includes a trumpet and a rib mounted internally and longitudinally along the trumpet.