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(54) FILLED CONTINUOUS PLASTICS ROD SUCH AS PLASTICS CIGARETTE FILTER ROD FILLED WITH A TOW OF CELLULOSE ACETATE AND METHOD OF FORMING SAME

(71) We, PHILIP MORRIS INCORPORATED, a corporation organized and existing under the laws of the State of Virginia, United States of America, of 100 Park Avenue, New York, New York 10017, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is concerned with a filled tubular article, as for example, cigarette filter rod and a method of making the same. It is common practice in the cigarette making art to form filter rod in a continuous operation by wrapping a continuous tow of filaments of a filter medium, most usually cellulose acetate, in a continuous paper wrapper customarily referred to as "plug wrap". This generally involves advancing the tow and paper wrap on which the former is laid through a forming device which shapes the paper wrap around the tow in the form of a part-cylindrical enclosure wherein the tow is compressed to a degree, the operation being such as to leave an edge outstanding tangentially from the paper at one side so that it thereafter may be overlapped or folded against the main body of the rod to form the seam of the finished rod. The outstanding part of the wrap is then coated with an adhesive and as the partly formed rod passes through a final folder device the outstanding edge is folded against the main body of the rod and held for a short period to allow an adhesive bond to be effected. If a heat activated adhesive is used, the final folder device can be provided with a heater to activate the adhesive. It is also possible to

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coat the inner surfaces of the wrapper with adhesive so that the tow confined therein will adhere to the wrapper. However, this known method of making cigarette filter rod has shortcomings which makes it unsuitable for use in modern cigarette making technology where very high manufacturing speeds are commonplace. For example, the use of an adhesive joint or seam usually limits production line speed to a speed not greater than about 300 feet per minute. Also the device with which adhesive is applied to the outstanding edge part of the plug wrap must be accurately controlled so that neither an overabundance nor an inadequacy of adhesive is applied to the edge part particularly since in the advent of either condition the seam of the formed rod has a tendency to pull open. A further disadvantage is that the overlapped seam formed on the filter rod has a generally flattened surface giving the finished product some degree of out-of-roundness. This flatness detracts from the appearance of smoking articles in which the filter rod is used and also can create problems in the cigarette making machines by causing upset of the process with which the filter plug is joined to the tobacco cylinder, as well as wrinkling of the tipping paper used for that purpose. Also, filter rod made according to the described known method would not easily be adapted for forming the mouthpiece part of a ventilated cigarette similar to the type described in British Patent specification No. 1,198,772. The cigarette described in said specification has a mouthpiece with a fluted external surface formed such that when it is joined with a tobacco cylinder by means of tipping paper, the tipping paper

and flutes enclose ventilation passages through which cooling air streams are aspirated by the smoker in the course of puffing the cigarette. The mouthpiece described in said specification is preferably made of plastics by an extrusion process, for example that described in United States Patent specification No. 3,538,210.

The present invention is concerned with a method with which a tubular article filled with a gas or pervious filler, such as a tow filled cigarette filter rod can be produced in continuous length by continuous forming operation and at a production speed of 1000 feet per minute or more, the article itself being of novel character and susceptible to uses for purposes other than merely as a filtering device in a smoking article. The invention can be used to give a constancy of processing that ensures nearly perfect uniformity of dimension in the finished product as well as of density of the filter medium enclosed within the tubular plastics workpiece.

According to one aspect of the present invention there is provided a method of making an article of composite structure comprising a mass of fibrous material enclosed in a tubular sheath, said method comprising extruding a thermoplastics material through an extrusion aperture to form a continuous tubular workpiece, conveying the workpiece away from the aperture, while advancing a continuous pervious tow of fibrous filler material into and codirectionally with the workpiece, uniformly drawing the workpiece down against the continuous tow sufficiently tightly to compress the tow radially inwardly by advancing the workpiece through a further aperture of smaller transverse cross-section than the extrusion aperture, and cooling the workpiece to set the external dimensions thereof at values substantially corresponding to those of the further aperture.

According to a second aspect of the invention there is provided an article of composite structure comprising a continuous substantially longitudinally untensioned pervious tow of fibrous material of generally circular cross-section and made up of a plurality of fibres extending generally longitudinally of and coextensively of said tow, and a tubular sheath of thermoplastics material enclosing and radially compressing said tow.

The apparatus and procedure by which the cooling of the extrudate to set its external surface is carried out is the same as that described in the previously mentioned United States Patent Specification No. 3,538,210.

In accordance with the invention various types of material suited to act as filter media may be used as the filler and various

types of plastics can be utilized for the tubular workpiece in which the filler is sheathed. Most commonly, however, cellulose acetate is employed as the filter medium, being formed from a stock of cellulose acetate in the usual manner by advancing a bloomed tow of filaments through a collecting horn to confine, partially compress, and shape the tow into a generally cylindrical shape. For the purpose of providing uniform density and overall cohesive character to the filler, it is customary as is done in prior art filter rod making methods, to treat the filaments thereof with a plasticizer to thereby promote inter-fiber bonding of the various filaments comprising the tow. In accordance with the present invention a heat activated plasticiser may be applied to the tow only a short time prior to its entry into the collection horn.

A fuller understanding of the invention will be had from the following detailed description, given by way of example, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a side elevational view partly in section of apparatus with which plastics cigarette filter rod of the present invention is formed;

Figure 2 is a fragmentary view illustrating the manner in which the tow is bloomed and coated with plasticiser prior to advancing same into the apparatus shown in Figure 1;

Figure 3 is a perspective view of a representative length of the tow-filled filter rod made according to the invention, portions thereof being broken away for purposes of clarity; and

Figure 4 is a perspective view on reduced scale showing a cigarette in which the article of Figure 3 is embodied as a filtered mouthpiece.

Throughout the following description like reference numerals are used to denote like parts in the drawings.

The present invention is concerned with a method for forming filled plastics tubing in continuous operation, as for example, a continuous hollow tube having the bore thereof filled with a tow of fibrous material such as cellulose acetate rendering the article useful when sectioned into lengths as a device for filtering gaseous or liquid media including cigarette smoke. The article could also be employed as a storage and dispersing device for liquid, as for example, as an ink cartridge for a writing implement. The invention is particularly directed to a method and means with which cigarette filter rod can be produced, the composite structured filter rod itself being of novel character. It will be understood that the method of the present invention has a broad range of applicability for form-

ing continuous rod-like articles having either a cylindrical or polygonal outer surface. The outer surface also can be of smooth or protuberant surface configuration, the latter including the structural arrangement shown in Figure 3. Turning now to a description of a representative embodiment of the invention, reference is made to Figure 3 which depicts a short length of cigarette filter rod 10 which is comprised of a thin-walled outer plastics sheath 12 of circular section, which encloses a filler 14 such as a tow of filaments of cellulose acetate, the tow functioning as a filter medium when a short length or plug of the rod is incorporated in a cigarette. The filler 14 is depicted as substantially filling the plastics sheath although it is of pervious character and although for cigarette filter rod this is preferable, it is not essential within the scope of this invention that the fibrous filler alone completely fills the sheath, it being possible to include particles of charcoal or other substance as described below. The overall diameter of the sheath 12 as depicted is approximately 0.3" with a wall thickness ranging between .005" to .020" although it will be understood that a wide range in these parameters is possible depending upon the intended use of the article. The rod shown in Figure 3 is advantageously employed in the ventilated cigarette described in the previously mentioned patent specification No. 1,198,772 and has a fluted external surface wherein the respective flutes intersect to form peaks as at 16, the peaks being enclosingly engaged by the cigarette tipping paper customarily used to join the filter plug with the tobacco cylinder so that the arcuate-shaped longitudinally arranged grooves 18 together with the tipping paper comprise ventilation passages through which cooling streams of dilution air are aspirated and delivered separately of the smoke stream to the smoker's mouth when the cigarette is puffed, the tipping paper being provided with a suitable arrangement of perforations for communicating the respective ventilation passages with atmosphere.

The filter rod 10 shown in Figure 3 can have an external dimension within prescribed limits but when used as a filter plug for a ventilated type cigarette of the description aforesaid, the circumference of a circle circumscribing the peaks of the flutes 16 preferably should measure 23.9 mm. $\pm$.05 mm. The reasons for controlling this circumferential dimension with such accuracy are set forth more elaborately in United States Patent specification No. 3,538,210 but in brief it is desirable to minimize conditions which can cause upset in cigarette making machinery when the filter plugs are joined with the tobacco cylinders.

Figure 1 illustrates apparatus denoted generally at 20 with which cigarette filter rod 10 of the present invention can be made. The apparatus 20 is generally similar to that described in United States specification No. 3,538,210 mentioned above, but modified in the construction of the extrusion die 22 details of which will be given shortly herein. As a preliminary to forming the cigarette filter rod 10, the filter medium which is described in representative form as being a tow of filaments of cellulose acetate is prepared as shown in Figure 2. Thus a stock of filaments is fed through a blooming and coating chamber 26a wherein the filaments are coated with a plasticizer comprising by way of example, a solution of 9% triacetin. The plasticizer is employed to promote inter-fiber bonding in the tow at the points of crossing or contact of the respective fibers and thereby produces cohesiveness in the mass of the tow. Furthermore, the plasticizer preferably is a solvent of the thermoplastics material from which the sheath 12 is made. Upon leaving chamber 26a, the tow is advanced through a feed roll set 27 and undergoes a loop transit as at 29 to relieve tension in the tow feed in the longitudinal direction since it is preferable that the tow thereafter be processed without any tension being present therein. The tow then enters into collection horn 26 in which the relatively loose fibrous mass is partially compressed and shaped into a generally continuous cylindrical body, the tow issuing from the collection horn 26 in the manner indicated and follows a course which leads it into the crosshead die 22. The tow issuing from horn 26 has a diameter larger than the intended final internal dimension of the sheath but, and for reasons as will appear, has a diameter smaller than the internal diameter of the extrudate leaving the die 22. Crosshead die 22 includes a body part 28 wherein is supported in known manner a mandrel 30, the mandrel being spaced from the internal bore of the body part 28 so as to define therewith an annular space in the body part in which can be received molten plastics 32 entering the crosshead die laterally from a reservoir (not shown). Depending on the speed with which the extruder screw (not shown) feeding the molten plastics 32 is rotating, a continuous tubular stock 12 of heated plastics issues from and is conveyed away from the mouth or extrusion aperture of the extruder die as at 34 (by means of puller unit 64 to be described later), the extrudate at that point having cross-sectional dimensions substantially larger than the intended final cross-sectional dimensions of the finished filter rod and being sufficiently heated to be plastically deformed and the inner surfaces as at 35 being tacky

or in a plastics state. Also, the extrudate possesses at that point an external surface configuration in substantial conformance with that of the finished product and to that end, the crosshead die 22 may be fitted with a suitable shaping means to impart the required configuration to the extrudate. The bore passage of die body part 28 can be fluted complementally to the fluted pattern of rod 10. Simultaneously with the issuance of the tubular workpiece 12 from the die, the compressed tow 14 of filter medium transits through a central cylindrical passage formed in the mandrel as at 38. The tow upon leaving the die 22 advances axially into and codirectionally with the extrudate, the tow mass having at that point a diameter at least slightly greater than the inside diameter of the sheath when the latter is fully processed. As will be noted, the codirectional movement of the extrudate 12 and tow 14 downstream of the point of exit from the crosshead die 22 is for some short distance one in which the hot extrudate does not contact the tow. The foregoing is provided to allow the extrudate to be drawn down in size in that distance of travel with the extrudate making first contact with the tow only as the composite structure enters portal gland 42 of the cooling chamber 40. While the filler (tow 14) is transiting the extruder die 22, it can be enclosed within a central sleeve (not shown) and the sleeve can be positively cooled for the purpose of inhibiting heat transfer to the tow within the extruder die so as to prevent heat discoloration to the surface of the tow. This is a consideration of some consequence when using a filler such as polyethylene or polypropylene materials since they are subject to damage from the heat present within the extruder die.

As the composite article enters the cooling chamber 40 through portal gland 42, the plastics sheath is drawn down sufficiently and uniformly tightly against the tow and to about the optimum final external dimension it is intended to have, and in so doing subjects the tow mass of filler 14 to a further and final radial compression. In this operation, the portal gland serves as a closing aperture having substantially the same diameter and shape as the final external diameter of the sheath. Thus in the finished article, the sheath 12 will enclose the tow mass with a positive constraint of the latter. The thermoplastics extrudate 12 can be extruded from die 22 at a temperature at which it is plastically deformable and at which at least the inner wall surface or bore thereof is plastic (tacky). Thus when the plastics sheath is drawn down against the tow filler 14 the fibers at the surface of the latter become embedded in and adhere to the inner wall surface of the extrudate as

at 120 in Figure 3. The adhesion of the tow to the extrudate in this manner serves to position longitudinally the tow mass within the sheath. If the extrudate is extruded under conditions which do not allow for sufficient tackiness of the inner wall surface, the plasticiser coating the tow will function to adhere the tow mass to the inner wall surface although to a lesser degree than the adhesion possible by embedding the tow in the extrudate material as above described.

In its passage through the cooling chamber the composite article is submerged in a bath of cooling water 46 and passes through a series of apertured sizing plates 48-58 in sizing relationship therewith. The respective sizing plates together comprise a sizing die assembly, the plates being initially spaced apart at equal distance from each other and thereafter at the increasingly larger distances shown in the direction of advance of the article, the apertures of the plates having complemental configuration to that external surface of the sheet. The purpose of providing a spaced apart plurality of sizing plates is to positively expose the extrudate external surface to the cooling fluid to ensure a positive and progressive setting or hardening of the external surface in correspondence to the advance of the article. In effecting the sizing of the sheath which is done in the same manner as described in the prior mentioned United States specification No. 3,538,210 the sleeve is subjected to an internal pressure that tends to expand it radially to hold same tightly in sizing relationship with the sizing plates 48-50 and produce the proper sizing in the sheath. The force of expansion is provided by maintaining the cooling chamber 40 and the fluid 46 therein under a condition of vacuum whereas the space enclosed by the sheath is communicated with atmospheric pressure, the atmospheric pressure entering the assembly by investing the low density tow mass 14 as the latter enters the extrusion die.

On leaving the cooling chamber 40, the sheathed article passes between the rotating belts 60-62 of suitable puller device 64 which feeds the article through a cutting unit (not shown) wherein the continuous length article is cut into short lengths as shown in Figure 3 and adaptable for use in further processing such as utilization in cigarette making machines.

The tubular article produced according to the present invention is advantageously employed as the mouthpiece component of a ventilated cigarette and accordingly can be sectioned into small lengths as indicated previously for that use. The tow of filters preferably is comprised of a plurality of filaments of cellulose acetate extending lon-

5 longitudinally and coextensively of the tow mass. It can be and preferably is treated with a plasticiser which causes adhesion between the representative fibers of the tow and hence produces a cohesive character in the tow. In addition to providing means for achieving adhesion between the fibers, the plasticiser may be used to adhere smoke treating substances such as filtrant or flavor-ent substances to the tow, as for example, particles of charcoal 122 as seen in Figure 3. When used in conjunction with a mouth-
 10 piece for a ventilated cigarette of the type previously described the cellulose acetate preferably should have a total denier of 25,000 to 75,000 but more preferably in the range of 30,000 to 50,000 the foregoing being based on a filament denier of about 1 to 16 and preferably 3 to 6 denier. Other materials are suitable for use as filler and can include polyalkenes, polyethylene, and paper tows. The plastics sheath 12 can be formed from various types of thermoplastics materials, preferably polyethylene, and can have various external and internal dimensions depending on the use. As was mentioned earlier for filtered cigarettes the circumference of a circle circumscribing the peaks of the flutes formed in the surface of the rod should be 23.9 mm. with a variation no greater than ± 0.5 mm. In accordance with the present invention it is not essential that the filler material be positively secured to the inner surfaces of the sheath since it
 35 is normally constrained therein by virtue of the tendency of the filler to expand. However, as mentioned earlier, the external or outer surface of the filler becomes adhered to the inner surface of the sheath as the latter is pulled down against the tow, the adhesion occurring at the time the still tacky inner surface of the sheath makes contact with the filler.

45 Figure 4 shows a ventilated cigarette embodying the mouthpiece structure of Figure 3. The cigarette 150 includes a wrapped cylinder of tobacco 152 which is aligned with the mouthpiece 10, the outer surface of the sheath being enclosed in a wrapper sheet 154 which also serves to join the mouthpiece to the tobacco cylinder. Perforations 158 are provided in the wrapper sheet to admit air as ventilated streams in the course of smoking.

55 An important advantage of the filled tubular article of the present invention is that it allows for extrusion and accurate external dimensional sizing of a continuous tubular element having very small wall thickness, the latter characteristic being desirable, for example, where reduction in overall article weight is sought. Such advantage accrues in that the filler serves as an internal support for the tubular element
 65 during the critical sizing and cooling pro-

cedures. It will be appreciated that relatively thin-wall, i.e., .004" thick tubing is most susceptible to collapse during cooling and sizing, particularly where the travel attending these procedures is prolonged. On the other hand, collapse of the tubing when filled with a compressed tow filler under similar sizing and cooling does not occur.

WHAT WE CLAIM IS:—

1. A method of making an article of composite structure comprising a mass of fibrous material enclosed in a tubular sheath, said method comprising extruding a thermoplastics material through an extrusion aperture to form a continuous tubular workpiece, conveying the workpiece away from the aperture, while advancing a continuous pervious tow of fibrous filler material into and codirectionally with the workpiece, uniformly drawing the workpiece down against the continuous tow sufficiently tightly to compress the tow radially inwardly by advancing the workpiece through a further aperture of smaller transverse cross-section than the extrusion aperture, and cooling the workpiece to set the external dimensions thereof at values substantially corresponding to those of the further aperture.
2. A method according to claim 1, wherein the tow is coated with a plasticiser before it is advanced into the workpiece.
3. A method according to claim 1 or 2, wherein the thermoplastics material is polyethylene and the fibrous filler material is cellulose acetate.
4. A method according to claim 1, 2, or 3, wherein the cooling of the workpiece is effected in a bath of a cooling liquid maintained at sub-atmospheric pressure while the interior of the workpiece communicates with atmosphere.
5. A method according to any one of the preceding claims, wherein the thermoplastics material is extruded at a temperature in excess of that at which the internal surface of the workpiece would become plastic, and the workpiece is drawn against the tow while said internal surface is still plastic.
6. A method according to any one of the preceding claims, wherein the tow is advanced into the workpiece as a cohesive but untensed mass.
7. A method according to any one of the preceding claims, wherein the external dimensions of the tow while it is advanced into the workpiece are between the internal dimensions of the workpiece as the workpiece leaves the extrusion aperture and the internal dimensions of the cooled workpiece.
8. An article of composite structure comprising a continuous substantially longitudinally untensioned pervious tow of fibrous material of generally circular cross-section and made up of a plurality of fibres

gitudinally and coextensively of the tow mass. It can be and preferably is treated with a plasticiser which causes adhesion between the representative fibers of the tow and hence produces a cohesive character in the tow. In addition to providing means for achieving adhesion between the fibers, the plasticiser may be used to adhere smoke treating substances such as filtrant or flavor-ent substances to the tow, as for example, particles of charcoal 122 as seen in Figure 3. When used in conjunction with a mouthpiece for a ventilated cigarette of the type previously described the cellulose acetate preferably should have a total denier of 25,000 to 75,000 but more preferably in the range of 30,000 to 50,000 the foregoing being based on a filament denier of about 1 to 16 and preferably 3 to 6 denier. Other materials are suitable for use as filler and can include polyalkenes, polyethylene, and paper tows. The plastics sheath 12 can be formed from various types of thermoplastics materials, preferably polyethylene, and can have various external and internal dimensions depending on the use. As was mentioned earlier for filtered cigarettes the circumference of a circle circumscribing the peaks of the flutes formed in the surface of the rod should be 23.9 mm. with a variation no greater than ± 0.5 mm. In accordance with the present invention it is not essential that the filler material be positively secured to the inner surfaces of the sheath since it is normally constrained therein by virtue of the tendency of the filler to expand. However, as mentioned earlier, the external or outer surface of the filler becomes adhered to the inner surface of the sheath as the latter is pulled down against the tow, the adhesion occurring at the time the still tacky inner surface of the sheath makes contact with the filler.

Figure 4 shows a ventilated cigarette embodying the mouthpiece structure of Figure 3. The cigarette 150 includes a wrapped cylinder of tobacco 152 which is aligned with the mouthpiece 10, the outer surface of the sheath being enclosed in a wrapper sheet 154 which also serves to join the mouthpiece to the tobacco cylinder. Perforations 158 are provided in the wrapper sheet to admit air as ventilated streams in the course of smoking.

An important advantage of the filled tubular article of the present invention is that it allows for extrusion and accurate external dimensional sizing of a continuous tubular element having very small wall thickness, the latter characteristic being desirable, for example, where reduction in overall article weight is sought. Such advantage accrues in that the filler serves as an internal support for the tubular element during the critical sizing and cooling pro-

cedures. It will be appreciated that relatively thin-wall, i.e., .004" thick tubing is most susceptible to collapse during cooling and sizing, particularly where the travel attending these procedures is prolonged. On the other hand, collapse of the tubing when filled with a compressed tow filler under similar sizing and cooling does not occur.

WHAT WE CLAIM IS:—

1. A method of making an article of composite structure comprising a mass of fibrous material enclosed in a tubular sheath, said method comprising extruding a thermoplastics material through an extrusion aperture to form a continuous tubular workpiece, conveying the workpiece away from the aperture, while advancing a continuous pervious tow of fibrous filler material into and codirectionally with the workpiece, uniformly drawing the workpiece down against the continuous tow sufficiently tightly to compress the tow radially inwardly by advancing the workpiece through a further aperture of smaller transverse cross-section than the extrusion aperture, and cooling the workpiece to set the external dimensions thereof at values substantially corresponding to those of the further aperture.
2. A method according to claim 1, wherein the tow is coated with a plasticiser before it is advanced into the workpiece.
3. A method according to claim 1 or 2, wherein the thermoplastics material is polyethylene and the fibrous filler material is cellulose acetate.
4. A method according to claim 1, 2, or 3, wherein the cooling of the workpiece is effected in a bath of a cooling liquid maintained at sub-atmospheric pressure while the interior of the workpiece communicates with atmosphere.
5. A method according to any one of the preceding claims, wherein the thermoplastics material is extruded at a temperature in excess of that at which the internal surface of the workpiece would become plastic, and the workpiece is drawn against the tow while said internal surface is still plastic.
6. A method according to any one of the preceding claims, wherein the tow is advanced into the workpiece as a cohesive but untensed mass.
7. A method according to any one of the preceding claims, wherein the external dimensions of the tow while it is advanced into the workpiece are between the internal dimensions of the workpiece as the workpiece leaves the extrusion aperture and the internal dimensions of the cooled workpiece.
8. An article of composite structure comprising a continuous substantially longitudinally untensioned pervious tow of fibrous material of generally circular cross-section and made up of a plurality of fibres



- extending generally longitudinally of and co-
extensively of said tow, and a tubular sheath
of thermoplastics material enclosing and
radially compressing said tow.
- 5 9. An article according to claim 8,
wherein the outer fibres of the tow are em-
bedded in the interior surface of the sheath.
- 10 10. An article according to claim 8 or
9, wherein the fibres are adhered to one
another.
11. An article according to claim 10,
wherein the fibres are coated with a plasti-
ciser to adhere the fibres together.
- 15 12. An article according to claim 11,
wherein the plasticiser is a solvent for the
material of the sheath and secures the outer
fibres of the tow to the inner surface of
the sheath.
- 20 13. An article according to any one of
claims 8 to 12, wherein the fibres of the
tow are fibers of cellulose acetate.
14. An article according to claim 13,
wherein the total denier of the tow is in the
range from 30,000 to 50,000.
- 25 15. An article according to any one of
claims 8 to 14, wherein the sheath is made
from polyethylene.
16. An article according to any one of
claims 8 to 15, wherein the outer surface of
30 the sheath is formed with longitudinally ex-
tending flutes.
17. A cigarette including an article ac-
cording to any one of claims 8 to 16, and
further including a wrapped cylinder of
tobacco axially aligned with the article and
35 a wrapper sheet around the outer surface of
the sheath and joining the latter to the
tobacco cylinder, the wrapper sheet having
perforations therein adjacent the tobacco
cylinder.
- 40 18. A cigarette according to claim 17,
further comprising a smoke treating sub-
stance incorporated in the tow and held to
the latter at the points of contact of the
fibers.
- 45 19. A method of making an article of
composite structure, said method being sub-
stantially as hereinbefore described with
reference to and as shown by the accom-
panying drawing.
- 50 20. An article of composite structure
made by a method according to any one of
claims 1 to 7.
21. A cigarette constructed and arranged
substantially as hereinbefore described with
55 reference to and as shown by the accom-
panying drawing.

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