Dec. 27, 1960 J. R. WYLDE 2,966,198

PRODUCTION OF CIGARETTE FILTER TIPS

Filed June 1, 1956

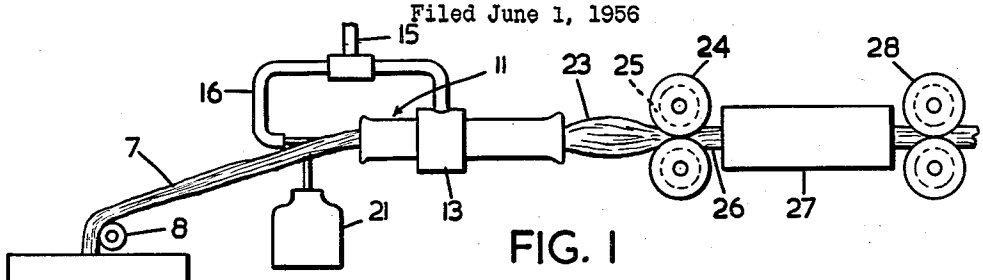


FIG. 1

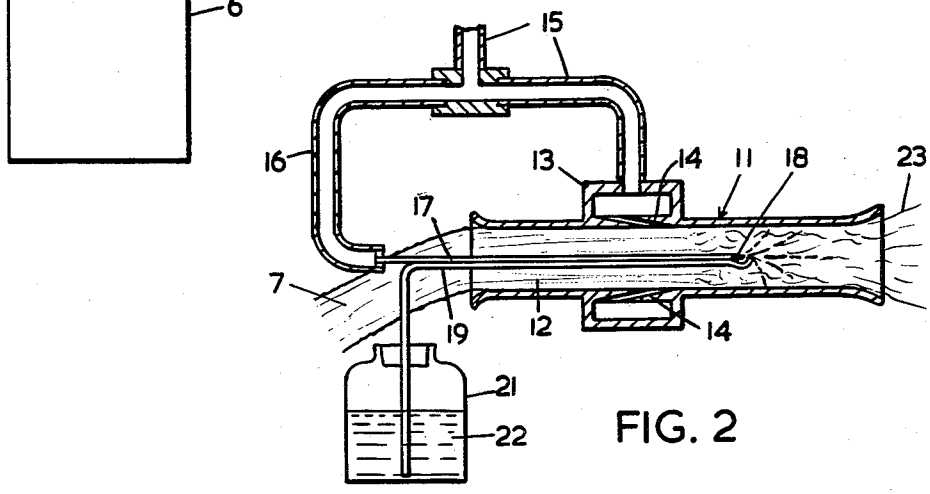


FIG. 2

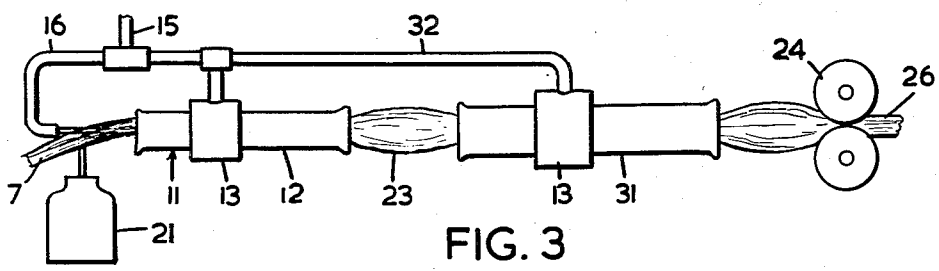


FIG. 3

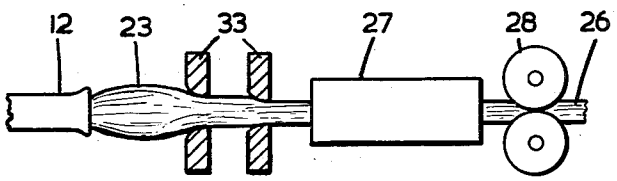


FIG. 4

United States Patent Office 2,966,198
Patented Dec. 27, 1960

2,966,198

PRODUCTION OF CIGARETTE FILTER TIPS

Joseph Rowland Wylde, Spondon, near Derby, England, assignor to British Celanese Limited, a British company

Filed June 1, 1956, Ser. No. 588,831

Claims priority, application Great Britain June 10, 1955

14 Claims. (Cl. 154—1.7)

This invention relates to the production of filter tips for cigarettes and is an improvement in or modification of the invention described in U.S.A. Patent No. 2,707,308.

In that specification there is described a cigarette filter tip comprising a rod of aligned crinkled cellulose acetate fibres bonded together by a film of a water-soluble cellulose derivative and pervious to air in the general direction of the length of the fibres. The filter tip is produced by forming a lap or tow of aligned crinkled cellulose acetate fibres, wetting the fibres with an aqueous film-forming solution of a water-soluble cellulose derivative, drawing the wet lap through dies to shape it to an appropriate diameter and drying the rod. Wetting of the lap can be effected by soaking it in the aqueous solution, excess solution being squeezed out of the product at the same time as it is shaped into a rod.

According to the present invention a method of producing cigarette filter tips comprises forming a lap or tow of aligned cellulose acetate fibres, passing said lap or tow through a turbulent current of air or other gas by which it is forwarded in the direction of its length and by which the fibres thereof are separated and opened out, spraying the opened-out lap or tow from the interior thereof with an aqueous film-forming solution of a water-soluble cellulose derivative and drying the resultant product in the form of the rod of a diameter appropriate for its use as a filter tip. By applying the aqueous film-forming solution in this way a much smaller quantity of film-forming solution, and a smaller quantity of the water-soluble cellulose derivative contained therein, are found to be sufficient for bonding the fibres into a rod, and the drying of the rod can be effected much more quickly and economically. Furthermore, the drying can be effected continuously with the spraying and forming of the rod instead of in a separate operation as specifically described in the parent specification. Moreover, the bonding material is uniformly distributed throughout the cross-section of the rod and is not unduly concentrated locally, e.g. so as to form a skin on the outside thereof.

The drying off of the aqueous film-forming solution in accordance with the present invention is partly effected in the act of applying the solution by spraying, the turbulent flow of air by which the fibrous tow is opened serving to carry off a substantial part of the water content of the applied solution. Further drying, if necessary, can be effected by passing the tow through one or more further air ejector devices, the tow being compacted into its rod-like form at a suitable stage at which the water content of the bonding material is sufficient for the fibres to be bonded together thereby. The subsequent ejector devices act upon the shaped tow without exerting any substantial opening effect thereon and without disturbing the bonding of the fibres. Alternatively, further drying can be effected by passing the formed rod through a suitable heater or through a high frequency electric dryer.

Crinkled cellulose acetate filaments can be produced cheaply by a variety of processes. Thus they can be

produced by dry-spinning a solution of cellulose acetate in acetone or other volatile solvent, using extrusion speeds very much higher than those normally employed, for example 700 to 1100 metres per minute and collecting the extruded filaments without tension. The resulting filaments, having about 10 to 15 crinkles per inch are preferably employed by collecting the continuous filaments together directly to form a tow. Alternatively, straight uncrinkled filaments produced by normal spinning methods can be given a crinkle by subjecting them to a crimping operation, e.g. one in which they are forcibly fed by feed rollers into a confined spaced from which their emergence is resisted so that they are subjected in the confined space to a crimping pressure. The invention is of especial advantage with filaments that have been crinkled by a crimping pressure, since any tendency the filaments may have to stick to one another, as a result of the crimping pressure, is overcome by the opening action of the turbulent air stream.

As in Patent No. 2,707,308, methyl cellulose and methyl hydroxy-ethyl cellulose have been found to be particularly satisfactory for use as the water-soluble film-forming cellulose derivative employed to bind the fibres together. Thus a methyl cellulose may be employed having a methoxy content of 28 to 30% and having a viscosity of the order of 20 to 100 centipoises (measured in 2% aqueous solution at 20° C.) or a methyl cellulose of higher methoxy content, say 31 to 32% with a somewhat lower viscosity say of the order of 10 centipoises. While the concentration of the aqueous solution employed should be fairly low to give a solution of a consistency suitable for spraying, it may be higher than that employed in Patent No. 2,707,308, e.g. of the order of 2 to 6% or more. The solution may then be applied to the opened lap or tow to an amount of 30 to 150% of the weight of the tow (instead of 200 to 300% or more as applied by soaking and squeezing) giving a product having a content of 2 to 10% by weight of bonding material. The spraying of the solution, from the inside of the opened out lap or tow, can be effected by delivering the solution either as a forced spray through an atomizer nozzle under a substantial pressure or as an induced spray brought about by the passage of a current of air past a point of supply of liquid.

The forming of the tow or lap into a rod can be effected by drawing it through a die of the appropriate diameter, or through a series of dies of successively smaller diameter. The dies thus employed may be fixed dies or they may be constituted by moving surfaces, e.g. a pair of grooved rollers whose grooves register with one another to constitute a die aperture. Such a pair of rollers can be used for forwarding the shaped product as well as for forming it into the desired shape.

By way of example, some forms of apparatus suitable for carrying out the present invention, and examples of the way of carrying out the process of the invention, will now be described in greater detail with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic side elevation of one form of layout of apparatus for carrying out the invention,

Figure 2 shows on a larger scale and in greater detail the opening and spraying means employed in Figure 1, and

Figures 3 and 4 show two variations of the layout of Figure 1.

In Figures 1 and 2 the apparatus comprises a can **6** serving as a source of supply of the lap or tow **7** to which the invention is to be applied, the lap or tow passing over a guide **8** and thence to the opening and spraying device indicated generally at **11** in Figure 1 and shown in greater detail in Figure 2. The device **11** comprises a tubular passage **12** surrounded partway along its length

by a casing **13** which communicates with the interior of the passage **12** by means of a number of oblique passages **14** inclined to the axis of the passage **12** in the direction of motion of the material **7**. Compressed air is supplied to the casing **13** by means of a pipe **15**, resulting in a strong and turbulent air flow just beyond the passages **14**, which impinges on the material **7** and causes it to be opened out. Compressed air from a branch **16** of the pipe **15** is also supplied to a straight tube **17** extending along the axis of the tube **12**, and terminating in a nozzle **18**. Just beyond the nozzle **18** is the end of a further tube **19** running parallel to the tube **18** and bent so as to present its orifice at right-angles to the nozzle **18**. The rear end of the tube **19** turns downwards into a container **21** holding a supply of an aqueous solution of a water-soluble cellulose derivative **22**. The air issuing from the nozzle **18** forms a spray of the liquid supplied by the tube **19** which is directed from inside against the fibres of the material **7**.

Emerging in an open and partly dried state from the tubular passage **12**, the sprayed material **23** is received by a pair of rubber-covered nip rollers **24** each having a groove **25** of semi-circular section so that the material is shaped by the co-operating grooves **25** into a rod **26** of circular section. The rod **26** is drawn through a heater **27** by a further pair of nip rollers **28**, to be cut into suitable lengths for use as filter tips in a cigarette-making machine. The tractive effect of the air flow in the passage **12** is almost sufficient by itself to draw the material **7** from the can **6**, and forward it to the rollers **24**. The rollers **24** determine the speed of treatment, but apply but little tension to the material to do so.

In the modification shown in Figure 3 the sprayed material **23** emerging from the tubular passage **12** is delivered to a further tubular passage **31**, slightly greater in length and diameter than the passage **12**, and similarly furnished with a casing **13** supplied with compressed air from a branch **32** of the air supply pipe **15**. By this means further drying of the sprayed material **23** is effected before it reaches the shaping rollers **24** forwarding it to the heater.

In the modification shown in Figure 4 the sprayed and partly dried material **23** emerging either from the tubular passage **12** or from the further tubular passage **31** is directed through a series of dies **33** (2 are shown) of successively smaller diameters by means of which (instead of by the rollers **24**) the sprayed material is shaped into a rod. The material is drawn by the nip rollers **28** through the dies **33** as well as through the heater **27**.

The following examples illustrate the carrying out of the invention by means of the apparatus described above.

Example I

A solution of cellulose acetate in acetone of about 26% concentration is dry spun at a linear speed of 700 to 800 metres per minute through a spinning jet having a large number of holes of approximately 0.005 mm. diameter, the filaments formed being allowed to fall naturally down the cabinet. In this way crinkled fibres are produced having 10 to 15 crinkles per inch and a filament denier of approximately 60. The filaments fall on a conveyor belt by which they are carried off to be collected, in association with the product of a number of similar jets, in the coiler can **6** of Figure 1 as a tow of filaments having a total denier of the order of 90,000. The material is then supplied from the can **6**, to the apparatus shown in Figure 1. The container **21** is supplied with a 3% solution of methyl cellulose of a methoxy content of 29% and a viscosity of 20 centipoises (measured in 2% aqueous solution at 20° C.), The tow **7** is fed to the ejector device **11** at 30 metres per minute and the solution **22** is supplied to the spray nozzle at 0.25 litre per minute. The rubber-coated nip rollers **24** together constitute an aperture of ⅜" diameter.

Example II

A tow of continuous filaments of cellulose acetate consisting of 15,000 filaments and having a total denier of 80,000 are crimped by forcibly feeding them into a confined space from which their emergence is resisted so that they are subjected to crimping pressure, and are collected in a can **6**. On being drawn from the can **6** they are subjected to the action of the apparatus shown in Figure 3, the container **21** being supplied with a 4% solution of methyl cellulose of methoxy content 30.5 and a viscosity of 15 centipoises. The tow **7** is fed to the ejector device **11** at 33 metres per minute and the solution **22** is supplied to the spray-nozzle at 0.33 litre per minute.

Having described my invention, what I desire to secure by Letters Patent is:

1. A method of producing cigarette filter tips which comprises forming a lap or tow of aligned cellulose acetate fibres, passing said lap or tow through a turbulent current of air which impinges on the outside of the lap or tow whereby the latter is forwarded in the direction of its length and the fibres thereof are separated and opened out, simultaneously spraying the opened-out lap or tow from the interior thereof with an aqueous film-forming solution of a water-soluble cellulose derivative and drying the resultant product in the form of a rod for use as a filter tip.

2. A method according to claim 1 comprising drying the lap or tow while it is travelling, continuously with the spraying thereof.

3. Method according to claim 2 comprising passing the lap or tow, after spraying thereof, through a further turbulent current of air without spraying.

4. Method according to claim 2 comprising passing the sprayed lap or tow in the form of a rod through a heating zone.

5. Method according to claim 1 wherein the fibres of the lap or tow are crinkled.

6. Method according to claim 5 comprising subjecting a lap or tow of uncrinkled fibres of cellulose acetate to an operation of crimping by mechanical pressure.

7. Method according to claim 1 wherein the water-soluble cellulose derivative is methyl cellulose.

8. Method according to claim 1 wherein the water-soluble cellulose derivative is methyl hydroxy-ethyl cellulose.

9. Apparatus for the production of cigarette filter tips, said apparatus comprising a tubular member adapted for the passage of a lap or tow of fibres, means supplying an air current to the outside of the lap or tow and positioned part-way along said tubular member to create therein a turbulent air flow in the direction of passage of the fibres, means within said member for simultaneously spraying the fibres from the interior of the lap or tow and means for shaping the sprayed product into the form of a rod.

10. Apparatus according to claim 9 comprising means for supplying liquid to a point within the tubular member and means for directing air blast past said point so as to induce a spray of the liquid.

11. Apparatus according to claim 9 comprising an additional tubular member and means for inducing a turbulent air flow therein, adapted for the passage of the sprayed fibres therethrough.

12. Apparatus according to claim 9 comprising a heater for the passage of the sprayed fibres therethrough.

13. Apparatus according to claim 9 comprising at least one pair of rollers formed with co-operating grooves for shaping the fibres into a rod.

14. A method of producing cigarette filter tips, which comprises forming a lap or tow of aligned cellulose acetate fibres, blowing air on to said lap or tow from a plurality of points surrounding said lap, and in directions at an acute angle to the length of said lap or tow, whereby a turbulent current of air is created which for-

wards said lap or tow in the direction of its length and separates and opens out its fibres, simultaneously spraying the opened-out lap or tow from the interior thereof with a 2% to 6% by weight aqueous solution of methyl cellulose in an amount of 30% to 150% based on the weight of the tow, and drying the resultant product in the form of a rod for use as a filter tip.

References Cited in the file of this patent

UNITED STATES PATENTS

984,195	Cooper	Feb. 14, 1911
2,115,218	Siever	Apr. 26, 1938
2,440,400	Hill	Apr. 27, 1948
2,468,081	Koster	Apr. 26, 1949
2,568,499	Hood	Sept. 18, 1951
2,707,308	Taylor et al.	May 3, 1955