Feb. 10, 1970 SACHIHIKO TACHIBANA ET AL 3,494,263

METHOD OF MAKING FIBROUS THIN SHEET CIGARETTE FILTERS

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Fig. 1

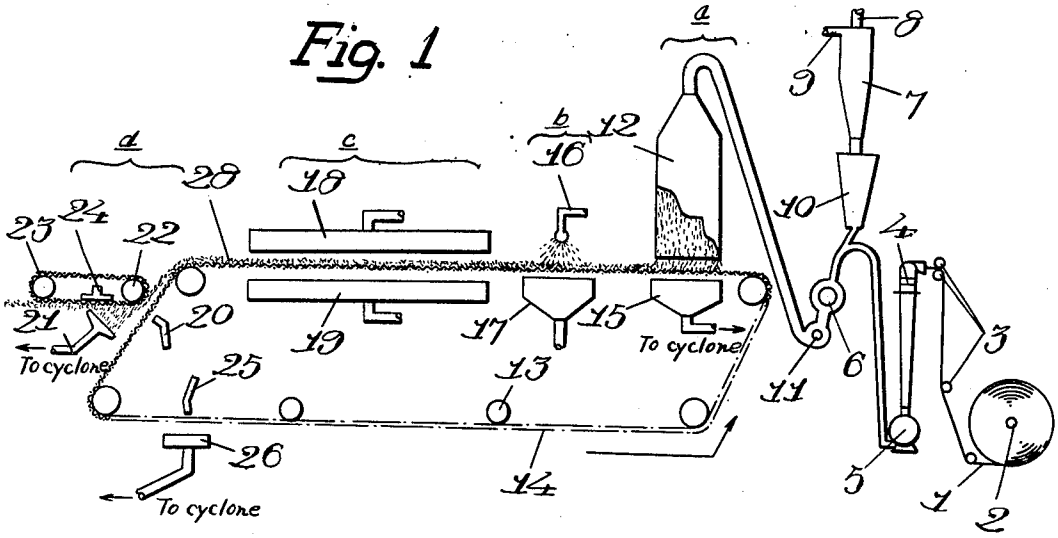
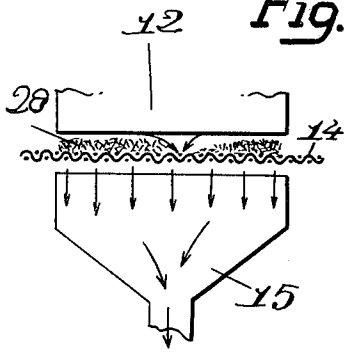


Fig. 3



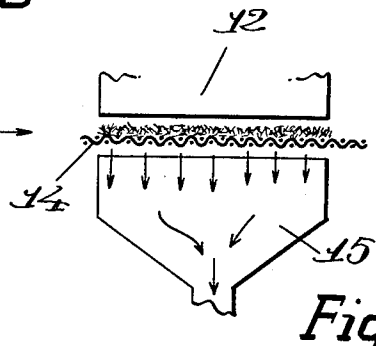


Fig. 5

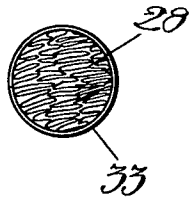


Fig. 2

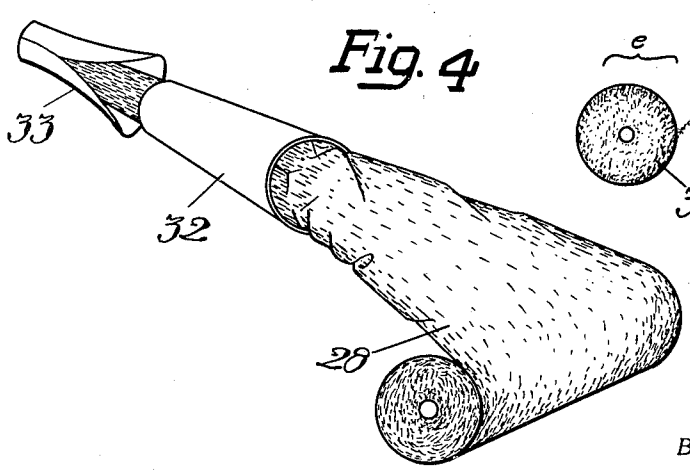
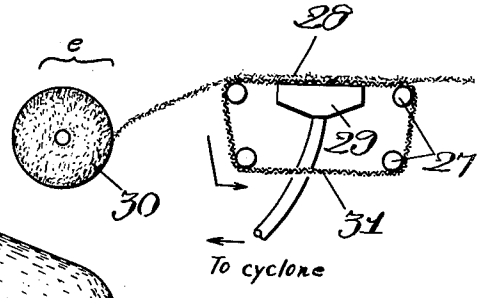


Fig. 4



INVENTORS
SACHIHIKO TACHIBANA
KAZUO MINAKUCHI
BY McGlew & Toren
ATTORNEYS

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METHOD OF MAKING FIBROUS THIN SHEET CIGARETTE FILTERS

Sachihiko Tachibana and Kazuo Minakuchi, Tokyo, Japan, assignors to Honshu Seishi Kabushiki Kaisha, Tokyo, Japan

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Claims priority, application Japan, July 11, 1964, 39/39,836
Int. Cl. D04h 1/64; B29d 23/12, 23/14
U.S. Cl. 93—1 3 Claims

ABSTRACT OF THE DISCLOSURE

A method of making a cigarette filter of a thin low density sheet from wood-pulp fibers which are formed as a layer upon a moving endless screen belt, and soaked by a spray of adhesive and then dried, without compression or other molding steps. The formed sheet is then rolled into a cylinder of cigarette size and enclosed with a wrapper.

This is a continuation-in-part application of our co-pending application Ser. No. 469,150, filed July 2, 1965, now abandoned.

This invention relates to a method of manufacturing a thin sheet of low density for filter tips of cigarettes and also to filter tips incorporating said sheet.

Recently, filter-tip cigarettes have become more popular. Commonly the materials of the tips are made from cellulose acetate, while in the present invention the tips are made from wood-pulp fibres. When these two materials are compared with respect to their utility as filter tips, wood-pulp fibres are superior to cellulose acetate in absorption of nicotine particles contained in tobacco smoke and also with respect to cost of manufacture. On the other hand, cellulose acetate is superior to wood-pulp fibres with respect to certain physical properties such as elasticity, stiffness and water-resistance, but these inferior properties of wood-pulp fibres can be improved by properly selecting an adhesive which is used in the method of the present invention. It also has been known that paper filters for cigarettes are made of milled papers processed so as to have fine creases or a number of longitudinal slits.

It is an object of this invention to provide an improved method of manufacturing a thin sheet of low density for filter tips of cigarettes, comprising feeding, in a continuous thin layer, wood-pulp fibres, unravelled from a dry roll sheet of wood, onto the outer surface of one end of a horizontal run of a moving endless wire gauze or screen, spraying an adhesive onto the layer in such an amount that it soaks through the layer but does not reach the wire gauze and subsequently drying it, and blowing compressed air from a nozzle having a slit directed against the inner surface of the wire gauze adjacent to the other end of the horizontal run, the sheet made thereby being continuously removed from the wire gauze, and the wood-pulp fibres which have not been bound into the sheet or become attached to the wire gauze being blown off from the sheet and wire gauze, wherein neither any compression nor a mold is employed resulting in producing a thin sheet of low density in which physical properties of wood-pulp fibres are not lost, and the remnants of the pulp fibre which have not become attached to the finished sheet are removed by the blast of compressed air resulting, in producing the sheet without any waste.

Other objects will become apparent from the following description of the invention made with reference to the accompanying drawing.

A method in accordance with the present invention will now be described by way of example with reference to the accompanying drawing.

In the accompanying drawing;

FIG. 1 shows diagrammatically principal parts of the present invention method,

FIG. 2 shows, similarly to FIG. 1, additional steps in the present invention method,

FIG. 3 explains the function by a collector opening placed facing to a material-supplying opening with a wire screen therebetween,

FIG. 4 is a perspective view illustrating a step of rolling a pulp-fiber sheet, which is obtained by the present invention method, into a cylindrical shape and enclosing it by a wrapper to produce a cigarette tip, and

FIG. 5 is a cross-sectional view of the cigarette tip made in accordance with the present invention.

Referring now in detail to the drawing, *a* is a section for forming the fibrous layer, hereinafter simply called a first section; *b* a section for spraying adhesive thereonto, hereinafter simply called a second section; *c* a section for drying the fibrous layer, hereinafter simply called a third section; *d* a section for blowing compressed air thereto, hereinafter simply called a fourth section; and *e* a section for winding up the product into a roll, hereinafter simply called the fifth section.

A bleached dry sheet **1** of wood-pulp fibres such as those of coniferous trees and having 10% moisture by weight which is wound onto a bobbin **2**, is fed by rollers **3** into a crusher **4**. The sheet is further fined by a fiiner **5** to produce well unravelled wood-pulp fibers. The fibers are transferred to a flock-breaker **6**, together with those collected by collector openings **15**, **21**, **26** and **29**, and recycled to a cyclone **7** through its inlet opening **9**. In the cyclone **7**, recycled fibers are separated from wastes and the latter is taken off from the processing system through an outlet opening **8** of the cyclone. The fibers thus recycled join the system through a hopper **10**. Newly supplied fibers and recycled fibers are supplied to a material-supplying opening **12** through the flock-breaker **6** and a transferring fan **11**. The fibers thus well unravelled and separated from each other are fed continuously at opening **12** of the first section *a* onto one end of a upper horizontal run of a moving endless wire screen **14** of about 70-mesh having 50 cm., width. The fibers may be screened by a reciprocating sieve of about 10 mesh (Tyler Standard) and provided inside the opening **12**. The wood-pulp fibres placed on the upper surface of the screen **14**, by passing through such screen if small enough, form an even fibrous loyer **28** of about 15 to 30 grammes per square meter. As particularly illustrated in FIG. 3, a collector opening **15**, placed facing to the material-supplying opening **12** with the moving wire screen **14** therebetween, and provided with an exhaust fan, operates to spread the pulp fibres over the wire uniformly as to the thickness of the layer, by drawing fibres from a portion of the layer where the fibres are relatively thick to a portion where the fibre layer is relatively thin. The collector opening further operates to draw too fine fibers through the wire screen and remove them from the layer. The thickness of the layer is controlled so as to be of greater magnitude than the thickness of the end sheet which it is desired to obtain, and within the above-mentioned range.

With the moving of the screen **14**, said layer is carried to the second section *b* where polyvinyl acetate emulsion (5%) is sprayed onto the layer, in the amount of about 15 percent by weight of the pulp fibre to be treated, from an adhesive-supplying tube **16** having a nozzle opening in the centre of the section *b*.

A suction pipe **17** is placed under the adhesive-supply-

ing tube **16** with the screen **14** therebetween. Since the adhesive sprayed in the adhesive-spraying section has the object of imparting bonding as well as stiffness and water-resistance to the wood-pulp fibrous layer, it is preferably of thermoplastic or thermosetting high polymer. Moreover, it should be tasteless, odorless and colorless in view of the fact that the product subjected to the adhesive is used for filter tips of cigarettes. It should also be non-toxic as well as substantially insoluble in water after hardening. Polyvinyl acetate, polyvinyl alcohol and its derivatives, or polyester resins, either alone or in a mixture thereof, for example, would meet these requirements. The amount of adhesives to be sprayed onto the layer should be such that the adhesives do not reach to the wire screen **14**, but soak through the layer to a thickness corresponding to the thickness of the desired sheet of about 6 to 20 grammes per square meter. It will be appreciated that a sheet of uniform thickness can be obtained, even when wood-pulp fibres placed on the screen are not completely even, by constantly controlling the amount of adhesives. Such adjustment might be obtained, for example, by controlling the suction force of the suction pipe **17** and consequently adjusting the permeation of adhesives into the layer.

Subsequently to the treatment in the second section *b*, the layer is subjected, in the third section *c*, to hot air blown from air-blowing openings **18** and **19**, and dried at about 100° C.

In the fourth section *d*, the layer **28** dried, into a self-sustaining sheet in the third section *c*, is further subjected to compressed aid blown from a nozzle **20**, having a slit of 2 mm. width directed against the under surface of the foraminous belt **14** adjacent to the other end of the horizontal run of the belt, so that the sheet may be removed from the belt and sustained in space along a wire screen **23** moving around rollers **22** and provided with a suction opening **24**. Consequently the wood-pulp fibres which have not been bound to the sheet or become attached to the belt, may be drawn into a collector suction opening **21** which connects to the inlet opening **9** of the cyclone **7**.

After the sheet has been removed from the endless belt of wire gauze **14**, the remnants of pulp fibres on the wire gauze surface are further blown off by the blast from the nozzle **25**, sucked in a collector **26** and recycled to the cyclone **9**.

Since the adhesive is sprayed onto the layer in such an amount that it does not reach to the wire gauze **14** under the layer, wood-pulp fibres, which remain on the wire gauze after the sheet has been removed, do not become attached to the gauze and the wire gauze can be used cyclically without cleaning it.

The sheet dried in this way is passed to winding machine **30**, where it is rolled up to a roll. The sheet might be passed over an additional suction opening **29** located on a run of wire gauze **31** travelling over rollers **27** and of comparatively small mesh, viz., of 5 to 10 mesh (Taylor Standard), so that fibers not bound to the sheet will completely be removed from the sheet. The discharge opening for pulp fibres indicated at **12** may also be used to discharge drying air.

The properties of the sheet produced in this way are as follows:

APPEARANCE

It is compact in structure and elastic throughout its entire surface, so that any pressure applied perpendicularly to the axial direction thereof does not produce spaced apart blemishes in the fibrous composition.

PHYSICAL PROPERTIES

Absorption of nicotine

Approximately 20 percent of nicotine particles contained in the tobacco smoke is absorbed as compared with 10 percent absorbed by the conventional filter-tips made from cellulose acetate.

Absorption of water

Under the conditions that the relative humidity is 100 percent and the temperature is 20° C., 11.8 percent of water is absorbed as compared with 18 percent absorbed by the filter-tips made from milled paper and 11 percent by the filter-tips made from cellulose acetate.

For making cigarette tips, the sheet thus obtained is rolled up to a cylindrical shape, having a diameter corresponding to the cigarette, by conventional means. One of such conventional means is illustrated in FIG. 4, in which the sheet **28** is gathered into a cylindrical shape by a tubular funnel-shaped guide **32** and enclosed by a wrapper **33**. Due to extremely flexible and elastic characters of the sheet, it is shaped without definite folding, as shown in FIG. 5.

The characteristics of the filter-tips for cigarettes made from the sheet in accordance with the method described are specified below.

(1) They have a uniform layer of pulp fibres, since the endless wire gauze is used for carrying and moving the layer of pulp fibres so that the current of air circulates evenly through the upper and under side of the pulp-fibre layer.

(2) Since the remnants of the pulp fibre which have not become attached to the finished sheet are removed from the wire gauze by the blast of compressed air when the finished sheet is removed from the wire gauze, only a very thin sheet with low density is produced without any waste.

(3) They are compact in their appearance and spiral or partial cavities, such as seen in conventional paper-filters, are not formed even when they are compressed laterally to their axial directions.

(4) They are excellent in absorption of nicotine as compared with the filter-tips made from cellulose acetate, and their absorption is uniform as compared with conventional filter-tips made from milled paper.

(5) The adhesive and the quantity in which it is used can be selected freely. Therefore, the elasticity, nicotine absorption, draught and water-resistance of the filter-tips can also be adjusted freely.

(6) The manufacturing cost of filter-tips according to the method described is low as compared with that of conventional products.

What we claim is:

1. A method of fabricating a thin, low density sheet, for use in making filter tips for cigarettes, comprising, at a feeding location, continuously feeding bleached wood-pulp fibres onto the upper surface of a moving foraminous conveyor to form, on the upper surface of the conveyor, a continuous layer of said wood fibres having a thickness greater than the desired thickness of the sheet; at the feeding location, continuously applying suction to the undersurface of the conveyor to distribute the fibres to a substantially uniform thickness and to draw undersized fibres through the conveyor; at a spraying location spaced from the feeding location, spraying the moving wood fibre layer with an adhesive, selected from the group comprising emulsions of thermoplastic and thermosetting synthetic resins which are tasteless, odorless, colorless, non-toxic and insoluble in water, in an amount such that the adhesive penetrates the layer of wood fibres to a depth substantially equal to the desired thickness of the sheet, but does not reach the upper surface of the conveyor; then drying the moving layer to form a self sustaining sheet; and thereafter directing a stream of air under pressure through the conveyor and against the undersurface of the moving layer to separate the formed sheet from the moving conveyor and to remove loose wood fibres from the sheet and the conveyor.

2. A method, as claimed in claim **1**, including the step of recycling the removed loose wood fibres to the feeding location.

3. A method, as claimed in claim 1, wherein the formed sheet is gathered and rolled to a cylindrical shape having a diameter corresponding to a cigarette, and enclosing the rolled sheet within a cylindrical wrapper to form filter tips.

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ROBERT F. WHITE, Primary Examiner

J. R. HALL, Assistant Examiner

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