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(54) **Reconstituted tobacco material and method and apparatus for the production thereof**

(57) A process for recovering and recycling tobacco dust comprises the steps of:
• mixing tobacco dust with a binder to provide a paste;
• extruding the paste through a die to provide an elongate extrudate;
• slicing the extrudate at one or more discrete locations along its length to provide a plurality of extrudate portions; and
• pressing at least one extrudate portion between two opposed surfaces, so as to flatten it.

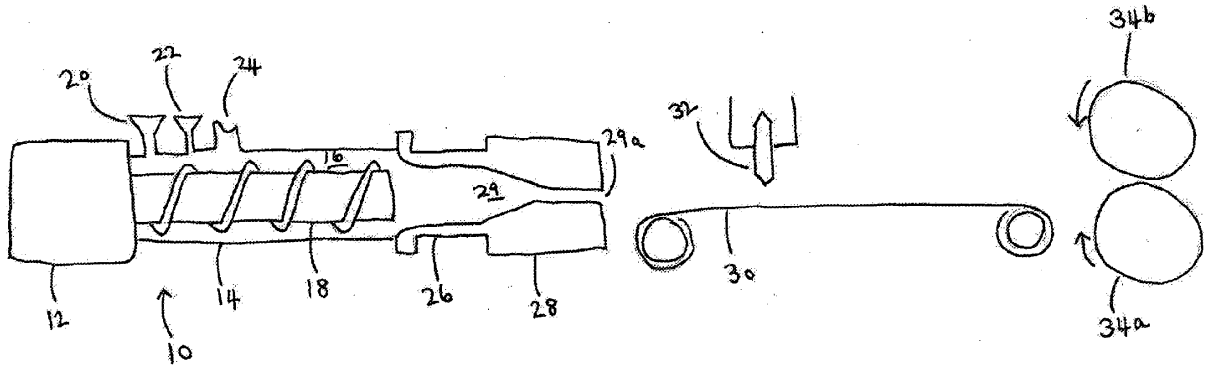

Fig. 1

EP 2 630 875 A2

Description

Field of the invention

[0001] The present invention relates to reconstituted tobacco material and methods and apparatus for the production thereof. In particular, the present invention relates to reconstituted tobacco material formed from tobacco dust and that is suitable for combination with natural tobacco lamina.

Background to the invention

[0002] Tobacco dust (also known as tobacco fines) is a common by-product of the processing of natural tobacco lamina to provide smoking articles such as cigarettes. During processing, e.g. cutting or handling, part of the tobacco lamina inevitably fragments to form dust, and this process may represent a significant economic loss for the cigarette manufacturer.

[0003] Therefore, attempts have been made to re-use the tobacco dust. For example, US 2008/0196731 describes a process in which tobacco fines are mechanically pressed into tobacco material, so as to adhere the fines to the tobacco material and allow for further processing to form a smoking article. This method may result in a material which is non-homogenous, with the possibility that during subsequent processing the tobacco fines become detached from the main body of the material.

[0004] EP 0404579 describes a method of making a smoking article rod, in which particulate tobacco and binder are mixed and extruded to provide a rod-form extrudate. The rod may then be wrapped in a conventional cigarette paper, for sale to the consumer. This process implies a radical change to the way in which cigarettes are manufactured, and as such there are considerable barriers to its adoption.

[0005] It is also known to mix tobacco fines with a binder and extrude the mixture as a thin, wide web of material that is subsequently drawn down in order to reduce its thickness, as described in GB2201081 and GB2266835. The thin reconstituted material may then be mixed with natural tobacco lamina (that is, tobacco leaf) for further processing according to conventional means. This process is often difficult to control, as the web of reconstituted tobacco material is liable to break during the draw-down process.

[0006] It is desirable to provide a process for producing reconstituted tobacco material that avoids the problems associated with known processes. In particular, it is desirable that the process should produce reconstituted tobacco material that has similar handling and processing properties to natural tobacco lamina (that is, tobacco leaf). When incorporated into a smoking article, the reconstituted tobacco material should not have any adverse effect on the smoking characteristics of the smoking article.

Summary of the invention

[0007] Therefore, at its most general, the present invention may provide a process in which tobacco dust is mixed with a binder to provide a paste, and the paste is then sliced and flattened to provide planar portions, e.g. flakes, of reconstituted tobacco material. Such flakes may have similar handling and processing properties to natural tobacco leaf, with the result that they may be processed alongside natural tobacco leaf and blended with it to provide smoking articles such as cigarettes or cigars.

[0008] In a first aspect, the present invention may provide a process for recovering and recycling tobacco dust, comprising the steps of:

- mixing tobacco dust with a binder to provide a paste
- extruding the paste through a die to provide an extrudate;
- slicing the extrudate at one or more discrete locations along its length to provide a plurality of extrudate portions;
- pressing at least one extrudate portion between two opposed surfaces, so as to flatten it.

[0009] The paste is extruded to provide an elongate extrudate (e.g. a rod-like extrudate), rather than a sheet-like extrudate such as described in GB2201081 and 2266835.

[0010] The tobacco dust is typically formed during processing of natural tobacco leaf, particularly for example, during cutting operations, in which sections of the leaf may fragment. The dust typically has a particle diameter less than 1 mm, and is sieved prior to mixing with the binder to remove any over-size particles.

[0011] The binder is generally a polymeric binder, e.g. a starch-based binder. Typically, the binder comprises starch and water. Many types of starch can be used: these include corn, rice and potato starches. Modified starches such as hydroxypropyl distarch adipate can also be used, and these may have advantages in obtaining a final product having the desired lighter-coloured appearance.

[0012] The tobacco dust and binder are typically mixed in an extruder comprising a barrel and a screw. The screw may serve to mix the components and to drive the paste towards the die. The pressure immediately upstream of the die may be in the range of 40-80 bar. The die aperture through which the paste is extruded typically has a maximum dimension of 1 mm to 10 mm, preferably 3 mm to 5 mm. In certain embodiments, the die may have multiple apertures through which paste may be extruded. In this case, a single slicing device may serve to slice the extrudate exiting the different apertures, and the extrudate portions obtained through the slicing step may all be pressed between the same two opposed surfaces.

[0013] The moisture content of the paste prior to extrusion is typically below 30 wt%, preferably below 20 wt%. Typically, this moisture content is 10 wt% or more,

preferably 12wt% or more.

[0014] As the paste emerges from the die in the form of extrudate, the reduction in pressure within the paste may cause flash evaporation of a portion of the internal moisture, which may result in some expansion (e.g. foaming) and cooling of the paste material. Typically, the temperature of the extrudate immediately after exiting the die is below 95°C, preferably below 90°C. Typically this temperature is above 70°C, preferably above 75°C, more preferably above 80°C.

[0015] The extrudate is typically sliced at locations spaced at intervals of 2-15 mm along its length, preferably at intervals of 3-10 mm.

[0016] Typically, the step of pressing the at least one extrudate portion between two opposed surfaces comprises passing the extrudate portion between two rollers that are axially aligned and displaced from each other along a radial direction.

[0017] The rollers typically comprise cast iron or another similar hard material. Optionally, the rollers may have a wear-resistant coating, comprising, for example, tungsten carbide.

[0018] The gap between the opposed surfaces of the two rollers is generally less than 1 mm, preferably less than 0.6 mm. In general, the gap is at least 0.1 mm, preferably at least 0.2 mm.

[0019] It has been found that it is preferable for flattening of the extrudate portions to occur through both longitudinal and sideways flow of the extrudate material. It is also desirable to minimise densification of the extrudate material. It has been found that these objectives may be achieved by passing the extrudate material between rollers that are rotating with different surface speeds. Typically, the rollers are individually driven to achieve this effect.

[0020] For example, one roller may have a surface speed that is at least 50% greater than the other roller, in certain cases at least 75% or 100 % greater than the other roller. In general, the slower roller has a surface speed of at least 1 m/s, preferably at least 1.5 m/s. Typically, the surface speed of the slower roller is less than 5 m/s, preferably less than 3 m/s.

[0021] Typically, the extrudate portion is passed through multiple pairs of rollers (that is, two or more pairs of rollers), the gap between the individual rollers in each pair of rollers decreasing in the sequence in which the extrudate passes through the pairs of rollers.

[0022] Typically, the temperature of the extrudate portions prior to being pressed between the two opposed surfaces is at least 65°C, preferably at least 85°C. Preferably, the moisture content of the extrudate portions at that stage of the process is at least 5 wt%, more preferably at least 10 wt%. It is thought that by keeping the temperature and moisture contents within these ranges, flow of the extrudate material during the pressing stage may be facilitated, while breakage of the material is avoided.

[0023] Preferably, the moisture content of the extrudate portions prior to the pressing stage is less than 25wt%, preferably less than 20 wt%. It is thought that this helps to prevent mould formation in the reconstituted tobacco material.

[0024] In order to maintain the temperature and moisture levels of the extrudate portions within these ranges, it is preferred that the time between extrusion of the paste through the die and pressing of the at least one extrudate portion is minimised. Effectively, this requires that the distance between die and the opposed surfaces is preferably as short as possible.

[0025] As a result of the process of the first aspect of the invention, flakes of reconstituted tobacco may be formed whose thickness and weight per unit area is such that they behave in a similar manner to pieces of natural tobacco lamina (that is, tobacco leaf) used in the manufacture of smoking articles.

[0026] In particular, when cut into strips of e.g. 0.8 mm width, this reconstituted material may have a similar terminal velocity when lifted pneumatically (e.g. in a cigarette-making machine) as strips of natural tobacco lamina of similar width. The friability and fragility of the reconstituted material may also be similar to that of natural tobacco leaf.

[0027] The process of the first aspect of the invention has the advantage over prior art processes (in particular, processes involving drawing down a web of reconstituted material) that it is relatively simple and does not require particularly careful control. For example, the extruder die shape is relatively simple to manufacture; there is no need for slicing of the extrudate to be carried out with a high degree of precision; and there is no need for very precise control of the speed of the downstream equipment handling the extrudate. Since the reconstituted material is typically provided in the form of flakes, rather than e.g. a web, the practical problems associated with maintaining the integrity of a broad planar material are avoided.

[0028] In a second aspect, the present invention may provide a planar portion of reconstituted tobacco material, prepared according to the process of the first aspect of the invention, the process including optionally any one or more optional features of the first aspect of the invention, whether taken alone or in combination.

[0029] In a third aspect, the present invention may provide a planar portion, e.g. a flake, of reconstituted tobacco material, comprising tobacco dust bound by a binder, the planar portion having a maximum dimension no greater than 6 cm and a thickness of less than 0.5 mm.

[0030] Typically, the binder comprises starch.

[0031] Preferably, the thickness of the portion is less than 0.4 mm. In general, the thickness of the portion is greater than 0.1 mm, preferably greater than 0.2 mm.

[0032] Preferably, the maximum dimension of the portion is no greater than 5 cm. Preferably, the maximum dimension of the planar portion is at least 1.5 cm, more preferably 2 cm.

[0033] Preferably, the planar portion has a rounded pe-

rimeter, e.g. it is substantially circular or elliptical in shape.

[0034] In a fourth aspect, the present invention may provide an apparatus for producing reconstituted tobacco material, comprising:

- an extruder for receiving and mixing tobacco dust and a binder to provide a paste, the extruder being in fluid communication with a die, and being configured to extrude the paste through the die to provide an elongate extrudate;
- slicing means for slicing the extrudate at discrete locations along its length, to provide extrudate portions;
- flattening means comprising two opposed surfaces, the flattening means being configured to press the extrudate portions between the opposed surfaces.

[0035] Typically, the flattening means comprises a first pair of rollers, the rollers being axially aligned and displaced from each other in a radial direction. Preferably the two rollers in the first pair of rollers are individually driven.

[0036] In certain embodiments, the apparatus may comprise a further pair of rollers that is configured to further provide flattening of the extrudate portions. Thus the gap between the two rollers in the further pair of rollers is smaller than the gap between the two rollers in the first pair of rollers.

Detailed description

[0037] The invention will now be described by way of example with reference to the following Figures in which:

Fig. 1 is a schematic section diagram of an apparatus for producing reconstituted tobacco material.

[0038] Referring to Fig. 1, an apparatus for producing reconstituted tobacco materials comprises an extruder 10 having driving means 12 and barrel 14. The barrel 14 defines a cavity 16 that houses a screw 18. The extruder is supplied by two feeders: a first feeder 20, for input of tobacco dust into the extruder, and a second feeder 22 downstream of the first feeder 20, for input of starch into the extruder. A water feedpipe 24 is provided downstream of the second feeder 22, for input of water into the extruder. The first and second feeders 20, 22 may each be e.g. a loss-in-weight feeder or a volumetric feeder. At its downstream end, the extruder cavity 16 is in fluid communication with a feedpipe 26 that feeds a die 28.

[0039] The die 28 has a conically-shaped interior cavity 29, the cavity 29 tapering in a downstream direction of the extruder 10. The cavity 29 is in fluid communication with the mouth 29a of the die, the mouth having a diameter of typically 3-5 mm.

[0040] A conveyor belt 30 provides conveying means from the die mouth 29a to a slicer 32 and a pair of rollers 34a, 34b. The pair of rollers 34a, 34b are made from chilled cast iron and have a coating comprising tungsten carbide.

[0041] To produce reconstituted tobacco material, tobacco dust is first sieved through a 1 mm aperture mesh to remove over-size material which might cause blockages. The sieved dust is then conveyed to the first feeder 20, which doses a flow of dust at a controlled rate into the extruder barrel 14. The second feeder 22 doses a flow of starch powder into the extruder barrel at a point just downstream of the tobacco dust entry. The water feedpipe 24 injects a controlled flow of water into the extruder at a point just downstream of the starch entry.

[0042] The extruder screw 18 is configured to mix the tobacco dust, starch and water to form a paste, and to feed the paste towards the die 28. The speed of rotation of the screw 18 is selected to generate a pressure of e.g. 45 - 80 bar behind the die 28. The water flow can be varied to provide the required moisture content in the paste, which is e.g. between 12% and 17% (wet weight basis).

[0043] Due to the pressure and heat generated in the extruder, the starch gels and binds the dust particles together.

[0044] As the paste is forced through the mouth 29a of the die 28, an elongate extrudate is formed. As the extrudate exits the mouth 29a of the die 28, the reduction in pressure within it causes flash evaporation of the internal moisture, resulting in some expansion and cooling of the paste to a temperature of e.g. between 80°C and 90°C.

[0045] The extrudate is then conveyed to the slicer 32 by means of a conveyor belt 30. The slicer 32 carries out repeated cutting actions as the extrudate travels beneath it, thus slicing the extrudate into extrudate portions. The timing of the repeating action of the slicer 32 is chosen such the extrudate portions have a length (measured in the axial direction of the extrudate) of e.g. between 1 and 2 times the diameter of the die mouth 29a.

[0046] The extrudate portions are conveyed to the flattening rollers 34a, 34b. The rollers are individually driven and arranged so that one may be driven significantly faster than the other, for example twice the speed of the other. The surface speed the lower speed roller is e.g. 1.8 - 2.5 m/s. The gap between the roller 34a, 34b is 0.2 - 0.6 mm.

[0047] The rollers are driven in opposite directions. That is, one roller rotates in an anti-clockwise direction, and the other in a clockwise direction.

[0048] The flattening of the extrudate portions by the rollers results in the formation of flakes of reconstituted tobacco material, the flakes being e.g. 10-20 mm in diameter and having a thickness of 0.2-0.4 mm. The flakes have a moisture content of 11-17 wt%, which may provide them with sufficient flexibility for normal handling, while being low enough to reduce the formation of mould.

[0049] The flakes of reconstituted tobacco material are

mixed with natural tobacco leaf and processed into smoking articles, e.g. cigarettes, according to conventional processes that are well-known in the art. That is, they may be cut together with the natural tobacco material in a conventional tobacco cutter, to form a homogeneous blend suitable for use as a cigarette filler.

Claims

1. A process for recovering and recycling tobacco dust, comprising the steps of:

- mixing tobacco dust with a binder to provide a paste
- extruding the paste through a die to provide an elongate extrudate;
- slicing the extrudate at one or more discrete locations along its length to provide a plurality of extrudate portions;
- pressing at least one extrudate portion between two opposed surfaces, so as to flatten it.

2. A process according to claim 1, wherein the binder comprises starch and water

3. A process according to claim 1 or claim 2, wherein the step of pressing the at least one extrudate portion between two opposed surfaces comprises passing the extrudate portion between two rollers of a first pair of rollers, the two rollers being axially aligned and displaced from each other along a radial direction.

4. A process according to claim 3, wherein the gap between the respective surfaces of the two rollers is 1 mm or less.

5. A process according to claim 3 or claim 4, wherein the two rollers comprise a faster roller and a slower roller, the faster roller having a greater surface speed than the slower roller.

6. A process according to claim 5, wherein the faster roller has a surface speed that is at least 50% greater than the surface speed of the slower roller.

7. A process according to claim 5 or claim 6, wherein the surface speed of the slower roller is at least 1 m/s.

8. A process according to any one of claims 3 to 7, comprising the further step, after the step of passing the extrudate portion between the first pair of rollers, of passing the flattened extrudate portion between a second pair of rollers, the two rollers of the second pair of rollers being axially aligned and displaced from each other along a radial direction, the gap between the two rollers of the second pair of rollers being smaller than the gap between the two rollers of the first pair of rollers.

9. A process according to any one of the preceding claims, wherein the temperature of the at least one extrudate portion prior to being pressed between two opposed surfaces is at least 65°C, preferably at least 85°C.

10. A process according to any one of the preceding claims, wherein the moisture content of the at least one extrudate portion prior to being pressed between two opposed surfaces is between 10-20wt%.

11. A process according to any one of the preceding claims, comprising the further step, after the step of pressing the at least one extrudate portion between two opposed surfaces, of blending the flattened extrudate portion with tobacco leaf for further processing to provide a product for smoking.

12. A planar portion of reconstituted tobacco material, prepared according to the process of any one of the preceding claims.

13. A planar portion of reconstituted tobacco material, comprising tobacco dust bound by a binder, the planar portion having a maximum dimension no greater than 6 cm and a thickness of less than 0.5 mm.

14. An apparatus for producing reconstituted tobacco material, comprising:

- an extruder for receiving and mixing tobacco dust and a binder to provide a paste, the extruder being in fluid communication with a die, and being configured to extrude the paste through the die to provide an elongate extrudate;
- slicing means for slicing the extrudate at discrete locations along its length, to provide extrudate portions;
- flattening means comprising two opposed surfaces, the flattening means being configured to press the extrudate portions between the opposed surfaces.

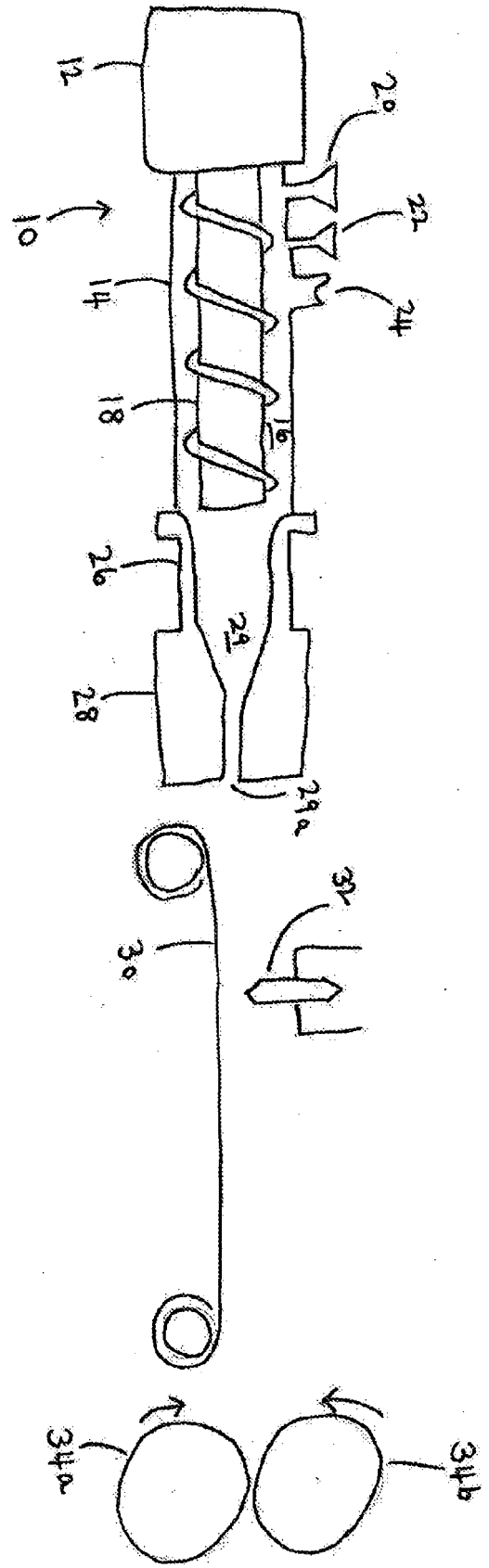

Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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