

"IMPROVEMENTS RELATING TO TOBACCO RECONSTITUTION"

The invention the subject of this application relates to tobacco reconstitution.

There have been many prior proposals for the production of tobacco based material utilising particulate tobacco. According to these proposals, the particulate tobacco may be derived from a waste product of smoking article manufacturing process, cigarette manufacturing processes for example, or may be obtained by grinding tobacco leaf lamina or stem portions. The materials produced from the particulate material may take the form of flat webs or sheets, rods, filaments or hollow cylinders. Processes producing these materials are commonly referred to as tobacco reconstitution processes.

It has been proposed to operate tobacco reconstitution processes to produce materials which can be used as smoking articles. Thus if the material is produced as a rod of open cell structure, of 8mm diameter say, it has been suggested that the rod can be smoked as a smoking article having a likeness to a cigarette or a cigar. It has though more usually been proposed that the products of tobacco reconstitution processes should be utilised, after having been cut or shredded, as constituents of cut filler for conventional smoking articles. A further use for reconstituted tobacco materials, when in web or sheet form, is as smoking article wrapping materials.

Components additional to tobacco which have been proposed for inclusion in materials produced by reconstitution processes are water; binding agents, e.g. pectin, starch, pullulan and cellulosic binders; fillers; humectants; expansion agents; reinforcing agents; and flavourants.

A prior proposed expansion process by the applicants was disclosed in UK Patent Specifications Nos. 2 201 081B and 2 201 080B. The process involved feeding a mixture of particulate tobacco, starch and binder, with the addition of water to an extruder to provide a sheet form extrudate, the extrusion being carried out under such conditions that the extrudate assumes a cross-section greater than that of the exit orifice of the extruder die. The description of these patent specifications are incorporated herein by reference.

Any extrudate to be subjected to a draw down process should be comprised of materials which render the extrudate capable of being drawn down in the plastic phase thereof. The extrudate should exhibit a degree of plasticity and may also exhibit elasticity.

Tobacco reconstitution processes, such as those mentioned above incorporating draw down steps often utilise draw down means comprising draw down drums provided with chilling and circulating means. The presence of water chilling and circulating means in the draw down means results in the cooling and consequent draw down, from contraction, of the extrudate. Some of the water held within the extrudate will condense on the

surface of the draw down means. There is also the likelihood of moisture from the atmosphere condensing on the surface of the draw down means, thus producing excess moisture at the draw down means.

Alternatively, even when cooling means is not provided in the draw down step, ambient air may still condense on the surface of the draw down means.

This excess moisture can be transferred back to the surface of the extrudate and can cause blockage problems when the extrudate is shredded by cutters and then processed into particulate material. Where sheet material is extruded and drawn down by means of chilled draw down drums, excess moisture is particularly prone to developing on the drums at the margins of the sheet material. The edges of the sheet material can retain excess moisture and thus become more moist than the remainder of the sheet. The cutters for the drawn down sheet material are prone to blockage at those parts of the cutting knives which correspond to the edges of the sheet. The present invention seeks to overcome these problems.

It is an object of the present invention to provide a tobacco sheet reconstitution process which incorporates draw down of the extrudate, and apparatus therefor, with means for removing excess moisture produced during draw down.

The present invention provides a tobacco reconstitution process, wherein tobacco-containing extrudate is extruded from an extruder die, the extrudate in the plastic phase thereof is drawn down to reduce the

thickness thereof, the draw down step including passing the extrudate about draw down means, and excess moisture in the draw down means being removed from the draw down means as draw down is effected.

The present invention further provides tobacco reconstitution draw down apparatus comprising an extruder capable of extruding tobacco-containing material, draw down means for drawing down the tobacco-containing material in the plastic phase thereof, and means for removing excess moisture from the draw down means.

Preferably the tobacco-containing material is sheet material, although this invention is applicable to the extrusion of strands of tobacco-containing extrudate.

Preferably the draw down means comprises one or more draw down drums. Suitably the surface of the drums is flat and smooth in order to prevent the collection of small particles of tobacco extrudate material in depressions in the surface of the draw down drum(s), such as might occur with a drum or drums having a knurled surface.

Preferably the draw down means comprises a first, large diameter draw down drum. The first draw down drum is suitably paired with a second large diameter draw down drum. Advantageously the first and second draw down drums are driven by common drive means at a common linear speed. Suitably the linear speed is within the range of 10-100m/min and is advantageously about 30m/min. Advantageously, there is a high degree of wrap-around of the extrudate about the cylindrical draw down means.

Preferably the draw down drums are provided with scraping means to remove the excess moisture. Advantageously the scraping means comprises a strip of flexible material fixed substantially along the length of retaining means, such as a metal bar. The flexible material may be plastic material. The retaining means is fixed in relation to the draw down drums.

Preferably the flexible material is curved concavely and arranged with respect to the draw down drum(s) to lift the moisture off the drum surface(s). Suitably the flexible material is curved in a direction opposite to the direction of movement of the draw down drum(s).

The means for removing excess moisture may, in the alternative, comprise wiping means which may wipe and/or absorb moisture from the drum surface.

Advantageously, transporting means is provided to transport the removed excess moisture away from the draw down drums.

Advantageously the retaining means of the scraping means associated with the first draw down drum is arranged with the axis thereof at an angle inclined to an axis parallel to the axis of the first drum, thus to guide and transport the excess moisture away from the drum towards the rear of the draw down unit, for example.

Alternatively, the scraping means associated with one of the draw down drums may be provided with moisture receiving means, which means may also have an axis inclined at an angle to an axis parallel to the axis of the said drum, thus to guide and transport the excess

moisture away from the drum towards the rear of the draw down unit, for example.

Advantageously the extrudate passes from the exit of the extruder die to the first draw down drum over a smaller diameter roller, which roller may suitably be free-running.

Preferably the draw down means is provided with water chilling and circulating means. Suitably the size of the first and second draw down drums is determined by the requisite degree of cooling of the extrudate which is required. The smaller the size of the draw down drums, the greater the degree of wrap around which is likely to be required.

The extrudate may suitably be in contact with the surface of the first draw down drum over at least 55% to about 90% of the circumference of the draw down drum. At least 60% of the drum circumference may be contacted by the extrudate and at least 65%, and even more preferably at least 70% of the drum circumference may be contacted by the extrudate. The extrudate is also preferably in contact with the surface of the second draw down drum over at least 45% to about 90% of the circumference of the drum. The degree of contact with the surface of one of the draw down drums may be less than the degree of contact with the other draw down drum, especially if the degree of contact of the extrudate with the surface of the other draw down drum is high, say greater than 75%.

The contact with the surface of the drums as used herein refers to the contact with respect to the

circumference of the drum in axial cross-section. In other words, the contact with the surface of the draw down drum or drums is an indication of the wrap-around of the extrudate about the draw down drum(s).

Preferably the size of the draw down drums is within the range of 30cm-90cm diameter.

In order that the present invention may be easily understood and readily carried into effect, reference will now be made to the accompanying diagrammatic drawings, wherein;

Figure 1 shows a tobacco reconstitution draw down apparatus according to the present invention, and

Figures 2 and 3 show in enlargement two scraping means, both according to the present invention.

Figure 1 shows tobacco reconstitution draw down apparatus 1 comprising an extruder 2, such as a twin-screw extruder. The extruder 2 comprises an extruder barrel 3 and an extruder die 4. Tobacco in fine particulate form, starch and cellulosic binder in a formulation such as described in UK Patent Specification No. 2 201 081B is fed from in-feed bin 5 directly to the extruder barrel 3. Water is fed from a water source 6 through a feed line 7 to the extruder barrel 3. Water may be present in the extruder in an amount such that water is present in the range of 5% to 20% by weight (wet basis) of the cut extrudate, without an extrudate drying step being utilised. Optionally, humectants, plasticisers and/or sugar may also be fed to the extruder barrel 3 from a source 6' through a feed line 7' or the in-feed bin 5.

The barrel 3 is provided with heating means (not shown) by the operation of which a desired temperature profile can be maintained along the barrel 3. The barrel temperature profile is suitably within the range of 25°C at the inlet end and 135°C at the outlet end. The barrel temperature may, for example, be maintained at 40°C at the inlet end increasing to 95°C at the outlet end.

The pressure within the extruder must be maintained at a high enough value to ensure that water therein remains in the liquid phase. A pressure range of 500 psig (3400kPa) to 2000 psig (13600 kPa) has been found to be suitable.

At these temperatures and pressures the starch in the tobacco formulation is caused to gelatinise within the extruder 2.

At the outlet end of the barrel 3 there is mounted an extruder die 4, which die has an exit orifice of horizontal slit formation. As the extrudate 8 issues from the die 4, some water in the extrudate 8 flashes off to steam, as a result of which the cross-section of the extrudate 8 becomes greater than the cross-section of the exit orifice of the die 4. There is thus imparted to the extrudate 8 a substantially closed cell interior structure. It is to be noted that the cellular structure of the extrudate may be open cell. Whatever the cellular structure the extrudate should exhibit plasticity.

The temperature at the extruder die 4 has typically been found to be about 130°C.

The sheet form extrudate is then passed over a free-running small diameter roller 9 and around two larger diameter draw down drums 10 and 11 of draw down unit 12. The draw down drums 10, 11 have a diameter of about 60cm and are driven at a common linear speed of about 30m/min. Drum 10 is driven in a clockwise direction and drum 11 is driven in an anti-clockwise direction as viewing the accompany drawing. The surface of each drum 10 and 11 is smooth, the drum surface being stainless steel. Chilled water, either alone or with other cooling additives such as glycol, is circulated through the rollers 10 and 11 from a pumping unit (not shown). The surface temperature of the chilled drums 10 and 11 is kept within the range of 0°-11°C and is usually less than about 8°C.

The drums 10 and 11 are arranged on parallel longitudinal axes. Their longitudinal axes are preferably horizontal. Drum 10 is provided at its upper reaches with scraping means 20, shown in enlargement in Figure 2, comprising a strip of concavely curved plastic material 21 attached to retaining means comprising a metal bar 22 and a fixing strip 23. The longitudinal axis of metal bar 22 is inclined upwards from a line which extends parallel to the axis of the drum 10. Drum 11 is provided with further scraping means 30, shown in enlargement in Figure 3, comprising a strip of concavely curved plastic material 31. The plastic material is affixed to an edge of retaining means and moisture receiving means 33 which comprises a hemi-spherical tray. The longitudinal axis of the hemispherical tray is also inclined upwards from a

line which extends parallel to the axis of the drum 11. There is thus provided scraping means and transporting means to remove excess moisture from the draw down means. It is to be understood that should the axes of the draw down drums 10, 11 be other than horizontal, the retaining means need not be angled with respect to a line running parallel to that axis. It is sufficient that, by the inclination of the retaining means, or scraping means itself, there is provided transporting means to transport the excess moisture away from the draw down means.

In operation, excess moisture which collects on the surface of drums 10, 11 is scraped off and lifted away from the drum surfaces by scraping means 20, 30 and guided along a downwardly inclined path away from the drum surfaces by transporting means 22, 33. Reducing or removing excess moisture from the surface of drums 10, 11 decreases and substantially prevents blockage of the cutters due to over moist sheet or sheet margins clogging the cutters.

Drum 11 is suitably located above drum 10, the location of drum 11 being such that the extrudate 8, when passed from drum 10 to drum 11, is in contact with at least 60% of the circumference of drum 10 to give a high degree of wrap-around of the extrudate 8 about drum 10. The contact with the circumference of drum 10 may be 70% or even 75%. The extrudate 8 passes from drum 11 to the infeed belt 13 of a feed conveyor 14. The feed conveyor 14 is positioned with respect to drum 11 at such an angle that the extrudate 8 is in contact with at least 45% of

the circumference of drum 11. The degree of wrap-around of the extrudate 8 about drum 11 may be greater than 50%, or greater than 55% of the circumference of drum 11.

It has been found that, provided the degree of wrap-around of the cooling drum(s) is sufficient to achieve the requisite cooling of the extrudate 8 and the extrudate 8 itself is capable of exhibiting plasticity, as contraction and stretching of the extrudate 8 occurs, the extrudate 8 will wrap around the smooth draw down drums 10,11 and will be driven by the frictional contact between the surface of the drums 10, 11 and the extrudate 8. Thus the need for nip rollers to feed the extrudate away from the exit of the extruder die 4 can be negated. Crushing forces exerted by the use of such nip rollers are also avoided, thus the cellular structure of the extrudate can be maintained.

Surprisingly, the extrudate 8 may be driven successfully away from the exit orifice of the extruder die 4, without the need for the surface of the drums to be provided with means for temporarily securing the extrudate 8 to the surface thereof. Such securing means may be, for example, a knurled drum surface. A disadvantage with such an arrangement is that particles of tobacco material can become lodged in the surface of the knurled drum, making the drums difficult to clean. The removal of excess moisture from the surface of such drums is also made more difficult. The trapped material will also deteriorate. Particles which attach to the reconstituted sheet can significantly affect the taste characteristics of the

extruded tobacco material when utilised in smoking articles, such as cigarettes. Furthermore, when it is important to maintain a particular sheet thickness, the possibility of material from the drum surface adhering to the extrudate 8 is highly undesirable. Such adhered material can contaminate the cutters at the cutting stage.

The extrudate 8 passes from the downstream end of the infeed belt 13 between slitters 15 to form longitudinal strips of reconstituted sheet material. The slit sheet material then passes between a multi-bladed, rotatably driven cylinder 16, whereby the slit sheet material is severed to provide discrete filaments of a length of 40mm, for example. The slitters 15 have a distance of about 0.7mm between each knife blade. The thickness of the sheet of reconstituted tobacco material is of the order of 1mm.

The discrete filaments are deposited on a conveyor 17 and conveyed to a skip 18. This cooling step allows the product to cool to substantially ambient temperature. The filaments may be fed during a further processing stage to the chimney of a cigarette making machine as particulate tobacco filler material.

The moisture content of the extrudate 8 as the extrudate 8 enters the cutters is often about 14%, and more often about 12%.

It has been found that, where the ambient temperature effects even further cooling of the extrudate and loss of moisture, at low sheet moisture contents, i.e. less than 10%, the sheet does not run effectively around the cooled



CLAIMS

1. Tobacco reconstitution draw down apparatus comprising an extruder capable of extruding tobacco-containing material, draw down means for drawing down the tobacco-containing material in the plastic phase thereof, and means for removing excess moisture from the draw down means.
2. Apparatus according to Claim 1, wherein the draw down means comprises one or more draw down drums.
3. Apparatus according to Claim 2, wherein the surface of the draw down drums is flat and smooth.
4. Apparatus according to any one of Claims 2 or 3, wherein the draw down drums are provided with scraping means to remove excess moisture.
5. Apparatus according to Claim 4, wherein said scraping means comprises flexible material.
6. Apparatus according to Claim 4 or 5, wherein said scraping means further comprises retaining means.
7. Apparatus according to Claims 5 or 6, wherein the flexible material is fixed substantially along the length of the retaining means.
8. Apparatus according to any one of Claims 5 to 7, wherein said flexible material is curved concavely and arranged with respect to the draw down drum or drums to lift the moisture off the drum surface(s).
9. Apparatus according to any one of Claims 1 to 3, wherein the means for removing moisture comprises



- wiping means to wipe or absorb moisture from the surface of the draw down drum(s).
10. Apparatus according to any one of Claims 2 to 9, wherein transporting means is provided to transport the removed excess moisture away from the draw down drums.
 11. Apparatus according to Claim 10 as appended to Claim 6, wherein the retaining means of said scraping means is arranged with the axis thereof at an angle inclined to an axis parallel to the axis of the first drum.
 12. Apparatus according to Claim 10, wherein said scraping means has moisture receiving means associated therewith, which moisture receiving means has an axis inclined at an angle to an axis parallel to the axis of the draw down drum.
 13. Apparatus according to any one of the preceding claims, wherein the draw down means is provided with water chilling and circulating means.
 14. Apparatus according to any one of Claims 2-13, wherein there is a high degree of wrap-around of the extrudate about the cylindrical draw down means.
 15. A tobacco reconstitution process, wherein tobacco-containing extrudate is extruded from an extruder die, the extrudate in the plastic phase thereof is drawn down to reduce the thickness thereof, the draw down step including passing the extrudate about draw down means, and excess moisture in the draw down



means being removed from the draw down means as draw down is effected.

16. A tobacco reconstitution process according to Claim 15, wherein the tobacco-containing material is sheet material.
17. Tobacco reconstitution draw down apparatus substantially as hereinabove described with reference to the diagrammatic drawings of Figures 1, 2 and 3 hereof.
18. A tobacco reconstitution process substantially as hereinabove described with reference to the diagrammatic drawings of Figures 1, 2 and 3 hereof.