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(54) **METHOD FOR PRODUCING A TUBULAR TOBACCO PRODUCT, TUBULAR TOBACCO PRODUCT, AEROSOL-FORMING STICK, AEROSOL-GENERATING DEVICE**

(57) The invention relates to a method for producing a tubular tobacco product (34) and a tubular tobacco product (34) and an aerosol-forming stick (170) and an aerosol-generating device (180)

It is provided that a method for producing a tubular tobacco product (34) comprises at least one hollow bore (extending along the longitudinal axis of the tubular tobacco product (34)). The method comprises the following steps: providing a tobacco composition (33) and extruding the tobacco composition (33) to form the tubular tobacco product (34), wherein the tobacco composition

(33) is extruded through a nozzle (24) having at least one central mandrel (25) for forming the at least one hollow bore. Furthermore, a tubular tobacco product (34) is provided, wherein said tubular tobacco product (34) is manufactured according to the presented method. Also provided is an aerosol-forming stick (170) for use in an aerosol-generating device (180), wherein the aerosol-forming stick (170) comprises the tubular tobacco product (34). Finally, the aerosol-generating device (180) itself is provided.

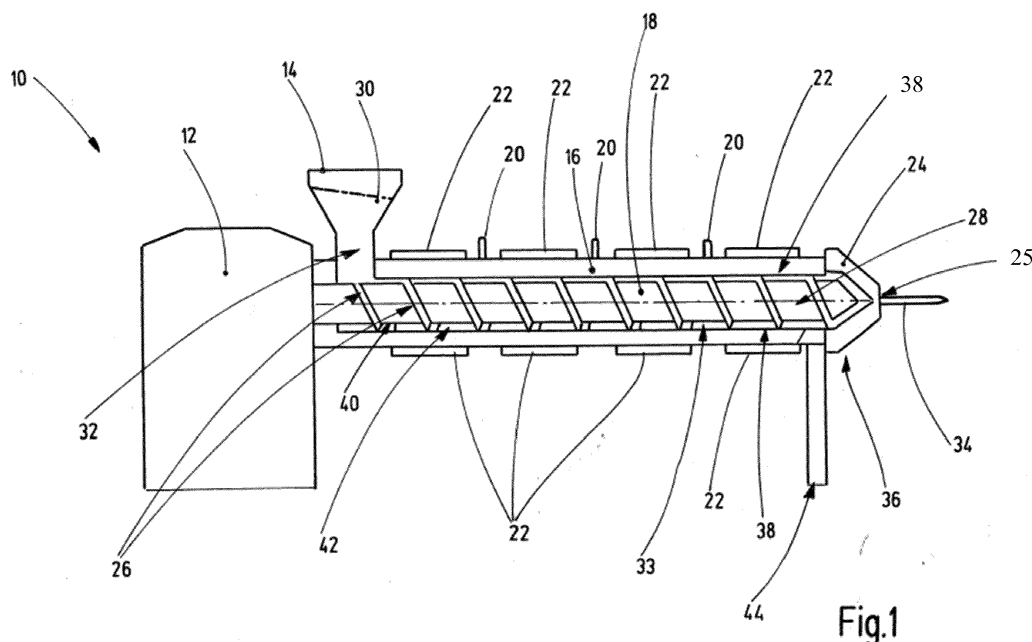


Fig.1

Description

Background of the invention

[0001] The invention relates to a method for producing a tubular tobacco product and a tubular tobacco product and an aerosol-forming stick and an aerosol-generating device.

[0002] In the field of tobacco containing products exists a variety of different approaches for producing a final product. Final products known from the state of the art therefore vary in the design and functionality and are often different in comparison to conventional cigarettes. Conventional cigarettes comprise a rod made of tobacco material (tobacco rod) with a wrapping made usually of cigarette paper. On the end of the tobacco rod usually a cylindrical filter (in the form of a plug) made of e. g. cellulose acetate with a wrapping made of filter paper (in the form of a plug wrap) is placed. In addition, the filter and an edging area of the tobacco rod is wrapped by wrapping made of a special paper, for example of a tipping paper. Commonly, the tobacco material is made of natural leaf tobacco. The material can be pre-treated or further processed for example by conditioning, stemming/stripping, drying, mixing, saucing, flavouring by spraying on flavouring substances and cutting. While producing final products from tobacco so called byproducts are generated from previous processes such as the threshing line. The by-product generated from previous processes such as the threshing line, primary production and make & pack, can be collected and used in the manufacture of a tobacco sheet very similar to that of natural leaves of tobacco. The sheet is then cut into strips for ease of blending with other tobacco types. In general, the tobacco based components may include the leaf lamina, cut and rolled stem, reconstituted sheet and expanded tobacco. The tobaccos stored in bales are broken up, cut into specific dimensions, and combined with other blend components such as casing and top dressing, and adjustment of the moisture content. American blend cigarettes contain the four types of tobacco mentioned above plus reconstituted or homogenized sheet tobacco. This is made from tobacco dust, fines and particles, and leaf ribs and stems. Reconstituted tobacco or homogenized sheet tobacco is a paper-like sheet approaching the thickness of tobacco laminae. It is made from tobacco dust, fines, and particles, and from ribs and stems. Various additives may be incorporated. In the past, most of these "tobacco by-products" were wasted.

[0003] Today, frequently up to 25% reconstituted tobacco or other tobacco substitute is mixed into the tobacco material used for example in conventional cigarettes produced as described. Beside the conventional cigarettes exists a variety of other tobacco containing products. A special category are the heat-not-burn tobacco products (HnB products or heated tobacco products). These products use devices where tobacco is not burning. Instead of burning the tobacco, these tobacco

products are heated and volatile constituents thereof are aerosolized. The design of these products are manufactured so that they are similar to their combustible counterparts. For example the tobacco product will be provided within a stick, whereby the stick can be placed within a heating element. A typical HnB product will heat the tobacco placed within a special device to a lower temperature in comparison to temperatures reached within a conventional cigarette. As temperatures within a conventional cigarette can reach between 800 ° to 1100 °C, unknown or unwanted substances can be released as a result of the burning of the tobacco material which is placed inside the cigarette. This can be seen as a disadvantage of a conventional cigarette. The HnB tobacco products can have the form of so called HnB tobacco plugs. Currently the HnB tobacco plugs are made of reconstituted tobacco. These are either made as solid cut tobacco plugs (like cigarettes), or tubes made of wrapped recon sheets (one or several layers). Reconstituted tobacco is limited in its absorbability of humectants and limits the product design (looking for a higher humectant content). Rolling sheet tobacco is technically challenging and limited in terms of speed and tobacco sheet characteristics. In this context, the use of extruding technology for producing smokeable devices is known from the state of the art. This approach is often combined with a focus on tobacco material itself.

[0004] The following documents represent some known solutions and can be seen as examples for the state of the art in this field.

Prior art

[0005] The document GB 2 078 087 A discloses smoking articles containing tobacco and method of making such. The smoking article comprises a coherent mass of combustible tobacco-containing material having at least one passage extending through it between two spaced openings in the surface of the mass, the tobacco mass having such porosity as to support combustion when ignited and such density and porosity as to substantially occlude gas flow there through. The article preferably has at least one air-permeable plug of readily ignitable material blocking the passage at one or both ends. The tobacco-containing mass may include non-tobacco filler particles, such as carbon or clays, and the plug may contain a flavorant.

[0006] The articles may be made by shaping a mixture of combustible tobacco material with a volatile liquid, for example a mixture of water and glycerol or propylene glycol, under pressure into a discrete coherent mass, preferably by extrusion, forming a passage through the mass, and drying the mass to a porosity and density such as to substantially occlude gas flow there through but to support combustion when ignited. However, this document does not disclose a method which comprises the step of extruding a tobacco composition to form a tubular tobacco product, wherein the tobacco composition is ex-

truded through a nozzle having at least one central mandrel for forming at least one hollow bore in the tubular tobacco product. In addition, this document does not disclose a tubular tobacco product comprising at least one hollow bore extending along the longitudinal axis of the tubular tobacco product. Furthermore, neither an aerosol-forming stick nor an aerosol-generating device according to the present invention is disclosed.

[0007] The document WO 1996/03060 discloses a hollow smokeable article. This cigarette-like smokeable article comprises a hollow rod for directing smoke and air from the lit end of the article to a filter located at the mouth end of the article. The rod is formed of tobacco material and/or other cellulosic or pyrolyzed bone material, together with a binder and preferably an organic or inorganic salt. The materials are mixed in an aqueous or mixed aqueous/nonaqueous solution and then cast, extruded, or molded into the hollow rod shape. The rod is either surrounded by leaf tobacco and wrapped in cigarette paper, or is wrapped directly with cigarette paper, and combined with a filter to form the smokeable article. Due to the hollow passage through the rod, the article burns in an inverted fire cone shape, which heat treats the mainstream smoke and also reduces the amount of side-stream smoke produced. However, this document does not disclose a method which comprises the step of extruding a tobacco composition to form a tubular tobacco product, wherein the tobacco composition is extruded through a nozzle having at least one central mandrel for forming at least one hollow bore in the tubular tobacco product. In addition, this document does not disclose a tubular tobacco product comprising at least one hollow bore extending along the longitudinal axis of the tubular tobacco product. Furthermore, neither an aerosol-forming stick nor an aerosol-generating device according to the present invention is disclosed.

[0008] The document US 4,981,522 discloses a thermally releasable flavour source for smoking articles. This flavour source to be used as a thermally releasable flavourant for smoking articles does not combust tobacco. The material includes tobacco particles, an aerosol precursor that forms an aerosol upon exposure to heat, and a filler material that absorbs and radiates heat to minimize the likelihood that the flavour material will ignite. The material is mixed in an extruder, extruded through a die, and cut into pellets having a substantially uniform shape. The pellets are loaded into a chamber for inclusion in a smoking article as a flavour generator. However, this document does not disclose a method which comprises the step of extruding a tobacco composition to form a tubular tobacco product, wherein the tobacco composition is extruded through a nozzle having at least one central mandrel for forming at least one hollow bore in the tubular tobacco product. In addition, this document does not disclose a tubular tobacco product comprising at least one hollow bore extending along the longitudinal axis of the tubular tobacco product. Furthermore, neither an aerosol-forming stick nor an aerosol-generating device ac-

cording to the present invention is disclosed.

[0009] There is a desire for a steady improvement in the cost structure associated with the production of tobacco products itself. In addition, there is a desire to produce products which can be used for special smoking devices, especially HnB devices. These special products should comprise a high functionality so that consumer friendly usage during the heating or in general during the handling of such products is provided.

[0010] It is therefore an object of the present invention to provide a method for producing a tubular tobacco product which allows a cost efficient production of the products itself while the produced products are consumer friendly in use and provide a good performance during the heating in the usage phase. Furthermore, it is an object of the present invention to provide an aerosol-forming stick and an aerosol-generating device which support the aforementioned objects during the usage phase of the produced tubular tobacco product. Furthermore, the method of the invention allows for more flexibility with regard to the constituents of the tobacco composition. In particular, the method of the present invention allows the use of higher contents of aerosol former like glycerol or propylene glycol.

[0011] In a preferred embodiment of the invention a method for producing a tubular tobacco product is provided. The product comprises at least one hollow bore (extending along the longitudinal axis of the tubular tobacco product) and the method comprises the steps of: providing a tobacco composition and extruding the tobacco composition to form the tubular tobacco product. The tobacco composition is extruded through a nozzle having at least one central mandrel for forming the at least one hollow bore. The presented method allows a cost efficient production as the usage of an extrusion device leads to a fast and lean production itself. Furthermore, the presented method allows the production of a tubular tobacco product which comprises a good performance during the heating in the usage phase. The at least one hollow bore allows the heating of the tobacco from the inside of the tube, the outside or both so that different parameters can influence the final product. A broad variety of products can be produced using the presented method so that a cost efficient production is possible. In addition, extrusion of tobacco allows also the production of tobacco tubes in a wide range of parameters and to control the tube characteristics. These parameters are for example tobacco density (by expansion), rod firmness, quantity of additives, rod shape, humidity (moisture content) and dimensions. Another benefit of tobacco extrusion is a loss-free process, in particular if cold extrusion is used. No tobacco ingredients get lost in the extrusion. Finally, a cost efficient production is possible as the final shape can already be achieved during the usage of the method so that the final product is suitable for the usage for example in an aerosol-forming stick which itself can be used in an aerosol-generating device. Such an aerosol-generating device could be for

example a HnB device. The presented method can be used with a cold extrusion which uses typically a temperature of not more than around 25°C or a warm extrusion which uses a temperature of more than 25°C up to 130°C.

[0012] In another preferred embodiment of the invention it is provided that a tubular tobacco product comprises at least one hollow bore (extending along the longitudinal axis of the tubular tobacco product), wherein said tubular tobacco product is manufactured according to a method of the invention. The aforementioned advantages apply in the same way as far as transferable for the presented product. Such products are not smokeable without using a special device, for example a HnB device.

[0013] In another preferred embodiment of the invention an aerosol-forming stick for use in an aerosol-generating device is provided. The aerosol-forming stick comprises the tubular tobacco product of the invention, preferably the aerosol-forming stick further comprises a filter section and optionally an aerosol-cooling element between the tubular tobacco product and the filter section. The aforementioned advantages apply in the same way as far as transferable for the presented product.

[0014] In another preferred embodiment of the invention it is provided that an aerosol-generating device comprises a receiving section for receiving the aerosol-forming stick of the invention and a heating section that is capable of heating the tubular tobacco product of said aerosol-forming stick when fully inserted into the receiving section. The aerosol-generating device further comprises an aerosol-forming stick of the invention fully inserted, wherein at least one of the heating section and the receiving section of the aerosol-generating device are designed to engage with an inner and/or outer cross-sectional shape of the tubular tobacco product. The aforementioned advantages apply in the same way as far as transferable for the presented product.

[0015] Further preferred embodiments of the invention will become apparent from the remaining features mentioned below and in the subclaims.

[0016] In a further preferred embodiment of the invention, it is provided that the nozzle has more than one central mandrel for forming more than one hollow bore in the tubular tobacco product. Such products can provide an even better performance concerning the heating from inside the product itself during the usage phase with in a special device, for example in a HnB product. This benefit increases therefore the consumer convenience as the heating can be provided within a desired temperature interval so that the consumption of the tobacco product is perceived as pleasant.

[0017] In a further preferred embodiment of the invention, it is provided that the nozzle is designed such that a tubular tobacco product is formed with a diameter of from 2 to 20 mm, preferably of from 4 to 15 mm, even more preferably of from 5 to 12 mm. Depending on the desired site of use, a product can thus be provided with the presented method, which accordingly has a precisely fitting size in order to be used at the desired site of use.

Such a site of use could be, for example, a stick or a device according to the presented invention.

[0018] In a further preferred embodiment of the invention, it is provided that the at least one mandrel is designed such that the at least one hollow bore has a diameter of from 1,5 to 18,5 mm, preferably of from 2,5 to 15 mm, even more preferably of from 3 to 12mm. Thus, depending on the diameter, a desired rate of heating from within the product to be produced by the process can be specifically provided. This makes it easier to deliver a product to the consumers which comprises certain desired properties so that a consumer friendly product can be produce with the present method.

[0019] In a further preferred embodiment of the invention, it is provided that the nozzle and the at least one mandrel are designed such that the tubular tobacco product has an average wall thickness of from 0,25 to 5 mm, 0,5 to 2 mm. The presented wall thicknesses make sure that the product made with the presented method comprises a sufficient stability during the usage phase so that a consumer friendly product can be provided.

[0020] In a further preferred embodiment of the invention, it is provided that the nozzle and/or the at least one mandrel are designed such that a cross section of the tubular tobacco product has a circular, oval, starlike, regular or irregular polygonal, rectangular, square or trapezoid shape or combinations thereof, wherein inner and outer shape can be the same or different. Depending on the design can be determined accordingly that the product specially produced by the method can only be used in suitable places, which then each have a matching structure to the respective design similar to a key-lock principle. Such suitable places could be for example a stick or a device according to the presented invention. Therefore, the method allows in a cost efficient manner the production of products which are consumer friendly as the design itself helps the consumer during the usage phase to be orientated in a very simply and easy to adopt manner.

[0021] The method of the invention can comprise further method steps downstream of the extrusion of step b). Preferably, the method of the invention comprises an additional step: c) wrapping the extruded tubular tobacco product around a circumferential outer surface thereof with a wrapping material. This step can be performed in a wrapping section located downstream of the extruding section. Devices, technology and materials used in the prior art to wrap conventional tobacco strands can be employed. Exemplary embodiments of wrapping material encompass paper, plastic or polymer material, metal foil or combinations thereof or layered material comprising at least one of said materials. Usually the wrapping is closed by adhering together overlapping edges along a longitudinal direction in order to form an endless seam. The person skilled in the art is well aware of techniques and materials which can be employed to form such a wrapping. E.g. if the wrapping material is paper, the seam can be formed using a suitable glue or adhesive; if the

wrapping material is plastic, polymer or metal foil, the seam can be formed using hotmelt, welding or heat-sealing methods. Optionally, between the extrusion step b) and the wrapping step c) the extruded tubular tobacco product is passing a shaping section, wherein the outer surface of the extruded tubular tobacco product is brought into a pre-defined shape prior to or after wrapping.

[0022] In a further preferred embodiment of the invention, it is provided that the method further comprises the additional step: d) cutting the extruded tubular tobacco product to a pre-defined length. The selected length can be easily chosen depending on the desired purpose. The method can therefore be used in such a way so that different products can be produced at the same time without a big effort concerning the needed equipment.

[0023] In a preferred embodiment of the method of the invention, the extruded tubular tobacco product of step b) is transferred in the form of an endless strand from the nozzle of the extruder towards means for wrapping and/or cutting the strand into extruded tubular tobacco products of a pre-defined length (means for performing steps c) and/or d)). Said transportation towards and/or through the wrapping and/or cutting section is preferably facilitated by use of a conveyor, e.g. a conveyor belt. Preferably, the nozzle of the extruder and the means for wrapping and/or cutting are distanced from each other so that the strand of the extruded tubular tobacco product forms a sag between the nozzle and said means for wrapping and/or cutting. Said sag has a height h_1 which e.g. represents the difference in height between the vertex of the sag and the upper edge of the nozzle.

[0024] In the method of the invention comprising at least one of a wrapping and/or a cutting step, the speed of the extrusion of step b) and the wrapping of step c) and/or the cutting of step d) are preferably synchronized to each other. By doing so, it can be secured that the time between extrusion and subsequent steps is kept within a constant interval allowing for controlled quality of the final product. Said synchronization can be achieved by various measures. Preferably, said synchronization is achieved by measuring the height h_1 of the sag formed by the strand of extruded tubular tobacco product between the nozzle and the means for wrapping and/or cutting. If the height h_1 of the sag exceeds a pre-defined range of threshold values (e.g. a minimum and maximum value), the speed of at least one of the extrusion and the wrapping and/or cutting is adjusted so that the height h_1 of the sag is returned to be within the pre-determined range of threshold values. E.g. when the height h_1 of the sag underruns a pre-defined minimum threshold value, either the speed of extrusion is accelerated, the speed of the wrapping and/or cutting is decelerated or a combination of both until the height h_1 of the sag exceeds the minimum threshold value again. Alternatively or in addition, when the height h_1 of the sag exceeds a pre-defined maximum threshold value, either the speed of extrusion is decelerated, the speed of the wrap-

ping and/or cutting is accelerated or a combination of both until the height h_1 of the sag underruns the maximum threshold value. The height h_1 of the sag can be measured by any means suitable to determine the difference in height between e.g. the upper edge of the nozzle and the vertex of the strand of extruded tubular tobacco product, preferably the height h_1 of the sag is measured using one or more sensors.

[0025] In a further preferred embodiment of the invention, it is provided that the tobacco composition to be extruded of step a) has a moisture content of at least 5% based on the total weight of the tobacco composition; preferably of at least 7%, more preferably of from 7% to 60%, even more preferably of from 7% to 30%. The presented composition and its various embodiments are particularly suitable to be used in the extrusion process while providing at the same time properties which can be seen as positive regarding the aspects of a consumer friendly product itself. As used herein, the term "moisture content" means the total water content as measured using a standardized method of water analysis, such as, Karl Fisher titration.

[0026] In a further preferred embodiment of the invention, the tobacco composition to be extruded in one of the steps of the method comprises: 10 to 90% particulate tobacco material (e.g. grinded tobacco, tobacco dust), 5 to 20% binder material (e.g. starch or guar gum), 0 to 40% aerosol former (e.g. glycerol or propylene glycol), and 0 to 15% water, based on the total weight of the tobacco composition. The presented composition and its various embodiments are particularly suitable to be used in the extrusion process while providing at the same time properties which can be seen as positive regarding the aspects of a consumer friendly product itself.

[0027] Finally, in a further preferred embodiment of the invention, in relation to the aerosol-generating device of the invention, at least one of the inner and outer cross sectional shape of the tubular tobacco product of the aerosol-forming stick is not circular, and preferably is oval, starlike, regular or irregular polygonal, rectangular, square or of trapezoid shape or combinations thereof, wherein inner and outer cross sectional shape can be the same or different. Depending on the design can be determined accordingly that the product specially produced by the method can only be used in suitable places, which then each have a matching structure to the respective design similar to a key-lock principle. In other words, as the aerosol-generating device comprises a receiving section designed for the produced product according to the presented method, the key-lock principle makes sure that only certain products can be implemented into the stick and finally into the presented device. This consumer friendly design helps the consumer during the usage phase to be orientated in a very simply and easy to adopt manner. In other words, the aim is to match the shape of the tubular tobacco products and a component of the aerosol-generating device that comes into contact with each other in such a way that a tubular tobacco product

with a specific shape fits only into a specific aerosol-generating device (key-lock principle).

[0028] The present invention is also directed to a device for performing a method of the present invention. Said device comprises an extruder having a nozzle with at least one central mandrel for forming a strand of an extruded tubular tobacco product; and a cutting section for receiving and cutting the extruded tubular tobacco product into pre-defined length; wherein the cutting section is arranged at a distance from the nozzle so that the strand of extruded tubular tobacco product forms a sag before entering the cutting section. Preferably, the device further comprises a wrapping section for wrapping an outer circumference of the strand of extruded tubular tobacco product, the wrapping section being arranged between the extruder and the cutting section, wherein the wrapping section is arranged at a distance from the nozzle so that the strand of extruded tubular tobacco product forms a sag before entering the wrapping section. The distance between the nozzle of the extruder and the wrapping section or the cutting section is not limited to a certain distance or range but is selected to ensure that the strand of extruded tubular tobacco product is forming a sag without disruption of the endless strand. Preferably, the distance is within the range of 5 cm to 50 cm. In a preferred embodiment, the device of the invention further comprises one or more sensors which are arranged and adapted to measure the location of the sag of the strand of extruded tubular tobacco product between the nozzle of the extruder and one of the wrapping and the cutting section.

[0029] The various embodiments of the invention mentioned in this application are, unless otherwise stated in the individual case, advantageously combinable with each other.

Description of the figures

[0030] The invention will be explained below in embodiments with reference to the accompanying drawing. In this drawing,

FIG. 1 is a section view illustrating an extrusion device for a method for producing a tubular tobacco product;

FIG. 2 shows a variety of possible shapes of cross sections of the tubular tobacco product (inner and outer shape);

FIG. 3 shows schematic representations of an aerosol-forming stick and an aerosol-generating device;

FIG. 4 is a section view illustrating a further device for executing a method for producing a tubular tobacco product.

[0031] FIG. 1 is a section view illustrating an extrusion

device 10 for a method for producing a tubular tobacco product 34. This extrusion device 10 comprises a drive system 12, a filling funnel 14, a cylinder 16, a screw 18, three temperature sensor 20, eight heating bands 22 and a nozzle device 24. The nozzle device 24 can comprise at least one mandrel 25, wherein this mandrel 25 is not shown in more detail in FIG. 1. The drive system 12 is functionally connected to the screw 18, which is placed substantially in the middle of the cylinder 16. FIG. 1 shows this connection only in a schematically view, wherein the screw 18 comprises ten turns 26 and a dashed line shows a central axis 28 of the screw 18. In the filling funnel 14 tobacco material 30 and binder material 32 is placed. Additional material may be placed as well in the filling funnel 14 so that the tubular tobacco product 34 according to the invention can be finally extruded respectively produced on the right end side 36 of the extrusion device 10. The tobacco material 30, the binder material 32 and additional material can also be called together a tobacco composition 33 which will be an essential part of the final product 34 at the end of the extrusion step. Between the inner walls 38 of the cylinder 16 and the screw 18 with the turns 26 can be seen the tobacco material 30 and the binder material 32. In this position water 40 and humectant 42 can be added to the mixture. The water 40 and the humectant 42 can be filled as well over the filling funnel 14 into the extrusion device 10. Four heating bands 22 are placed on the top of the cylinder 16 and four heating bands 22 are placed on the bottom of the cylinder 16. The heating bands 16 are shown only in a schematically view and the form may differ in other variations of the extrusion device 10. Between the four heating bands 16 respectively on the top of the cylinder 16 can be seen the three temperature sensors 20 which are also only shown in a schematically view. On the right end side 36 of the extrusion device 10 can be seen a holding device 44 which is placed on the left side related to the picture plane from the nozzle device 24. The holding device 44 together with the drive system 12 hold the cylinder 16 in a horizontal position so that through the nozzle device 24 the tobacco-containing product 34 according to the invention can be finally extruded respectively produced on the right end side 36 of the extrusion device 10. The nozzle device 24 has an extrusion hole through which the tobacco-containing product 34 according to the invention can be finally extruded respectively produced. The extrusion hole can be technically specified so that the final tobacco-containing product 34 can have a substantially round form. The at least one mandrel 25 which is placed at the extrusion device 10 so that the final product 34 is produced with at least one hollow structure (hollow bore) within a cross section area of the final product 34. In other words the final product 34 has the form of a round tube wherein for example the wall thicknesses are 0,5 to 5 mm or preferably 0,75 to 2 mm. The extrusion process can be performed cold typically with a temperature between 0°C and 25°C or warm with temperatures between 25°C and 130°C. A combination of

the different temperature intervals can also be performed so that the temperature varies over the entire process in a controlled manner so that the final product 34 can be influenced in a predetermined way. The screw 18 can also be a twin-screw configuration and the process can be performed for example with a low sheer rate. The combination of a twin-screw configuration and a low sheer rate leads to best results.

[0032] FIG. 2 shows a variety of possible shapes of cross sections of the tubular tobacco product (inner and outer shape). In more detail, a circular shape 100, an oval shape 110, a starlike shape 120, regular polygonal shape 130 (which also could be an irregular polygonal shape), a rectangular shape 140, a square shape 150 and a trapezoid shape 160 is shown. These shapes can be combined in any way. The sizes and geometries shown are therefore only shown as examples and any variations of the forms shown here are conceivable.

[0033] FIG. 3 shows schematic representations of an aerosol-forming stick 170 and an aerosol-generating device 180.

[0034] FIG. 4 shows a preferred device for performing a preferred embodiment of the method of the present invention. The device of FIG. 4 comprises an extruder 10 having a nozzle 24 from which a strand of extruded tubular tobacco product 34 can be derived. An exemplary embodiment of such an extruder 10 is shown and described in detail in FIG. 1 and the corresponding part of the specification.

In addition, the device of FIG. 4 comprises further means to perform additional steps of the method of the invention. The device of FIG. 4 comprises a wrapping section 300 and a cutting section 400.

[0035] The wrapping section 300 is designed to perform the additional step c) of the method of the invention, i.e. wrapping of the extruded tubular tobacco product around a circumferential outer surface thereof with a wrapping material. Means, technology and materials used in the prior art to wrap conventional tobacco strands can be employed here. Exemplary embodiments of wrapping material encompass paper, plastic or polymer material, metal foil or combinations thereof or layered material comprising at least one of said materials. Usually the wrapping is closed by adhering together overlapping edges along a longitudinal direction in order to form an endless seam. The person skilled in the art is well aware of techniques and materials which can be employed to form such a wrapping. E.g. if the wrapping material is paper, the seam can be formed using a suitable glue or adhesive; if the wrapping material is plastic, polymer or metal foil, the seam can be formed using hotmelt, welding or heat-sealing methods.

[0036] The cutting section 400 is formed to cut the extruded and wrapped tubular tobacco product into pieces of pre-defined length. Thus, the cutting section 400 is designed to perform the additional step d): cutting the wrapped extruded tubular tobacco product to a pre-defined length. The selected length can be easily chosen

depending on the desired purpose.

[0037] Optionally, between the extrusion step b) and the wrapping step c) the extruded tubular tobacco product is passing a shaping section, wherein the outer surface of the extruded tubular tobacco product is brought into a pre-defined shape prior to wrapping.

[0038] The wrapping section 300 and the cutting section 400 are distanced from the nozzle 24 of the extruder 10 and, thus, the strand of extruded tubular tobacco product 34 transferred from the extruder 10 to the wrapping section 300 forms a sag between the nozzle 24 and the wrapping section 300. Said sag has a height h_1 which e.g. represents the difference in height between the vertex of the sag and the upper edge of the nozzle 24.

[0039] The device of FIG. 4 comprises means for measuring the height h_1 of the sag. Suitable means comprise e.g. sensors for measuring the position of the vertex of the sag and means for calculating the height h_1 and comparing said height h_1 with pre-determined threshold values. The speed of the extrusion of step b) and the wrapping of step c) and/or the cutting of step d) can be synchronized to each other using said height h_1 . Such synchronization can be achieved by various measures. E.g., said synchronization is achieved by measuring the height h_1 of the sag formed by the strand of extruded tubular tobacco product between the nozzle and the means for wrapping and/or cutting. If the height h_1 of the sag exceeds a pre-defined range of threshold values 200, e.g. a minimum values 210 and maximum value 220, the speed of at least one of the extruder 10 and the wrapping and/or cutting section 300, 400 is adjusted so that the height h_1 of the sag is returned to be within the pre-determined range of threshold values 200. E.g. when the height h_1 of the sag underruns a pre-defined minimum threshold value 210, either the speed of extruder 10 is accelerated, the speed of the wrapping and/or cutting section 300, 400 is decelerated or a combination of both, until the height h_1 of the sag exceeds the minimum threshold value 210 again. Alternatively or in addition, when the height h_1 of the sag exceeds a pre-defined maximum threshold value 220, either the speed of extruder 10 is decelerated, the speed of the wrapping and/or cutting section 300, 400 is accelerated or a combination of both until the height h_1 of the sag underruns the maximum threshold value 220.

List of reference numbers

[0040]

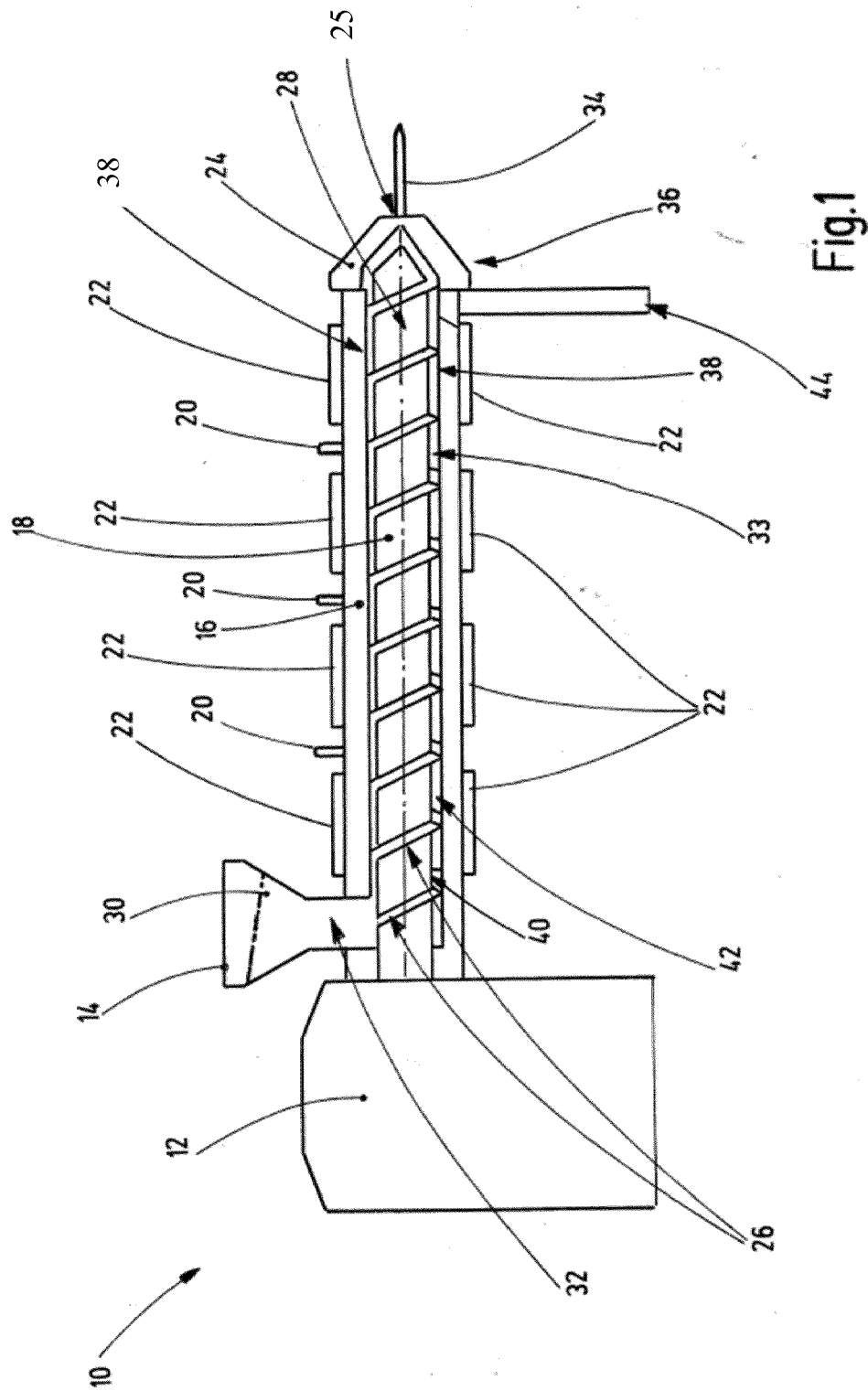
10	extrusion device
12	drive system
14	filling funnel
16	cylinder
18	screw
20	temperature sensor
22	heating band
24	nozzle drive

25 mandrel
 26 turn
 28 central axis
 30 tobacco material
 32 binder material
 33 tobacco composition
 34 tubular tobacco product
 36 right end side
 38 inner wall
 40 water
 42 humectant
 44 holding device
 100 circular shape
 110 oval shape
 120 starlike shape
 130 regular polygonal shape
 140 rectangular shape
 150 square shape
 160 trapezoid shape
 170 aerosol-forming stick
 180 aerosol-generating device
 200 range of threshold values
 210 threshold minimum
 220 threshold maximum
 300 wrapping station
 400 cutting station

Claims

1. Method for producing a tubular tobacco product (34) comprising at least one hollow bore (extending along the longitudinal axis of the tubular tobacco product (34)), the method comprising the steps of:
 - a) providing a tobacco composition (33); and
 - b) extruding the tobacco composition (33) to form the tubular tobacco product (34), wherein the tobacco composition (33) is extruded through a nozzle (24) having at least one central mandrel (25) for forming the at least one hollow bore.
2. The method of claim 1, wherein the nozzle (24) has more than one central mandrel (25) for forming more than one hollow bore in the tubular tobacco product (34).
3. The method of one of the preceding claims, wherein the nozzle (24) and the at least one mandrel (24) are designed such that the tubular tobacco product (34) has an average wall thickness of from 0,25 to 5 mm.
4. The method of one of the preceding claims, wherein the nozzle (24) and/or the at least one mandrel (25) are designed such that a cross section of the tubular tobacco product (34) has a circular (100), oval (110), starlike (120), regular or irregular polygonal (130), rectangular (140), square (150) or trapezoid shape (160) or combinations thereof, wherein inner and outer shape can be the same or different.
5. The method of one of the preceding claims, wherein the method further comprises the additional step:
 - c) wrapping the extruded tubular tobacco product (34) around a circumferential face thereof with a wrapping material.
6. The method of one of the preceding claims, wherein the method further comprises the additional step:
 - d) cutting the extruded tubular tobacco product (34) to a pre-defined length.
7. The method of claim 5 or 6, wherein the extruded tubular tobacco product (34) of step b) is transported in form of an endless strand from the nozzle (24) towards means for wrapping and/or cutting the strand into extruded tubular tobacco products (34) of a pre-defined length, wherein the nozzle (24) and the means for wrapping and/or cutting are distanced from each other so that the strand of the extruded tubular tobacco product (34) forms a sag between the nozzle (24) and said means for wrapping and/or cutting.
8. The method of claim 7, wherein the speed of the extrusion in step b) and the wrapping of step c) and/or the cutting of step d) are synchronized to each other.
9. The method of claim 8, wherein synchronization is achieved by measuring the height h_1 of the sag formed by the strand of extruded tubular tobacco product (34) between the nozzle (24) and the means for wrapping and/or cutting, and if the height h_1 of the sag exceeds a pre-defined range of threshold values, the speed of at least one of the extrusion and the wrapping and/or cutting is adjusted so that a height h_1 of the sag is achieved which is within the pre-determined range of threshold values.
10. The method of claim 9, wherein, when the height h_1 of the sag underruns a pre-defined minimum threshold value, either the speed of extrusion is accelerated, the speed of the wrapping and/or cutting is decelerated or a combination of both until the height h_1 of the sag exceeds the minimum threshold value.
11. The method of claim 9 or 10, wherein, when the height h_1 of the sag exceeds a pre-defined maximum threshold value, either the speed of extrusion is decelerated, the speed of the wrapping and/or cutting is accelerated or a combination of both until the height h_1 of the sag underruns the maximum threshold value.

12. The method of anyone of claims 9, 10 and 11, wherein the height h_1 of the sag is measured using one or more sensors.
13. The method of one of the preceding claims, wherein the tobacco composition (33) to be extruded of step a) has a moisture content of at least 5% based on the total weight of the tobacco composition; preferably of at least 7%, more preferably of from 7% to 60%, even more preferably of from 7% to 30%.
14. Tubular tobacco product (34) comprising at least one hollow bore (extending along the longitudinal axis of the tubular tobacco product (34)), wherein said tubular tobacco product (34) is manufactured according to a method of one of claims 1 to 13.
15. Aerosol-forming stick (170) for use in an aerosol-generating device (180), the aerosol-forming stick (170) comprising the tubular tobacco product (34) of claim 14; preferably the aerosol-forming stick (170) further comprises a filter section and optionally an aerosol-cooling element between the tubular tobacco product (34) and the filter section.
16. Aerosol-generating device (180) comprising a receiving section for receiving the aerosol-forming stick of claim 15 and a heating section that is capable of heating the tubular tobacco product (34) of said aerosol-forming stick (170) when fully inserted into the receiving section, the aerosol-generating device (180) further comprising an aerosol-forming stick (170) of claim 15 fully inserted, wherein at least one of the heating section and the receiving section of the aerosol-generating device (180) are designed to engage with an inner and/or outer cross-sectional shape of the tubular tobacco product (34).
17. Device for performing the method according to any of claims 1 to 13, the device comprising:
- an extruder (10) having a nozzle (24) with at least one central mandrel for forming a strand of an extruded tubular tobacco product (34); and a cutting section (400) for receiving and cutting the extruded tubular tobacco product (34) into pre-defined length;
- wherein the cutting section (400) is arranged at a distance from the nozzle (24) so that the strand of extruded tubular tobacco product (34) forms a sag before entering the cutting section (400).
18. The device of claim 17, wherein a wrapping section (300) for wrapping an outer circumference of the strand of extruded tubular tobacco product (34) is arranged between the extruder (10) and the cutting section (400), wherein the wrapping section (300) is arranged at a distance from the nozzle (24) so that the strand of extruded tubular tobacco product (34) forms a sag before entering the wrapping section (400), preferably the distance between the nozzle 24 of the extruder (10) and the wrapping section (300) or the cutting section (400) is in the range of 5 cm to 50 cm.
19. The device of one of claims 17 and 18, wherein the device further comprises one or more sensors which are arranged and adapted to measure the location of a sag of a strand of extruded tubular tobacco product (34) between the nozzle (24) of the extruder (10) and one of the wrapping or the cutting section (300, 400).



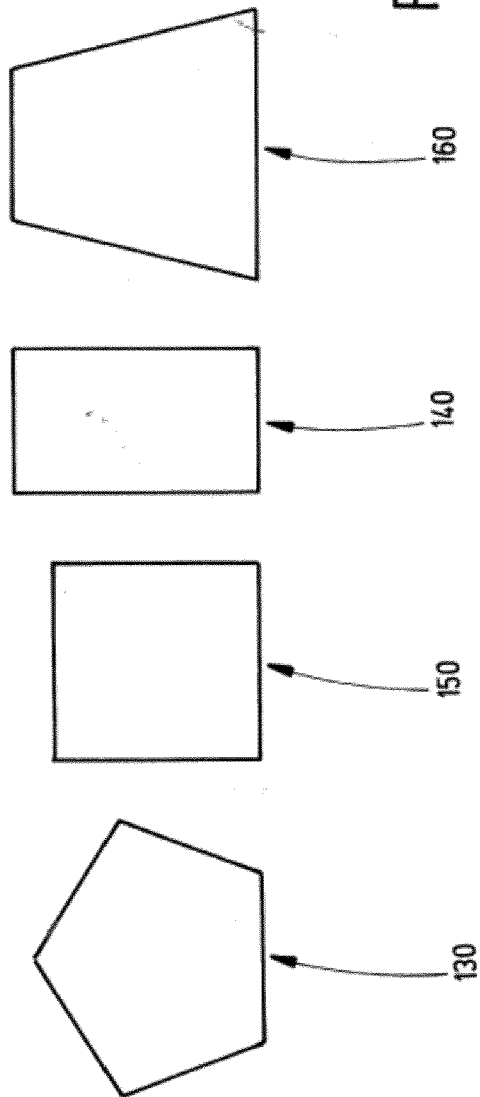
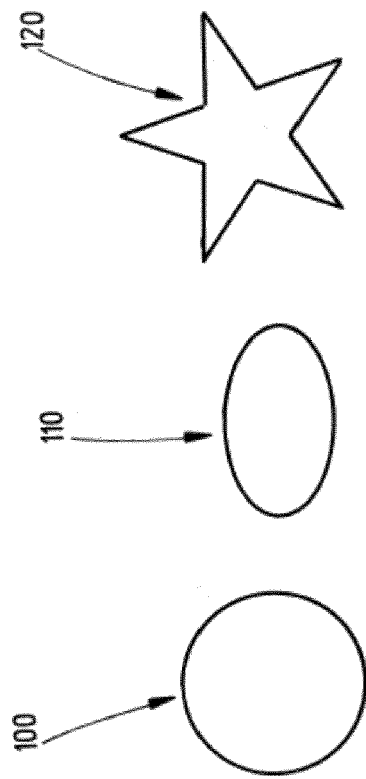


Fig.2

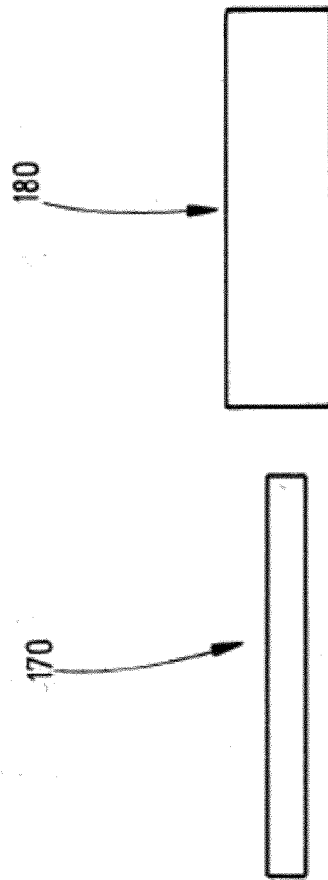
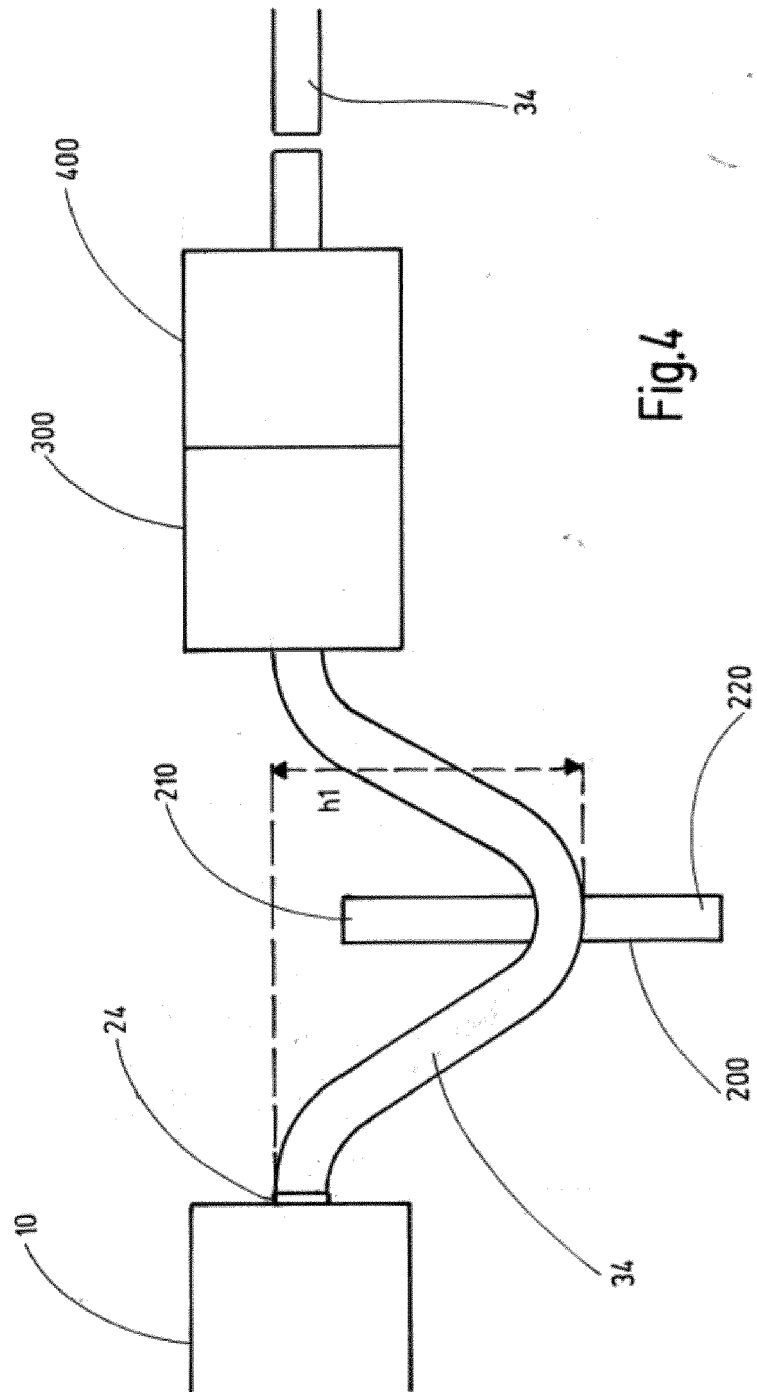


Fig.3





EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 223 090 A (STRUBEL DAVID G ET AL) 14 December 1965 (1965-12-14)	1-6, 13-15	INV. A24B3/14
Y	* figures 1-4 * * column 2, lines 52-59 * * column 2, line 68 - column 3, line 12 * * column 3, lines 27-32, 67-71 *	7-12, 16-19	
X	CH 275 420 A (BURGER SOEHNE [CH]) 31 May 1951 (1951-05-31)	1-6, 13-15	
Y	* figures *	16	
A	* page 1, lines 5-11 * * page 2, lines 45-51, 58-62 *	7-12, 17-19	
Y	US 5 727 571 A (MEIRING ROBERT LEONARD [US] ET AL) 17 March 1998 (1998-03-17) * figure 5 * * column 10, line 32 - column 11, line 12 *	7-12, 17-19	
Y	EP 0 917 830 A1 (PHILIP MORRIS PROD [US]) 26 May 1999 (1999-05-26) * figures 1-2 * * paragraph [0032] *	16	TECHNICAL FIELDS SEARCHED (IPC) A24B A24C A24F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 March 2019	Examiner Kirchmayr, Katrin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 19 6321

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3223090	A	14-12-1965	NONE
CH 275420	A	31-05-1951	NONE
US 5727571	A	17-03-1998	AT 180629 T 15-06-1999
		AU 3550193 A 30-09-1993	
		BG 61211 B1 31-03-1997	
		BR 9301251 A 28-09-1993	
		CA 2090918 A1 26-09-1993	
		CA 2466075 A1 26-09-1993	
		CA 2527939 A1 26-09-1993	
		CN 1077360 A 20-10-1993	
		CO 4130167 A1 13-02-1995	
		CZ 9300438 A3 17-11-1993	
		DE 69325121 D1 08-07-1999	
		DE 69325121 T2 28-10-1999	
		DK 0562474 T3 29-11-1999	
		EC SP930918 A 09-02-1994	
		EG 19960 A 31-10-1996	
		EP 0562474 A2 29-09-1993	
		ES 2133338 T3 16-09-1999	
		FI 931328 A 26-09-1993	
		GR 3030911 T3 30-11-1999	
		HR P930490 A2 30-04-1996	
		HU 214253 B 02-03-1998	
		IL 104930 A 31-12-1995	
		JP H067139 A 18-01-1994	
		JP 3472591 B2 02-12-2003	
		KR 100269437 B1 16-10-2000	
		NO 931087 A 27-09-1993	
		PL 298219 A1 13-12-1993	
		RO 110195 B1 30-11-1995	
		RU 2097997 C1 10-12-1997	
		SI 9300148 A 30-09-1993	
		SK 22993 A3 06-10-1993	
		TW 235906 B 11-12-1994	
		US 5727571 A 17-03-1998	
		ZA 9301675 B 29-12-2004	
EP 0917830	A1	26-05-1999	AT 182440 T 15-08-1999
			AT 211622 T 15-01-2002
			AT 228782 T 15-12-2002
			AU 683217 B2 06-11-1997
			BG 61989 B1 30-12-1998
			BR 9307046 A 29-06-1999
			CA 2144431 A1 31-03-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 19 6321

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-03-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		CR 4971 A	09-09-1994
		CZ 9500471 A3	11-09-1996
		DE 69325793 D1	02-09-1999
15		DE 69325793 T2	05-01-2000
		DE 69333324 D1	08-01-2004
		DE 69333324 T2	21-10-2004
		DE 69824982 D1	19-08-2004
		DE 69824982 T2	28-10-2004
20		DK 0615411 T3	21-02-2000
		DK 0917830 T3	03-03-2003
		DK 0917831 T3	29-04-2002
		EC SP941045 A	15-12-1994
		EP 0615411 A1	21-09-1994
		EP 0917830 A1	26-05-1999
25		EP 0917831 A1	26-05-1999
		ES 2134269 T3	01-10-1999
		ES 2171282 T3	01-09-2002
		ES 2189075 T3	01-07-2003
		FI 951119 A	10-03-1995
		GR 3031362 T3	31-01-2000
30		HU 227906 B1	29-05-2012
		LV 10899 B	20-04-1996
		MD 960302 A	31-05-1997
		NO 950919 A	10-03-1995
		NZ 274763 A	24-11-1997
		OA 9972 A	11-12-1995
35		PL 174703 B1	30-09-1998
		PL 308174 A1	24-07-1995
		PT 917830 E	30-04-2003
		PT 917831 E	31-07-2002
		RO 119920 B1	30-06-2005
40		RU 2135054 C1	27-08-1999
		SK 24195 A3	03-04-1996
		TJ 343 B	06-10-2002
		US 5505214 A	09-04-1996
		US 5613504 A	25-03-1997
		US 5692291 A	02-12-1997
45		US 5730158 A	24-03-1998
		US 5865185 A	02-02-1999
		WO 9406314 A1	31-03-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 2078087 A [0005]
- WO 199603060 A [0007]
- US 4981522 A [0008]