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(54) PRODUCTION AND PLANT FOR THE PRODUCTION OF RECONSTITUTED TOBACCO

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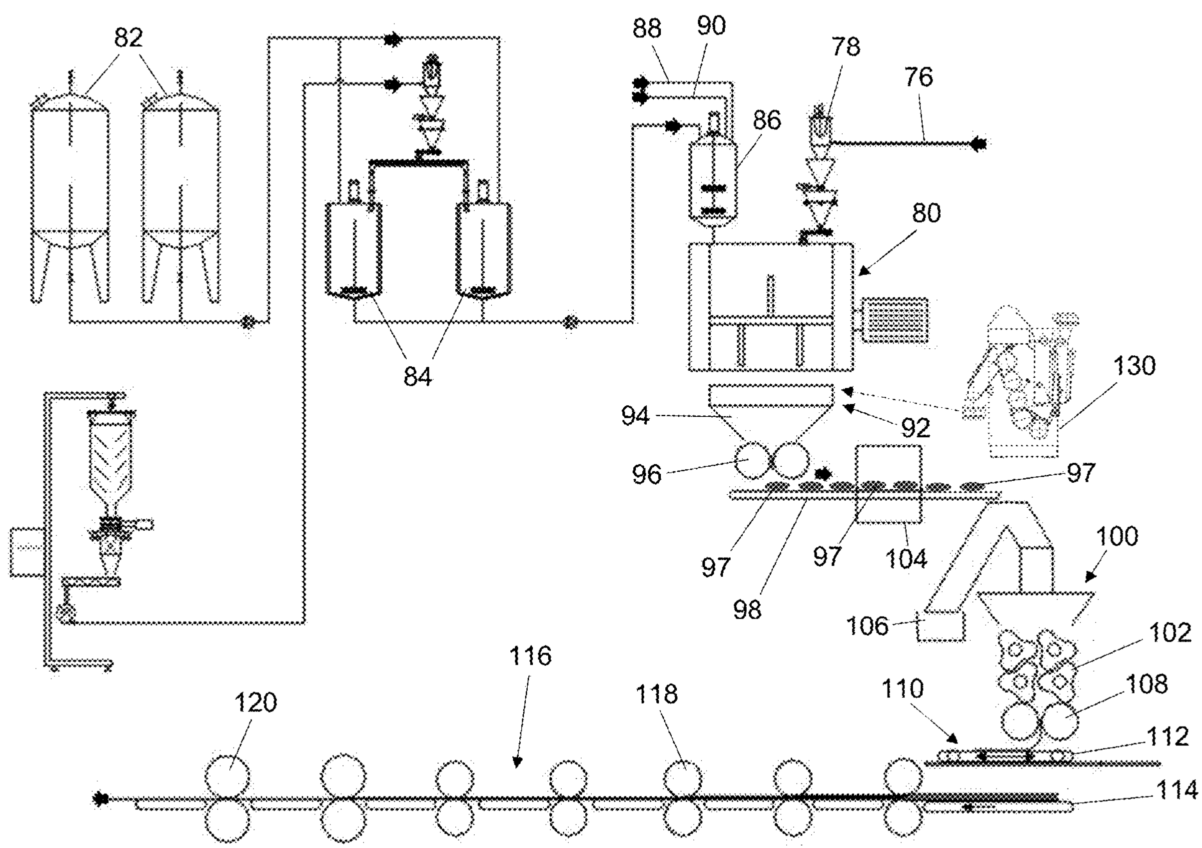
(57) **ABSTRACT**

A method for producing reconstituted tobacco includes comminuting the solid components of tobacco to a particle size of about 20-220 μm; mixing the comminuted tobacco product with water, at least one binding agent and at least one material to form an aerosol until a mixture with a liquid content of about 30-50% is obtained; subjecting that mixture to a first lamination to obtain a strip of continuous thickness of about 1-20 mm; subjecting the strip to additional rolling passages to obtain a strip having a substantially constant thickness of approximately 90-280 μm; and drying the strip to bring its liquid content to about 8-15%.



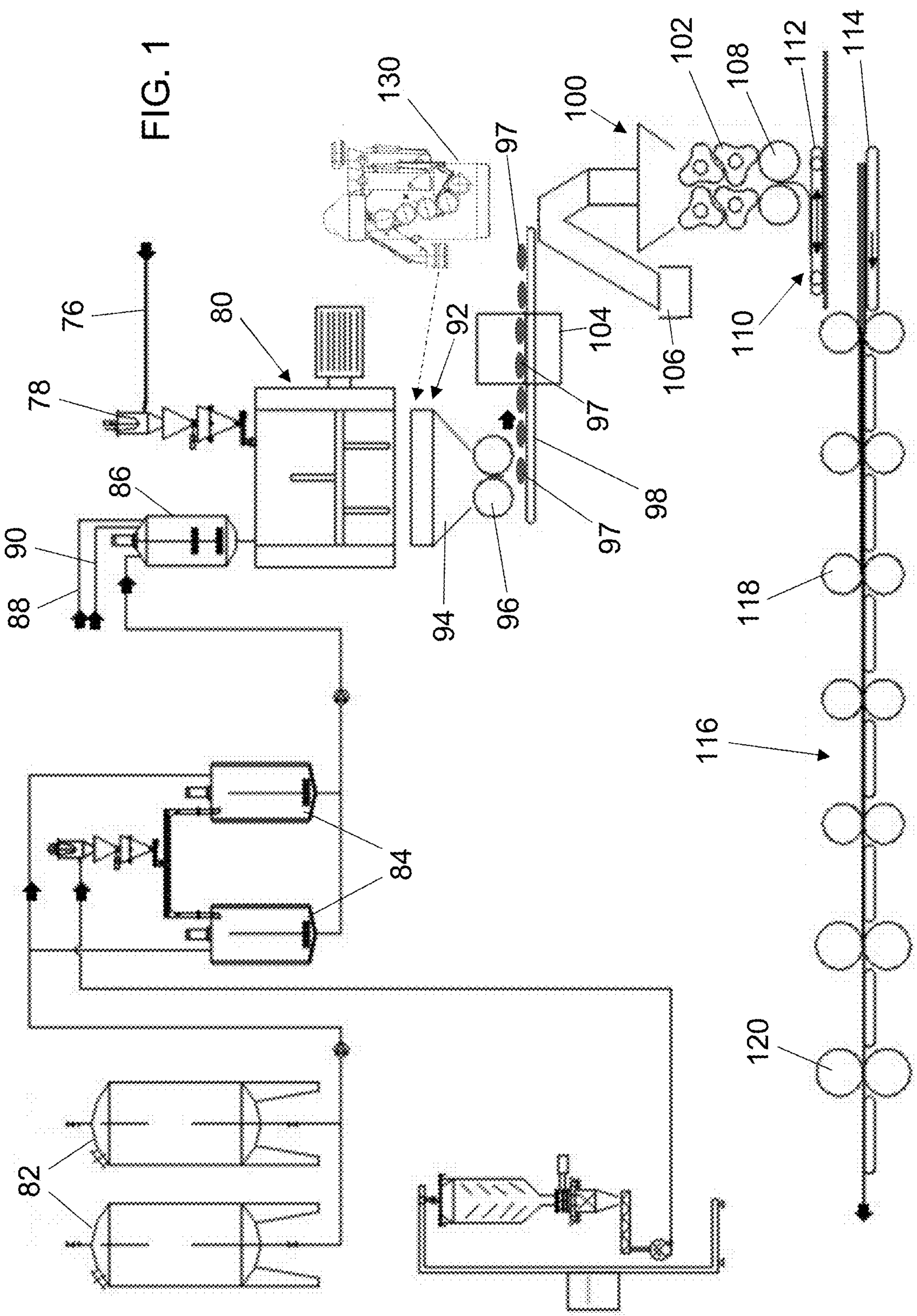

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FIG. 1

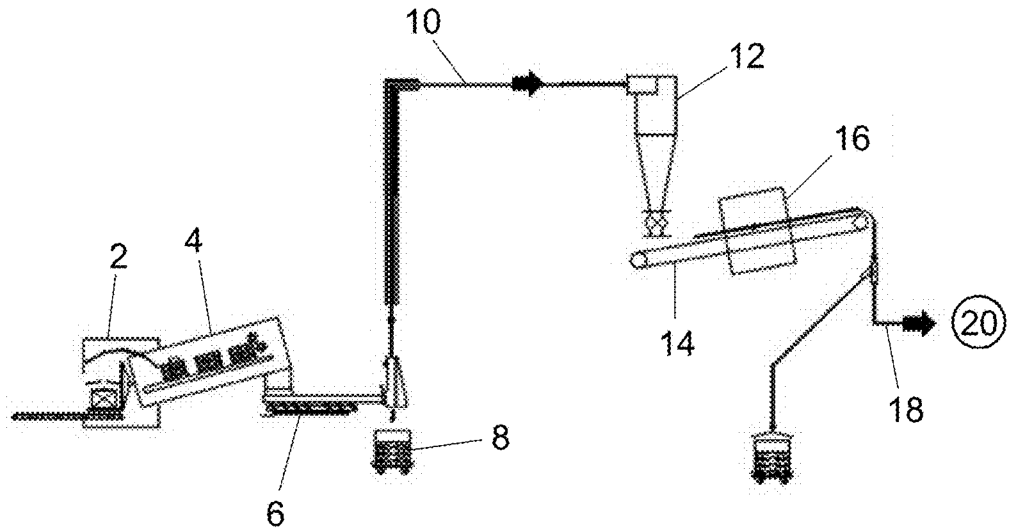


FIG. 2

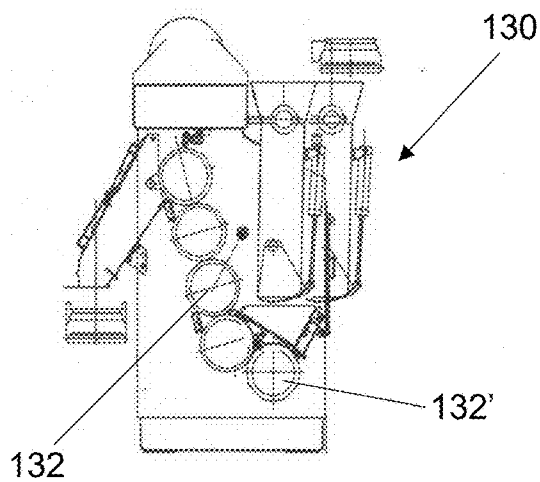


FIG. 6

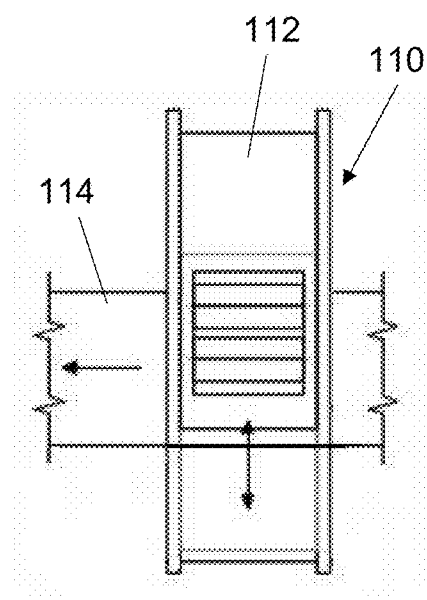


FIG. 7

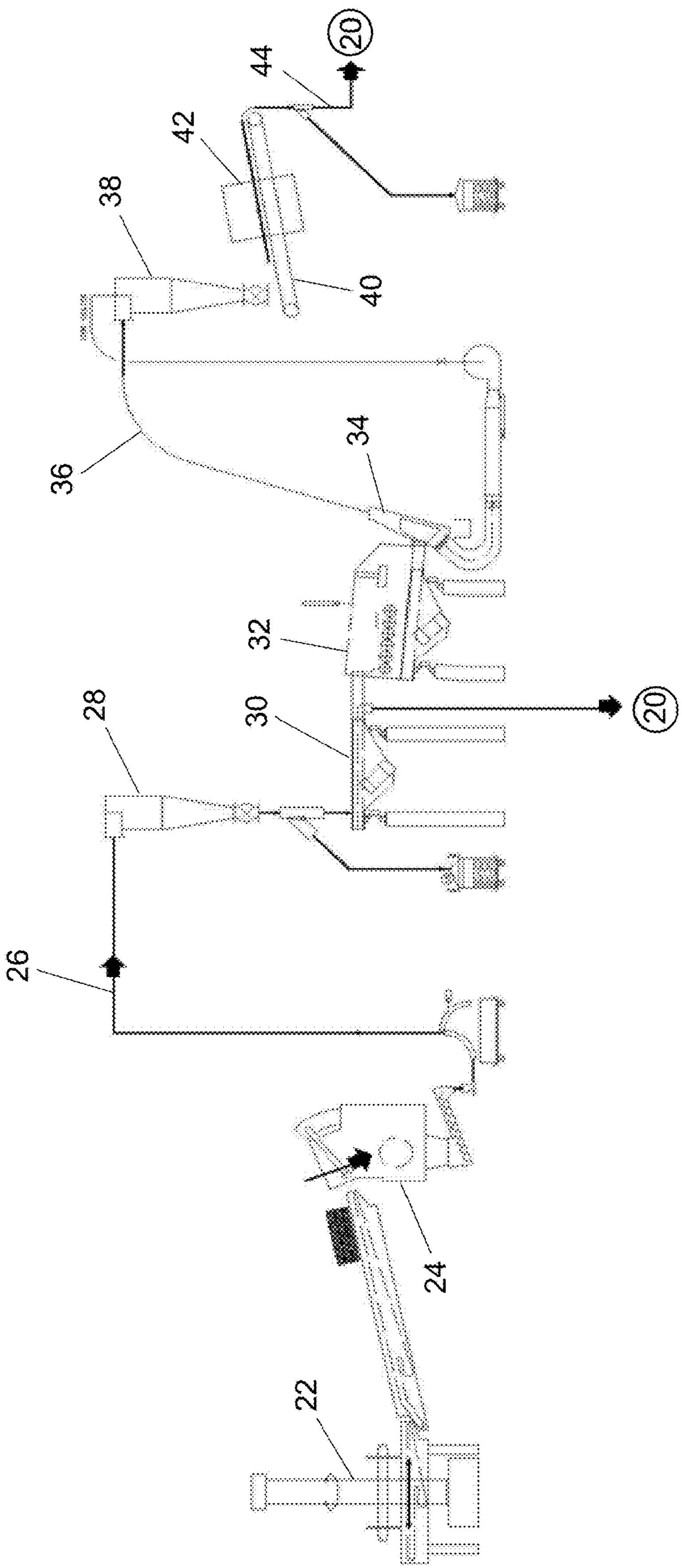


FIG. 3

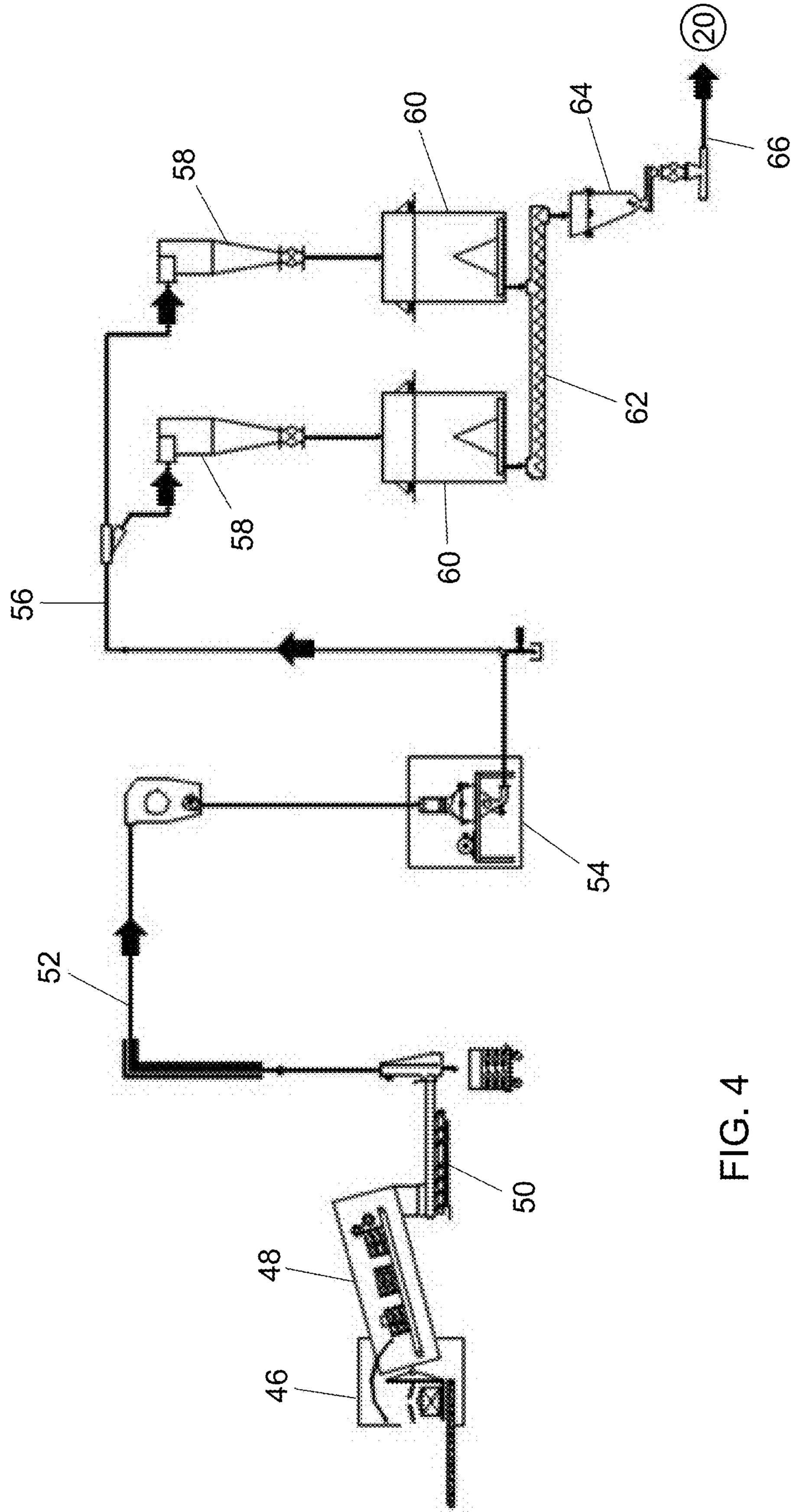


FIG. 4

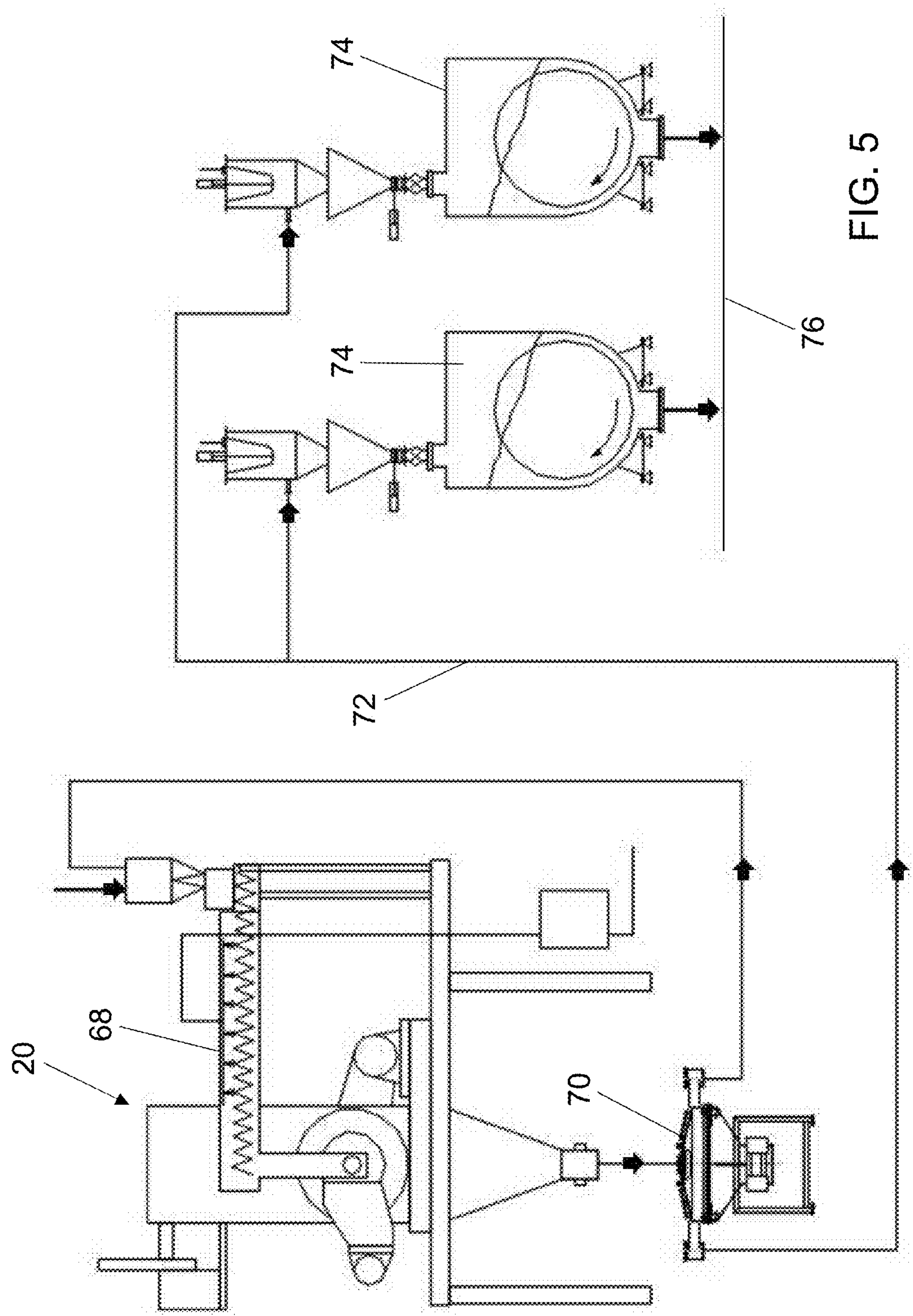
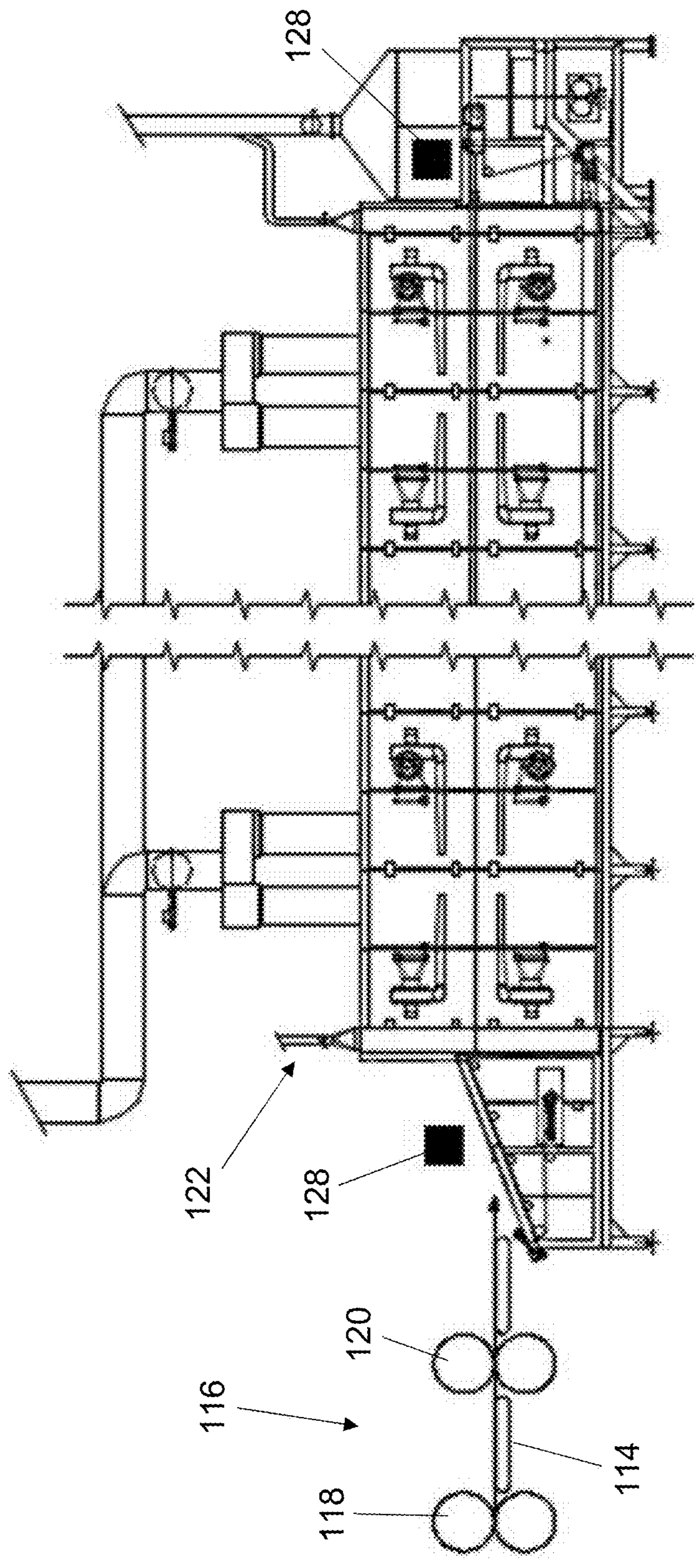


FIG. 5

FIG. 8



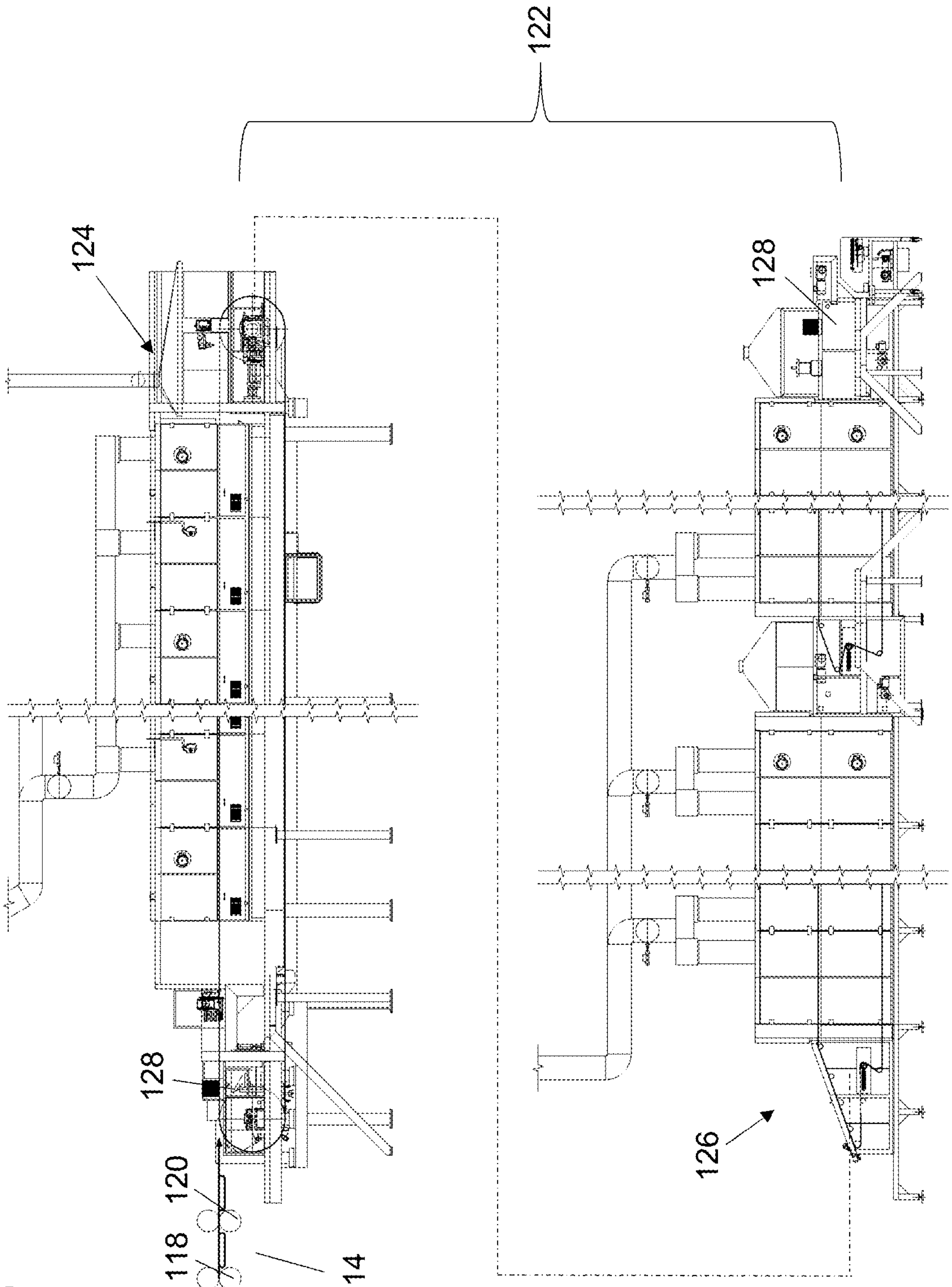


FIG. 9

PRODUCTION AND PLANT FOR THE PRODUCTION OF RECONSTITUTED TOBACCO

[0001] The present invention relates to a method and a plant for producing reconstituted tobacco, both of the conventional type and of the non-conventional type, the latter also referred to as H N B (Heat Not Burn).

[0002] In general, the reconstituted tobacco is obtained by using tobacco by-products and processing waste (ribs, small pieces of leaves, dust, etc.) which, properly shredded until they are practically reduced to powder and mixed with water, glycerine binders and other liquid additives, allow to obtain an extremely fluid mixture (slurry) having a liquid content of about 70% by weight, which is then poured into a veil on a steel belt and with this transferred into a drying oven. Here the evaporation of the liquid fraction of the mixture takes place, so that the solid residue forms a sort of continuous tobacco strip having approximately the same width as the steel belt. Subsequently the strip of dried mixture is separated from the steel belt and is cut into pieces of various sizes depending on the request. These pieces are then transformed into thin filaments which, suitably mixed, are fed to a conventional packaging machine for cigarettes.

[0003] Depending on the raw materials used and, in particular, depending on whether tobacco products shredded to a particle size comprised between 50 μm and 120 μm, or chopped tobacco leaves having sizes included between 5 and 10 mm are used, the reconstituted tobacco is distinguished as conventional or unconventional.

[0004] WO 2016/050469, WO 2016/050470, WO 2016/050471, WO 2016/050472 describe known techniques of production of reconstituted tobacco, which require plants of considerable size and involve high energy consumption to bring the mixture, which when it is produced is rather fluid, to the consistency of a tobacco sheet. It is sufficient to point out that a drying oven can reach 100 m in length.

[0005] Another drawback of the known techniques of production of reconstituted tobacco with the use of the by-products consists in the fact that the formation of the sheet starting from the layer of mixture is rather irregular, since the starting products are not homogeneous and their distribution on the steel belt is not uniform; it follows that the reconstituted tobacco sheet does not allow it to be reeled, nor to be cut regularly.

[0006] The object of the invention is to eliminate these drawbacks and to produce reconstituted tobacco of both conventional and unconventional types, with implants of much smaller dimensions.

[0007] Another object of the invention is to produce reconstituted tobacco with limited energy consumption.

[0008] Another object of the invention is to produce reconstituted tobacco using equipment partly already available on the market, even if never used in this specific technical field.

[0009] Another object of the invention is to produce reconstituted tobacco which is alternative to traditional methods.

[0010] Another object of the invention is to produce reconstituted tobacco with characteristics suitable for satisfying different market demands.

[0011] Another object of the invention is to produce reconstituted tobacco operating at low temperature and thus preserving all the aromas of tobacco.

[0012] All of these objects and others which will become apparent from the following description are attained, according to the invention, with a reconstituted tobacco production method according to claim **1** and with a plant according to claim **16**.

[0013] In particular, the method according to the invention for producing reconstituted tobacco is characterized in that it comprises the carrying out, in sequence, of the following steps:

[0014] the solid components of tobacco are comminuted until they reach a granulometry of about 20-220 μm, preferably about 80-180 μm,

[0015] the comminuted product thus obtained is mixed with water, at least one binding agent and at least one material to form an aerosol until a mixture with a liquid content of about 30-50%, preferably about 35-40%, is obtained,

[0016] said mixture is subjected to a first lamination to obtain a continuous strip having a thickness of about 1-20 mm, preferably of about 1-10 mm,

[0017] said strip already subjected to the said first rolling is subjected to a series of further rolling passages, until a strip having a substantially constant thickness of about 90-280 μm, preferably about 140-200 μm, is obtained;

[0018] said strip is dried to bring its liquid content to about 8-15%.

[0019] The present invention is further clarified hereinafter in some of its preferred embodiments which are given purely by way of a non-limiting example with reference to the accompanying drawings, in which:

[0020] FIG. **1** shows in a schematic general view a plant for the production of reconstituted tobacco according to the invention,

[0021] FIG. **2** shows its power supply section in the case that the plant is intended for the production of reconstituted tobacco of the conventional type,

[0022] FIG. **3** shows its power supply section in the case the plant is intended for the production of reconstituted tobacco of the unconventional (HNB) type,

[0023] FIG. **4** shows its feeding section of the ribs,

[0024] FIG. **5** shows its milling mixing and storage sections,

[0025] FIG. **6** shows in a schematic view its refiner displacements,

[0026] FIG. **7** shows a plane view of its layering section in a different embodiment,

[0027] FIG. **8** shows in a schematic view its hot air drier, and

[0028] FIG. **9** shows in a schematic view its hot air drier in a different embodiment.

[0029] As can be seen from the figures, the plant for producing reconstituted tobacco according to the invention comprises several sections arranged in series and aimed at operating on the input raw materials until they are transformed into a continuous strip of reconstituted tobacco to be sent for subsequent packaging operations of the cigarettes.

[0030] In particular, the plant according to the invention for the production of reconstituted tobacco comprises:

[0031] a comminution unit of the solid components of tobacco, to bring them to a granulometry of about 20-220 μm, preferably of about 80-180 μm; advantageously, said comminution unit comprises a mill **20** (preferably cryogenic) and/or a grinder **24** and/or a hammer mill **54**;

[0032] a kneading machine **80** which is fed with metered quantities of comminuted material, with water, with at least one binding agent and with at least one material to form an aerosol; said kneading machine being configured to obtain a mixture with a liquid content of about 30-50%, preferably about 35-40%,

[0033] a first lamination unit **100** for obtaining from said mixture a continuous strip having a thickness of about 1-20 mm, preferably of about 1-10 mm,

[0034] a rolling line **116** located downstream of said first lamination unit **100** to carry said continuous strip to a thickness of about 90-280 μm, preferably about 140-200 μm,

[0035] a drier **122**, placed downstream of said rolling line **116**, to bring the liquid content of said strip, laminated and coming out from said rolling line **116**, to about 8-15%.

[0036] Advantageously, the plant **1** also comprises a mixture forming unit **92** for forming a plurality of portions **97** of said mixture; suitably, therefore, the first lamination unit **100** is configured to obtain, from the portions **97** of said mixture, a continuous strip having a thickness of about 1-20 mm, preferably of about 1-10 mm.

[0037] Preferably, the plant according to the invention comprises:

[0038] a pre-treatment section of the starting solid products (tobacco leaves, ribs, fragments of leaves, powder, etc.) for the preparation thereof to subsequent grinding treatments,

[0039] a milling and storage section awaiting subsequent mixing with suitable treatment liquids; suitably, said milling section comprises said comminution unit,

[0040] a kneading section of solid and liquid materials to obtain a homogeneous mixture of a rather dense consistency,

[0041] a section for transforming the mixture, and in particular for a plurality of portions of said mixture, in a continuous strip,

[0042] a continuous strip rolling line for its reduction to the desired final thickness,

[0043] a section for drying the laminated strip.

[0044] Conveniently, the section for preparing and pre-treating the starting solid products is different depending on whether the implant is intended to produce reconstituted conventional tobacco (FIG. **2**) or non-conventional type (FIG. **3**). In addition, advantageously, it may be provided also a section of preparation and pre-treatment of the tobacco ribs (FIG. **4**), to be used for the production of reconstituted tobacco both conventional type that unconventional type.

[0045] Advantageously, in the case in which the preparation and pre-treatment section is intended to supply a plant for the production of reconstituted tobacco of the conventional type (FIG. **2**), it includes a tilter **2** of cartons containing tobacco products, to overturn their contents on a feeder **4** of a vibrating conveyor **6**, which separates any heavy bodies from the product to be treated. The heavy bodies are collected in a suitable container **8**, while the product to be treated is transferred, through a pneumatic conveyor line **10**, to a cyclone **12**, a conveyor belt **14**, provided with metal detector **16** for the removal of any metal bodies, and a pneumatic conveying line or **18**, to a mill **20**, advantageously of the cryogenic type.

[0046] Advantageously, in the case in which the preparation and pre-treatment section is provided for the preparation of reconstituted tobacco of an unconventional type (FIG. **3**), it comprises a feeding station with a counter **22** for unloading the bales of tobacco leaves from cartons of approximately 200 kg, which typically contain them, and the transfer of these to a grinder **24**.

[0047] Suitably, the output of this grinder **24** is connected, through a pneumatic conveying line **26**, to a cyclone **28**, in which the transport air is separated from the solid product, which is transferred to a vibrating sieve **30** for the separation of the fine parts from the remaining parts of the product. The output of the fine parts is directly connected with the cryogenic mill **20**, while the output of the remaining parts of the product feeds a conventional twine remove machine **32**, which provides for eliminating any twine previously not removed from the bales of tobacco leaves.

[0048] The exit of the twine remove machine **32** feeds a separation chamber **34** for the separation of any heavy foreign bodies from the ground tobacco leaves, which through a pneumatic conveyor line **36**, a cyclone **38**, a strip conveyor **40**, provided with metal detectors **42** for removing any metal bodies, and a pneumatic conveyor line **44**, are transferred to the cryogenic mill **20**.

[0049] Advantageously, in the case in which the preparation and pre-treatment section is provided for the preparation of the tobacco ribs to be used for the production of reconstituted tobacco of both the conventional and the non-conventional type (FIG. **4**), it comprises a tipper **46** for cartons containing the ribs of tobacco, feeder **48** for the ribs to a vibrating conveyor **50**, for the separation from these of any heavy bodies, and a pneumatic transport line **52** for their movement to a hammer mill **54**, where they are comminuted.

[0050] The hammer mill **54** has its output connected, via a pneumatic conveyor line **56** provided with cyclone filters **58**, to one or more storage silos **60**.

[0051] The output of the of the storage silo or silos **60** is in turn connected, by means of a screw conveyor **62**, to a metering device **64**, which provides for dosing the shredded ribs before sending them to the mill **20**, preferably cryogenic, through a pneumatic line of transport **66**.

[0052] As mentioned above, the plant according to the invention also includes the mill **20** (FIG. **5**), which carries out the grinding of various products received to bring them to an average particle size of about 20-220 μm, preferably about 80-180 μm.

[0053] Various types of mills can be used, although it is more advantageous to use a cryogenic rungs mill, which allows the product to be kept at low process temperatures and therefore to retain tobacco aromas.

[0054] The pinned-disk mill is in itself conventional and includes a closed structure with inside a fixed and a rotating disc or two counter-rotating discs, provided with rungs facing and partially interpenetrating each other. Being an apparatus in itself traditional, it has been globally indicated with **20** in FIG. **5** but is not shown in its internal construction characteristics or in its operating modes.

[0055] Preferably, the rungs mill **20** is predisposed to make a cryogenic grinding, namely a grinding in the presence of liquid nitrogen.

[0056] As mentioned, in a plant for the production of reconstituted tobacco, a cryogenic pin mill is somewhat more advantageous than a traditional mill, essentially due to the different ways in which the products to be ground are treated. In fact, grinding at room temperature can lead to obtaining products of poor quality, while grinding in the presence of liquid nitrogen preserves the physical properties and the chemical and organoleptic characteristics of the products.

[0057] The amount of liquid nitrogen used in cryogenic grinding processes is a fundamental part to consider when the pros and cons of the process are studied and may vary depending on the materials processed. The liquid nitrogen at a temperature of −175° C. is injected onto the product inside the chamber of a screw conveyor **68** which feeds the mill **20** and its residence time in contact with nitrogen is about 2 to 5 sec., which is also the transit time of the product inside the cochlea that feeds the pin mill. The temperature of the product coming out of the mill **20** is advantageously less than 10° C., in a way that the nitrogen vapours, which are released almost instantaneously upon contact with the tobacco to be cooled, travel upstream all of mill feed system, performing the desired pre-cooling effect. The flow of liquid nitrogen in the precooling system and the mill is controlled by thermocouples, that make the cryogenically grinding process fully automatic.

[0058] In summary, the positive factors of cryogenic grinding are:

[0059] higher yields,

[0060] better quality of the final product without breaking or tearing the molecular structure,

[0061] reduction of the needed energy,

[0062] better quality of the final product,

[0063] lower amount of waste due to overheating and to oxidation,

[0064] more homogeneous and finer final product,

[0065] lower amount of material to be reprocessed in the grinding system.

[0066] Suitably, the output of the rungs cryogenic mill **20** is connected to a fluidized sieve bed **70**, which has the function of separating the ground product, which exits from the mill itself and typically has an average particle size of about 20-220 μm, preferably about 80-180 μm, from particles of larger sizes, inevitably present.

[0067] Suitably, the sieve with a fluidized bed therefore has the function of sorting the product and put back into the cycle in the mill **20** the one with fractions greater than 120 μm, after having them separated from those comprised between 20 μm and 120 μm, that through a line of pneumatic conveying **72** are sent to one or more mixing and storage silos **74**.

[0068] Advantageously, the output of the of mixing and storage silos **74** feeds, via a pneumatic transport line **76**, and a cyclone filter **78**, which has the function of breaking down the dusty air and more specifically to separate the dust, which then is recovered and fed back into the cycle, from the air, which can then be ejected.

[0069] Conveniently, the output of the cyclone filter **78** feeds, through a continuous dosing system, preferably with a screw, the kneader **80**, which can be of various types, for example of a horizontal type with overturning or a vertical spiral type.

[0070] The kneading machine **80** is fed with a quantity of minced tobacco, water, at least one binding agent and at least one material to form an aerosol and is configured to obtain a mixture with a liquid content of about 30-50%, preferably by about 35-40%.

[0071] In particular, the values of liquid or humidity, indicated in the present description, are intended to be determined according to the measurement system on a wet basis. In particular, the humidity values are defined as the percentage of water contained in the total mass of the corresponding product and, in other words, it is the percentage ratio between the quantity of water and the total mass of the mixture. Suitably, these values are obtained using the traditional methods provided in the literature for measuring the quantity of water in a product, such as those presented in "Tobacco Moisture, Water and Oven Volatiles—A status report of common moisture methods used within the tobacco industry" By Nils Rose ET AL. in "Analytical and bioanalytical chemistry" (1 Jul. 2014, pages 1-16).

[0072] Preferably, to kneader **80** is headed at least a duct or water inlet, of a material for the formation of aerosols (e.g. glycerine) and at least one binding agent (binder). Conveniently, one or more inlet ducts can be provided for other additives required by the particular recipe to be prepared.

[0073] More particularly, the system includes one or more tanks **82** for the storage of material for the formation of aerosols and one or more pre-mixers **84**, in which can be entered said material for the formation of aerosols and, preferably, a plurality of additives dosed in the right proportions to form the liquid to be introduced into the mixer **80**.

[0074] Examples of preferred materials for the formation of the aerosol (and in particular for the formation of a visible aerosol) include polyhydric alcohols (e.g. Glycerol, propylene glycol, triethylene glycol and tetraethylene glycol), aliphatic esters of mono-, di- or poly-carboxylic acids (e.g. Methyl—stearate, dimethyl—dodecandioate and dimethyl—tetradecandioate), as well as mixtures thereof. Suitably, glycerine, propylene glycol, triethylene glycol and tetraethylene glycol can be mixed together to form an aerosol forming material. The aerosol forming material can also be supplied as a portion of the binding agent (e.g., when the binding agent is alginate propylene glycol). Advantageously, suitable combinations of materials for the formation of the aerosol can also be provided.

[0075] Preferably, said at least one agent and a binder comprises at least one of hydroxypropyl cellulose, hydroxypropyl methylcellulose, hydroxyethyl cellulose, microcrystalline cellulose, methylcellulose, carboxymethylcellulose (CMC), corn starch, potato starch, guar gum, carob seed flour, pectins and alginates (for example ammonium alginate and sodium alginate).

[0076] Advantageously, the output of the pre-mixer the **84** is connected with the input of a hydrator **86**, having other inputs connected with a line **88** of water and with a supply line **90** to supply compressed air.

[0077] Preferably, the output of the mixer **80** feeds to the forming units **92** the mixture to obtain a plurality of portions **97**, preferably conformed to breads/loaves and separated from each other. Suitably, the forming unit **92** includes a pair of forming rollers **96**, presenting grooves preferably parallel to the axis of cylinders and configured to pick up the incoming mixture and to output the portions **97**. Advantageously, the forming unit **92** is also configured to perform a roughing mixture and for this purpose, preferably, comprises a hopper **94** provided with a break lumps in its interior and of said pair of forming rollers **96** on the bottom.

[0078] Advantageously, at the exit from the forming unit **92** a conveyor belt **98** is provided for transferring the portions **97** to the first lamination unit **100**.

[0079] Preferably, the first lamination unit **100** comprises a lobed feeder **102**.

[0080] Advantageously, along the transfer path from the forming unit **92** to the lobed feeder **102** may be provided a further metal detector **104**, whose function is to remove any metal parts, that may still be present in the mixture and may damage the subsequent processing units. These metal parts are conveyed along a distinctive path to the inlet of the lobed feeder **102** and are collected within a suitable container **106**.

[0081] The lobed feeder **102** comprises a series of feeding lobed rollers, between which are conveyed the portions **97** (which come from the forming rollers **96** of the forming unit **92**) so as to push them between a displaced couple of rolling cylinders **108**, which are configured so as to form a continuous strip having a thickness of about 1-20 mm, preferably of about 1-10 mm.

[0082] Suitably, in a version not represented of the plant, the rolling line **116** may be provided directly downstream of the lobed feeder **102**. In particular, in this case, the rolling line receives the continuous strip input, having thickness of about 1-20 mm, preferably of about 1-10 mm, which exits from the first lamination unit **100** provided in the lobed feeder **102**.

[0083] Advantageously, downstream of the first lamination unit **100** and upstream of the rolling line **116**, a stratification unit **110** can be provided. Preferably, it is configured to lay out the continuous single-layer strip, having a thickness of about 1-10 mm, which comes out of the first lamination unit **100**, on several layers, so as to transform it into a multilayer strip having a thickness of about 2-20 mm., which is then sent to the rolling line **116**.

[0084] Preferably, said stratification unit **110** consists of an upstream conveyor belt **112**, which has the function of depositing on a lower downstream conveyor belt **114**, preferably belonging to the rolling line **116**, the product strip arranging it so that it is stratified on said downstream conveyor belt **114**, for example folding it several times on itself. Preferably, the upstream conveyor belt **112** is raised above the downstream conveyor belt **114** and is provided with a continuous advancement movement with respect to its supporting structure, and at the same time with a reciprocating motion with its supporting structure, parallel to the its longitudinal axis.

[0085] Suitably, the stratification unit **110** feeds the lower successive rolling line **116** and depending on the type of plant the upstream conveyor belt **112** stratification unit **110** may be arranged parallel or perpendicular to the rolling line **116**. In particular, if the downstream conveyor belt **114** of the rolling line **116** have a width substantially equal to the width of the strip of product that exits the stratification unit **110**, the upstream conveyor belt **112** is disposed parallel to the downstream conveyor belt **114** provided it the rolling line **116** (FIG. **1**), while if the downstream conveyor belt **114** of the rolling line **116** are wider than the product that exits the stratification unit **110**, it is preferable that the upstream conveyor belt **112** is arranged orthogonally to the downstream conveyor belt **114** provided of the rolling line **116** (FIG. **8**), so that with its movements can distribute the product strip on the whole useful width of the rolling line **116**.

[0086] Conveniently, both cases, the reciprocating movement of the structure supporting the upstream conveyor belt **112** stratification unit **110** causes a stratification of the strip of product, which exits from the first lamination unit **100** on the underlying first downstream conveyor belt **114** of the rolling line **116** and the formation of a stratified strip of width substantially equal to the useful width of the rolling line itself.

[0087] The rolling line **116** is formed by several lamination stations, each comprising a pair of cylinders **118**, which delimit between them an increasingly narrow passage to gradually reduce the strip thickness of the product being processed. In particular, the rolling line **116** is configured to progressively bring the endless strip to a thickness of 90-280 μm, preferably about 140-200 μm.

[0088] Preferably, between one laminating station and the next one is placed a downstream conveyor belt **114** having a length of preferably about 1.5-2 m, which has the function to rest the product before it is subjected to the next step of lamination.

[0089] Advantageously, the rolling line **116** is then completed with one or more calibration stations, each formed by a pair of calibrating cylinders **120**.

[0090] It is advantageously provided that the laminating cylinders **118** and possibly also the calibrating cylinders **120** can be heated, so as to be able to start the drying step already during the rolling.

[0091] Conveniently, downstream of the rolling line **116** it is provided a drier **122**, preferably with air recirculation (FIG. **7**), to bring the liquid content of said rolled strip to about 8-15%. Advantageously, the dryer **122** can be divided into two units **124**, **126**, placed in series with respect to each other. More particularly, the upstream unit **124** is provided to perform the first drying step and it presents in its interior a carrier made steel sheet or of a mesh conveyor belt for the transport of the product that comes out of the rolling line **16**; the downstream unit **126** is provided to perform the second drying step and the subsequent cooling step and is provided inside with a mesh conveyor belt.

[0092] Moreover, the dryer **122** is advantageously provided at the entrance and exit of sensors **128**, preferably with infrared rays, which control the product along its entire length.

[0093] The operation of the plant now described for the production of conventional reconstituted tobacco (FIG. **2**) is as follows.

[0094] Preferably, the containers of tobacco scraps are placed on the tipper **2**, which reverses the products on the feeder **4**, which transfers them to the vibrating conveyor **6**. Here takes place the separation of heavy bodies from the tobacco by-products: the former are collected in the container **8** while the latter are transferred by an air flux along the pneumatic conveying line **10** up to the cyclone **12**, which separates the air from solid products and let these fall on the conveyor **14**, for their transfer, through the pneumatic line **18**, to the cryogenic mill **20**.

[0095] Preferably, instead, for the production of non-conventional reconstituted tobacco (FIG. **3**), the cartons containing the tobacco leaves are placed in the unpacking bench **22**, where the individual bales of tobacco leaves are removed from the cartons and sent to the grinder **24**, which reduces the leaves themselves to a substantially uniform size of between 5 and 10 mm.

[0096] Conveniently, the thus comminuted product is then transferred along the pneumatic conveying line **26** to the cyclone **28**, which separates it from the air and makes it fall on the vibrating sieve **30**.

[0097] Here occurs the separation of the finer parts, which are sent directly to the cryogenic mill **20**, from the remaining parts which, after having passed the twine remove machine **32**, reach the separation chamber **34**. Here takes place the separation of any heavy bodies from the shredded leaves, which after being subjected to the control of the metal detector **42** are sent to the cryogenic mill **20**.

[0098] Conveniently, to the same cryogenic mill **20** can also be transferred, if the recipe requires it, the shredded tobacco ribs, which can be used for the production of reconstituted tobacco of both conventional and non-conventional type.

[0099] In this case (FIG. **4**) the containers with the ribs are placed on the tilter **46**, which feeds the ribs themselves to the vibrating conveyor **50** for the removal of any heavy bodies. The ribs are then transferred through the pneumatic line **52** to the hammer mill **54**, which shreds them to reduce them to a size between 5 and 8 mm.

[0100] From here the shredded ribs, separated in the cyclones **58** by the conveying air, are transferred to the storage silos **60**, from which the different types of ribs, coming from different qualities of tobacco, can be withdrawn and transferred through the screw conveyor **62** to the doser of the ribs **64**, which doses them according to the particular recipe to be prepared.

[0101] The ribs, shredded and dosed in the correct quantities, are transferred via the pneumatic line transport **66** to the cryogenic mill **20**.

[0102] Advantageously, independently from the type of reconstituted tobacco to produce, and to the type of solid tobacco parts introduced into the comminution unit, from the latter comes out a ground product with an average particle size of approximately 20-220 μm, preferably about 80-180 μm. Preferably, the ground product, which comes out of the sieve with a fluid bed fed by the cryogenic mill **20**, has an average particle size of about 20-220 μm, preferably about 80-180 μm.

[0103] Advantageously, the product thus ground is sent to the mixing and storage silos **60**, from which the products can then be taken according to requirements and transferred to the kneading machine **80**.

[0104] Suitably, in the mixer **80**, in addition to the ground tobacco (and preferably the solid products from blending silos and storage **60**), also water, at least one binding agent and at least one material to form an aerosol are introduced. Preferably, compressed air and other additives are also added.

[0105] Suitably, the whole is then mixed together to form a mixture having a percentage of liquids (humidity) of about 30-50%, preferably of about 35-40%, by weight on a wet basis, i.e. a rather dense consistency.

[0106] Preferably, the mixture thus obtained is transferred to the forming unit **92**, from which a plurality of portions **97** emerge, preferably shaped like loaves.

[0107] Suitably, therefore, the portions **97** of mixture, which emerge from the forming unit **92** are transferred at the first lamination unit **100** which is configured to output a continuous ribbon thickness of about 1-20 mm, preferably about 1-10 mm.

[0108] This continuous strip, which comes from the first lamination unit **100**, is directly transferred to the rolling line **116** or—by means of the stratification unit **110**—is folded onto itself so as to be deposited in stratified form on the input strip **114** of the rolling line **116**.

[0109] Suitably, as has been said, the stratification is obtained by dropping the continuous strip on the conveyor belt **112**, which is made to advance with respect to its support structure, which moves of reciprocating motion, so as to have more than one layer of the product strip on said downstream conveyor belt **114**. Depending on the plant and the direction of the alternating movement of the support structure of the conveyor belt **112** immediately downstream of the stratification unit **110**, the product strip can be arranged on several layers parallel to the longitudinal direction of the rolling line **116** or orthogonally to it.

[0110] Suitably, during each passage from one station to another of the rolling line **116** the strip of product undergoes a reduction in thickness, up to reach, in correspondence with the displaced output calibrating cylinders **120**, the desired thickness, which has a value substantially constant of about 90-280 μm, preferably of about 140-200 μm. Advantageously, moreover, at the exit from the rolling line **116** the strip has a liquid content lower to 20% or even 15%, in case the displaced cylinders **118** are heated and the water is removed already during the rolling process.

[0111] The product strip coming out of the rolling line **116** is then subjected to drying in the dryer **122**, where its liquid content is brought to about 8-15%.

[0112] Preferably, the dryer **122** is in air recirculation, which compared to the driers traditionally used in production systems of reconstituted tobacco is more advantageous in terms of complexity both in terms of encumbrance and in terms of energy consumption. This is because the traditional systems treat a product (mixture) very fluid and little stable, unlike the treated product from the plant according to the invention, which is much denser and much more stable. Consequently, while the systems which treat slurries require traditional irradiation and conduction dryers, the plant according to the invention can advantageously use an air recirculating dryer **122** with a net conveyor or a combined system of steel belt conveyors for the first drying step and mesh strip conveyors for the second drying step and the cooling step. In this way we obtain, with the same performance, reduced size (about 45 m compared to more than 100 m of a traditional drier) and lower energy consumption given the lower amount of water to be removed (using approximately 1000 kg/hour of steam/hour compared to over 5000 kg/hour of steam from a traditional dryer).

[0113] Suitably, at the exit of the drier **122** the product is ready to be wound in a reel or to be shredded into strands of the prescribed size, to be used for the packaging of cigarettes.

[0114] Conveniently, in case the plant is provided for the production of reconstituted tobacco of the unconventional type, in addition to using the different preparation and treatment section already described, it uses, as an alternative to the forming unit **92** or in addition and upstream of this, a refiner to cylinder refiner **130** which has the task of bringing the solid components of the mixture to a particle size of not more than 20 μm.

[0115] The refiner (FIG. **6**) comprises within a closed container a plurality of cylinders **132** arranged in sequence in narrow closeness between them, so as to delimit the corresponding milling gaps. The lower cylinder **132** is mounted with the axis outside the plane containing the axis of all the other cylinders **132** and functions as a feeder of the mixture which is taken from the bottom of the container and made re rise upwards so as to pass between the lower cylinder and the one immediately above and then to follow among all the others. The various pairs of cylinders **132** between which the mixture passes rotate at different speeds, in the sense that the upper cylinder rotates at a speed greater than the lower cylinder, with which it cooperates, in order to subject the mixture to a stretch during the passing between the cylinders **132** of each pair and thereby reducing the particle size of the mixture itself. One of the fundamental parameters for the success of the refining process is precisely the different speeds of the different cylinders **132**, from which depends the passage of the entire mass of the mixture which has passed through the milling gap. The pressure between the cylinders is hydraulically controlled.

[0116] All cylinders **132** are cooled with cold water that circulates inside each cylinder and thereby counteracts the heat which is developed from mixing due to friction due to both the movement of the cylinders itself and the rubbing with the product. In this way the temperature of the product is reduced to 25° C.

[0117] Thanks to the cylinder refiner **130** now described, the action of friction, which is exerted on the mixture by the cylinders **132** of the former, develops a considerable binding action of the cellulose fibres contained in tobacco and in particular in its ribs, and this generates the double advantage of developing the aromatic components of the product and eliminating the need to introduce other fiber into the mixture to obtain the required bonding effect.

[0118] The operation of the plant in this different embodiment requires that the shredded leaves and chopped ribs coming from the preparation and pre-treatment stations are fed to a rungs cryogenic mill **20** in an amount proportionally metered according to the recipe to obtain, and from this are brought to a particle size of about 20-220 μm, preferably about 80-180 μm.

[0119] The product is then transferred in the manner already described in the mixer **80**, in which a product mixture is formed as described above.

[0120] The mixture thus obtained is then fed to the cylinder refiner **130**, which has the task of bringing the solid components of the mixture to a particle size not exceeding 20 μm. In this way, the action of friction exerted on the mixture by the cylinders **132** of the cylinder refiner **130** develops a considerable binding action of the cellulose fibers contained in the tobacco and in particular in its ribs, and this causes the dual advantage of developing, on one hand, the aromatic components of the product and, on the other hand, eliminating the need to introduce other fibers into the mixture to obtain the required bonding effect.

[0121] FIG. **1** schematically indicates the position of the cylinder refiner **130** between the kneading machine **80** and the forming unit **92**, but the invention also provides that the cylinder refiner **130** can be an alternative to the forming unit **92**, and in this case the mixture which exits from the cylinder refiner **130** is transferred directly to the first lamination unit **100**, for the continuation of the processing cycle according to the methods already described.

1. A method for producing reconstituted tobacco, comprising:

comminuting solid components of tobacco to a particle size of about 20-220 μm;

mixing said comminuted solid components of the tobacco with water, at least one binding agent, and at least one material to form an aerosol until a mixture with a liquid content of about 30-50% is obtained;

subjecting said mixture to a first lamination to obtain a strip of continuous thickness of about 1-20 mm;

subjecting said strip, already subjected to said first lamination, a series of further rolling passages, to obtain a fully rolled strip having a substantially constant thickness of approximately 90-280 μm; and

drying said fully rolled strip to bring its liquid content to about 8-15%.

2. The method according to claim **1**, wherein the dried fully rolled strip is subjected to coiling or shredding in wires of predefined dimensions.

3. The method according to claim **1**, wherein the solid components of the tobacco are comminuted by grinding.

4. The method according to claim **1**, wherein the solid components of the tobacco are comminuted with a mill.

5. The method according to claim **1**, wherein the solid components of the tobacco are comminuted by crushing with a cryogenic rung mill.

6. The method according to claim **1**, wherein the mixture configured to form an aerosol is subjected to:

a roughing step for passage through at least one pair of grooved cylinders, and/or

a refining step by passing it-through at least one pair of refining cylinders until the mixture brought to a particle size of no more than 20 μm.

7. The method according to claim **1**, wherein said mixture is subjected to a homogenization and forming step before being subjected to said first lamination.

8. The method according to claim **7**, wherein said mixture is subjected to a homogenization and forming step to generate a continuous strip, of a substantially constant width of between 100 and 2000 mm and a thickness of between 1 and 10 mm, to then be subjected to said first lamination.

9. The method according to claim **7**, wherein said mixture is subjected to a homogenization and forming step to generate a sequence of portions to be then subjected to said first lamination.

10. The method according to claim **1**, wherein said first lamination of the mixture is carried out by rolling said mixture with a unit comprising a lobed feeder and at least a pair of rolling cylinders.

11. The method according to claim **1**, wherein, at an output of said first lamination, a single-layer strip of a thickness of about 1-10 mm is obtained.

12. The method according to claim **1**, wherein, before said series of further rolling passages, said strip, already subjected to said first lamination, is subjected to stratification until a multilayer strip having a thickness of about 2-20 mm is obtained.

13. The method according to claim **1**, wherein, in said series of further rolling passes, the mixture is made to rest between one lamination station and a next lamination station.

14. The method according to claim **1**, wherein said further rolling passages are lamination is performed with pairs of cylinders that are at least partially heated.

15. The method according to claim **1**, wherein drying comprises passage of said fully rolled strip through a recirculating air dryer.

16.-**32**. (canceled)

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