



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.01.2017 Bulletin 2017/03

(51) Int Cl.:
A24D 3/02 (2006.01)

(21) Application number: **16178272.7**

(22) Date of filing: **06.07.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(30) Priority: **06.07.2015 IT UB20151932**

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(54) **METHOD AND MACHINE FOR MANUFACTURING FILTERS**

(57) A method and a machine (1) for manufacturing coaxial filters (2) without paper for cigarettes (3); two tows (7, 11) of filtering material are fed along respective paths (P1, P2) to an intermediate station (9), where they are brought into contact so as to obtain a combined tow (14) having one of the two tows (7, 11) around the other; the combined tow (14) is treated by means of steam so as to activate the triacetin contained in the tows (7, 11) and thereafter dried to obtain a rod (20) of hardened filtering material without paper; one of the tows (7, 11) is treated by means of steam before reaching the intermediate station (9); in this manner the triacetin binds the tows (7, 11) of filtering material in a particularly homogeneous way.

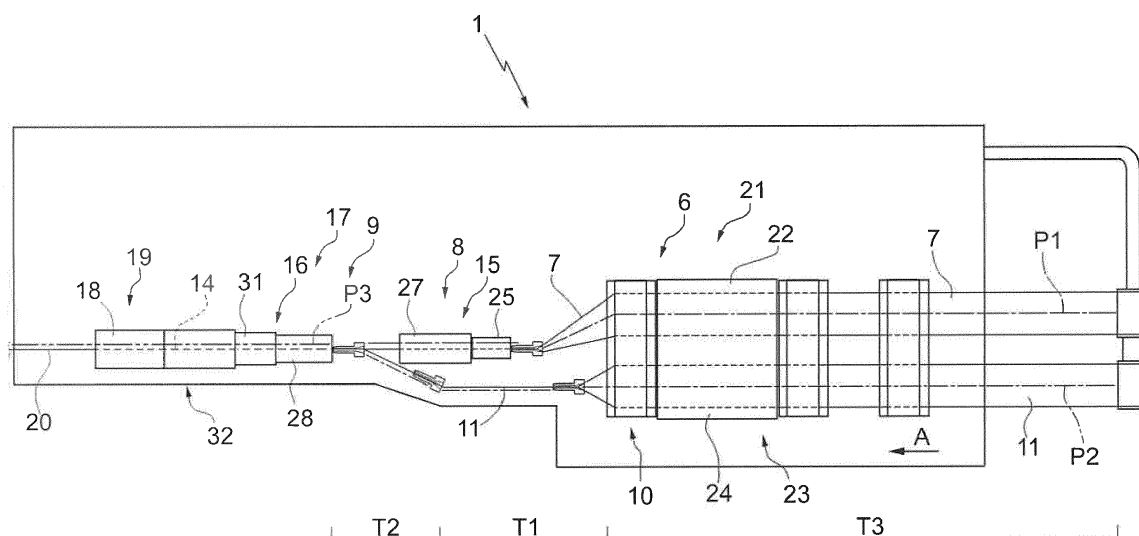


FIG.2

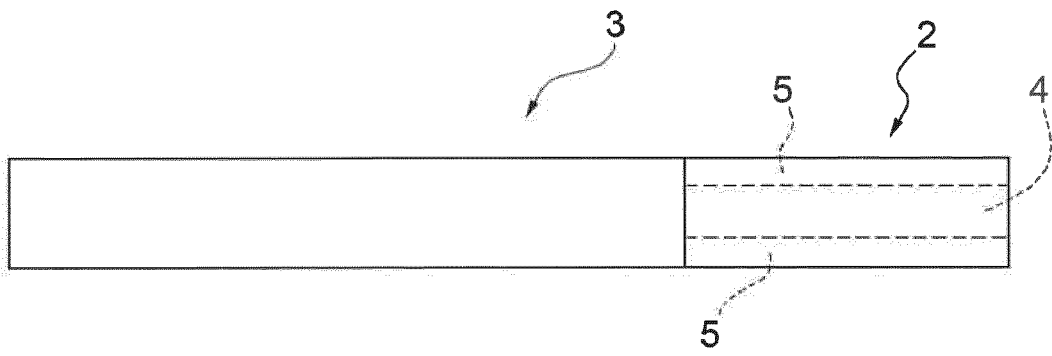


FIG.3

Description

[0001] The present invention relates to a method and to a machine for manufacturing filters for the tobacco processing industry. In particular, the present invention relates to a method and to a machine for manufacturing filters for smoking articles (cigarettes).

[0002] In the field of the tobacco processing industry, it is known, to produce filters by using a continuous tow of filtering material, normally cellulose acetate, which is fed with a continuous motion through an application station, in the area of which the tow is impregnated with a hardening substance, normally triacetin (1,2,3-triacetoxyp propane), and a treatment station, where a given shape (cross section) is given to the tow of filtering material and vapor is provided, normally water vapor, to the hardening substance to activate the hardening substance itself and, subsequently, to stiffen the filtering material. In this way a continuous rod with a given section (typically, circular) and a relatively high axial stiffness is obtained.

[0003] This continuous rod is therefore, always fed with a continuous motion to a cutting station, to be cut into filter segments of a given length.

[0004] The patent application, with the publication number WO2011148130 describes the manufacturing of coaxial filters, each comprising an inner portion with a particular shape (for example, Figure 1 shows such an inner portion with a star shaped section) and a peripheral portion arranged around the inner portion. The filters are produced by cutting transversely a rod, formed by the combination (obtained through a hollow tube) of two tows of a filtering material, which are treated by means of vapor before being brought into contact with one another.

[0005] The patent US4291711 describes the manufacturing of coaxial filters starting from a first and a second tow, of different materials, which are combined with one another. The first tow is treated by means of steam and then cooled so as to harden before coming into contact with the second tow.

[0006] The methods proposed so far for manufacturing coaxial filters have several disadvantages, among which the following are mentioned.

- The machines used so far are relatively complex and expensive, requiring a duplication of the devices needed for the treatment of the two tows of filtering material.
- The filters obtained are of a relatively low quality and, in particular, the connection between the inner section and the outer section is not optimal. This aspect has a negative effect, among others such as, the filtration capacity of the filter, creating a possible privileged passage for the smoke (which therefore is poorly cleaned) between the two sections.

[0007] The object of the present invention is to provide a machine and a method which allows, at least partially,

the drawbacks of the prior art to be overcome and is at the same time, easy and inexpensive to implement.

[0008] According to the present invention a machine and a method are provided, as claimed in the independent claims cited in the following, and, preferably, in any one of the claims depending directly or indirectly on the aforementioned independent claims.

[0009] The present invention will now be described with reference to the accompanying drawings, which illustrate a non-limiting example of embodiment thereof, wherein:

- Figure 1 is a schematic side view of a machine according to the present invention;
- Figure 2 is a schematic plan view of the machine of Figure 1;
- Figure 3 illustrates schematically a smoking article (in particular, a cigarette) provided with a filter obtained according to the present invention; and
- Figures 4 to 8 illustrate in sequence cross sections of a component of the machine of Figure 1.

[0010] In Figure 1, 1 denotes in its entirety a machine for manufacturing filters 2 of the tobacco processing industry (Figure 3). In particular, the machine 1 is adapted to produce filters 2 for cigarettes 3. More precisely, the machine 1 is adapted to produce filters 2 without paper.

[0011] Each filter 2 comprises a portion 4, which is rod-shaped and comprises (in particular, consists of) a first filter material and a portion 5, which is in contact with the portion 4 and comprises (in particular, consists of) a second filter material. According to some embodiments, the portion 5 surrounds the portion 4. In other words, the portions 4 and 5 extend along the filter 2 (from one end to the other of the filter 2) so that the portion 4 is inside the portion 5. Typically, said first and second material differ in some aspects. For example, the first and the second material have colors and/or flavorings and/or filtering capacities different one from the other.

[0012] The machine 1 (Figures 1 and 2) comprises a feeding assembly 6 for feeding a tow 7 of filtering materials along a path P1 (in a direction A), through a treatment station 8, to an intermediate station 9; a feeding assembly 10 to feed a tow 11 of filtering material along a path P2 (in a direction A) to the intermediate station 9; and a conveying assembly 12, for transporting the tows 7 and 11 from the intermediate station 9 along a path P3 (in the direction A). A combining device 13 is provided in the area of the path P3 (in particular, at the area of the intermediate station 9) to bring (directly) into contact (and bind one with the other) the tows 7 and 11 so as to obtain a combined tow 14.

[0013] In particular, the tows 7, 11 and 14 are fed, respectively along the paths P1, P2 and P3, with a substantially continuous motion.

[0014] Advantageously, in this combined tow 14 the tows 7 and 11 (which, were cut transversely in successive steps, define the portions 4 and 5) already assume a

relative position corresponding to that of the portions 4 and 5 in the filter 2. In other words, by making particular reference to the embodiment illustrated, in the combined tow 14, the tow 11 is arranged around the tow 7 (Figure 7) as the portion 5 is arranged around the portion 4 (Figure 3).

[0015] Note that the tows 7 and 11 comprise, respectively, the first and the second filter material.

[0016] The machine 1 also comprises a treatment device 15, which is arranged in the area of the treatment station 8 and is adapted to supply heat (in particular, steam) to a hardening substance (typically, triacetin) contained in the tow 7 of filtering materials, and (therefore) activates (making more fluid) said hardening substance; and a treatment device 16, which is arranged along the path P3 (in the area of a treatment station 17) downstream of the combining device 13 to supply heat (in particular, steam) to a hardening substance (typically, triacetin) contained in the tow 11 of filtering materials, and (then) activates (making more fluid) said hardening substance.

[0017] In other words, the heat (steam) is supplied to the tow 11 when the latter has been combined with the tow 7.

[0018] In this way several different advantages are obtained, among which we mention the following: the risk of the hardening substance of the tow 11 becoming active (and thus leads to a hardening of the filtering material) is reduced, only in the first part, before the tows 7 and 11 are combined; the possibility for the hardening substance of the tow 11 to interact with the tow 7, and with the hardening substance of the tow 7 is given. It is, therefore, possible to obtain an intrinsically very stable connection between the tows 7 and 11.

[0019] Usually, the hardening substances of the tows 7 and 11 have the same composition and, in particular, comprise (consist of) triacetin.

[0020] Advantageously, the treatment device 15 is also adapted to give a given shape to the tow 7 of filtering material.

[0021] The machine 1 also comprises a cooling device 18, which is arranged along the path P3 (in the area of a cooling station 19) downstream of the treatment device 16 to cool (and, in particular, dry) at least partially, the combined tow 14 and to obtain a rod 20 of hardened filtering material (without paper).

[0022] Note that the position of the cooling device 18 is particularly advantageous because it allows the activation of the hardening substances to be accelerated only when the combined tow 14 has already been obtained.

[0023] In this respect, advantageously, there is no additional cooling device arranged along the path P1 and downstream of the treatment device 15 (to blow air onto the tow 7). In particular, there is no additional cooling device arranged along the path P1 between the treatment device 15 (or treatment station 8) and the combining device 13 (or intermediate station 9) to cool (in particular, to blow air onto) the tow 7.

[0024] It is important to emphasize that the absence of the cooling device along path P1 allows the hardening substance of the tow 7 to arrive at least partially active to the combining device 13. Therefore, the hardening substance of the tow 7 has the possibility of interacting (when still active - not solidified) with the tow 11 and with the hardening substance of the tow 11 itself. More precisely, the steam is given time to take effect before eliminating the same by drying.

[0025] This aspect allows, in combination with the others previously described, the tows 7 and 11 to bind in a profound way and to solidify (at least partially) together in order to obtain the rod 20 substantially free of inhomogeneities at the interface between the tows 7 and 11.

[0026] This particularly effective bond is, therefore, also present between the portions 4 and 5. *Inter alia*, in this way, in use, the smoke does not pass in a preferential manner between the portions 4 and 5, but can properly be filtered by passing inside the portions 4 and 5.

[0027] According to the illustrated embodiment, the feeding assembly 6 is adapted to feed the tow 7 of filtering material through an application station 21, which is arranged along the path P1 upstream of the treatment station 8 and where an application device 22 is arranged to provide the tow 7 of filtering material with the respective hardening substance. Typically, the tow 7 is also stretched in the area of the application station 21.

[0028] Moreover, the feeding assembly 10 is arranged to convey the tow 11 of filtering material through an application station 23, which is arranged along the path P2 upstream of the intermediate station 9 and where an application device 24 is arranged to provide the tow 11 of filtering material with the respective hardening substance. Typically, the tow 11 is also stretched in the area of the application station 23.

[0029] Advantageously, the treatment device 15 is also adapted to give a given shape to the tow 7. Examples of shapes that can be given to the tow 7 are illustrated in US4291711 and in WO2011/148130.

[0030] Typically, the paths P1 and P2 have respective sections T2 substantially converging (in particular, so as to lead the tow 11 under the tow 7 in the area of the intermediate station 9).

[0031] According to some embodiments, the section T2 of the path P1 extends from the treatment station 8 to the intermediate station 9.

[0032] In particular, the paths P1 and P2 also have respective sections T1 substantially diverging one in respect to the other (and arranged upstream of the sections T2).

[0033] Moreover, advantageously, the paths P1 and P2 have respective sections T3 facing each other and arranged upstream of respective sections T1. More precisely, the sections T3 are substantially parallel one to the other. Even more precisely, the sections T1 extend from respective sections T3 to respective sections T2.

[0034] With regard to what indicated above, note that what has been proposed can be applied to existing dual-

rod machines (which can be adapted with relative ease).

[0035] According to some embodiments, the machine 1 (in particular, the treatment device 15) comprises a forming beam 25 (which has an inner channel with a cross section that changes along the longitudinal extension of the forming beam itself - of the type known per se) and porous conveyor means 26 (in particular, a porous tape), which extend and can be operated to move along (at least) a section of the path P1. More precisely, the conveyor means 26 are adapted to slide along the forming beam 25 (more precisely, along its inner channel). During sliding, the conveying means 26 are deformed following the profile of the inner channel so as to impose a given shape (typically, round) to the tow 7.

[0036] In some cases, the shape of the cross section of the tow 7 is determined from the (end) cross section of the channel of the forming beam 25. According to some examples, the cross (end) section of the forming beam 25 may be triangular, square or rectangular (or any of the shapes of the inner sections of the rod described in US4291711 and in WO2011/148130).

[0037] According to alternative (and preferred) embodiments, the shape of the cross section of the tow 7 is obtained by passing the tow 7 (having a substantially circular section) through a die (which is part of the treatment device 15). In particular, the die (known per se and not illustrated) is arranged downstream of the forming beam 25. In some cases, it is possible to obtain, in this way, a triangular, square or rectangular (or any of the shapes of the inner sections of the rod described in US4291711 and WO2011/148130) cross section of the tow 7.

[0038] Typically, the aforementioned die has a through hole (through which passes the tow 7 thus deforming) with a (end) cross section of the shape of which the cross section of the tow is needed to be obtained. Therefore, for example, the through hole has a triangular, square or rectangular (end) cross section (or any of the shapes of the inner sections of the rod described in US4291711 and in WO2011/148130).

[0039] Advantageously, the treatment device 15 comprises an application unit 27, which is adapted to blow steam onto the tow 7 through the pores of the conveying means 26 and is arranged in the area of (in some cases, at the end of) an end section of the forming beam 25.

[0040] With particular reference to Figures from 4 to 7, according to some embodiments, the machine 1 (in particular, the combining device 13) comprises a forming beam 28 (which has an inner channel 29 with a cross section that is modified along the longitudinal extension of the forming beam 28 itself - of a type known per se) and a porous conveying means 30 (in particular, a porous tape), which extend and can be operated to move along (at least) a part of the path P3. More precisely, the conveying means 30 are adapted to slide along the forming beam 28 (more precisely, along the inner channel 29). While sliding, the conveying means 30 are deformed by following the profile of the inner channel 29 so as to im-

pose a specific shape (in particular, circular) to the tow 11. In particular, the conveying means 30, by sliding along the forming beam 28, wind the tow 11 around the tow 7.

[0041] Also in this case, the shape of the cross section of the rod 20 is determined by the (end) cross section of the channel of the forming beam 28. Typically, the (end) cross section of the forming beam 28 is circular or elliptical.

[0042] Advantageously, the treatment device 16 comprises an application unit 31, which is adapted to blow steam onto the combined tow 14 through the pores of the conveying means 30 and is arranged in the area of (in some cases, at the end of) an end section of the forming beam 28.

[0043] Advantageously, the cooling device 18 is adapted to blow air onto the combined tow 14 (through the pores of the conveying means 30). In particular, the cooling device 18 is arranged downstream of the application unit 31 in the area of (in some cases, at the end of) an end section of the forming beam 28.

[0044] According to a further aspect of the present invention, a method (normally implemented by the machine 1) for manufacturing filters 2 (as defined above) of the tobacco processing industry (in particular filters 2 for cigarettes 3) is provided. The method comprises: a first feeding step to feed the tow 7 of filtering material along the path P1 through the treatment station 8 to the intermediate station 9; a second feeding step to feed the tow 11 of filtering material along the path P2 to the intermediate station 9; and a first treatment step, during which, in the area of the treatment station 8, heat (in particular, steam) is supplied to a hardening substance contained in the tow 7 to activate the hardening substance itself. In particular, the first and second feeding step are substantially simultaneous.

[0045] The method also comprises a conveying step to convey the tows 7 and 11 from the intermediate station 9 along the path P3; and a combining step, to bring (directly) into contact the tows 7 and 11 in the area of the path P3 (in particular, in the area of the intermediate station 9) so as to obtain a combined tow 14.

[0046] Advantageously, the method comprises a second treatment step, which is subsequent to the combining step and during which, in the area of the treatment station 17 arranged along the path P3, heat (in particular, steam) is supplied to a hardening substance contained in the tow 11 of filtering material, so as to activate the hardening substance itself; and a cooling step, which is subsequent to the second treatment step, during which the tows 7 and 11 coupled in the combined tow 14 are both at least partially cooled (in particular, dried) so as to obtain the rod 20 of hardened filtering material without paper.

[0047] Advantageously, during the combining step, the hardening substance of the tow 7 is now at least partially active (thanks to the energy that the steam is still yielding).

[0048] According to some embodiments, during the

conveying step, the tows 7 and 11 (in particular, the combined tow 14) are conveyed along the path P3 through the treatment station 17 and the cooling station 19, which is arranged downstream of the treatment station 17 and where the cooling step takes place. During the cooling step, air is blown onto the combined tow 14. In particular, the hardening substances of the tows 7 and 11 have substantially the same composition.

[0049] Advantageously, no air is blown onto the tow 7 along path P1 between the treatment station 8 and the intermediate station 9 (as long as the tow 7 is not brought into contact with the tow 11).

[0050] According to some embodiments, the tow 11 is led around the first tow during the combining step. In this way, in each filter 2 the portion 5 surrounds the portion 4.

[0051] In some cases, a tow 7 is fed through the application station 21, which is arranged along the path P1 upstream of the treatment station 8 and where the tow 7 is provided with the hardening substance. The tow 11 is fed through the application station 23, which is arranged along the path P2 upstream of the intermediate station 9 and where the tow 11 is provided with the hardening substance.

[0052] The paths P1 and P2 are structured as indicated above.

[0053] Advantageously, the path P3 extends through a resting station 32, which is arranged between the treatment device 16 and the cooling device 18. In the area of the resting station the hardening substances have time to perform their function in the correct way before the cooling station 19 (before being dried).

[0054] Unless it is explicitly stated to the contrary, the content of the references (articles, texts, patent applications etc.) cited in this text is fully referred herein for completeness of description. In particular, the mentioned references are incorporated herein by reference.

Claims

1. A machine for manufacturing filters (2) of the tobacco processing industry, in particular filters (2) for cigarettes (3); each filter (2) comprises a first portion (4) of filtering material, which is rod-shaped, and a second portion (5) of filtering material, which is in contact with the first portion (4); the machine (2) comprises:

a first feeding assembly (6) to feed a first tow (7) of filtering material along a first path (P1) through a first treatment station (8) to an intermediate station (9);

a second feeding assembly (10) to feed a second tow (11) of filtering material along a second path (P2) to the intermediate station (9);

a first treatment device (15), which is arranged in the area of the first treatment station (8) and is adapted to give a given shape to the first tow (7) of filtering material and to supply heat (in particular, steam) to a first hardening substance contained in the first tow (7) of filtering material, so as to activate the first hardening substance itself;

a conveying assembly (12) to convey the first and the second tow (7, 11) of filtering material from the intermediate station (9) along a third path (P3); and

a combining device (13), which is arranged in the area of the third path (P3) to cause the first and the second tows (7, 11) of filtering material to come into contact, so as to obtain a combined tow (14);

the machine (1) **being characterized in that** it comprises:

a second treatment device (16), which is arranged along the third path (P3) downstream of the combining device (13) to supply heat (in particular, steam) to a second hardening substance contained in the second tow (11) of filtering material, so as to activate the second hardening substance itself and so that the heat is supplied to the second tow (11) when the second tow (11) itself has already been combined with the first tow (7); and a cooling device (18), which is arranged along the third path (P3) downstream of the second treatment device (16) to at least partially cool (and, in particular, dry) the combined tow (14) and to obtain a rod (20) of hardened filtering material without paper;

no further cooling device, adapted to blow air onto the first tow (7), being provided along the first path (P1) and downstream of the first treatment device (15).

2. A machine according to Claim 1, wherein the conveying assembly (12) is adapted to feed the first and the second tow (7, 11) of filtering material along the third path (P3) through a second treatment station (17), where the second treatment device (16) is arranged, and through a cooling station (19), which is arranged downstream of the second treatment station (17) and where the cooling device (18) is placed; the cooling device (18) being suited to blow air onto the combined tow (14); in particular, the first and the second hardening substance substantially have the same composition.
3. A machine according to Claim 2, and comprising porous conveying means (30), which can be operated so as to move along at least a section of the third path (P3), the cooling device (18) being suited to blow air through the conveying means (30).
4. A machine according to Claim 3, and comprising a

forming beam (28), along which said conveying means (30) extend and can slide; in particular, the forming beam (28) being shaped in such a way that the conveying means (30), when sliding along the forming beam (28) itself, wind the second tow (11) of filtering material around the first tow (7) of filtering material.

5. A machine according to any one of the preceding claims, wherein the combining device (13) is adapted to give a given shape (in particular, a substantially circular shape) to the second tow (11) of filtering material; in particular, the combining device (13) is adapted to wind the second tow (11) around the first tow (7).
6. A machine according to any one of the preceding claims, wherein said second portion (5) surrounds said first portion (4); the combining device being adapted to lead the second tow (11) of filtering material around the first tow (7) of filtering material.
7. A machine according to any one of the preceding claims, wherein the first feeding assembly (6) is adapted to feed the first tow (7) of filtering material through a first application station (21) arranged along the first path (P1) upstream of the first treatment station (8); the second feeding assembly (10) being adapted to feed the second tow (11) of filtering material through a second application station (24) arranged along the second path (P2) upstream of the intermediate station (9); the machine (1) comprising a first application device (22), which is arranged in the area of the first application station (21) to provide the first tow (7) of filtering material with the first hardening substance, and a second application device (24), which is arranged in the area of the second application station (23) to provide the second tow (11) of filtering material with the second hardening substance.
8. A machine according to any one of the preceding claims, wherein the first and second path (P1, P2) are shaped so as to have respective first sections (T1), which are substantially diverging; and second sections (T2), which are downstream of the first sections (T1) and substantially converging (in particular, so as to lead the second tow (11) of filtering material under the first tow (7) of filtering material in the area of the intermediate station (9)).
9. A method to manufacture filters (2) of the tobacco processing industry, in particular filters (2) for cigarettes (3); each filter (2) comprises a first portion (4), which is rod-shaped and a second portion (5), which is rod-shaped and is in contact with the first portion; the method comprises:

a first feeding step to feed a first tow (7) of filtering material along a first path (P1) through a first treatment station (8) to an intermediate station (9);

a second feeding step to feed a second tow (11) of filtering material along a second path (P2) to the intermediate station (9) ;

a first treatment step, during which, in the area of the first treatment station (8), heat (in particular, steam) is supplied to a first hardening substance contained in the first tow (7) of filtering material, so as to activate the first hardening substance itself;

a conveying step to convey the first and the second tow (7, 11) of filtering material from the intermediate station (9) along a third path (P3); and

a combining step to cause the first and the second tows (7, 11) of filtering material to come into contact in the area of the third path (P3) (in particular, in the area of the intermediate station), so as to obtain a combined tow (14);

the method being **characterized in that** it comprises:

a second treatment step, which is subsequent to the combining step and during which, in the area of a second treatment station (17) arranged along the third path (P3), heat (in particular, steam) is supplied to a second hardening substance contained in the second tow (11) of filtering material so as to activate the second hardening substance itself and so that the heat is supplied to the second tow (11) when the second tow (11) itself has already been combined with the first tow (7); and

a cooling step, which is subsequent to the second treatment step and during which the first and the second tow (7, 11) coupled in the combined tow (14) are both at least partially cooled (in particular, dried), so as to obtain a rod (20) of hardened filtering material without paper.

10. A method according to Claim 9, wherein, during the combining step, the first hardening substance is still at least partially active.

11. A method according to Claim 9 or 10, wherein, during the conveying step, the first and the second tow (7, 11) of filtering material are conveyed along the third path (P3) through the second treatment station (17) and through a cooling station (19), which is arranged downstream of the second treatment station (17) and where the cooling step take place; during the cooling step, air is blown towards the combined tow (14); in particular, the first and the second hardening sub-

stance substantially have the same composition.

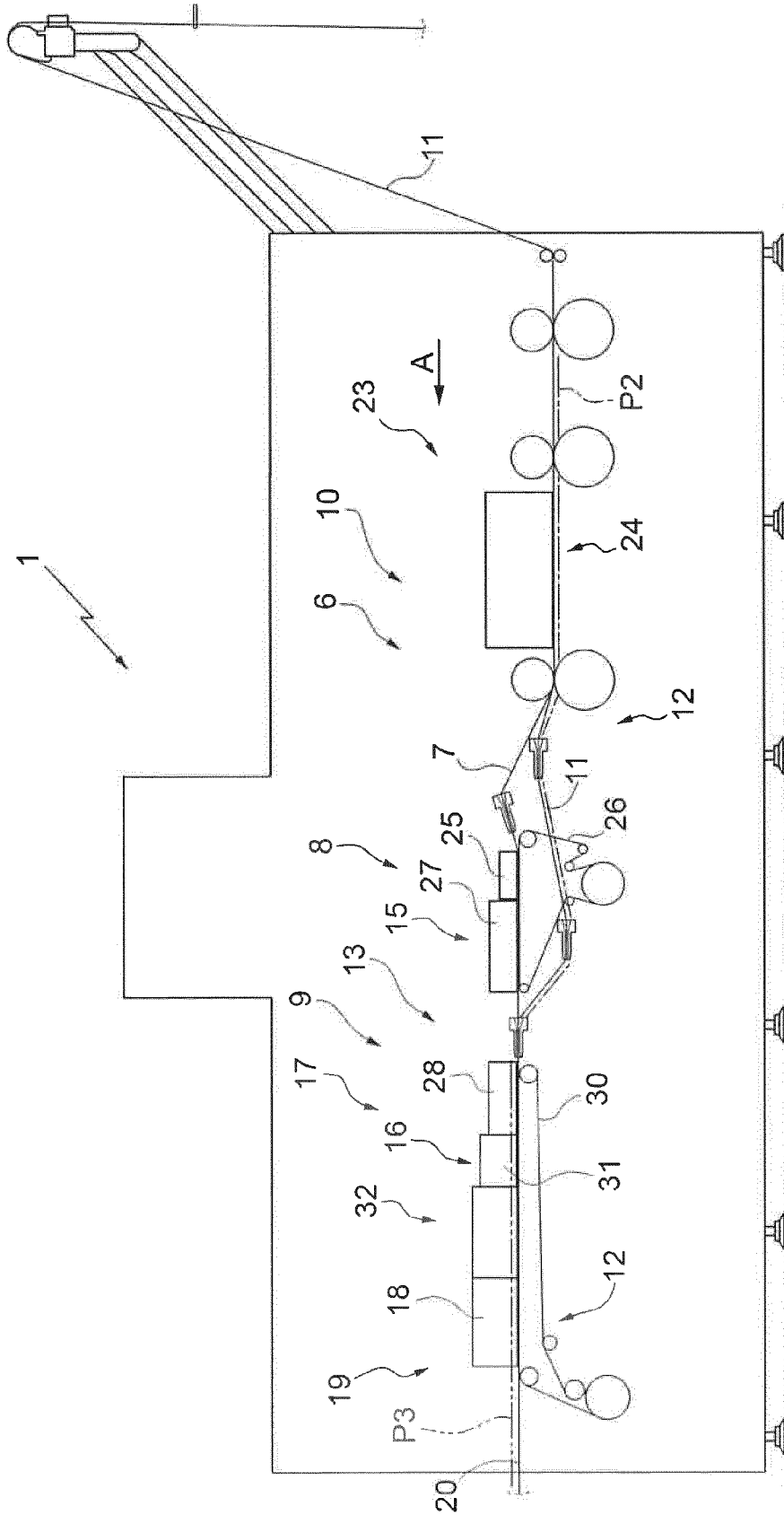
12. A method according to any one of Claims from 9 to 11, wherein no air is blown onto the first tow (7) of filtering material along the first path between the first treatment station (8) and the intermediate station (9). 5
13. A method according to any one of Claims from 9 to 12, wherein the second tow (11) is led around the first tow (7) during the combining step; said second portion (5) surrounds said first portion (4). 10
14. A method according to any one of Claims from 9 to 13, wherein the first tow (7) of filtering material is fed through a first application station (21), which is arranged along the first path (P1) upstream of the first treatment station (8) and where the first tow (7) of filtering material is provided with the first hardening substance; the second tow (11) of filtering material is fed through a second application station (24), which is arranged along the second path (P2) upstream of the intermediate station (9) and where the second tow (11) of filtering material is provided with the second hardening substance. 15
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15. A method according to any one of Claims from 9 to 14, wherein the first and second path (P1, P2) are shaped so as to have respective first sections (T1), which are substantially diverging; and second sections (T2), which are downstream of the first sections (T1) and substantially converging (in particular, so as to lead the second tow (11) of filtering material under the first tow (7) of filtering material in the area of the intermediate station (9)). 30
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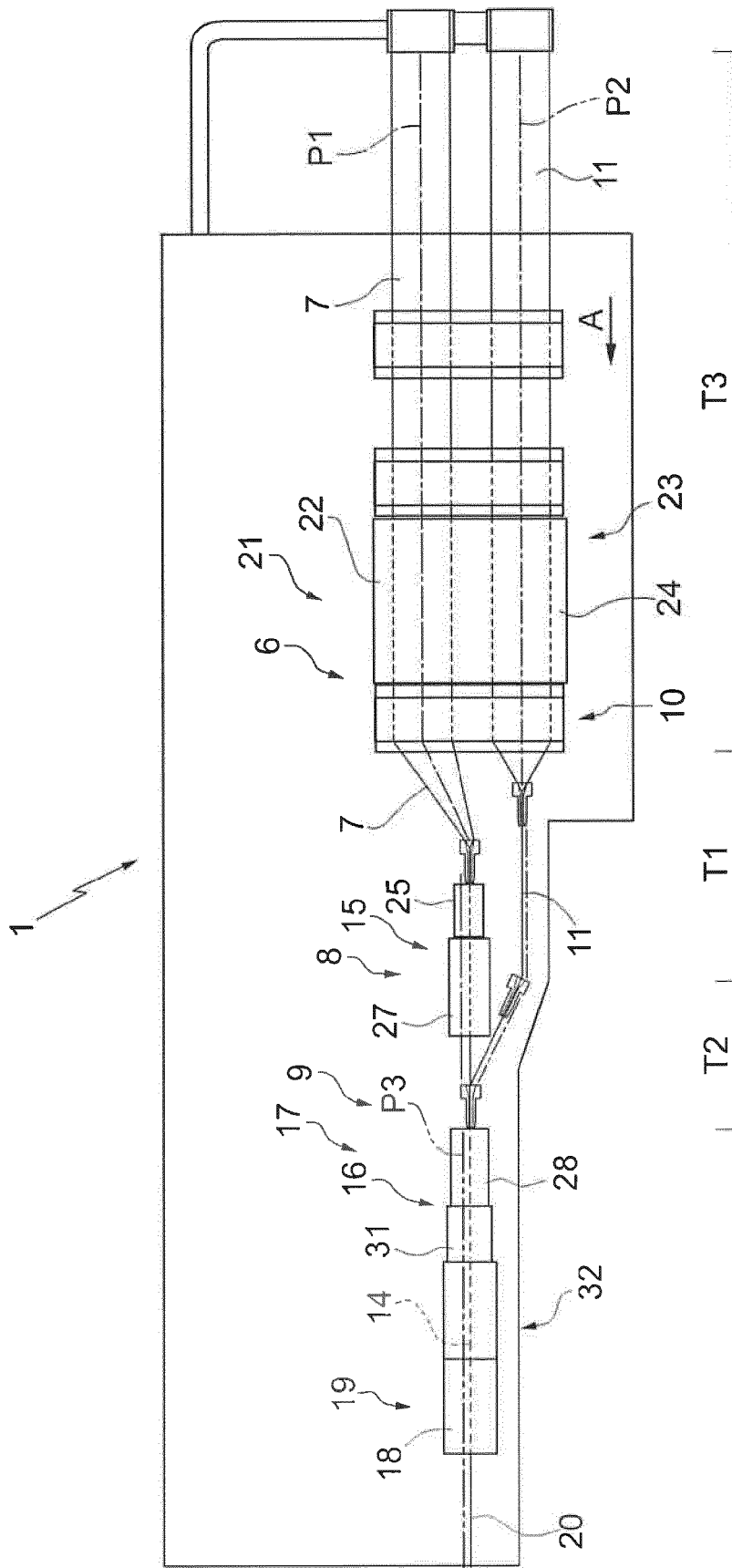


FIG.2

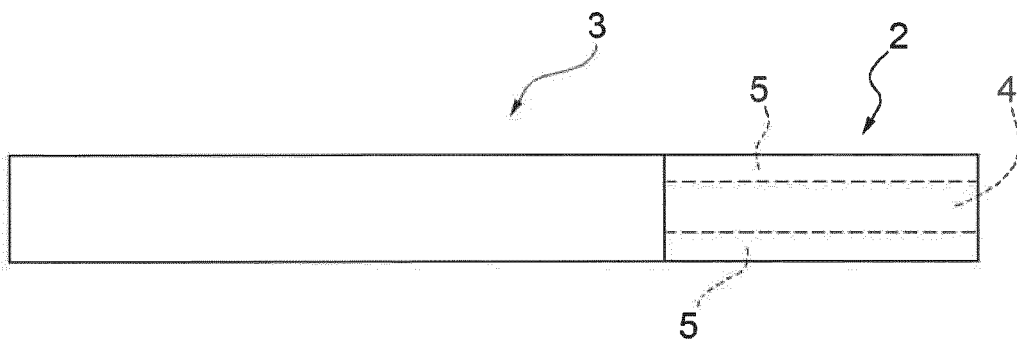


FIG.3

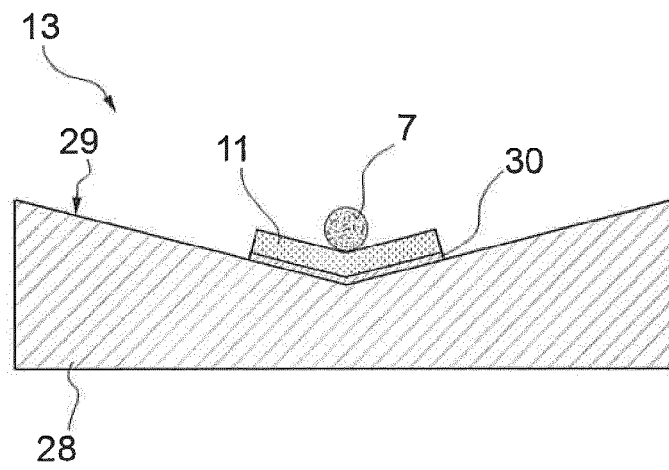


FIG.4

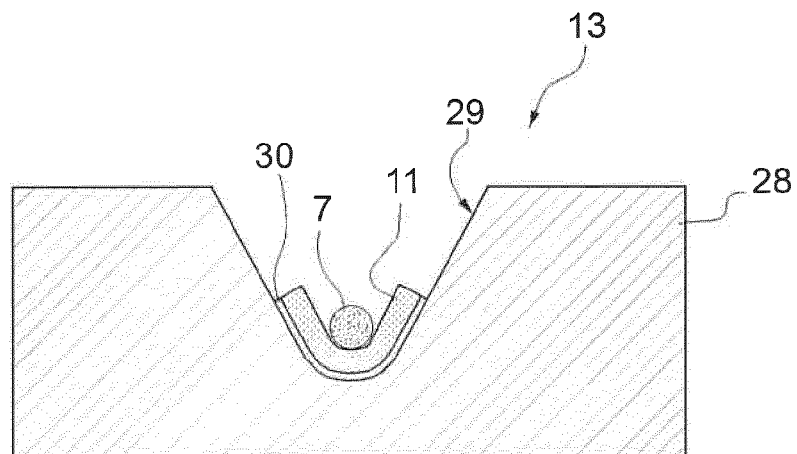


FIG.5

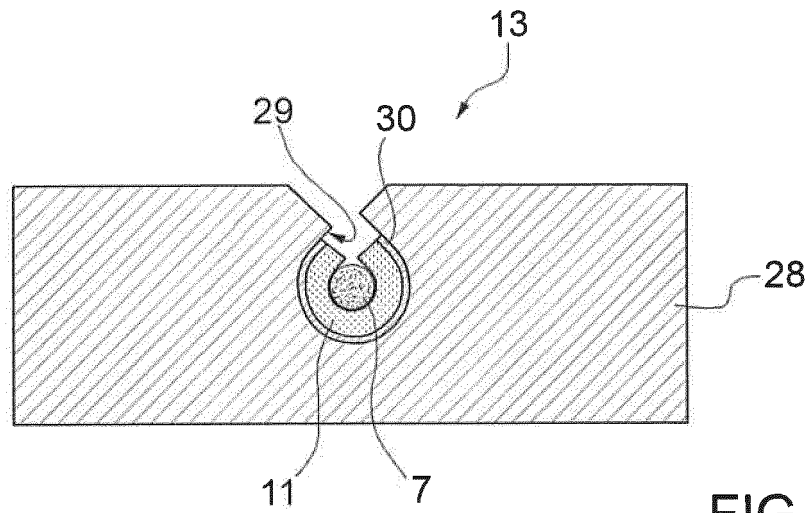


FIG. 6

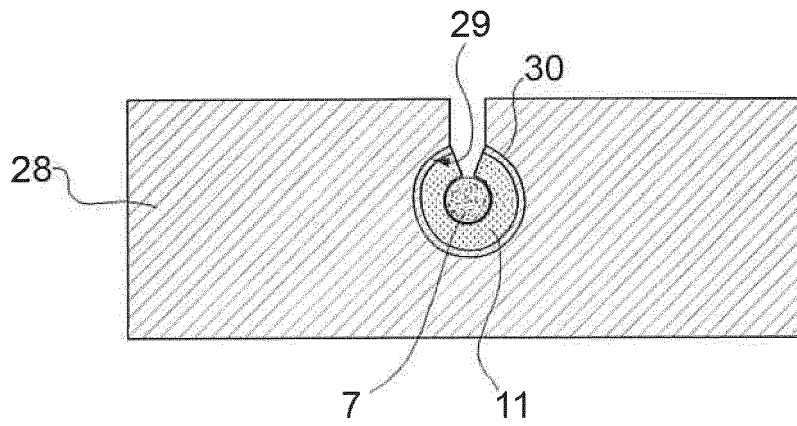


FIG. 7

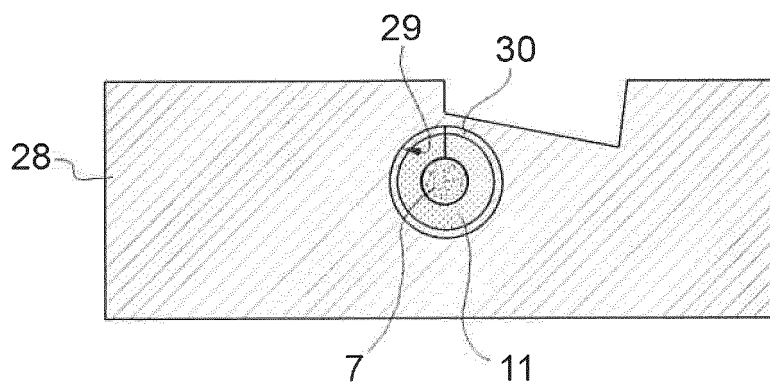


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
EP 16 17 8272

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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,D	WO 2011/148130 A1 (FILTRONA INT LTD [GB]; CHIMCHAM NATTAPON [TH]) 1 December 2011 (2011-12-01) * page 6, line 7 - page 7, line 8; figures *	1-15	INV. A24D3/02
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