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(54) **AIR SPINNING METHOD FOR THE PRODUCTION OF LARGE YARNS WITH COUNT LOWER THAN NE20 AND RESPECTIVE YARN**

LUFTSPINNVERFAHREN ZUR HERSTELLUNG VON GROSSGARNEN MIT TITER NIEDRIGER ALS NE20 UND GARN

PROCÉDE DE FILAGE À L'AIR POUR LA PRODUCTION DE GRANDS FILS AVEC UN TITRE INFÉRIEUR À NE20 ET FILS

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Description

FIELD OF APPLICATION

5 [0001] The present invention relates to an air spinning method for the production of yarns with a count lower than or equal to Ne20 (295.25 dtex) and greater than or equal to Ne10 (590.5 dtex), and a relative yarn obtained with said method.

PRIOR ART

10 [0002] In particular, the air spinning of yarns having lower counts than Ne20 is complicated since the tenacity and regularity of the yarn tend to decrease drastically when making yarns with such low counts.

[0003] WO-A-00/03078 and EP-A-3 330 416 disclose an air jet spun yarn having a count of Ne20.

[0004] Nazan Erdumlu et al. "The structure and properties of carded cotton vortex yarns" in the Textile Research Journal, vol. 82, no 7 describes a 100% cotton vortex yarn with a Ne20 count.

15 [0005] The yarns that are normally processed on air-spinning machines are PES, Viscose (and its modal, tencel variants, etc.), cotton and the various compounds.

[0006] The prior art of the production of such yarns involves the use of high quality fiber webs, that is with an average length of 38mm and fiber diameter between 1.3 and 1.5 dtex for artificial fibers and, in the case of cotton, with micronair lower than 4.2.

20 [0007] An empirical formula defines the following link: micronair = 2,824deniers = 2,824*1,111dtex; so it follows that: dtex = micronair/3,135.

[0008] The commonly accepted idea in the art is that in air spinning machines it is necessary to have many fibers, indeed, as many fibers as possible to obtain yarn with high strength and elasticity.

[0009] The formula that calculates the number of fibers per section is given as follows:

25
$$\text{Number_fibers_section} = 5917 / (\text{Yarn_Count (Ne)} * \text{fibre_count (dt ex)}) = 15030 / (\text{Yarn_Count (Ne)} * \text{micronair}(\mu)).$$

[0010] Clearly the first formula can be used in the case of artificial fibers, the second for cotton.

30 [0011] There are even formulas of the American Ministry of Agriculture which provide the maximum tenacity that can be reached in spinning as a function, among the various parameters, of the number of fibers that contribute to the formation of the yarn.

[0012] This formula of the American FDA, valid for ring cotton carded yarns is the following:

35
$$\text{Expected_Yarn_Resistance (cN/tex)} = (1/\text{count(Ne)}) * (19 - 52 * \text{Count(Ne)} + 6618 * \text{Fiber_length(Inches)} - 236 * \text{micronair}(\mu) + 51 * \text{Fiber_resistance(g/tex)}).$$

[0013] From the above formula, considering that lower micronair values mean longer and more resistant fibers, it is evident that greater resistances are obtained with lower micronairs.

40 [0014] Therefore, summarizing, the idea of increasing the number of fibers in yarns in order to improve the strength and elasticity of the yarn produced is known and consolidated in the art.

[0015] Thus the idea of making yarns with a low count, with a high number of fibers, in which said fibers are relatively thin, to increase their mechanical strength, is consolidated in the art.

45 [0016] It has instead been verified that this solution, in the case of applications with air spinning, does not always give the optimum compromise between strength and quality of the yarn thus obtained.

DISCLOSURE OF THE INVENTION

50 [0017] The need to solve the drawbacks and limitations mentioned with reference to the prior art is therefore felt. Such a need is met by an air spinning method according to claim 1 and by a yarn obtained by the air spinning method according to claim 6.

DESCRIPTION OF THE DRAWINGS

55 [0018] Further features and advantages of the present invention will appear more clearly from the following description of preferred non-limiting embodiments thereof, in which:

figure 1 shows a schematic view of an air spinning device for implementing a spinning method according to an

embodiment of the present invention;
 figures 2a, 2b, 2c show a view, with increasing magnifications, of a yarn made with air spinning, of the prior art;
 figures 3a-3b show schematic sectional views of two yarns obtained according to the method of the present invention
 and according to the teachings of the prior art, respectively.

[0019] Elements or parts of elements in common to the embodiments described below are referred to with the same reference numerals.

DETAILED DESCRIPTION

[0020] With reference to the aforesaid figures, reference numeral 4 indicates a yarn obtained by means of an air spinning, preferably with multiple feeding.

[0021] The present invention finds application in the use on man-made/synthetic fibers and possibly fibers mixed with cotton, but not 100% cotton.

[0022] The yarn 4 comprises a plurality of threads 8 each comprising a plurality of fibers 12.

[0023] By analyzing the threads 8 in section, a plurality of fibers 12 can be seen which can be divided into external fibers 16 and internal fibers 20.

[0024] The internal fibers 20 are those which constitute the core of the thread 8 in turn surrounded by the external fibers 16.

[0025] Advantageously, the present invention provides to obtain yarns 4 with an overall number of fibers 12 lower than 200.

[0026] Advantageously, it has been found that it is useful to use thicker fibers as the yarn count decreases, so as to keep the total number of fibers 12 below 200.

[0027] The optimum is to have a number of fibers 12 sufficient to give substance to the thread 8 but not too high to worsen its technical features.

[0028] All this is due to the fact that, in air spinning, there is no real twist as in traditional ring spinning: rather, in air spinning, bundles of fibers are obtained that are wound more or less regularly around a core of "neutral" central fibers, that is, substantially not twisted.

[0029] Therefore in the air spinning it has been verified that the external fibers 16 are twisted, while the internal fibers 20 are neutral as can easily be seen in figures 2a, 2b and 2c.

[0030] Typically, in the solutions of the prior art, a yarn Pes 100% of count Ne20 (295.25 dtex), produced with air spinning machines, has a fiber length of 38mm and a section of 1.3 dtex and contains about 227 fibers.

[0031] A yarn Ne16 (369.1 dtex) of the prior art, with the same raw material, would contain 285 fibers.

[0032] The solution of the present invention provides instead to maintain the fibers 12 under 200 units (maximum value) and the reason is shown in figures 3a, 3b.

[0033] In fact, in air spinning only the outermost fibers 16 are involved in the "twisting" while the central or internal ones 20 remain substantially neutral. This means that the ratio between external fibers 16 and internal fibers 20 must remain high, in order to have a yarn with adequate mechanical features.

[0034] Regardless of the count being worked, it can be said that the number of external fibers that are involved in the twisting always remains the same, which is why the more fibers are in the section, the more unfavorable, that is, low, the ratio between external fibers (twisted) and internal fibers (not twisted).

[0035] In the accompanying figures (3a, 3b), a yarn with a count Ne20 (295.25 dtex) is ideally represented, made with 1.5 dtex fibers (figure 3a) and 1.0 dtex fibers (figure 3b). It is clearly seen that in the first case (figure 3a), having fibers of an average greater diameter, the number of external fibers 16 or twisted, which are wound, with respect to the internal ones 20 which remain neutral, is much higher than in the second case (figure 3b), where the individual fibers 12 (whether they are external fibers 16 or internal fibers 20) have a lower average diameter.

[0036] The present invention (figure 3a), as the counts decrease, provides to increase the section of the fibers 12 used and therefore reduce the total number thereof, to below 200.

[0037] This section increase becomes extremely useful in synthetic fibers where the value of the elongation at break increases with the increase in the section of the fibers, with obvious benefits in the final yarn: more resistance and more elasticity mean greater quality and workability of the same yarn.

[0038] The air spinning method provides the steps of preparing at least one web of textile fibers N1, to be fed by at least one introducer element 24 upstream of an air spinning device 28.

[0039] The web N1 is previously drawn with at least one drawing device 32, and then, after drawing, said web N1 is fed into a spinning chamber 36 of an air spinning device 28.

[0040] Inside the spinning chamber 36 the fibers 12 are spun by means of jets of compressed air, so as to obtain a yarn 4 comprising internal fibers 20 surrounded by external fibers 16, in which the yarn has an overall count lower than or equal to Ne20 (295.25 dtex) of and greater than or equal to Ne10 (590.5 dtex), and in which the total number of internal and external

fibers is less than 200.

[0041] In particular, the working pressures, i.e. the jets of compressed air inside the spinning chamber 36, are between 0.45 and 0.6 MPa, i.e. between 4.5 and 6 bar.

[0042] The working speeds of the compressed air leaving the relative jets are comprised between 400 m/min and 500 m/min.

[0043] Obviously, it is possible to feed two or more webs N1, N2, with respective introducer elements 24, into the air spinning device 28: these webs are joined together inside the spinning chamber 36.

[0044] As can be seen from the above description, the air-jet spinning method according to the invention allows the drawbacks of the prior art to be overcome.

[0045] In particular, the present invention allows obtaining, by means of air spinning, yarns with a count lower than or equal to Ne20 (295.25 dtex) and greater than or equal to Ne10 (590.5 dtex). These yarns have features of resistance and elasticity which are superior to the solutions obtainable with the methods of the prior art.

[0046] In fact, as seen, as the counts decrease, it is provided to increase the section of the fibers used and therefore reduce the total number thereof, to a value below 200.

[0047] In this way, increasing the average diameter of the fibers, the number of external fibers, twisted, which are wound, with respect to the internal ones which remain neutral, is much higher: this aspect determines the improvement of the mechanical features of the yarn obtained.

[0048] Moreover, as seen, the section increase becomes extremely useful in synthetic fibers where the value of the elongation at break increases with the increase in the section of the fibers: therefore more resistance and more elasticity are obtained and, consequently, even greater quality and workability of the same yarn.

[0049] Substantially, the present invention goes against the known and consolidated idea in the art of increasing the number of fibers in yarns in order to improve the strength and elasticity of the yarn produced. The present invention teaches exactly the opposite, namely to decrease the number of fibers in the yarns, increasing their average size, in order to improve their mechanical and workability features. Such teaching finds advantageous application in the air-jet spinning sector.

Claims

1. Air spinning method comprising the steps of:

- preparing at least one web of textile fibers (N1), to be fed by at least one introducer element (24) upstream of an air spinning device (28), said textile fibers being man-made/synthetic fibers and possibly fibers mixed with cotton but not 100% cotton,
- drawing said at least one web (N1) with at least one drawing device (32),
- feeding said web (N1), previously drawn, in a spinning chamber (36) of the air spinning device (28),
- spinning the fibers (12) inside the spinning chamber (36) by means of compressed air jets, so as to:
- obtain a yarn (4) comprising internal fibers (20) surrounded by external fibers (16),
- wherein the yarn (4) has an overall thread count not exceeding Ne20 (295.25 dtex) and wherein the total number of internal (20) and external (16) fibers is less than 200, determined according to the formula given in the description,
- wherein the external fibers (16) are twisted, while the internal fibers (20) are neutral and
- wherein the working pressures, i.e. of the compressed air jets inside the spinning chamber (36), are between 0.45 and 0.6 MPa.

2. An air spinning method according to claim 1, wherein said overall thread count (4) is greater than or equal to Ne10 (590.5 dtex).

3. An air spinning method according to claim 1 or 2, wherein the method comprises the step of increasing the average cross-section or diameter of the fibers (12) of the yarn (4) gradually as the yarn count in Ne of the yarn (4) to be produced decreases, so as to maintain the total number of internal (20) and external (16) fibers below 200, determined according to the formula given in the description.

4. Air spinning method according to claim 1, 2 or 3, wherein the method comprises the steps of preparing two textile fibre webs (N1, N2), to be fed by at least one corresponding introducer element (24) upstream of the air spinning device (28), the fibers being man-made/synthetic fibers and possibly fibers mixed with cotton but not 100% cotton,

- drawing each of said webs (N1, N2) with at least one drawing device (32),

- joining said webs (N1,N2) inside the spinning chamber (36) and spinning the fibers so as to obtain a yarn with a total thread count of less than Ne20 (295.25 dtex) and wherein the total number of internal (20) and external (16) fibers is less than 200, determined according to the formula given in the description.

- 5 5. Air spinning method according to any one of the preceding claims, wherein the working speeds of the compressed air in output from relative jets, inside the spinning chamber (36), are between 400 m/min and 500 m/min.
6. A yarn (4) obtained by means of the air spinning method according to any one of the preceding claims wherein said yarn has an overall thread count of less than Ne20 (295.25 dtex), wherein the total number of inner (20) and outer (16) fibers of the yarn (4) is less than 200, determined according to the formula given in the description, and wherein said fibers are man-made/synthetic fibers and possibly fibers mixed with cotton but not 100% cotton.
7. The yarn (4) according to claim 6, wherein said overall thread count is greater than or equal to Ne10 (590.5 dtex).

Patentansprüche

1. Luftspinnverfahren, umfassend die Schritte:

- Herstellen von zumindest einer Bahn bzw. einem Gewebe aus Textilfasern (N1), das von zumindest einem Einbringungselement (24) stromaufwärts einer Luftspinnvorrichtung (28) zuzuführen ist, wobei die Textilfasern Man-Made-Fasern bzw. Chemiefasern/synthetische Fasern und möglicherweise mit Baumwolle, aber nicht 100 % Baumwolle, vermischte Fasern sind,
- Strecken des zumindest einen Gewebes (N1) mit zumindest einer Streckvorrichtung (32),
- Zuführen des zuvor gestreckten Gewebes (N1) in eine Spinnkammer (36) der Luftspinnvorrichtung (28),
- Spinnen der Fasern (12) im Inneren der Spinnkammer (36) mittels Druckluftstrahlen, um:
 - ein Garn (4) zu erhalten, das innere Fasern (20) umfasst, die von äußeren Fasern (16) umgeben sind,
 - wobei das Garn (4) eine Gesamtfadenzahl von höchstens Ne20 (295,25 dtex) aufweist und wobei die Gesamtfadenzahl der inneren (20) und äußeren (16) Fasern kleiner als 200 ist, und zwar bestimmt gemäß der in der Beschreibung angegebenen Formel,
 - wobei die äußeren Fasern (16) verdreht sind, während die inneren Fasern (20) neutral sind, und
 - wobei die Arbeitsdrücke, d. h. der Druckluftstrahlen im Inneren der Spinnkammer (36), zwischen 0,45 und 0,6 MPa betragen.

2. Luftspinnverfahren nach Anspruch 1, wobei die Gesamtfadenzahl (4) größer oder gleich Ne10 (590,5 dtex) ist.

3. Luftspinnverfahren nach Anspruch 1 oder 2, wobei das Verfahren den Schritt umfasst, den durchschnittlichen Querschnitt oder Durchmesser der Fasern (12) des Garns (4) in dem Maße allmählich zu erhöhen, wie die Garnzahl in Ne des herzustellenden Garns (4) abnimmt, um die Gesamtfadenzahl der inneren (20) und äußeren (16) Fasern unter 200 zu halten, und zwar bestimmt gemäß der in der Beschreibung angegebenen Formel.

4. Luftspinnverfahren nach Anspruch 1, 2 oder 3, wobei das Verfahren die Schritte umfasst: Herstellen von zwei Textilfaserbahnen bzw. -geweben (N1, N2), die von zumindest einem entsprechenden Einbringungselement (24) stromaufwärts der Luftspinnvorrichtung (28) zuzuführen sind, wobei die Fasern Man-Made-Fasern bzw. Chemiefasern/synthetische Fasern und möglicherweise mit Baumwolle, aber nicht 100 % Baumwolle, vermischte Fasern sind,

- Strecken jeder der Bahnen (N1, N2) mit zumindest einer Streckvorrichtung (32),
- Verbinden der Bahnen (N1, N2) im Inneren der Spinnkammer (36) und Spinnen der Fasern, um ein Garn mit einer Gesamtfadenzahl von weniger als Ne20 (295,25 dtex) zu erhalten, und wobei die Gesamtfadenzahl der inneren (20) und äußeren (16) Fasern weniger als 200 beträgt, und zwar bestimmt gemäß der in der Beschreibung angegebenen Formel.

5. Luftspinnverfahren nach einem der vorhergehenden Ansprüche, wobei die Arbeitsgeschwindigkeiten der aus relativen Strahlen austretenden Druckluft im Inneren der Spinnkammer (36) zwischen 400 m/min und 500 m/min betragen.

6. Garn (4), das mittels des Luftspinnverfahrens nach einem der vorhergehenden Ansprüche erhalten wird, wobei das Garn eine Gesamtfadenzahl von weniger als Ne20 (295,25 dtex) aufweist, wobei die Gesamtzahl der inneren (20) und äußeren (16) Fasern des Garns (4) weniger als 200 beträgt, und zwar bestimmt gemäß der in der Beschreibung angegebenen Formel, und wobei die Fasern Man-Made-Fasern bzw. Chemiefasern/synthetische Fasern und möglicherweise mit Baumwolle, aber nicht 100 % Baumwolle, vermischte Fasern sind.
7. Garn (4) nach Anspruch 6, wobei die Gesamtfadenzahl größer oder gleich Ne10 (590,5 dtex) ist.

Revendications

1. Procédé de filage à l'air comprenant les étapes de :

- préparer au moins une bande / botte de fibres textiles (N1) destinée à être introduite par au moins un élément d'introduction (24) en amont d'un dispositif à filer à air (28), lesdites fibres textiles étant des fibres artificielles ou synthétiques et éventuellement des fibres mixtes avec du coton, mais pas à 100 % de coton,
- tirer ladite au moins une bande (N1) avec au moins un dispositif à tirer (32),
- introduire ladite au moins une bande botte (N1) préalablement tirée dans une chambre à filer (36) du dispositif de filage à l'air (28),
- filer les fibres (12) à l'intérieur de la chambre à filer (36) moyennant des jets d'air comprimé afin
- d'obtenir un fil (4) comprenant des fibres intérieures (20) entourées de fibres extérieures (16),
- dans lequel le fil (4) a un titre général de fil ne dépassant pas Ne20 (295,25 dtex) et dans lequel le nombre total de fibres intérieures (20) et extérieures (16) est inférieur à 200, déterminé selon la formule figurant dans la description,
- dans lequel les fibres extérieures (16) sont twistées alors que les fibres intérieures (20) sont neutre et
- dans lequel les pressions de travail, c'est-à-dire à l'intérieur de la chambre à filer (36), sont entre 0,45 et 0,6 MPa.

2. Procédé de filage à l'air selon la revendication 1, dans lequel le titre général de fil (4) est supérieur à ou égal à Ne10 (590,5 dtex).

3. Procédé de filage à l'air selon la revendication 1 ou 2, dans lequel le procédé comprend l'étape d'augmentation graduelle de la section transversale moyenne ou du diamètre moyen des fibres (12) du fil (4) autant que le titre, en Ne, du fil (4) à produire diminue afin de maintenir le nombre total de fibres intérieures (20) et extérieures (16) en-dessous de 200 selon la formule figurant dans la description.

4. Procédé de filage à l'air selon la revendication 1, 2 ou 3, dans lequel le procédé comprend les étapes de préparer deux bande bottes de fibres textiles (N1, N2) destinées à être introduites par au moins un élément d'introduction (24) en amont du dispositif à filer à air (28), les fibres étant des fibres faites man-made ou synthétiques et éventuellement des fibres mixtes avec du coton, mais pas à 100 % de coton,

tirer chacune desdites bottes (N1, N2) avec au moins un dispositif de tirage (32),
rejoindre lesdites bottes (N1, N2) à l'intérieur de la chambre à filer (36) et filer les fibres afin d'obtenir un fil avec un moins de Ne20 (295,25 dtex), et dans lequel le nombre total de fibres intérieures (20) et extérieures (16) en-dessous de 200 selon la formule figurant dans la description.

5. Procédé de filage à l'air selon l'une des revendications précédentes, dans lequel les vitesses de travail en entrée de jets correspondants, à l'intérieur de la chambre à filer (36), sont entre 400 m/min et 500 m/min.

6. Fil (4) obtenu moyennant le procédé de filage à l'air selon l'une des revendications précédentes, dans lequel ledit fil a un titre général de moins de Ne20 (295,25 dtex), dans lequel le nombre total de fibres intérieures (20) et extérieures (16) en-dessous de 200 selon la formule figurant dans la description et dans lequel lesdites fibres sont des fibres faites man-made ou synthétiques et éventuellement des fibres mixtes avec du coton, mais pas à 100 % de coton.

7. Fil (4) selon la revendication 6, dans lequel ledit titre général est supérieur à ou égal à Ne10 (590,5 dtex).

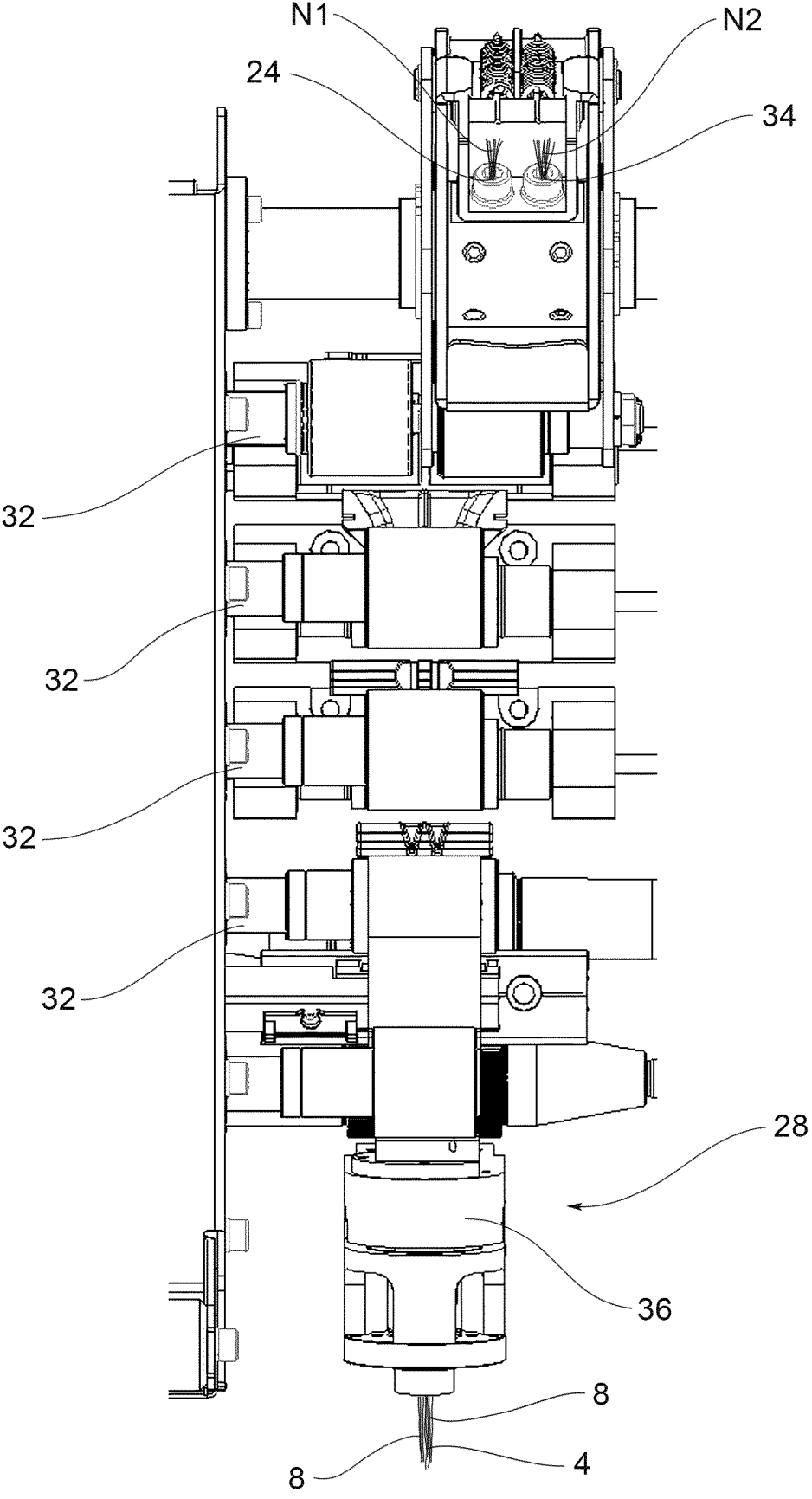


FIG.1

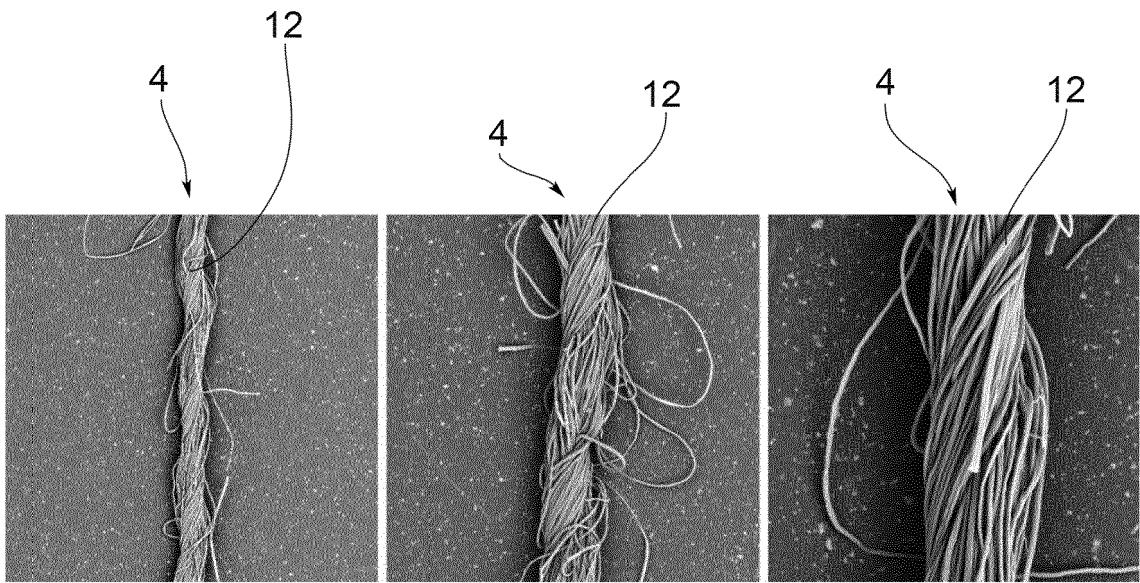


FIG.2a

FIG.2b

FIG.2c

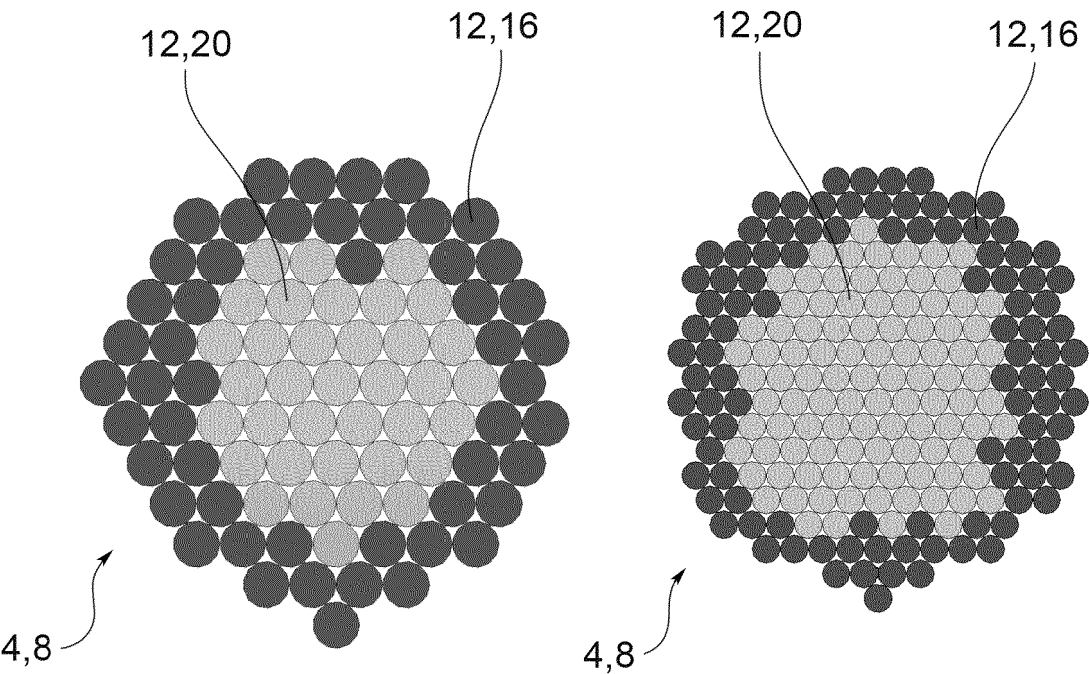


FIG.3a

FIG.3b

REFERENCES CITED IN THE DESCRIPTION

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