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(72) Inventors:
• **Burysek, Frantisek**
562 01 Usti nad Orlici (CZ)
• **Smisek, Ales**
562 06 Usti nad Orlici (CZ)

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(74) Representative:
Holasova, Hana, c/o A. Holas & partner
Krizova 4
603 00 Brno (CZ)

(71) Applicant: **Saurer Czech a.s**
549 41 Cerveny Kostelec (CZ)

(54) **Multi-component rotor-spun yarn**

(57) Multi-component rotor spun yarn consists of at least two sets (2, 3) of staple fibres (4, 5), repeatedly alternating in consequent sections (6, 7) inter-connected by transition sections (8) consisting of staple fibres (4, 5) from both sets (2, 3) of staple fibres (4, 5).

The invention also relates to the method of the production of the multicomponent rotor spun yarn and the spinning unit designed for this method.

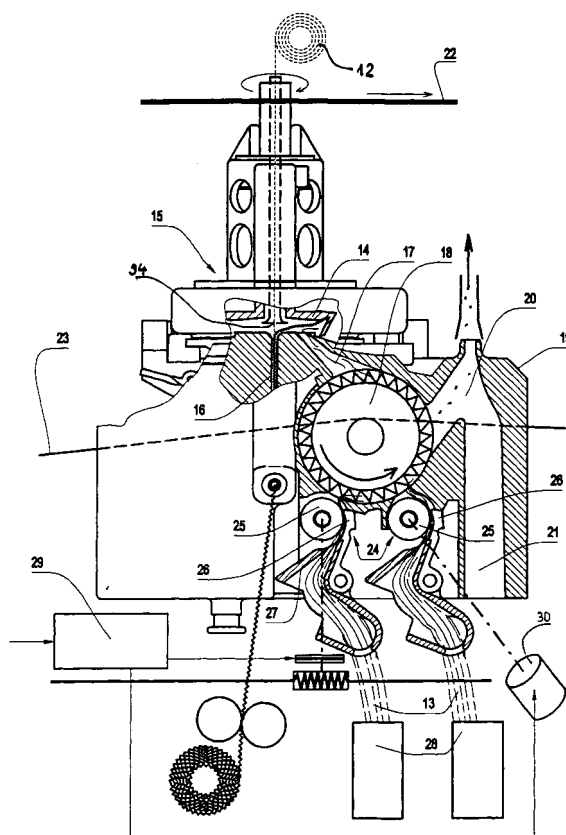


Fig. 6

Description

Technical Field

[0001] The invention concerns multi-component rotor-spun yarn, method of its production and spinning unit designed for this method.

The contemporary state of art

[0002] Yarns of various characteristics are needed for the purposes of designing and production of flat fabrics according to client's requirements and various mode trends. Rotor spinning is highly productive and the sphere of its use further extends. There is known and used the spinning of multi-component yarns, when materials that are mixed into one sliver just in the course of production preparation are supplied together to the spinning unit. The ratio of the materials mixing does not change in the course of spinning and it is set by their ratio in the supply package.

[0003] For this procedure it is necessary so as both textile materials can be simultaneously processed into sliver in the course of the sliver preparation - for example in case of drawing. But it is not always possible - for example in case of their significantly different characteristics as far as e.g. the staple length is concerned. Then, such materials cannot be processed in this way at all.

[0004] There are known such technical solutions of the spinning unit input, when more than one sliver is fed to one feeding device, using separate sliver condensers. But such measure solves the problem only partially. It is possible to feed materials of various qualities, but their mutual mixing ratio is fixed as it is set by the ratio on length weights of individual components and it cannot be flexibly adjusted depending on new requirement via machine adjustment. So as they could be processed, both materials must have similar characteristic features, as they are processed jointly and the geometry of both materials input - like e.g. distance of the grip line from the combing roller cover - is identical for both of them. That makes significantly harder or completely impossible the joint processing of long-fibre and short-fibre material.

[0005] If such mixtures are finally successfully processed the characteristics of the finished yarn along its length are more or less stable.

[0006] But there has not been successfully created a multi-component rotor-spun yarn for the purposes of designing or obtaining their special characteristics concerning permeability and absorbability up to now.

Nature of the invention

[0007] The aim of this invention is to create a multi-component rotor-spun yarn that would change its character in repeated sections from the point of view of material composition, colour, staple length and so on and

that could be easily manufactured using a simple device.

[0008] To a significant level, this can be reached by a multi-component rotor-spun yarn, in compliance with the invention, with its base including mainly the fact that it consists of at least two sets of staple fibres that take turns in consequent sections inter-connected with transition sections consisting of stable fibres from both sets of staple fibres.

[0009] For standard processing it seems advantageous for the length weight of sections and transition sections to be identical, while on the contrary, for special procedures it is advantageous to use yarn with length weight of at least one of the sections of the staple fibres sets to differ from transition sections of stable fibres.

[0010] From the point of view of short and long fibres processing or processing of fibres with different material or colour composition it is advantageous for one of the sections to be created from the set of stable fibres that are shorter or material- or colour-different than the other section.

[0011] The usability of yarns according to the invention can be purposefully extended by simple core spinning of threads from endless fibres or staple fibres, continually going through the sections of staple fibres and transition sections.

[0012] A simple way of production of multi-component yarn by rotor spinning includes the procedure, when there are spun the singled-out fibres from at least two slivers of different fibre composition, that are combed out depending on composition of the set of fibres of the currently spun section of the multi-component yarn. When finishing the spun section, the comb-out of slivers is adjusted according to the composition of the fibre set of the following multi-component yarn section, which creates a transition section containing fibres of both fibre sets among the consequent sections of the multi-component yarn.

[0013] It is possible to simply proceed in such a way that the comb-out of fibres is performed alternatively from the first and the second sliver, which is advantageous for production of multi-colour yarn.

[0014] If it is advisable for the transition section to be the shortest possible, then it is possible to make the change of the combing speed, respectively sliver supply in steps, i.e. simultaneously during the supply as well as combing stop, when one sliver is stopped, while the other is put into motion.

[0015] A longer transition section and fluency of the composition change can be simply reached by fluent change of the sliver combing speed.

[0016] A change of the mass weight of the sliver along the yarn may be simply reached by a change of the quantity of comb-out sliver fibres, while the changes may be done in individual sections as well as independently in the spun section, which can create random or periodical attenuations or reinforcements of the yarn, or possibly the combing in all the sections and transition

sections may be done in such a way so as the quantity of combed fibres is constant.

[0017] Other possibilities in appearance and composition of the yarn may be reached by addition of an endless thread to the spun fibres.

[0018] The method of spinning the rotor multi-component yarn according to this invention may be easily performed using a spinning unit that is based mainly on the fact that it includes the spinning rotor connected via transport channel with at least one combing roller and the combing roller is completed with at least one pair of supply units equipped with individual drives.

[0019] Because of alternating spinning and its simplicity it is purposeful for the supply units to be organised one after each other along the circumference of the combing roller.

[0020] Taking into consideration the air conditioning and combing the fibres of different staple, it seems to be more purposeful for the supply units to be organised next to each other, in parallel with the combing roller axis.

[0021] So as to allow easy regulation of combing it is advisable for at least one supply unit to be equipped with a servo engine.

[0022] It is advisable - taking into consideration the existing version of the machine - for the supply unit to consist of the supply roller and pressing table.

[0023] For spinning of materials with identical length of staple it is possible to use a combing roller with identical cover along all of its width.

[0024] For parallel layout taking into consideration the combing quality it is purposeful for the combing roller to be equipped with a separately adjusted cover for each supply unit.

[0025] For easier production possibility is appears advantageous for the combing roller to consist of a set of rings, equipped with a cover.

[0026] Such a layout of the combing roller is also connected with the advantage that the rings are located separately and equipped with individual drives, which extends the possibilities of combing regulation.

[0027] For processing of volume slivers it is useful to use two combing rollers with their transport channels leading to a joint spinning rotor.

[0028] For development of covered yarn it is necessary to use a spinning rotor containing outlet of an additional thread pipe.

[0029] In consideration of the existing construction of machines for spindle-free spinning it is purposeful for the supply roller and combing roller drives to be connected with the programmable control unit of the machine.

List of figures in drawings

[0030] The invention will be explained in detail by using the drawings - Fig. 1 schematically shows the yarn, Fig. 2 shows an alternative yarn version, Figures 3, 4,

5 show another type of yarn, Fig. 6 shows the spinning unit with a pair of supply rollers, Fig. 7 shows a detail of a pair of supply rollers, Fig. 8 shows layout of a pair of sliver inputs to the combing roller with two various covers organised in parallel, Fig. 9 shows a combing roller in the form of rings and Fig. 10 shows an axonometric view of a pair of combing rollers, each of them with an independent supply unit.

10 Description of samples

[0031] Multi-component yarn 1 according to version as shown in Fig. 1 is rotor-spun and so it has a characteristic interlacing of staple fibres 4, 5 for this type of spinning. The multi-component yarn 1 consists of two sets 2, 3 of staple fibres 4, 5, that alternate along the multi - component yarn 1 in consequent sections 6, 7 of the multi-component yarn 1, inter-connected with transition sections 8 consisting of staple fibres 4, 5 from both sets 2, 3 of staple fibres 4, 5.

[0032] The staple fibres 4 of one set 2 may differ from staple fibres 5 of the other set 3 in colour, staple length or material composition. For example one set 2 may be of natural materials like cotton or wool and the other set 3 of artificial materials. Naturally, it is possible to make various combinations of staple fibres 4, 5 in individual sets 2, 3.

[0033] Version according to Fig. 2 shows the variant with individual sections 6, 7 and the transition section 8 to differ by being of various sets 2, 3 of staple fibres 4, 5, as well as by the fact that the transition section 8 has a different length weight. Similarly, the transition section 8 and one of the sections 6 may have the same weight while the remaining section 7 may have a different length weight.

[0034] Fig. 3 shows design of a multi-component yarn 1, with its length weight balancing in individual sections 6, 7 as well as in the transition section 8. Such oscillation of length weight may be regular or fully random and so strengthening and weakening of multi-component yarn 1 develop.

[0035] All of the described designs of the multi-component yarn 1 contained two sets 2, 3 of staple fibres 4, 5. But the multi-component yarn 1 may contain even more various sets 2, 3 of staple fibres 4, 5. Fig. 4 contains three sets 2, 3, 9 of staple fibres 4, 5, 10 creating three different sections 6, 7, 11 repeating along multi-component yarn 1. Then, Fig. 5 shows multi-component yarn 1 consisting of two sets 2, 3 of staple fibres 4, 5 covered with endless thread 12, created by endless fibre or yarn.

[0036] The method of production of the above-described multi-component yarns 1 by rotor spinning is based on the fact that for individual sections 6, 7, 11 of the multi-component yarn 1 of staple fibres 4, 5, 10 the combing is performed from several slivers 13 depending on which one of the sections 6, 7, 11 of the multi-component yarn 1 is currently spun. In case of spinning the

multi-component yarn 1 according to Fig. 1 and section 6 is to be white and section 7 is to be black, staple fibres 4, 5 are combed out of two slivers 13, one of them containing white and the other containing black staple fibres 4, 5 - always in turns from one of them. Combing may be changed in steps, i.e. simultaneously with termination of combing from one of the slivers 13 there starts combing from the other sliver 13 or it is performed fluently - i.e. combing of one sliver 13 is being reduced while combing from the other sliver 13 is appropriately extended. In case of suddenly finished combing the transition section 8 is shorter and it contains staple fibres 4, 5 of both colours, in case of fluent change of combing, the transition section 8 is longer, depending on how quickly the change in combing speed is performed. In fact, it is possible to change the length of sections at will. The only limiting condition is that the length of the spinning rotor 14 circumference limits the minimal length of sections 6, 7, 11.

[0037] Sections 6, 7 that differ in composition of staple fibres 4, 5 may be also obtained by simultaneous combing of staple fibres 4, 5 from both slivers 13. For example, if one of sections 6 consists of set 2 of staple fibres 4 containing 30% of staple fibres 4, 5 from one sliver 13 and 70% of staple fibres 5 from the other sliver 13, another section 7 contains 50% of staple fibres 4, 5 from both slivers 13, and consequently the ratio changes to 70% and 30%, then there are combed out the slivers 13 in above stated ratios. Combing of slivers 13 may also be continually changed within the scope of 0-100%. That allows e.g. creation of various colour effects along the multi-component yarn 1. Similar procedure may be applied also to slivers 13 that differ one from each other by the length of staple fibres 4, 5 or by material composition, e.g. wool and cotton - it is an interesting possibility for affecting the appearance and characteristics of the multi-component yarn 1.

[0038] The design according to Fig. 3 shows the multi-component yarn 1 with alternating weaker and stronger sections. Weaker sections are created by reduced combing of staple fibres 4, 5, which can be easily reached by short-term stopping or by reduction of speed of the combed-out sliver 13. In transition section 8 it is easily possible to reach the same on the basis of exchange of slivers 13 combing. Similarly, repeated strengthening of multi-component yarn 1 may be reached and it can be regularly or randomly repeated by immediate increase of combing intensity.

[0039] Other effects referring the above-described multi-component yarns 1 may be reached by continuous intake of the tread 12 to spun staple fibres 4, 5. In this way you get multi-component yarn 1, containing the above-described effects, i.e. construction of sections 6, 7 consisting of different compositions of staple fibres 4, 5, stronger or weaker sections 6, 7, as well as continuous coverage with thread 12, that can have significant appearance or special mechanic characteristics.

[0040] All of the above-described types of multi-component yarn 1 may be produced by rotor spinning after

relatively easy construction adjustment of the spinning unit 15, as it will emerge from the description of the sample design in Fig. 6. The spinning unit 15 includes a spinning rotor 14, from which the multi-component yarn 1 is taken away by the take-off tube 16. The spinning rotor 14 is connected via the transport channel 17 with the combing roller 18 placed in the body 19 of the spinning unit 15. The waste channel 20 leads to the combing roller 18 and it is connected with the suction channel 21 also located in the body 19 of the spinning unit 15.

[0041] Combing roller 18 and spinning rotor 14 are driven in a usual way - e.g. the spinning rotor 14 and combing roller 18 by endless bend 22, 23. Next to the combing roller 18 there is located a pair of supply units 24 of slivers 13 organised one after each other along the direction of the combing roller 18 rotation. Both of the supply units 24 are - just for simplifications - constructed identically and they consist of the supply roller 25, with continuous pressing of the pressure table 26 and from the superposed condenser funnel 27. Below the supply units 24 there are located the cans 28, from which the sliver 13 is taken off by the supply unit 24.

[0042] The supply rollers 25 drive may be arranged in simplified version - if there is required only alternating combing of slivers 13 - alternatively across the non-drawn electro-magnetic connections connected to the control unit 29. But it is more favourable for the supply rollers 25 to be driven individually, by non-shown servo engine or by a step engine 30 connected according to Fig. 7 with the control unit 29, e.g. according to the utility model.

[0043] It is not a necessary condition for the supply units 24 to be located one after each other along the circumference of the combing roller 18, but they may also be organised one next to each other in the direction of the combing roller 18 axis, as can be seen in simplified version in Fig. 8. In this case the combing roller 18 is wider and it is equipped with two different covers 31 and 32 for combing by a composition of different slivers 13. It is natural that the combing roller 18 may have - if needed - one identical cover 31 for both of the supply units 24. From the construction point of view it is purposeful for the combing rollers 18 to be made of rings 33 located on the common axis of rotation and equipped with covers 32. The drive of rings 33 may be selected individually, e.g. by step engines 30, as can be seen in Fig. 9.

[0044] The design according to Fig. 10 uses two combing rollers 18 organised with parallel axes of rotation and equipped with only one supply unit 24 each. But this design has higher demands referring space and it requires a transport channel 17 accumulating fibres from both of the combing rollers 18 or two separate transport channels 17.

[0045] Should any of the above-described spinning units 15 spin also the covered yarn, the intake 34 of thread 12 leads to the spinning rotor 14, as shown in dashed line in Fig. 1. The spinning unit 15 needs to be

equipped with this intake only in the above-described case.

[0046] Spinning of multi-component yarn 1 according to design as per Fig. 6 with central drive of supply rollers 25 via electromagnetic connections is performed with alternating switching on and off the connection of supply rollers 25 in compliance with the program. So if there is set the switch off of electromagnetic connections in a constant time interval and if there is supplied the sliver 13 from the left can 28, which contains e.g. white sliver 13, there are combed out the staple fibres 4 and they are transported by the transport channel 17 to the spinning rotor 14, where section 6 spins the multi-component yarn 1 of white colour. After expiration of the pre-set time interval there will be disconnected the electromagnetic connection of the left supply roller 25 and there will be interrupted the supply of sliver 13 from the left can 28. By simultaneous connection of the electromagnetic connection or connection of the drive 30 of the supply roller 25 of the right supply unit 24, sliver 13 is taken off e.g. with staple fibres 5 of black colour from the right can 28. The staple fibres 5 start to be transported via the transport channel 17 to the spinning rotor 14, with addition of other staple fibres 4 from the sliver 13 from the left can 28 and simultaneously there start to run even the staple fibres 5 from the staple can 28, while for a specific time period in the spinning rotor 14 the staple fibres 4, 5 lead from both slivers 13 and there is settled the transition section 8 of the multi-component yarn 1. By interruption of combing of the staple fibres 4 from the sliver 13 in the left can 28, their number in the spinning rotor 14 gradually reduces and finally, the spinning rotor 14 fills only the fibres 5 from the sliver 13 in the right can 28 and so there starts spinning of the black section 7 of the multi-component yarn 1, which is terminated by disconnection of the right supply unit 24 and switching on the electromagnetic connection puts into operation the left supply unit 24 of the sliver 13 from the left can 28, which is performed repeatedly for creation of the section 6, 7 of the multi-component yarn 1 and transition sections 8. In case of individual drives control it is not necessary to comb-out the slivers 13 alternatively, but they can be combed simultaneously and so they are mixed. For example in case of using the combing roller 18 according to Fig. 8 it is possible to set the program in such a way that different sections 6, 7 are created of staple fibres 4, 5 simultaneously combed from two sliver 13 by different ratio of combed staple fibres 4, 5 by alternating increase and decrease of ratio of sliver 13 supply speed. In case of individually driven supply rollers 25 it is possible to change the sliver 13 supply speed to create stronger and weaker sections of the multi-component yarn 1. The procedure for the version with a pair of combing rollers 18 is similar. For all the versions - in case of the spinning unit 15 to include the continually fed thread 12 - it is possible to create covered multi-component yarn 1.

[0047] As it emerges from the description, the device

allows development of spindle-free yarn made of mixtures of materials, which were up to now difficult for spinning due to necessity of one sliver 13 creation.

5 Industrial applicability

[0048] The invention is designed for spinning of multi-component yarns.

10 Claims

1. Multi-component rotor spun yarn, **characterised by** the fact that it consists of at least two sets (2, 3) of staple fibres (4, 5), repeatedly alternating in consequent sections (6, 7) inter-connected by transition sections (8) consisting of staple fibres (4, 5) from both sets (2, 3) of staple fibres (4, 5).
2. Multi-component rotor spun yarn according to claim 1 **characterised by** the fact that the length weight of sections (6, 7) and transition sections (8) is identical.
3. Multi-component rotor spun yarn according to claim 1 or 2, **characterised by** the fact that the length weight of at least one of the sections (6, 7) of the sets (2, 3) of staple fibres (4, 5) differs from the transition sections (8) of staple fibres (4, 5).
4. Multi-component rotor spun yarn according to claim 1 or 2 or 3, **characterised by** the fact that one of the sets (2, 3) of staple fibres (4, 5) has a much longer staple length than the other set (2, 3) of staple fibres (4, 5).
5. Multi-component rotor spun yarn according to any of the claims 1 up to 4, **characterised by** the fact that one of the sets (2, 3) of staple fibres (4, 5) differs from the other set (2, 3) of staple fibres (4, 5) in material composition.
6. Multi-component rotor spun yarn according to any of the claims 1 up to 5, **characterised by** the fact that one of the sets (2, 3) of staple fibres (4, 5) differs from the other set (2, 3) of staple fibres (4, 5) in colour.
7. Multi-component rotor spun yarn according to any of the claims 1 up to 6, **characterised by** the fact that contains at least one endless thread (12) continually passing through the sections (6, 7) of staple fibres (4, 5) and transition sections (8) of staple fibres (4, 5).
8. Method of production of the multi-component rotor spun yarn according to any of the claims 1 up to 7, **characterised by** the fact that there are spun the

singled fibres from at least two slivers of different fibre composition that are combed out depending on composition of the set of fibres of the spun section, while when finishing the spun section there is adjusted the combing of slivers according to the composition of the fibre set of the following section, which creates a transition section between consequent sections, with fibres from both fibre sets.

9. Method of production of the multi-component rotor spun yarn according to claim 8, **characterised by** the fact that the slivers are combed alternatively.

10. Method of production of the multi-component rotor spun yarn according to claim 8 or 9, **characterised by** the fact that the combing of slivers is changed in steps.

11. Method of production of the multi-component rotor spun yarn according to claim 9, **characterised by** the fact that the combing of slivers is changed fluently.

12. Method of production of the multi-component rotor spun yarn according to 8 or 9, **characterised by** the fact that constant quantity of fibres is combed for spinning of the section and transition sections.

13. Method of production of the multi-component rotor spun yarn according to 8 or 9 or 10, **characterised by** the fact that the quantity of combed fibres in transition sections differs from the quantity of combed fibres for spinning of consequent sections.

14. Method of production of the multi-component rotor spun yarn according to 8 or 9, **characterised by** the fact that the quantity of combed fibres for spinning is periodically or randomly increased or decreased.

15. Method of production of the multi-component rotor spun yarn according to 8, **characterised by** the fact that fibres are spun together with a thread fed to them.

16. Spinning unit for implementation of method according to any of the claims 9 up to 15, **characterised by** the fact that it includes the spinning rotor (14) connected by a transport channel (17) with at least one combing roller (18), by at least one pair of supply units (24) added to the combing roller (18) and equipped with individual drives.

17. Spinning unit according to claim 16, **characterised by** the fact that supply units (24) are organised one after each other along the circumference of the combing roller (18).

18. Spinning unit according to claim 16, **characterised**

by the fact that supply units (24) are organised one next to each other, in parallel with the axis of the combing roller (18).

19. Spinning unit according to claim 16 or 17 or 18, **characterised by** the fact that at least one supply unit (24) is driven by a servo engine.

20. Spinning unit according to any of the claims 16 up to 19, **characterised by** the fact that the supply unit (24) contains the supply roller (25) and the pressing table (26).

21. Spinning unit according to claim 16 or 17 or 18, **characterised by** the fact that the combing roller (18) is equipped for each supply unit (24) with a separately adjusted cover (31).

22. Spinning unit according to claim 16 or 17 or 18, **characterised by** the fact that the combing roller (18) consists of rings (33) equipped with cover (31).

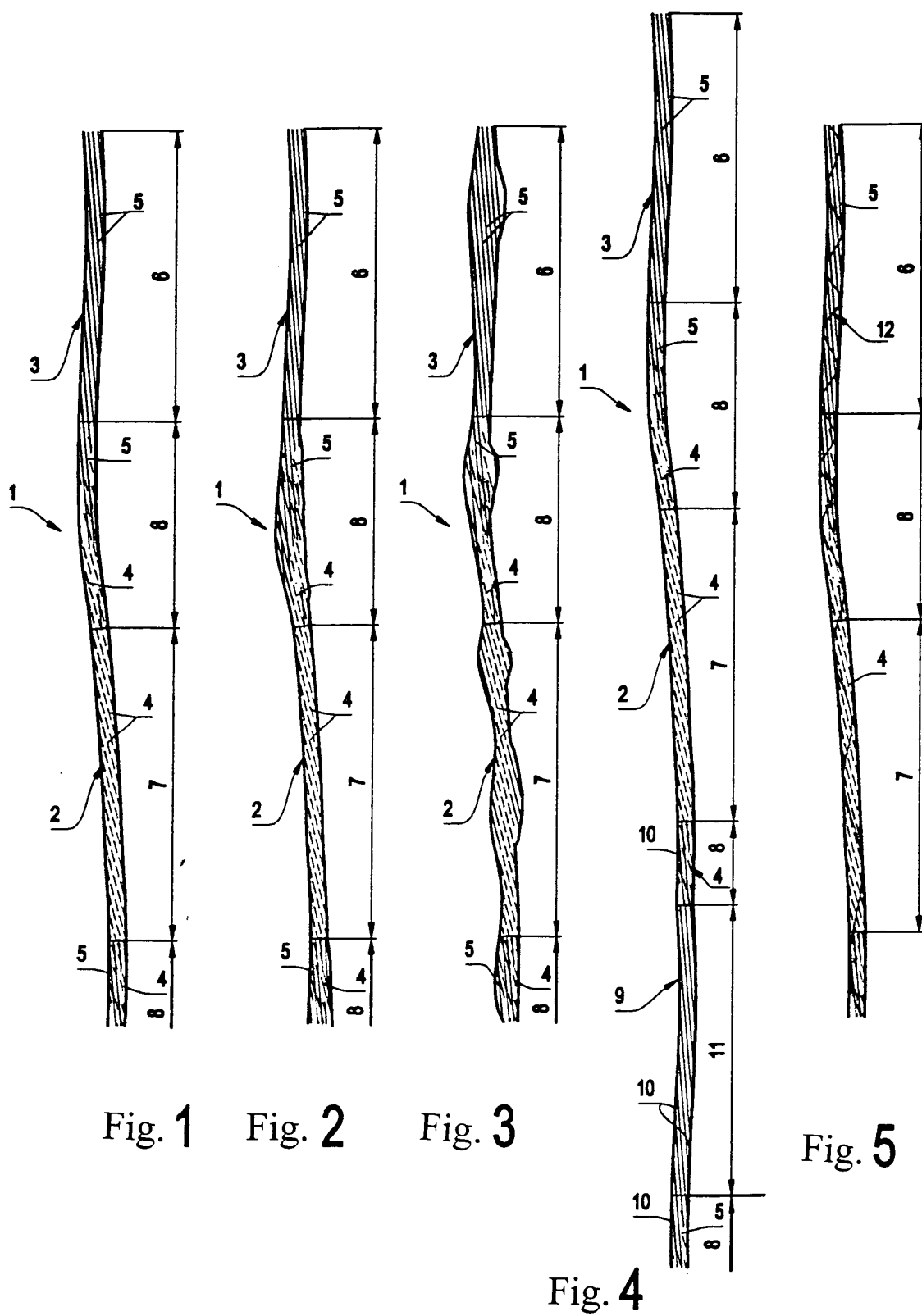
23. Spinning unit according to claim 22, **characterised by** the fact that each ring (33) is located separately and so the developed combing roller (18) is equipped with an individual drive.

24. Spinning unit according to claim 22 and 23, **characterised by** the fact that each ring (33) is related to at least two supply rollers (25).

25. Spinning unit according to claim 16, **characterised by** the fact that it is equipped with two combing rollers (18) with their transport channels (17) leading to the spinning rotor (14).

26. Spinning unit according to claim 16, **characterised by** the fact that intake (34) of an additional thread (12) leads to the spinning rotor (14).

27. Spinning unit according to claim 16, **characterised by** the fact that individual drives are connected with control circuits of the programmable unit.



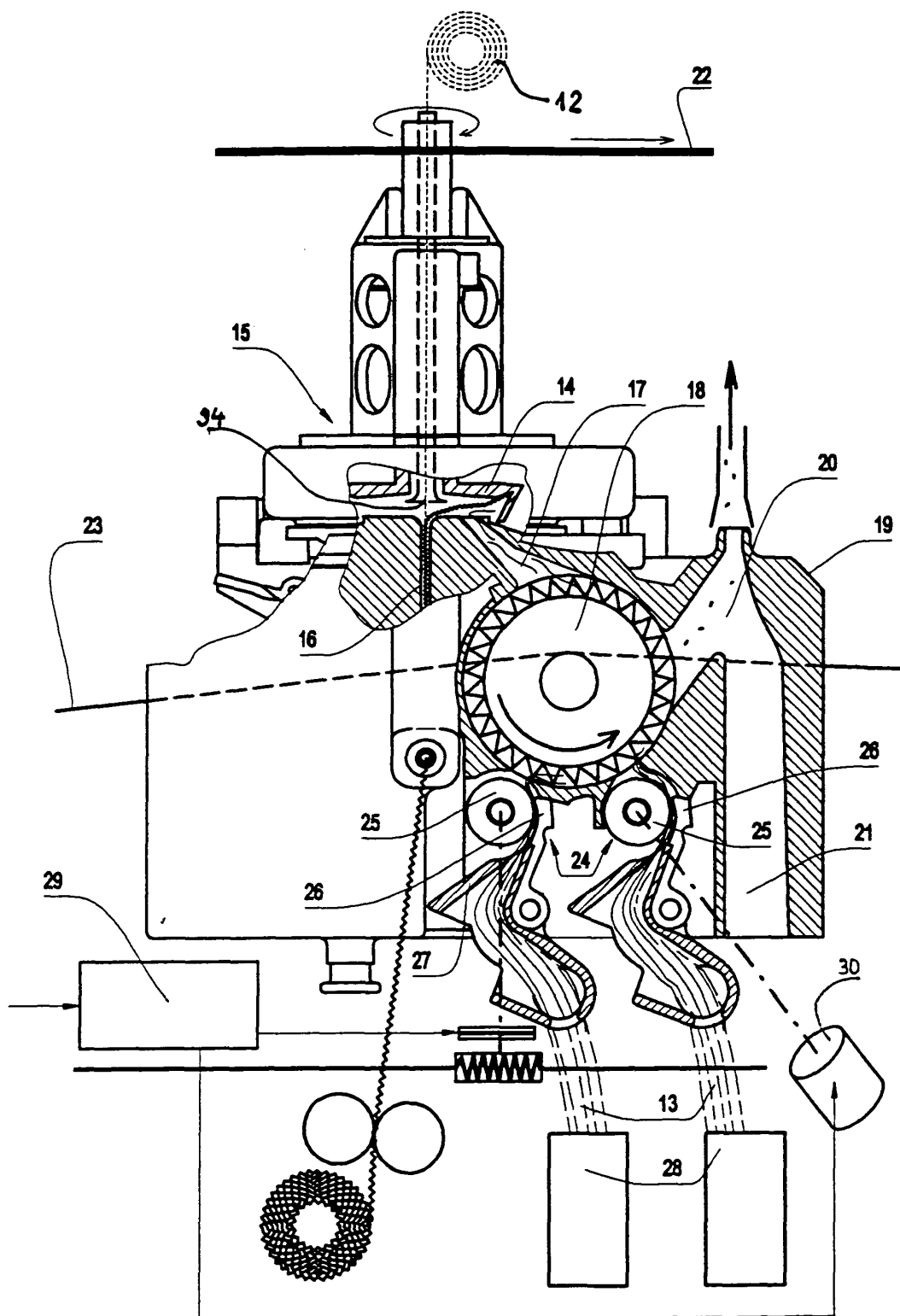


Fig. 6

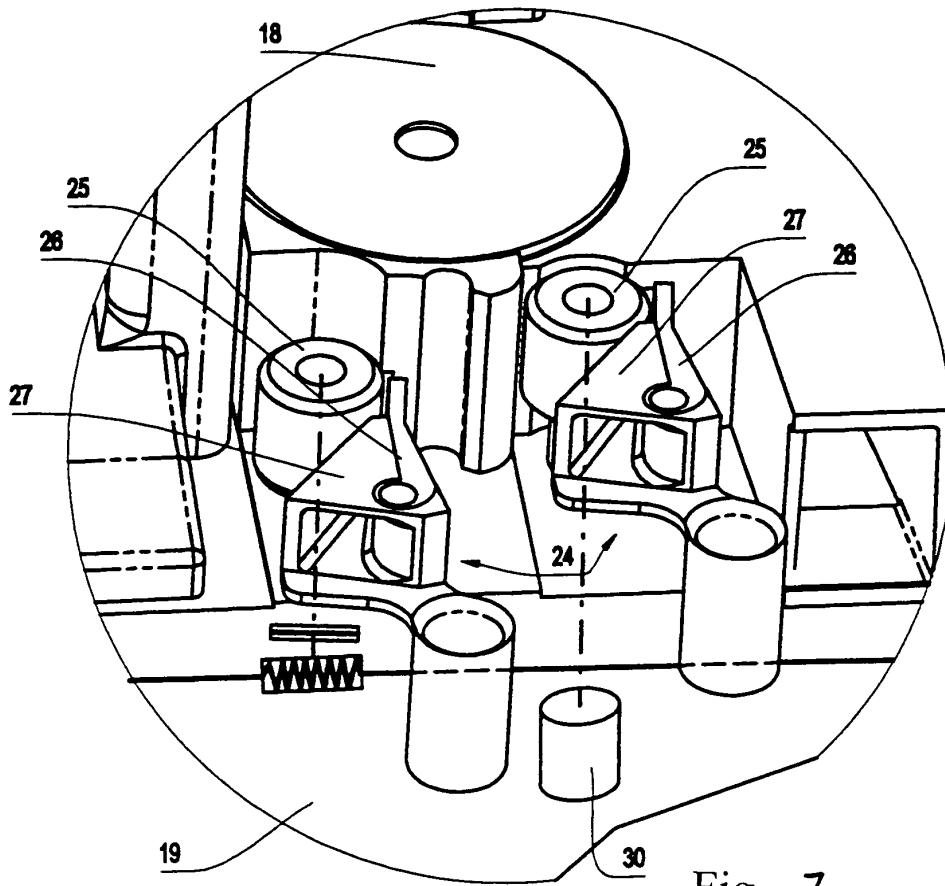


Fig. 7

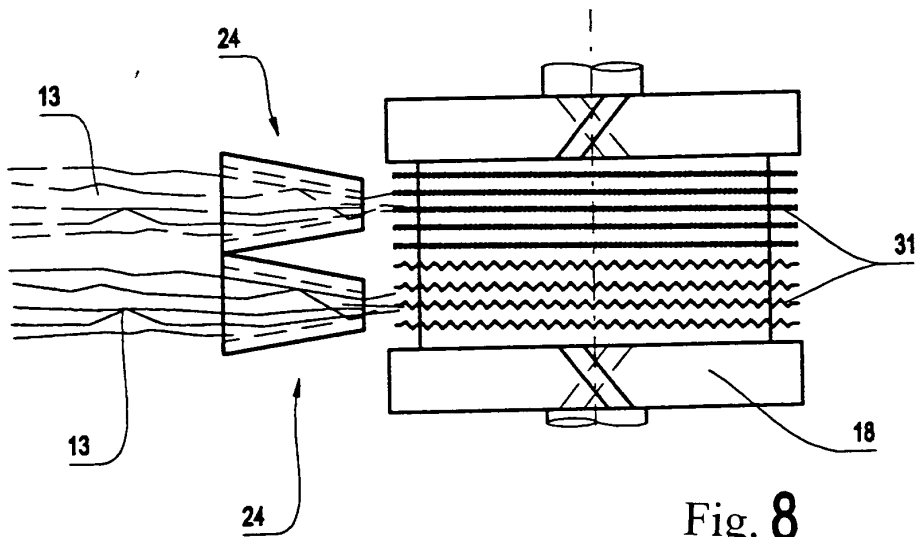
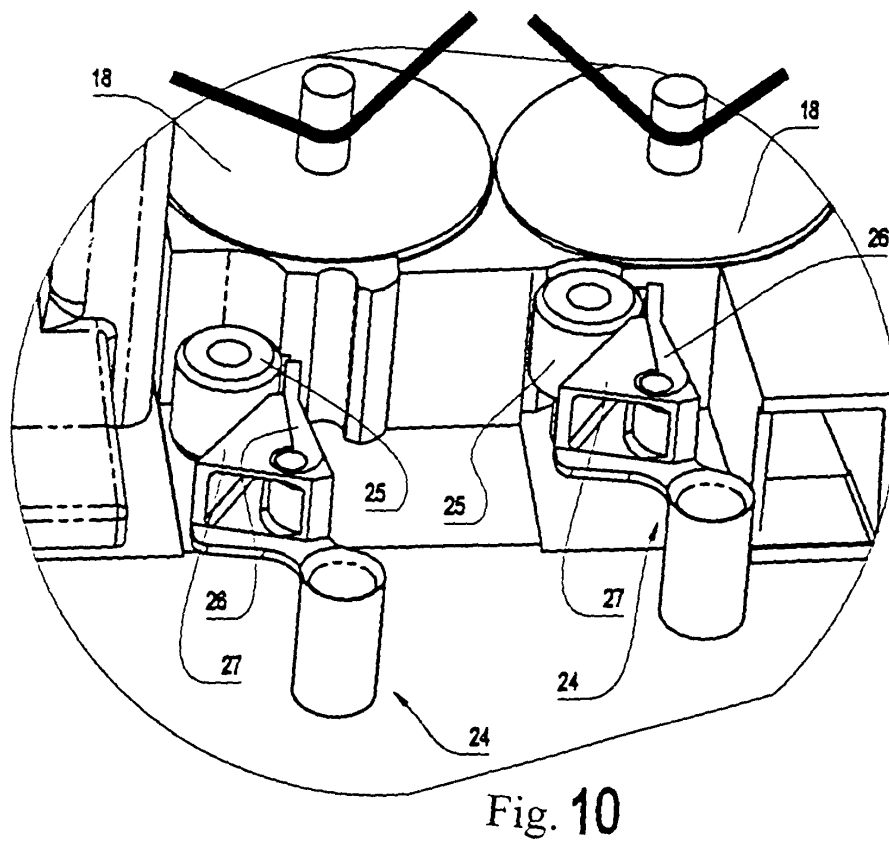
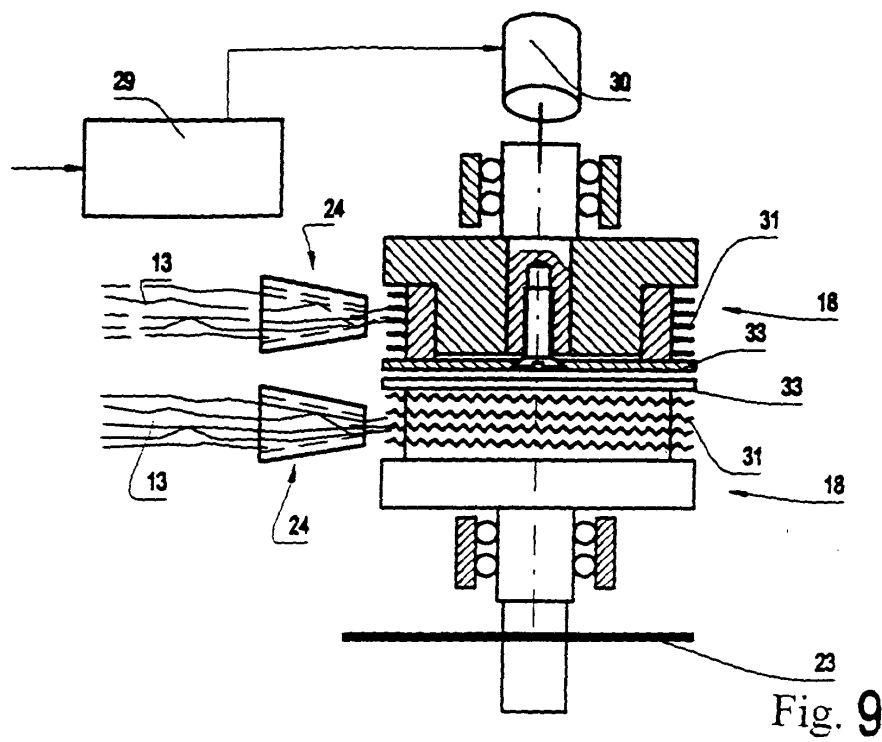


Fig. 8





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EUROPEAN SEARCH REPORT

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Place of search The Hague		Date of completion of the search 9 July 2004	Examiner D'Souza, J
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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