

Description

[0001] The present invention relates to an apparatus and method for the finishing of yarns.

[0002] In particular, the present invention relates to an apparatus and method for performing operations of finishing such as, in particular, the dyeing of yarns. The present invention is particularly useful when adding to the yarns various types of chemical substances suitable to give multifunctional properties such as waterproofing, mechanical strength, and flame resistance.

[0003] As known, the processes for dyeing yarns include bobbin dyeing or hank dyeing. Generally, in the case of a bobbin yarn, a dipping technique is used that involves the use of reactive dye and the insertion of the bobbins inside special tanks containing water under pressure and at a predetermined temperature.

[0004] This technology has major limitations arising from the inability to achieving different colours on the single yarn. Furthermore, the bobbin dyeing can define an uneven colouring depending on the various portions of yarn wound on the bobbin.

[0005] It should also be considered that the dipping technique needs to use a substantial amount of water at high temperature and under pressure. Consequently, dipping dyeing is particularly costly both in terms of energy and of water consumption.

[0006] In the case of the hank dyeing, systems are provided both for the dipping systems similar to those mentioned above, and for spray dyeing systems in which the colour is sprayed onto the hanks suitably supported on special frames.

[0007] Also in this case, however, the dyeing of the hank may cause an uneven colouring derived from the positioning of the threads with respect to the colourant delivery nozzles.

[0008] Furthermore, again, it is impossible to achieve particular effects such as different and repeatable colours on the individual threads that make up the yarn.

[0009] A further drawback related to both technologies (either dipping or spraying dyeing) described above is the impossibility to use the dyeing systems in order to add various types of chemical substances to the yarn. Such operations are mostly made with specific equipment and on dedicated finishing lines.

[0010] In this context, the technical task underlying the present invention is to devise an apparatus and method for the finishing of yarns, which are able to solve the above drawbacks.

[0011] In particular, the object of the present invention is to provide an apparatus and method for the finishing of yarns which is able to achieve homogeneous dyeing of the yarns.

[0012] In greater detail, it is an object of the present invention to provide an apparatus and method that is able to dye any type of yarn by any type of colouring agent and aesthetic effect.

[0013] Even more specifically, it is an object of the

present invention to provide an apparatus and method for implementing a random and repeatable colouring on the individual yarns.

[0014] A further object of the present invention is to provide an apparatus and method to perform on yarns both dyeing and additivation operations with chemical substances suitable to give the yarn specific multifunctional features.

[0015] Yet another object of the present invention is to provide an apparatus and method for the finishing of yarns which is structurally simple, effective in terms of production speed, and cost-efficient, while also being able to reduce as much as possible the possible environmental impact both in terms of energy consumption and consumption of the raw materials used (i.e. water).

[0016] The technical task and the object specified are substantially achieved by an apparatus and method for the finishing of yarns characterised in that it comprises one or more of the technical solutions that are claimed hereinafter.

[0017] The description of a preferred but not exclusive embodiment of an apparatus and method for the finishing of yarns is shown by way of example and not of limitation, in accordance with the accompanying figures in which:

- Figure 1 shows a perspective and schematic view of the apparatus for the finishing of yarns in accordance with the present invention;
- Figure 2 shows a further perspective and schematic view of the apparatus of Figure 1;
- Figure 2a shows an enlargement of a constructive detail of the apparatus of Figure 2; and
- Figure 3 shows a side elevational view with some parts cut away to better illustrate other parts of the apparatus according to the present invention.

[0018] With reference to Figure 1, the numeral 1 generally refers to an apparatus for the finishing of yarns.

[0019] In particular, the present invention is particularly useful in finishing operations of yarns, such as the dyeing and the additivation of chemical substances suitable to give the yarns specific multifunctional features. By way of example, the multifunctional features include waterproofing, flame resistance, and mechanical strength.

[0020] In greater detail, with particular reference to Figure 1, the apparatus 1 comprises a feed station 2 for at least one yarn "Y" to be treated. Preferably, the feeding station 2 comprises at least a support frame 3 for a plurality of spools 4 on which the respective yarns "Y" are wound.

[0021] The bobbins 4 are advantageously supported on the frame 3 rotatably, to facilitate the unwinding of each individual yarn "Y" from the spool 4. In other words, the unwinding action of each yarn "Y" implies the rotation of the spool 4 around a respective longitudinal axis.

[0022] The frame 3 is preferably like a picture frame, and can support any number of spools 4. In the accompanying drawings, a frame 3 suitable to support four

spools 4 (and consequently four yarns) is illustrated purely by way of example and without limitation. It should, however, be specified that the shape of the frame and the number of support frames for the spools can be different according to the number of yarns "Y" to be treated.

[0023] The yarns "Y" are then placed in traction and unwound along a line of advance 5 and in a direction indicated by "D".

[0024] Preferably, it should be noted that the yarns "Y" in the line of advance 5 are fed parallel to each other and along a respective substantially horizontal axis.

[0025] Downstream of said line of advance 5, a collecting station 6 of the yarn "Y" is located. Such a collecting station 6 includes a winding roller 7 rotatable about a horizontal axis and perpendicular to the direction of advance "D" of the yarns. On the roller 7, which is not described and illustrated in detail, the yarns "Y" treated along the line 5 into individual hanks "M" are collected.

[0026] The rotation of the roller 7 that winds the yarns "Y" therefore determines the traction action of the same yarns "Y" that are unwound by the respective spools 4.

[0027] The feeding station 2 also comprises at least one tensioning device 8 associated to the yarn "Y" to tighten the thread along the line of advance 5 to a predetermined tensioning value as a function of the features and dimensions of the yarn "Y".

[0028] Preferably, as illustrated in the accompanying figures, the feeding station 2 comprises a plurality of tensioning devices mounted on the frame 3 and each of which is aligned with a pool 4 of a respective yarn "Y".

[0029] With particular reference to Figure 2a, it is noted that each tensioning device 8 comprises at least one restraining roller 9 around which the thread dipping is partially wound upstream of the line of advance 5.

[0030] The restraining roller 9 is rotatably engaged on a supporting element 10, which is engaged on the frame 3 and has a further diverter roller 11 disposed upstream of the restraining roller 9 with respect to the direction of advance of the yarn "Y".

[0031] The restraining roller 9 has a brake system (not shown or described in detail because it is of a known type) in order to implement resistance to the advance of the thread "Y" towards the collecting station 6. This resistance is determined according to the predetermined tensioning value to be obtained.

[0032] Advantageously, the tensioning device 8 further comprises detecting means 10a and adjustment means (also not described and illustrated in detail since of known type) adapted to control the resistance action of the roller 9. These means are constituted by a sensor for detecting the thread tension and by appropriate interface members that allow manually setting and displaying a predetermined tensioning value.

[0033] In this way, according to the structure and count of each individual yarn "Y", is possible to set a respective tensioning value of the yarn "Y" itself during the feeding step along the line of advance 5. Furthermore, the tensioning device 8 provides the automatic adjustment of

the tension of the yarn "Y" by the restraining action of the roller 9 in an automatic and controlled way. This adjustment action of the tensioning value (set manually) is carried out taking advantage of the features of the yarn "Y" during the continuous feeding along the line 5.

[0034] Each single yarn is controlled during the step of advance and maintained at the optimum tensioning in order to perform the finishing operations and, at the same time, to avoid any damage to the thread itself. Advantageously, this specific control on each thread allows the use of yarns "Y" of any type (material) and count, also those having a very high fineness.

[0035] The apparatus 1 further comprises distribution means 12, for distributing a finishing additive that is arranged along the line of advance 5.

[0036] The distribution means 12 deliver on each yarn "Y" fed along the line of advance 5 a respective additive that can be a dye to impart a specific colour to the yarn treated "Y". In addition or as an alternative, the distribution means 12 may be adapted to distributing on the yarns "Y" an additive capable of imparting final specific features of the yarn.

[0037] In greater detail, the distribution means 12 comprise at least one delivery device 13, for delivering the finishing additive, equipped with a chamber 14 (only visible in the partial cutaway view of Figure 3) for the passing of the yarn "Y".

[0038] As is best shown in two perspective views, Figures 1 and 2, the chamber 14 of the dispensing device 13 defines an inlet opening 15 and an outlet opening 16 of the thread "Y" for passing through the chamber 14 itself. Preferably, as illustrated in the accompanying figures, the distribution means 12 comprise a plurality of dispensing devices 13, arranged in series along the line of advance 5 of the yarn. In this circumstance, note that each yarn "Y" is fed in sequence inside the chamber 14 of each dispensing device 13.

[0039] In the accompanying figures, four dispensing devices 13 are illustrated that are arranged one after another along the line of advance 5. The dispensing devices 13 may be arranged to feed the same additive or substances different between each other.

[0040] It should, however, be specified that the number of dispensing devices 13 and the type of additive fed by each device 13 may be different according to the various production requirements of the yarn "Y".

[0041] With particular reference to the view of Figure 3, the first dispensing device 13 is shown in a partial cutaway view to better show the chamber 14 disposed within each device 13.

[0042] Within each chamber 14 there is a spray nozzle 17 adapted to distribute a jet of additive on the yarn "Y" while it is being continuously fed. Advantageously, the dispensing device 13 comprises a plurality of spray nozzles 17 mounted on a support member 18 that is movable inside the chamber 14 to direct the jet of additive towards the yarn "Y" intermittently. Preferably, the support member 18 comprises a rotary drum that is rotatable about a

rotation axis "X" transverse to the direction of advance "D" of the yarn "Y". In this circumstance, the nozzles 17 are arranged on a peripheral area of the drum 18 to be facing the yarn "Y" and for direct the spray of additive to the yarn "Y" itself periodically.

[0043] The additive sprayed by the nozzles 17 then reaches the advancing yarn "Y" and a portion of the additive falls downwards in a respective collection tank (not shown). Appropriate pumping means, active in the tank, allow the additive to be brought again towards the nozzles 17, then recycling the material that has not been absorbed by the yarns. Advantageously, this system allows for recovering a considerable amount of additive reducing the consumption of raw material (additive), and then the entire cost of the finishing process.

[0044] The distribution means 12 further comprise a comb 19 disposed between the feeding station 2 and the first dispensing device 13. In particular, the comb 19 is mounted facing the inlet opening 15 of the first dispensing device 13 to guide the yarns "Y" maintaining them horizontal and close to each other along the feed line 5. Moreover, the comb 19 maintains the yarns "Y" suitably spaced apart along the line of advance 5, to allow the correct distribution of the additive on the yarns themselves within the individual chambers 14.

[0045] The presence of the comb 19 is also required to ensure the smooth passage of the yarns "Y" through the openings 15, 16 and each single device 13.

[0046] An object of the present invention is also a method for the finishing of yarns "Y" usable with the apparatus 1 described hereinabove.

[0047] The method comprises the steps of: feeding at least a yarn "Y" to be treated along the line of advance 5 and distribute one or more finishing additives on the yarn along said line of advance 5.

[0048] The step of feeding the yarn comprises the sub-step of stretching the yarn along the line of advance 5 to a predetermined tensioning value depending on the features and dimensions of the yarn itself.

[0049] As described above, the step of stretching the yarn is implemented by the resistance imparted by the restraining roller 9 around which the thread is partially wound. Therefore, the roller 9 brakes the advance of the thread towards the collecting station 6 depending on the predetermined tensioning value that is set and adjusted according to the structure, the features and dimensions of the thread.

[0050] The step of distributing the finishing additive on the yarn "Y" is implemented by passing the yarn in a sequential manner in a plurality of dispensing devices 13 for the additive.

[0051] Within each device 13, the additive is sprayed on the yarn "Y" intermittently.

[0052] The yarn "Y" exiting the last dispensing device 13 is collected by a roller 7 to form respective hanks "M". The formation of each hank "M" is preferably implemented by further guide elements (not illustrated since of known type) provided on the roller 7 to allow the correct

positioning of the respective yarns "Y" on the roller 7.

[0053] Finally, the step is implemented to fix the additive previously distributed on the yarn "Y" collected in hanks "M" by means of a vaporization step at a predetermined pressure and temperature. This step is implemented by transferring the hanks "M" inside a respective steaming to allow for the fixing step.

[0054] The above described invention solves the problems found in the prior art and provides numerous advantages.

[0055] First, the apparatus 1 and method thereof that is able to achieve a homogeneous dyeing on the yarns "Y".

[0056] This advantage is due to the dyeing action on the single yarn "Y" on which the colour is sprayed, in contrast to the known technique in which dyeing is performed on the bobbin or the entire hank.

[0057] Furthermore, the present invention allows for treating any type of yarn regardless of its structure and size. This advantage is thanks to the presence of each tensioning device 8 active on a respective thread. This device 8, in addition to maintaining each yarn in the optimum tensioning condition for feeding and finishing, also preserves the yarn from any tearing and damage.

[0058] Still, the presence of a plurality of devices in series allows the use of any type of additive, also additives different to each other.

[0059] Consequently, the apparatus 1 is very versatile and usable not only in dyeing operations but also in any finishing operation which includes the distribution of chemical additives on the yarn.

[0060] For example, the present invention is particularly advantageous when the aim is to obtain multicoloured dyeing on the yarn "Y" with a "random" and repeatable effect on the individual yarns.

[0061] In addition or alternatively, the apparatus 1 can advantageously be used to give the yarn "Y" specific multifunctional features.

[0062] Finally, a further advantage of the present invention is provided by the significant reduction in terms of environmental impact mainly due to the reduction of the raw materials used (water and additive).

Claims

1. Apparatus for the finishing of yarns, comprising:

a feeding station (2) for at least one yarn (Y) to be treated for feeding said yarn (Y) along a line of advance (5);

a collection station (6) for said yarn (Y) located downstream of the line of advance (5); and
distribution means (12) for distributing a finishing additive on said at least one yarn (Y), said means (12) being arranged along the line of advance (5);

characterised in that said feeding station (2)

- also comprises at least one tensioning device (8) associated to the yarn (Y) to stretch the thread along the line of advance (5) to a predetermined tensioning value as a function of the features and dimensions of the yarn (Y).
2. Apparatus according to the preceding claim, **characterised in that** said tensioning device (8) comprises at least one restraining roller (9) around which the thread (Y) is partially wrapped upstream of the line of advance (5); said roller (9) implementing a resistance to the advance of the thread (Y) towards the collection station (6) according to the predetermined tensioning value.
 3. Apparatus according to the preceding claim, **characterised in that** said tensioning device (8) further comprises means (10a) for detecting and adjusting the resistance of the roller (9) to determinate said predetermined tensioning value.
 4. Apparatus according to any one of the preceding claims, **characterised in that** said feeding station (2) comprises a support frame (3) having a plurality of spools (4), each spool (4) supporting a respective yarn (Y) which is unwound along the line of advance (5); said support frame (3) also supporting a plurality of tensioning devices (8) each of which is coupled to a respective yarn (Y).
 5. Apparatus according to any one of the preceding claims, **characterised in that** said distribution means (12) comprise at least one dispensing device (13) for said finishing additive having a chamber (14) for the passaging of the yarn (Y) defining an opening input (15) for the thread inside the chamber (14) and an outlet opening (16) for the thread to which the additive has been distributed.
 6. Apparatus according to the preceding claim, **characterised in that** said dispensing device (13) further comprises a spraying nozzle (17) arranged within said chamber (14) for the passaging of the yarn (Y) to distribute a jet of additive on the yarn (Y) fed continuously.
 7. Apparatus according to the preceding claim, **characterised in that** the said dispensing device (13) comprises a plurality of spraying nozzles (17) and a support member (18) for said nozzles (17); said member (18) being movable inside the chamber (14) to direct the jet of additive towards the yarn (Y) intermittently.
 8. Apparatus according to the preceding claim, **characterised in that** said support member (18) comprises a rotary drum rotatable about a rotation axis (X) transverse to the direction of advance (D) of the yarn (Y); said nozzles (17) being arranged on a peripheral area of the drum.
 9. Apparatus according to any one of claims 5 to 8, **characterised in that** said distribution means (12) comprise a plurality of dispensing devices (13) for said finishing additive, arranged in series along the line of advance (5) of the yarn (Y); said yarn (Y), being fed in sequence within each chamber (14) of the dispensing devices (13).
 10. Apparatus according to the preceding claim, **characterised in that** said additives distributed on the yarn (Y) in the respective dispensing devices (13) are different between each other.
 11. Apparatus according to any one of the preceding claims, **characterised in that** said additive is a dye for colouring the yarn (Y) and/or a chemical agent to give the yarn (Y) a multifunctional feature.
 12. Apparatus according to any one of the preceding claims, **characterised in that** said collecting station (6) comprises at least one roller (7) for winding the yarn (Y) in hanks (M) exiting the distribution means (12) of the finishing additive.
 13. Method for the finishing of yarns, comprising the steps of:
 - feeding at least a yarn (Y) to be treated along a line of advance (5);
 - distribute a finishing additive on the yarn (Y) along said line of advance (5);
 - and
 - collect the treated yarn (Y) at the end of the line of advance (5);**characterised in that** said step of feeding the yarn (Y) comprises the substep of stretching the yarn (Y) along the line of advance 5 to a predetermined tensioning value depending on the features and dimensions of the yarn itself.
 14. Method according to the preceding claim, **characterised in that** said step of stretching the yarn (Y) is implemented by the resistance imparted by a restraining roller (9) around which the thread is partially wound; said roller (9) braking the thread advance towards the collection station (6) according to the predetermined tensioning value.
 15. Method according to the preceding claim, **characterised in that** said step of stretching the yarn (Y) further comprises the substep of adjusting the resistance action of the roller (9) as a function of the predetermined tensioning value.

16. Method according to any of claims 13 to 15, **characterised in that** said step of distributing the finishing additive on the yarn (Y) is carried out by passing the yarn in a sequential manner in a plurality of dispensing devices (13) for said additive; said additive being sprayed on the yarn (Y) intermittently within each dispensing device (13). 5
17. Method according to any of claims 13 to 16, **characterised in that** it further comprises the step of fixing the additive on the yarn (Y) collected in hanks (M) by a vaporisation step at a predetermined pressure and temperature. 10

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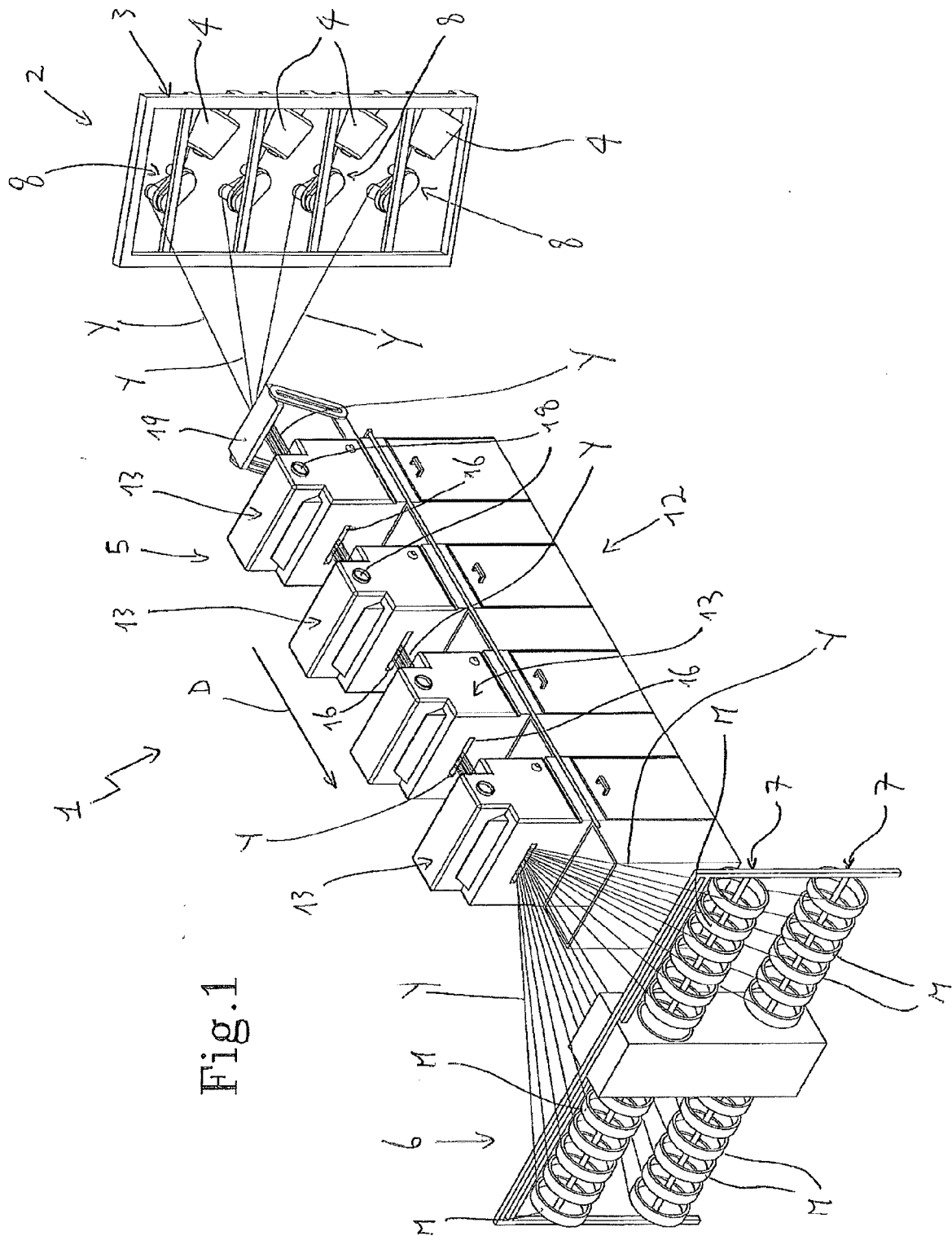
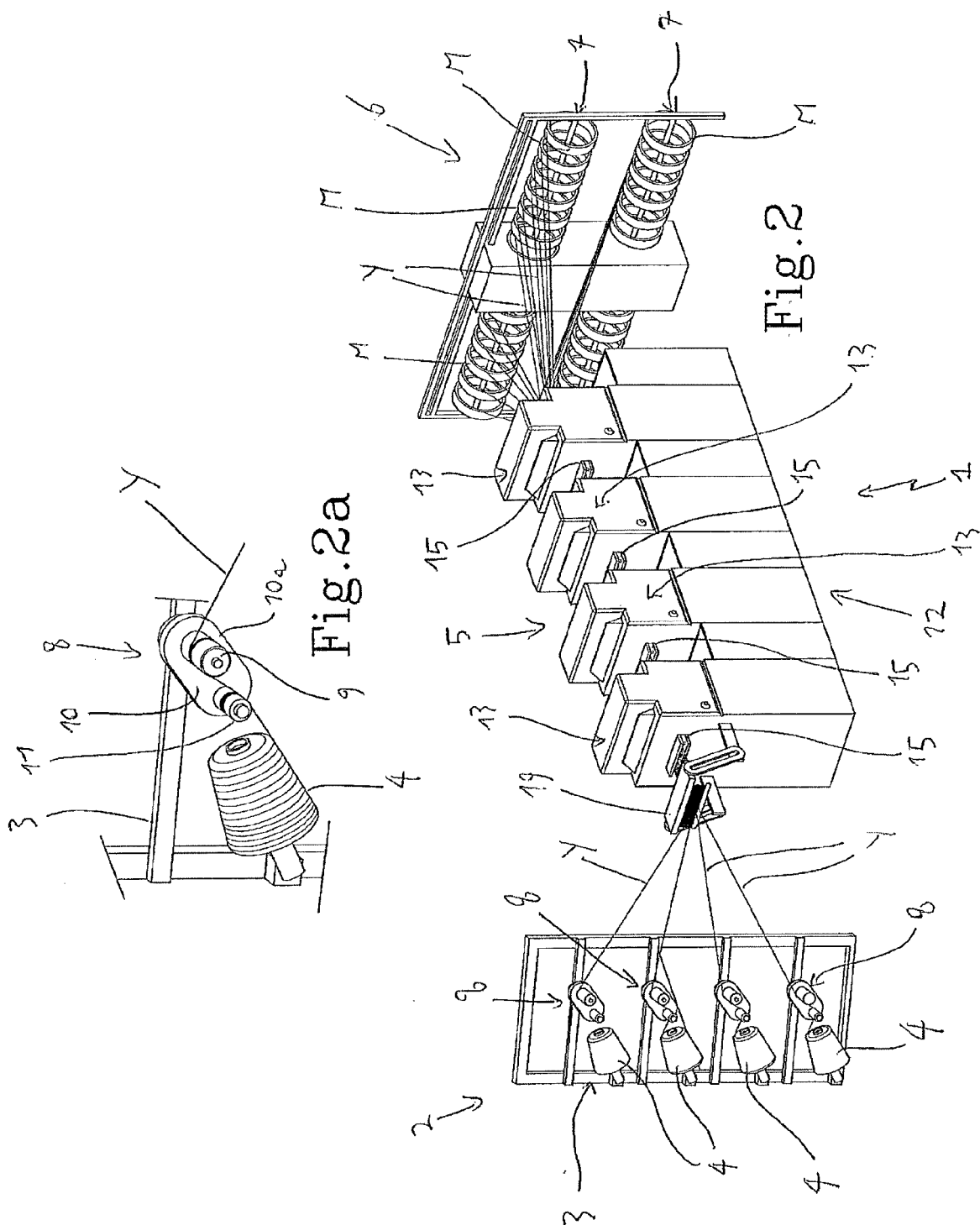
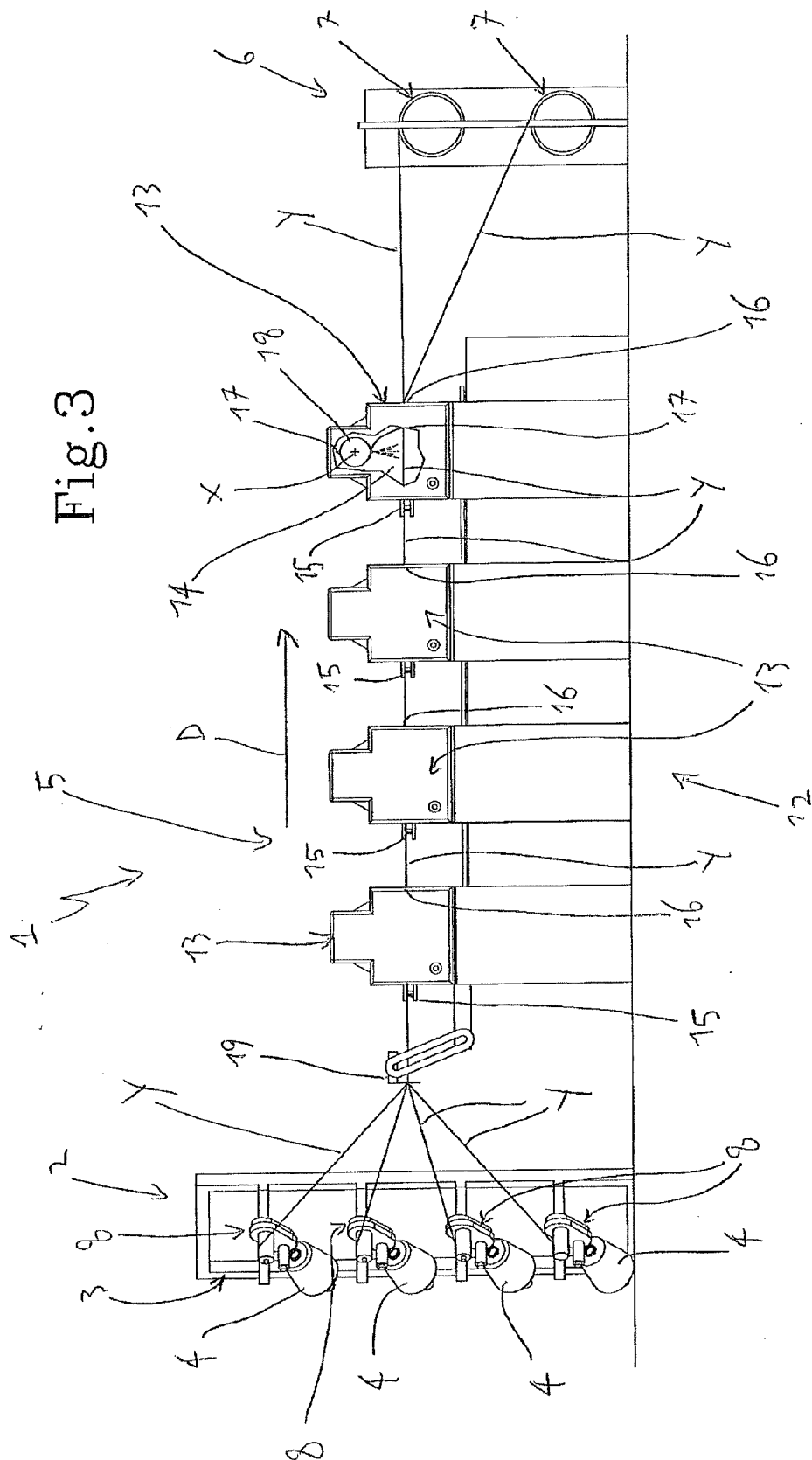


Fig.1







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