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(54) **Yarn heat treatment device**

(57) The present invention provides a method in which a yarn heat treatment device having yarn guides 27 is provided in a heating space in a non-contact type heater H1, having disposed therein a means 28, 28a operating when a yarn 3 is broken and injecting compressed air in the direction in which the yarn 3 is separated from the yarn guides 27. The present invention has disposed therein a means 28, 28a operating upon a yarn broken to inject compressed air in the direction in which the yarn is separated from the yarn guides, so upon a yarn broken, the yarn can be instantaneously separated from the yarn guides and prevented from melting and sticking to the yarn guides.

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Description

Field of the Invention

[0001] The present invention relates to, for example, a yarn heat treatment device such as a first heater device used in a draw texturing machine, wherein the first heater device is used to heat a yarn that has been pulled from a yarn supplying package and drawn and false-twisted, wherein a cooling plate (also referred to as a "balloon plate" due to its function to restrict yarn from ballooning) is subsequently used to cool the yarn, wherein a second heater device is then used to heat the yarn again in order to reduce torque, and wherein the yarn is then wound around a package via an oiling member or the like. The second heater device may be omitted, and in this case, the heater device comprises only the first heater device.

Background of the Invention

[0002] A non-contact type high-temperature heater is known as a yarn heat treatment device such as a first heater device used in a draw texturing machine. In such a non-contact type high-temperature heater, however, if the yarn is broken and tops in a heating space in the first heater device, the broken yarn comes in contact with the yarn guides disposed in the first heater device and may melt and become stuck to the yarn guides. When operations are resumed, new yarn may come in contact with melted yarn that is stuck to the yarn guide and may be broken again. To solve this problem, yarn heat treatment devices used in a draw texturing machine and including a first heater device have been proposed, wherein the temperature is set so as to avoid temperatures at which yarn processing cannot be quickly resumed due to the aforementioned melting, wherein yarn guides each incorporate a self-cleaning heating coil for burning and carbonizing a yarn melted and stuck to the yarn guides for self-cleaning, or wherein upon a yarn broken, the yarn guides that are constantly held by an electromagnet are released from the holding effected by the electromagnet so as to eject the yarn from the first heater device (Unexamined Japanese Patent Application Publication (Tokkai-hei) Number 3-234834, and 3-174047).

[0003] In the conventional yarn heat treatment devices such as a first heater device used in a draw texturing machine, if the temperature is set so as to avoid temperatures at which yarn processing cannot be quickly resumed due to the aforementioned melting, the yarn processing temperature is correspondingly limited. In addition, if yarn guides each incorporate a self-cleaning heating coil for burning and carbonizing yarn melted and stuck to the yarn guides, the shape of the yarn guides is not only limited but the yarn guides also become expensive, thereby increasing the manufacturing costs of the draw texturing machine and the costs of

the manufactured processed yarns. Furthermore, if a yarn is broken, yarn guides that are constantly held by an electromagnet are released from the holding effected by the electromagnet so as to eject the yarn from the first heater device, the electromagnet must be constantly operated during the normal operation of the draw texturing machine thereby wasting energy. In addition, a predetermined amount of time is required to operate a yarn-lifting guide of an appropriate length and weight, thereby causing the yarn to be melted and stuck to the yarn guide.

[0004] An objective of the present invention is to solve the problems of the conventional yarn heat treatment devices such as a first heater device used in a draw texturing machine and to provide a yarn heat treatment device that can be configured as a compact short heater.

Summary of the Invention

[0005] To achieve this objective, a first aspect of the present invention provides a yarn heat treatment device having yarn guides in a heating space in a non-contact type heater, having disposed therein a means to operate, when a yarn is broken, to inject compressed air in the direction in which the yarn is separated from the yarn guides. According to a second aspect of the present invention, the means for injecting compressed air is disposed in the heating space. According to a third aspect of the present invention, the means for injecting compressed air is operated by a yarn breakage detection device disposed between a first and a second feed roller.

[0006] A yarn heat treatment device according to the present invention will be described below in conjunction with a first heater device in a draw texturing machine. The present invention, however, is not limited to this embodiment. Any other embodiment examples can be used as long as the principal idea of this invention is included.

Brief Description of the Drawing

[0007]

Figure 1 is a schematic drawing of a draw texturing machine as an example of that to which a yarn heat treatment device according to the present invention is applied.

Figure 2 is a sectional view of a first heater device as an example of a yarn heat treatment device according to the present invention, as seen perpendicular to the longitudinal direction of the device.

Figure 3 is a sectional view of an inner case of the first heater device as an example of a yarn heat treatment device according to the present invention, as seen in the longitudinal direction of the inner case.

Figure 4 is a block diagram as an example of a yarn heat treatment device according to the present invention.

Figure 5 is a sectional view of the integral part of a first heater device according to another embodiment as an example of a yarn heat treatment device according to the present invention, as seen in the longitudinal direction of the device.

Detailed Description of the Preferred Embodiments

[0008] A yarn heat treatment device according to the present invention will be described below in conjunction with a first heater device in a draw texturing machine. The present invention, however, is not limited to this embodiment. Any other embodiment examples can be used as long as the principal idea of this invention is included.

[0009] First, yarn traveling and so on in a draw texturing machine as an example of that to which a yarn heat treatment device according to the present invention is applied is described with reference to Figure 1.

[0010] 1 is a creel stand, and each yarn 3 pulled from a yarn supplying package 2 supported by the creel stand 1 is introduced to a first feed roller 5 via an appropriate guide 4. Subsequently, while being guided by appropriate guides 6 and 7 disposed on a yarn input side of a heater body of a first heater device H1, the yarn 3 is inserted and passed through the first heater device H1. The yarn 3 from the first heater device H1 enters a cooling plate 8, is then twisted by a false twisting member 9, and is subsequently introduced to a second feed roller 11 via an appropriate guide 10. The yarn 3 from the second feed roller 11 is wound around a winding package 16 via a second heater device H2, a guide 12, a third feed roller 13, an oiling roller (not shown in the drawing), and guides 14 and 15.

[0011] The first heater device H1 is described chiefly with reference to Figures 2 and 3.

[0012] 17 is a sheath heater placed in an approximately prism-shaped heater block 18 formed of metal such as brass having a high heat conductivity, and a cross section of the heater block 18 perpendicular to the vertical direction is formed like a rectangle. According to this embodiment, two sheath heaters 17 are installed in parallel in the vertical direction and along the longitudinal direction.

[0013] 19 is a horizontal heat insulating member placed at the top of the heater block 18 and composing a plate-shaped heat insulating material. 20 is side heat insulating members placed along the respective sides of the heater block 18 in the horizontal direction and composing a plate-shaped heat insulating material. 21 is an intermediate heat insulating member placed so as to extend downward from the bottom surface of the heater block 18 and approximately parallel with the side heat insulating members 20. A bottom surface 20a of the side heat insulating members 20 and a bottom sur-

face 21a of the intermediate heat insulating member 21 are configured to be approximately flush with each other. The heater block 18 incorporating the sheath heaters 17 and the horizontal heat insulating member 19, side heat insulating members 20, and intermediate heat insulating member 21 disposed around the heater block 18 are integrated in an inner case 22 of an approximately U-shaped cross section.

[0014] 23 is an outer circumferential heat insulating member placed in such a way as to surround the horizontal heat insulating member 19 and the side heat insulating members 20, and the outer circumferential heat insulating member 23 is accommodated in an appropriate outer case 24. The outer case 24 covers the bottom surface 20a of the side heat insulating members 20 and lower sides of the side heat insulating member 20 closer to the intermediate heat insulating member 21. 25 is a cover that covers the bottom of the intermediate heat insulating member 21.

[0015] 26 is a slit-shaped heating space formed between the side heat insulating member 20 and the intermediate heat insulating member 21. According to this embodiment, the side heat insulating member 20 located on the left side and the intermediate heat insulating member 21, and the side heat insulating member 20 located on the left side and the intermediate heat insulating member 21 form two slit-shaped heating spaces 26, as shown in Figure 2. By forming a cross section of the heating space 26 perpendicular to the longitudinal direction so as to be shaped like an inverted trapezoid that is tapered toward a yarn insertion opening 26a of each heating space 26, the air in the heating space 26 heated by the heater block 18 incorporating the sheath heaters 17 can be effectively protected from heat radiation.

[0016] 27 is a yarn guide disposed in the heating space 26 at the side of the heater block 18 and an appropriate number of yarn guides 27 are disposed along the longitudinal direction of the heating space 26 at predetermined intervals. As shown in Figure 3, the yarn guides 27 are arranged along the heating space 26 in the horizontal direction in such a way as to bend downward. The yarn guide 27 is molded from abrasion resistant ceramic material and shaped like a hourglass, and has formed therein a guide groove 27a with which the yarn 3 engages. 27b is a horizontal shaft formed on a side of the yarn guide 27, and by fitting the horizontal shaft 27b in a hole drilled in the side heat insulating member 20, an appropriate number of yarn guides 27 are disposed on the side heat insulating member 20 at predetermined intervals. As shown in Figures 2 and 3, the yarn 3 is designed to be guided by the yarn guides 27 in such a way as to keep in contact with the bottom surfaces of the yarn guides 27. Plate-shaped yarn guide members (not shown in the drawings) placed so as to correspond to the heating spaces 26 and in which are a pair of slits are mounted on the yarn input and output sides of the first heater device H1.

[0017] 28 is a compressed air supply pipe disposed in a space section formed between the yarn guides 27 and the horizontal heat insulating member 19 so as to extend approximately over the heating space 26 in the horizontal direction along the heating space 26. The compressed air supply pipe 28 is disposed above the yarn 3 being guided by the yarn guide 27. One end of the compressed air supply pipe 28 is closed, and a connection pipe 30 connected to a compressed air supply source (not shown in the drawings) is connected to an open end of the pipe 28 via a solenoid valve 29. In addition, an appropriate number of air injection holes 28a for injecting compressed air downward are drilled in that part of the compressed air supply pipe 28 that is located within the heating space 26, at predetermined intervals.

[0018] 31 is a yarn breakage detection device disposed between the first heater device H1 and the cooling plate 8, and whether mechanical or photoelectric, various yarn breakage detection devices can be used as the yarn breakage detection device 31. When the yarn breakage detection device 31 detects a breakage in the yarn 3, as is shown in the block diagram in Figure 4, a yarn breakage signal is transmitted to a control section 32 incorporating a microcomputer, and the solenoid valve 29 is opened via the control section 32 to supply compressed air to the compressed air supply pipe 28 disposed above the yarn 3 being guided by the yarn guides 27. Consequently, compressed air is injected downward from the air injection holes 28a in the compressed air supply pipe 28 to separate the yarn 3 being guided in such a way as to keep in contact with the bottom surfaces of the yarn guides 27, and the yarn falls through the yarn insertion opening 26a of the heating space 26.

[0019] In addition, when the yarn breakage detection device 31 detects a breakage in the yarn 3, a timer 33 is operated for a predetermined amount of time via the control section 32. When the time expires, the solenoid valve 29 is closed to stop supplying compressed air to the compressed air supply pipe 28. The amount of time during which compressed air is supplied to the compressed air supply pipe 28 under the control of the timer 33 may be, for example, 0.1 to 0.5 seconds. The yarn 3 instantaneously separates from the yarn guides 27 due to the injection of compressed air through the air injection holes 28a and falls through the yarn insertion opening 26a of the heating space 26 due to its weight and despite the stoppage of the injection of compressed air through the air injection holes 28a.

[0020] According to the embodiment shown in Figure 5, instead of disposing the compressed air supply pipe 28 in the space section formed between the yarn guides 27 and the horizontal heat insulating member 19, an appropriate number of vertical pipes 34 penetrating the outer circumferential heat insulating member 23 and the horizontal heat insulating member 19 are disposed in this space along the longitudinal direction of the first heater device H1 so that the tips of the pipes 34

are located above the yarn 3 being guided so as to keep it in contact with the bottom surfaces of the yarn guides 27. The upper ends of the vertical pipes 34 are connected together by a horizontal pipe 35 connected to a compressed air supply source (not shown in the drawings) via the solenoid valve 29, as in the above embodiment. The description of the operation of this embodiment is omitted as it is the same as in that described in the above embodiment.

[0021] Although the above embodiments have shown examples in which the yarn breakage detection device 31 is disposed between the first heater device H1 and the cooling plate 8, the position of the yarn breakage detection device 31 is not limited to the position between the first heater device H1 and the cooling plate 8 but the yarn breakage detection device 31 may be disposed in any appropriate position. If, however, the yarn 3 is broken between the first feed roller 5 and the second feed roller 11, the broken yarn 3 located at the first feed roller 11 side will stop within the first heater device H1 and will melt and stick to the yarn guides 27. Accordingly, it is recommended that the yarn breakage detection device 31 is provided between the first feed roller 5 and the second feed roller 11 so that compressed air is instantaneously injected through the air injection holes 28a to separate the yarn 3 from the yarn guides 27 if the yarn 3 is broken between the first feed roller 5 and the second feed roller 11. Even if the yarn 3 is broken at a position other than the one between the first feed roller 5 and the second feed roller 11, since the yarn 3 continues to move between the first feed roller 5 and the second feed roller 11, the second feed roller 11 allows the yarn 3 to travel continuously. As a result, operations continue thereby preventing the broken yarn 3 from stopping within the first heater device H1, so the broken yarn 3 is unlikely to be melted and stick to the yarn guides 27.

[0022] In addition, if the yarn 3 is broken between the appropriate guides 6 and 7 disposed on the yarn input side of the first heater device H1, the yarn 3 within the first heater device H1 is drawn out by the second feed roller 11 and is not melted. However, if the yarn is broken between an outlet of the first heater device H1 and the second feed roller 11, the yarn 3 will remain within the first heater device H1 and may be melted and stick to the yarn guides 27. Accordingly, it is recommended that the yarn breakage detection device 31 is provided between the outlet of the first heater device H1 and the second feed roller 11.

[0023] The above embodiments have shown examples in which when the yarn 3 is broken, compressed air is injected against the yarn 3 located within the heating space 26 of the first heater device H1. However, instead of injecting compressed air against the yarn 3 located within the heating space 26 of the first heater device H1, the compressed air supply pipes 28 with the air injection holes 28a drilled therein may be disposed near the inlet and outlet of the first heater device H1 so that com-

pressed air is injected to separate the yarn 3 located near the inlet or outlet of the first heater device H1 to separate the yarn 3 from the yarn guides 27. If a plurality of heating spaces 26 are formed in the first heater device H1 and a plurality of yarns 3 are inserted and passed through the first heater H1 as in this embodiment and when one of the yarns 3 is broken and compressed air is injected against the broken yarn 3 near the inlet or outlet of the first heater device H1, the compressed air is injected against the unbroken yarn 3, thereby adversely affecting the heat treatment for the unbroken yarn 3. Thus, if the plurality of yarns 3 are inserted and passed through the first heater device H1, compressed air is preferably injected against the yarn 3 located within the heating space 26 of the first heater device H1. In addition, depending on the location of the air piping, an air suction force can be used to separate the yarn 3 from the yarn guides 27. For example, a suction pipe that is open toward a yarn guide can be placed on the yarn input side of the heater body so that a signal from the yarn breakage detection device can operate the valve to instantaneously suck out the yarn retaining within the heating space.

[0024] As described above, the device has disposed therein the means for injecting compressed air in the direction in which the yarn 3 is separated from the yarn guides 27, the yarn 3 can be instantaneously separated from the yarn guides so as not to melt and become stick to the yarn guides 27.

[0025] Since the yarn 3 is instantaneously separated from the yarn guides 27 when the yarn 3 is broken, it is prevented from being melted and stick to the yarn guides 27, thereby enabling the temperature of the first heater device H1 to be arbitrarily set without the need to pay attention to the possible melting and sticking of the yarn 3 to the yarn guides 27.

[0026] The yarn 3 can be prevented from melting and sticking to the yarn guides 27 by using the simple system in which the yarn guides each incorporate a heating coil and which has disposed therein the means for instantaneously separating the yarn 3 from the yarn guides 27 when the yarn 3 is broken, rather than a complicated process for burning and carbonizing the melted and stuck yarn.

[0027] Since the means for injecting compressed air is disposed in the heating space 26, if the plurality of yarns 3 are inserted and passed through the first heater device H1, the unbroken yarn 3 is precluded from being adversely affected.

[0028] Since the yarn breakage detection device 31 is disposed between the first feed roller 5 and the second feed roller 11, when the yarn 3 breaks between the first feed roller 5 and the second feed roller 11, compressed air is immediately injected through the air injection holes 28a to instantaneously separate the yarn 3 from the yarn guides 27, thereby preventing the yarn 3 from melting and sticking to the yarn guides 27.

[0029] In addition, compared to the method in which

the broken yarn is drawn out of the first heater device by releasing the holding effect of the electromagnet when the yarn is broken, as described above, the present invention employs compressed air to instantaneously eject the yarn 3 from the first heater device H1.

[0030] In addition, the yarn guides held by the electromagnet are disposed in the first heater device, so the yarn guides are heated and the yarn 3 may be melted if it comes in contact with the yarn guides.

[0031] Compared to the method in which the broken yarn is drawn out of the first heater by releasing the holding effect of the electromagnet when the yarn is broken, as described above, the present invention uses the simple mechanism to eject the yarn 3 from the first heater device H1, thereby requiring almost no adjustments or maintenance for the ejection mechanism and requiring only low-cost maintenance.

[0032] Compared to the method in which the broken yarn is drawn out of the first heater device by releasing the holding effect of the electromagnet when the yarn is broken, as described above, requires the yarn guides to be recovered after the ejection of the yarn from the first heater device. The present invention, however, employs compressed air, thereby eliminating the need for the recovery operation and thus it has no mechanism for this operation enabling the structure to be simplified and time to be saved, thereby improving the working efficiency.

[0033] Compared to the method in which the broken yarn is drawn out of the first heater device by releasing the holding effect of the electromagnet when the yarn is broken as described above, which requires the electromagnet to be constantly magnetized during normal operation of the draw texturing machine when there is no breakage in the yarn. Thus, this mechanism hinders energy saving. The present invention, however, employs compressed air and only requires power consumption for a short time and only if the yarn is broken, thereby saving energy. Compressed air may be stored as the air used in a false twister to thread the yarn, and no new compressed air source need be installed, thereby contributing to energy saving.

[0034] Due to the above configuration, the present invention provides the effects described below.

[0035] The present invention has disposed therein a means operating when a yarn is broken to inject compressed air in the direction in which the yarn is separated from the yarn guides. Thus, when a yarn is broken, the yarn can be instantaneously separated from the yarn guides and prevented from melting and sticking to the yarn guides.

[0036] Since the means for injecting compressed air is disposed in the heating space, if the plurality of yarns are inserted and passed through the first heater device, compressed air is precluded from being injected against the unbroken yarn, thereby preventing the heat treatment of the unbroken yarn from being adversely affected.

[0037] Since the means for injecting compressed air is disposed between the first and second feed rollers, the broken yarn can be prevented from melting and sticking to the yarn guides.

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Claims

1. A yarn heat treatment device having yarn guides in a heating space in a heater body, characterized in that upon a yarn broken, an air flow is allowed to act on a yarn within said heating space so that the yarn is separated from said yarn guides. 10
2. A yarn heat treatment device having yarn guides in a heating space in a heater body as in Claim 1, characterized in that the device has disposed therein a means operating upon a yarn broken to inject compressed air in the direction in which the yarn in said heating space is separated from said yarn guides. 15 20
3. A yarn heat treatment device as in Claim 2, characterized in that the means for injecting compressed air is disposed in said heating space. 25
4. A yarn heat treatment device as in any one of Claims 1 to 3 in a draw texturing machine comprising a first feed roller, a heater body, a cooling zone, a false twisting member, a second feed roller, and a winding unit sequentially disposed therein in the direction that the yarn travels, characterized in that the means for injecting compressed air is operated by a yarn breakage detection device disposed between the first roller and the second feed roller. 30 35
5. A yarn heat treatment device as in Claim 1, characterized in that a suction member for sucking in the yarn within the heating space when the yarn is broken is disposed near an opening of yarn input side of the heater body. 40

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FIG. 1

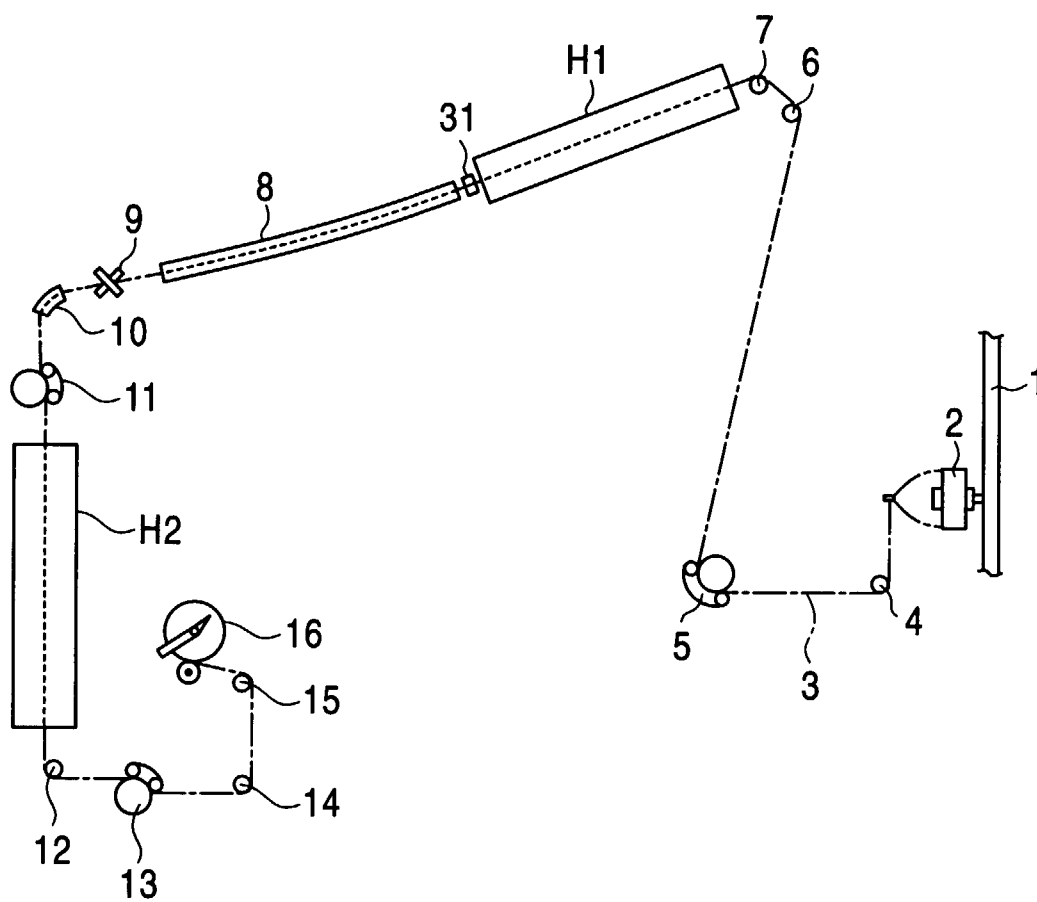


FIG. 2

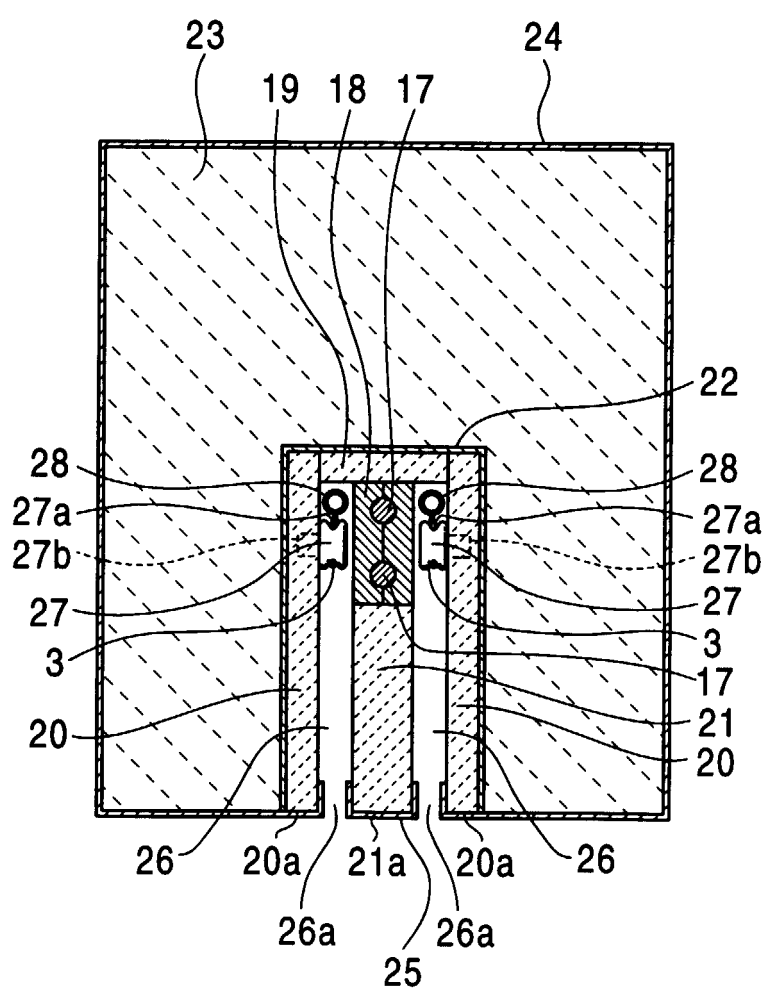


FIG. 3

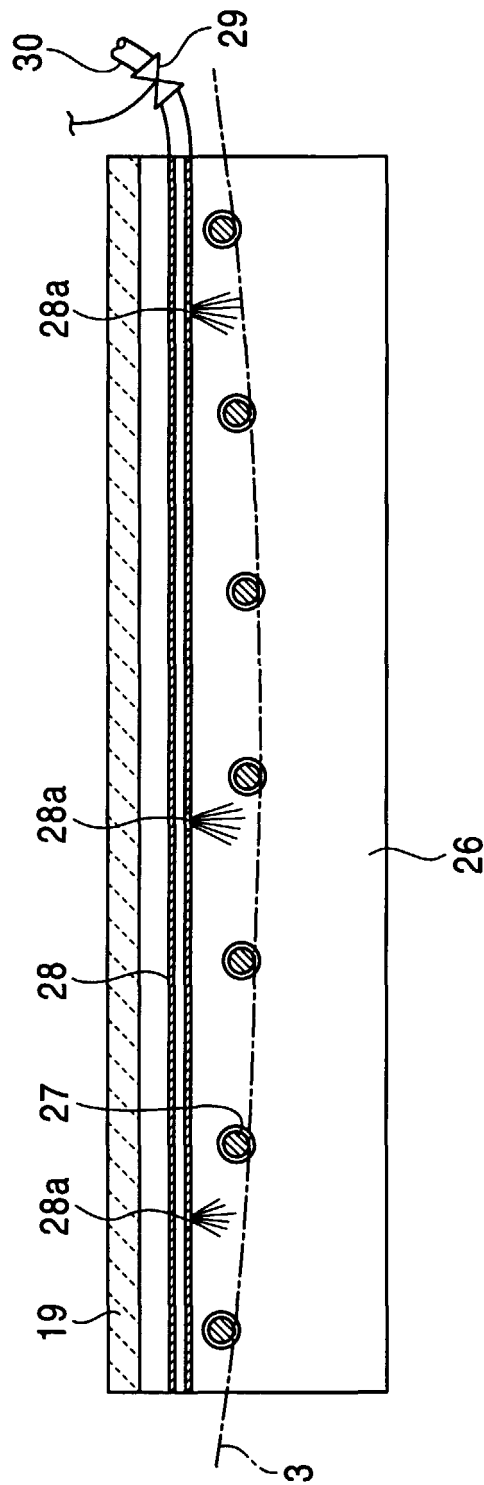


FIG. 4

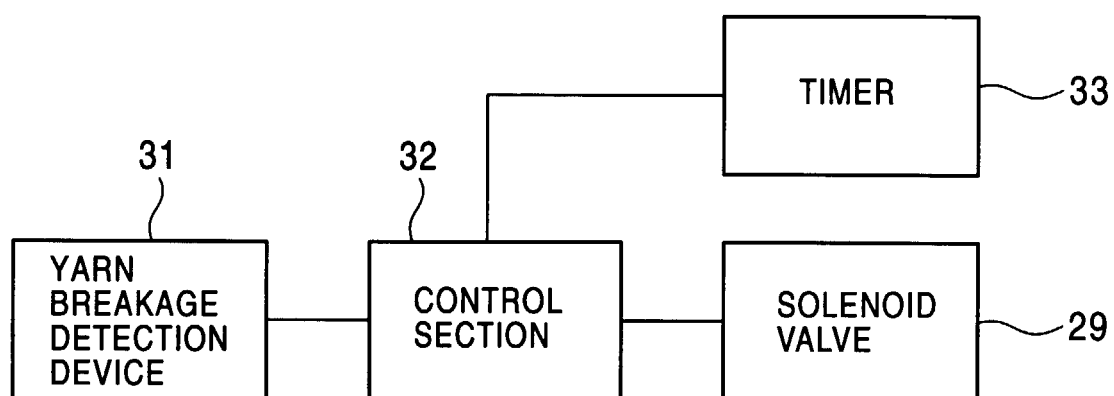
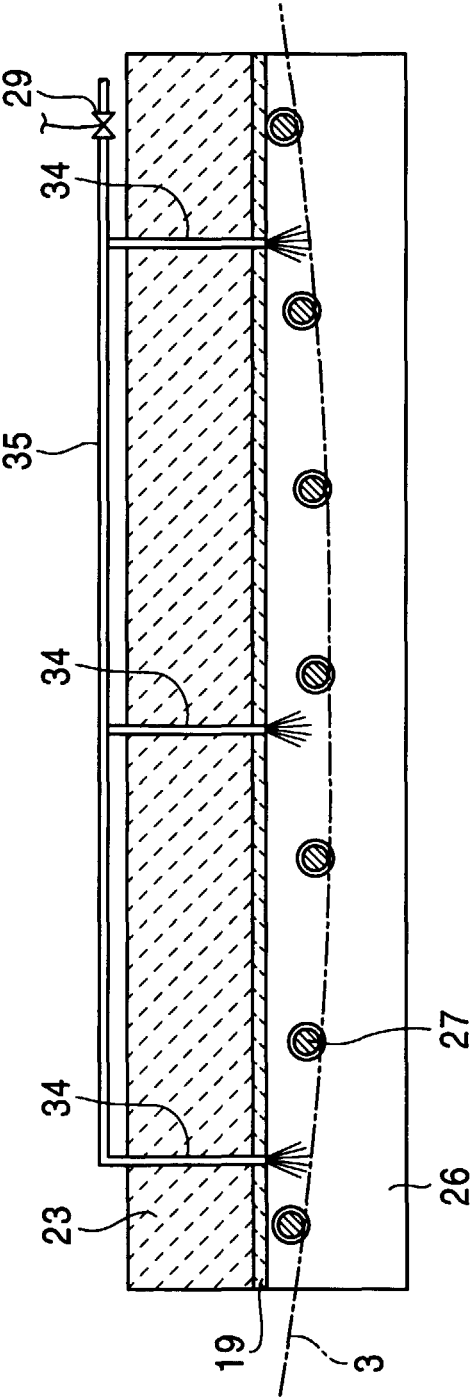


FIG. 5





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EUROPEAN SEARCH REPORT

Application Number
EP 99 11 8819

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Place of search THE HAGUE		Date of completion of the search 9 February 2000	Examiner Barathe, R
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EUROPEAN SEARCH REPORT

Application Number
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Place of search THE HAGUE		Date of completion of the search 9 February 2000	Examiner Barathe, R
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