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(71) Applicant (for all designated States except US): **RIETER CZ, A.S.** [CZ/CZ]; Cs. armády c.p. 1181, 562 15 Ústí nad Orlicí (CZ).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PILAR, Evzen** [CZ/CZ]; Z. Kopala 1155/2, 570 01 , Litomysl (CZ). **POZNIK, Petr** [CZ/CZ]; Chodska 1193, 562 06, Usti nad Orlici (CZ).

(74) Agent: **MUSIL, Dobroslav**; Cejl 38, 602 00 Brno (CZ).

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(54) Title: ATTENDING DEVICE OF JET SPINNING MACHINE AND METHODS OF MANIPULATION WITH YARN IN OPERATING UNIT OF JET SPINNING MACHINE

(57) Abstract: The invention relates to the attending of device for attending operating unit of the jet spinning machine, the attending device is adjustable along a row of operating units of the jet spinning machine, while the attending device comprises the working means out of which at least some can be displaced between their rest position and at least one working position. The attending device is in its lower section on level under the spinning nozzle (1) in operating unit of the machine provided with an adjustable suction tube (13), which is on its mouth provided with yarn brake (14), and which is further provided with yarn presence sensor (15) in cavity of suction tube (13) and with means (16) for yarn end preparation, while above the suction tube (13) is arranged an adjustable introducing head (17) of the spinning-in yam end equipped with clamp, while to the introducing head (17) there is assigned the adjustable yarn breaker (19) and swing arm (36) and above the introducing head (17) is arranged the adjustable underpressure compensator (20) and adjustable underpressure yam reservoir (21), above which is situated the guiding tube (22) of auxiliary yarn (33), to whose inlet of auxiliary yam (33) is assigned the feeding device of auxiliary yam (33), and auxiliary bobbin (18) of auxiliary yam (33) and guiding tube (22) of auxiliary yarn (33) is further provided with inlet (24) of pressure air and with means (25) for yam breakage, while the attending device further comprises the adjustable multifunction nozzle (26) with longitudinal suction opening (27) on which there is mounted the adjustable shutter (28) of a section of width of longitudinal suction opening (27), the knife (29) for yam breakage and yarn transposer (30) onto the tooth plate (31) of winding device (8) in the operating unit, while the attending device and/or each operating unit is equipped with adjustable catching hook (32) and auxiliary draw-off rollers (38). The invention also relates to several methods of manipulation with yam in operating unit of the jet spinning machine.

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Attending device of jet spinning machine and methods of manipulation with yarn in operating unit of jet spinning machine

Technical field

5 The invention relates to the attending device for attending of operating unit of the jet spinning machine, the attending device is adjustable along a row of operating units of the jet spinning machine, while the attending device comprises the working means out of which at least some can be displaced between their rest position and at least one working position.

10 The invention relates also to several methods of manipulation with yarn by means of attending device in operating unit of the jet spinning machine, at which the attending device stops at the operating unit and working means of the attending device in a time sequence and in co-operation with the means of the operating unit performs the attending operation.

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Background art

 There are known many methods of manipulation with yarn by means of attending device in operating unit of rotor spinning machines. Known are also several methods of manipulation with yarn by means of attending device in
20 operating unit of the jet spinning machines.

 The disadvantage of the known methods is the fact that in their integrity it is difficult to use them on structurally various types of spinning machines, because each type of machine comprises rather differently arranged elements, which in certain phases require specific manipulation procedures with yarn.
25 Another collective disadvantage is necessity of relatively large quantity of working means of attending device and relatively large quantity of positioning devices of each working means.

 The goal of this invention is to eliminate or at least minimise the disadvantages of the background art.

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Principle of the invention

The goal of the invention has been reached through the attending device for attending of operating unit of the jet spinning machine, whose principle consists in that the attending device is in its lower section on level under the spinning nozzle in operating unit of the machine provided with an adjustable suction tube, which is on its mouth provided with yarn brake and it is further provided with yarn presence sensor in cavity of suction tube and with means for yarn end preparation, while above the suction tube is arranged an adjustable introducing head of the spinning-in yarn end equipped with clamp, while to the introducing head there is assigned the adjustable yarn breaker and swing arm and above the introducing head is arranged the adjustable underpressure compensator and adjustable underpressure yarn reservoir, above which is situated the guiding tube of auxiliary yarn, to whose inlet of auxiliary yarn is assigned the feeding device of auxiliary yarn, and auxiliary bobbin of auxiliary yarn and guiding tube of auxiliary yarn is further provided with inlet of pressure air and with means for yarn breakage, while the attending device further comprises the adjustable multifunction nozzle with longitudinal suction opening on which there is mounted the adjustable shutter of a section of width of longitudinal suction opening, the knife for yarn breakage and yarn transposer onto the tooth plate of winding device in the operating unit, while the attending device and/or each operating unit is equipped with adjustable catching hook and auxiliary draw-off rollers.

This attending device reduces the essential number of working elements and their positioning devices, at the same time it is able to fulfil all the tasks for which it has been designed.

The principle of manipulation methods with yarn by means of the attending device in operating unit of the jet spinning machine arises out of the patent claims and description of exemplary embodiments of the invention.

Description of the drawing

The invention is schematically represented in the drawing where Fig. 00 shows survey of arrangement of operating unit of the jet spinning machine and

the attending device, Fig. 0 to 13 procedures of spinning-in on an empty tube by means of auxiliary yarn, Fig. A0 to A10 procedure of spinning-in after yarn breakage by means of yarn end being backward unwound from a bobbin in winding device of operating unit and Fig. B0 to B5 show procedure of continual
5 doffing at replacement of fully wound bobbin for an empty tube without spinning interruption.

Examples of embodiment

The invention will be described on examples of embodiment of attending
10 device of the jet spinning machine and examples of attending operations the device is able to perform.

The jet spinning machine comprises a row side by side arranged operating units, out of which each comprises the spinning nozzle 1, under which the feeding device 2 of fibre material is positioned, under which the drafting
15 device 3 of fibre material is positioned. Above the spinning nozzle 1 there is arranged the yarn draw-off device 4 which comprises a couple of loose draw-off rollers. In the represented example of embodiment the yarn waxing mechanism 5 is arranged above the yarn draw-off device 4. Between the spinning nozzle 1 and the draw-off device 4 the yarn presence and quality sensor 6 is arranged
20 due to known reasons, while between the draw-off device 4 and waxing mechanism 5 the yarn presence sensor 7 is arranged due to known reasons. Above the waxing mechanism 5 the winding mechanism 8 is arranged which comprises the yarn traversing mechanism 9 which, due to yarn high speed motion, is formed of wing traversing mechanism. The winding mechanism 8
25 further comprises the rotating driving roller 10 and the not represented tilting arms between which the tube 11 is rotatably mounted, on which by means of yarn winding the package 12 is formed. The tube 11 with package 12 forms the bobbin. The tube 11 or the bobbin is driven through contact of its surface with the driving roller 10. The moving parts of the operating unit are coupled with the
30 not represented suitable drives, e.g. central drive and/or individual drive and further are coupled with a control device. The yarn sensors 6, 7, are coupled with the not represented evaluation equipment and with control device.

The jet spinning machine further comprises an attending device which is displaceable along a row of operating units with possibility of stopping at the selected operating unit. Attending device is provided with working means for performance of attending operations in operating unit. In its lower section on the level under the spinning nozzle 1 the attending device is provided with adjustable suction tube 13, which on its mouth is provided with the yarn brake 14. In the represented example of embodiment the yarn brake 14 is formed of magnetic yarn brake. The suction tube 13 is further provided with yarn presence sensor 15 in cavity of the suction tube 13 and with means 16 for yarn end preparation.

The attending device further comprises above the suction tube 13 arranged adjustable introducing head 17 of spinning-in yarn end, which may be formed of either the end of spun yarn backward unwound from the bobbin in winding mechanism of operating unit or it may be formed of an end of auxiliary yarn stored on the auxiliary bobbin 18 in attending device. The introducing head 17 in the attending device is assigned to the adjustable yarn breaker 19. The introducing head 17 is further provided with the swing arm 36 and the not represented clamp.

Above the introducing head 17 of spinning-in yarn end there is arranged the adjustable underpressure compensator 20 and the adjustable underpressure yarn reservoir 21, above which the guiding tube 22 of auxiliary yarn is situated. Before the entry of auxiliary yarn into the guiding tube 22 the feeding device 23 of auxiliary yarn is situated, while the guiding tube 22 of auxiliary yarn is provided with pressure air inlet 24 and with means 25 for yarn breakage.

The attending device further comprises the adjustable multifunction nozzle 26 with longitudinal suction opening 27, which is coupled with source of underpressure. The multifunction nozzle 26 is provided with some working means for attending of operating unit, especially it is provided with adjustable shutter 28 of section of the width of longitudinal suction opening 27, the knife 29 for yarn breakage and the yarn transposer 30 onto the known tooth plate 31 on one of the not represented arms of winding mechanism 8 in operating unit.

Each operating unit of the jet spinning machine and/or attending device is further provided with adjustable catching hook 32, whose function will be described later. The attending device is further provided with auxiliary draw-off rollers 38, which assist to backward yarn unwinding from the bobbin in the winding mechanism of the operating unit.

The adjustable elements of attending device are coupled with suitable drives and the control device.

In the following text there will be described the methods of operation of attending device in three modes, which are spinning-in on an empty tube using the auxiliary yarn, spinning-in after yarn breakage using the yarn end on bobbin in the winding mechanism of operating unit, and continual doffing upon replacement of fully wound bobbin for an empty tube without spinning interruption.

The spinning-in on empty tube using the auxiliary yarn is performed as follows (the procedure is represented in the Fig. 0 to 13). The operating unit shall send a signal requiring attendance to the machine control device. The attending device stops at the operating unit, and all participating elements of the operating unit as well as of attending device are in their initial positions as it is represented in the Fig. 0. In the attending device the auxiliary yarn 33 is introduced into the guiding tube 22 and in the operating unit in the winding mechanism the empty tube 11 is inserted, in the drafting device 3 of fibre material is the fibre material 34 and the draw-off rollers of the yarn draw-off device 4 are lifted off one from another. As represented in the Fig. 1, the multifunction nozzle 26 transfers to outlet 35 of guiding tube 22 and the shutter 28 of section of width of longitudinal suction opening 27 of multifunction nozzle 26 covers a section of width of longitudinal suction opening 27. The multifunction nozzle 26 is connected to the source of underpressure and it sucks the end of auxiliary yarn 33, whose motion through the guiding tube 22 is supported by the feeding device 23 of auxiliary yarn and by the pressure air brought into the inlet 24 of pressure air into the guiding tube 22. As represented in Fig. 2, to the auxiliary yarn 33 in the initial position there is assigned the catching hook 32, the shutter 28 lifts off and exposes a section of width of

longitudinal suction opening 27 of multifunction nozzle 26 and the auxiliary hook 32 catches the yarn and deflects it aside. The introducing head 17 swings upwards and moves upwards, the auxiliary yarn 33 passes aside next to the introducing head 17. The catching hook 32 returns back and the auxiliary yarn

5 33 passes under the introducing head 17. As represented in Fig. 3, the introducing head 17 returns into its initial position, at the same time it catches the auxiliary yarn 33 and pulls it down and the auxiliary yarn now passes before the underpressure compensator 20. As represented in Fig. 4, the underpressure compensator 20 shifts forwards, at the same time it catches the auxiliary yarn

10 33 and directs it into the yarn presence sensor 7. The arm 36 on the introducing head 17 swings and leads the auxiliary yarn into the not represented clamp on the introducing head 17, where the auxiliary yarn 33 is grasped. As represented in Fig. 5, the adjustable yarn breaker 19 on introducing head 17 interrupts the auxiliary yarn 33, through which is formed the spinning-in end of

15 auxiliary yarn 33 that is held by means of a clamp on the introducing head 17. Remaining part of auxiliary yarn 33 sucked into the multifunction nozzle 26 is sucked by means of the multifunction nozzle 26 into the not represented waste. As represented in Fig. 6, the underpressure compensator 20 initiates suction, the introducing head 17 shifts forward above the outlet opening of the spinning

20 nozzle 1, the auxiliary yarn 33 is directed into the yarn draw-off device 4 and in underpressure compensator 20 the reserve of auxiliary yarn 33 is formed. The required length of auxiliary yarn 33 for shift of the introducing head 17 and formation of reserve of the auxiliary yarn 33 in underpressure compensator 20 is unwound from the auxiliary bobbin 18. As represented in Fig. 7, the catching

25 hook 32 releases the auxiliary yarn, which by means of air stream from not represented nozzle on the introducing head 17, by means of air stream from inlet 24 of pressure air into the guiding tube 22 of auxiliary yarn and by means of the feeding device 23 of auxiliary yarn is introduced into the spinning nozzle 1, through which the auxiliary yarn 33 further supported also by the pressure air

30 introduced into the spinning nozzle 1, passes up to mouth of the suction tube 13, which is connected to the source of underpressure and into which the auxiliary yarn 33 is sucked, while the end of auxiliary yarn 33 is by the suction tube 13 sucked up to behind level of the yarn presence sensor 15 and the

device 16 for preparation of spinning-in end of auxiliary yarn 33. The introducing head 17 returns to its initial position. As represented in Fig. 8, the auxiliary yarn 33 is grasped between the rollers of the draw-off device 4 and the spinning nozzle 1 including the feeding device 2 of fibre material is prepared for spinning.

- 5 The yarn brake 14 on mouth of the suction tube 13 grasps the auxiliary yarn under the spinning nozzle 1. After then the means 25 for yarn breakage breaks the auxiliary yarn 33 in the guiding tube 22 of auxiliary yarn, through this breakage the second end of auxiliary yarn 33 is formed. Consequently the multifunction nozzle 26 connects to underpressure and begins to suck the air
- 10 from its surroundings and into the pressure air inlet 24 of the guiding tube 22 of auxiliary yarn the pressure air is brought, by means of which the second end of auxiliary yarn 33 in the guiding tube 22 is blown out into the space in front of the suction opening 27 of multifunction nozzle 26, where it is by suction of the multifunction nozzle 26 caught and is sucked into the multifunction nozzle 26,
- 15 as it is represented in Fig. 9. As it is represented in Fig. 10, the multifunction nozzle 26, that still sucks the second end of auxiliary yarn 33 shifts to the tube 11 in the winding mechanisms in operating unit and into the guiding tube 22 of auxiliary yarn the auxiliary yarn 33 is delivered for further spinning-in. The yarn draw-off device 4, the spinning nozzle 1 like at spinning and the feeding device
- 20 2 of fibre material gets moving, by which from the suction tube 13 the auxiliary yarn 33 with spinning-in end starts to be drawn-off. Simultaneously the empty tube 11 in arms of the winding mechanism 8 of operating unit is laid on the driving roller 10 and starts rotating and the yarn traversing mechanism 9 is activated. After passage of the spinning-in end of auxiliary yarn in the suction
- 25 tube 13 around the yarn presence sensor 15 in the suction tube 13 the drafting device 3 of fibre material is activated, by means of which is the fibre material transported into the feeding device 2 of fibre material and the spinning nozzle 1 for spinning into the yarn. Simultaneously with the spinning-in end of auxiliary yarn 33 into the spinning nozzle 1 arrives also the fibre material for spinning,
- 30 which in the spinning nozzle 1 is spun to the spinning-in end of auxiliary yarn 33 and further normal spinning by the spinning nozzle 1 continues as it is represented in Fig. 11. The newly spun yarn 37 is sucked-off into the multifunction nozzle 17. As it is further represented in Fig. 11, suction into

underpressure compensator 20 is started, while the multifunction nozzle 17 approaches to the winding mechanism 8 and the yarn transposer 30 deflects the yarn 37 into the path of teeth of the tooth plate 32 of winding mechanism 8, which catches the newly spun yarn 37 which starts to be wound on the tube 11 and to be distributed by the traversing mechanism 9. The tooth plate 32 breaks the end of yarn 37 sucked in the multifunction nozzle 17 and this yarn 37 end is sucked off into the nozzle 17 and into the waste. As it is represented in Fig. 12, the winding mechanism 8 of the yarn 37 gets moving gradually and consumes the yarn loop in underpressure compensator 20 and the multifunction nozzle 17 returns into its initial position. After the yarn loop from underpressure compensator 20 is consumed, the underpressure compensator 20 also returns into its initial position and yarn spinning-in onto the empty tube 11 with usage of the auxiliary yarn 33 is completed. Upon failure in any step of this procedure, it is possible to return all working means into their initial positions and to start the process newly from the beginning, or only the erroneously performed section of the process may be repeated.

Spinning-in after breakage with usage of end of the spun yarn searched on and unwound from bobbin in the winding mechanism 8 in the operating unit runs as follows (the procedure is represented in drawings A0 to A10). The operating unit shall send a signal requiring attendance to the machine control device. The attending device stops at the operating unit, and all participating elements of the operating unit as well as of attending device are in their initial positions as it is represented in the Fig. 0. The multifunction nozzle 26 connects to the source of underpressure and it begins to suck in the air from its surroundings. With its longitudinal suction opening 27 it approaches to the bobbin in the winding mechanism 8 of the operating unit which starts to rotate counter clockwise upon yarn winding. By suction into the multifunction nozzle 26 the yarn end on the bobbin is sucked into the nozzle 26, which after then distances from the bobbin, as it is represented in Fig. A1. The yarn between the bobbin and nozzle 26 is caught by the catching hook 32, which deflects the yarn into the side. The introducing head 17 swings upwards and it moves above level of the yarn between the bobbin and the nozzle 26. After then the catching hook 32 returns the yarn back into the straight path, through which the yarn gets

directly under the introducing head 17. As it is represented in Fig. A2, the introducing head 17 transfers backwards down, at the same time it catches the yarn and directs it downwards, while the yarn in the sector between the catching hook 32 and introducing head 17 passes in front of the underpressure compensator 20. As it is represented in Fig. A3, the swing arm 36 on the introducing head 17 swings and directs the yarn into the not represented clamp on the introducing head 17 and the underpressure compensator 20 transfers forwards in direction to the operating unit, where it directs the yarn into the yarn presence sensor 7. As it is represented in Fig. A4, the yarn in the sector between the clamp on the introducing head 17 and the multifunction nozzle 26 is interrupted by the yarn breaker 19 through which the spinning-in yarn end held on the introducing head 17 is created and the separated yarn end is sucked off by the multifunction nozzle 26 into the waste. As represented in Fig. A5, the introducing head 17 transfers above outlet opening of the spinning nozzle 1, it directs the yarn in between the distanced rollers of the draw-off device 4 of spun yarn and the underpressure compensator 20 begins to suck the yarn to create the yarn reserve in for introducing of yarn into the spinning nozzle 17 and suction tube 13. The catching hook 32 by its movement directs the yarn into the sector between itself and the yarn presence sensor 7 in between the mutually distanced auxiliary draw-off rollers 38, which assist to the backward yarn unwinding from the bobbin in the winding mechanism 8. The yarn is constantly unwound and in underpressure compensator 20 the yarn reserve is created. In the not represented example of embodiment the catching hook 32 by its movement directs the yarn in the sector between itself and the yarn presence sensor 7 in between the mutually distanced auxiliary draw-off rollers 38 earlier, namely e.g. simultaneously with a swing of the swing arm 36 on the introducing head 17 and by directing the yarn into the not represented clamp on the introducing head 17, as it is represented in Fig. A3. As it is represented in Fig. A6, the auxiliary draw-off rollers 38 draw near one to another and begin to support the backwards yarn unwinding from the bobbin, while with assistance of pressure air from the not represented air nozzle on the introducing head 17 the yarn end is introduced into the spinning nozzle 1. As it is represented in Fig. A7, the action of auxiliary draw-off rollers 38 continues and

into the spinning nozzle 1 the pressure air is introduced, and by this common action the yarn passes through the spinning nozzle 1 up to the mouth of suction tube 13 connected to the source of underpressure, into which the yarn end is sucked subsequently as far as behind the yarn presence sensor 15 and the means 16 for yarn end preparation. The yarn reserve in underpressure compensator 20 is thus consumed and the underpressure compensator 20 transfers back into its initial position. The yarn remains in the sensors 6 and 7. As represented in Fig. A8, the yarn brake 14 on the mouth of suction tube 13 grasps the yarn and upon the continuous yarn unwinding from the bobbin it begins to be sucked into the underpressure yarn reservoir 21, through which the yarn reserve is created. Simultaneously by means of the means 16 for yarn end preparation the yarn is interrupted in the suction tube 13 and the yarn spinning-in end is formed. The cut off yarn end is sucked into waste through the suction tube 13. After the spinning-in yarn end is formed and required yarn length is positioned into reserve in the underpressure yarn reservoir 21 the backward yarn unwinding from bobbin in the winding mechanism 8 of the operating unit is stopped. As it is represented in Fig. A9, the draw-off rollers of the yarn draw-off device 4 grasp the yarn and begin to rotate in direction of yarn drawing-off from the spinning nozzle 1 and they begin to pull out the yarn from the suction tube 13. The catching hook 32 releases the yarn and the bobbin in the winding mechanism 8 begins to rotate in direction of winding, it begins to consume the yarn reserve in the underpressure yarn reservoir 21 and the yarn traversing mechanism 9 of the winding mechanism 8 gets moving. In a time sequence to passage of the spinning-in yarn end through the yarn presence sensor 15 the feeding device 2 gets moving, the pressure air is brought into the spinning nozzle 1 like at spinning, and in a time sequence to passage of the spinning-in yarn end through the yarn presence sensor 15 the drafting device 3 of fibre material gets moving, which into the spinning nozzle 1 begins deliver the fibre material for yarn spinning, which into the spinning nozzle 1 arrives simultaneously with the spinning-in yarn end from the suction tube 13 and it spins-in onto it. Then normal spinning begins by the spinning nozzle 1 from the fibre material transported into the nozzle 1 by the drafting device 3 and the feeding device 2, while the yarn reserve in the underpressure yarn

reservoir 21 is gradually consumed and wound on the bobbin in the winding mechanism 8 in operating unit. Subsequently all participating elements on the attending device return into their initial positions as it is represented in Fig. A10 and spinning-in after breakage is finished. Upon failure in any step of this procedure it is possible to return all working means into their initial positions and to start the process once again from the beginning, or only the erroneously performed section of the process may be repeated.

In alternative embodiment of arrangement according to Fig. A8, to the yarn in the sector between the sensors 7 and the yarn draw-off device 4 from the lateral side the underpressure yarn reservoir 21 approaches, which is connected to the source of underpressure. The brake 14 in mouth of the suction tube 13 grasps the yarn and upon the ongoing unwinding of yarn from the bobbin the yarn begins to be sucked into the underpressure yarn reservoir 21 where it is deposited, through which a new yarn reserve is formed, and simultaneously the yarn is laterally pulled out from the space between the rollers of the yarn draw-off device 4. After the yarn is grasped by the brake 14 the yarn in the suction tube 13 is interrupted by the means 16 for yarn end preparation and the spinning-in yarn end is formed. The cut off yarn end is sucked into waste by the suction tube 13. After the yarn spinning-in end is formed and the required yarn length is deposited into reserve in the underpressure yarn reservoir 21 the backward yarn unwinding from the bobbin in the winding mechanism 8 of operating unit stops. In this alternative example of embodiment according to Fig. A9, the lifted off draw-off roller of the yarn draw-off device 4 draws near to the second roller of the yarn draw-off device 4 and the yarn draw-off device 4, without yarn between the rollers, begins to rotate in direction of yarn drawing-off from the spinning nozzle 1. The catching hook 32 releases the yarn and the yarn winding mechanism 8 begins to rotate the bobbin in direction of yarn winding. The yarn gets to the track of the traversing mechanism 9, which starts to traverse it along the bobbin width, and the yarn reserve deposited in the underpressure yarn reservoir 21 is gradually consumed by winding onto the bobbin, which starts rotating to its operating speed. At the same time the yarn is constantly held outside the yarn draw-off device 4 thanks to the underpressure yarn reservoir 21. When consuming the

yarn reserve from the underpressure yarn reservoir 21 the bobbin gradually achieves its operating speed. After the yarn reserve from the underpressure yarn reservoir 21 is consumed, the yarn is stretched between the sensors 6, 7 and it itself slips laterally in between the compressed rollers of the yarn draw-off device 4 and yarn drawing-off from the spinning nozzle 1 begins. Through this also the part of yarn passing through the spinning nozzle 1 into the suction tube 13 gets moving. The created yarn spinning-in end in the suction tube 13 begins to move in direction to the spinning nozzle 1. In a time sequence to passage of the yarn spinning-in end through the yarn presence sensor 15 the feeding device 2 is activated, into the spinning nozzle 1 pressure air is brought like as at spinning, and in a time sequence to passage of the yarn spinning-in end through the yarn presence sensor 15 the drafting device 3 of fibre material is activated, which into the spinning nozzle 1 begins to deliver the fibre material for yarn spinning, which into the spinning nozzle 1 arrives simultaneously with the yarn spinning-in end from the suction tube 13 and it spins-in onto it. Then normal spinning begins by the spinning nozzle from the fibre material transported into the nozzle 1 by the drafting device 3 and the feeding device 2. Subsequently all participating elements on the attending device return into their initial positions as it is represented in Fig. A10 and spinning-in after breakage is finished. Upon failure in any step of this procedure it is possible to return all working means into their initial positions and to start the process once again from the beginning, or only the erroneously performed section of the process may be repeated. Also in this alternative embodiment the catching hook 32 directs by its movement the yarn in the sector between itself and the yarn presence sensor 7 in between the mutually distanced auxiliary draw-off rollers 38 earlier, namely e.g. simultaneously with a swing of the swing arm 36 on the introducing head 17 and by directing the yarn into the not represented clamp on the introducing head 17, as it is represented in Fig. A3.

Continual doffing, i.e. replacement of fully wound bobbin in the winding mechanism on the operating unit with the empty tube without stoping of the spinning is performed as follows (procedure is represented in Fig. B0 to B5). The operating unit shall send a signal requiring attendance to the machine control device. The attending device stops at the operating unit, and all

participating elements of the operating unit as well as of attending device are in their initial positions as it is represented in Fig. B0. The multifunction nozzle 26 connects to the source of underpressure and it begins to suck in the air from its surroundings. The shutter 28 covers a section of the width of the suction opening 27 of multifunction nozzle 26, which approaches to the yarn in operating unit under the traversing mechanism 9, as it is represented in Fig. B1. The underpressure compensator 20 moves forwards and retains yarn in the yarn presence sensor 7, the multifunction nozzle 26 sucks the yarn and rotation of the bobbin in the winding mechanism 8 in the operating unit stops.

Once the yarn is sucked into the multifunction nozzle 26, the yarn is interrupted between the multifunction nozzle 26 and the bobbin, while continuously the spun yarn is fluently sucked off into the multifunction nozzle 26, as it is represented in Fig. B2. After then the fully wound bobbin is replaced by an empty tube 11. The traversing mechanism 9 of the winding mechanism 8 in the operating unit is constantly in operation. Once the empty tube 11 is inserted into the winding mechanism 8, the tube is laid on the driving roller 10, through which it starts rotating. As it is represented in Fig. B3, the multifunction nozzle 26 approaches to the rotating tube 11, the suction of the spun yarn into the underpressure compensator 20 for creation of yarn reserve is commenced, and the transposer 30 mounted on the multifunction nozzle 26 deflects the spun yarn in the sector between the yarn draw-off device 4 and the multifunction nozzle 26 into the track of teeth of the tooth plate 3 of winding mechanism 8 in operating unit, by which the yarn is caught and interrupted, while the section of yarn leading from the spinning nozzle 1 is wound on the tube 11 into the bobbin and the section of yarn being sucked by the multifunction nozzle 26 is sucked off into the waste. The yarn is directed into the traversing mechanism 9 and the yarn reserve in the underpressure compensator 20, represented in Fig. B4, is consumed. As represented in Fig. B5, the participating elements of attending device return into their initial positions and the continual doffing is finished.

Upon failure in any step of this procedure it is possible to return all working means into their initial positions and to start the process once again from the beginning, or only the erroneously performed section of the process may be repeated.

In the not represented example of embodiment the function of underpressure compensator 20 is modified by the sensor 7 with yarn catching hooks against a spontaneous slippage of yarn from the sensing area of the yarn presence sensor 7 so that after introducing the yarn into the spinning
5 nozzle 1 the underpressure compensator 20 returns back into its initial position. At continual doffing the underpressure compensator 20 , contrary to the represented embodiment, does not participate in the attending process at all.

List of referential markings

	1	spinning nozzle
	2	feeding device of fibre material
5	3	drafting device of fibre material
	4	yarn draw-off device
	5	waxing mechanism
	6	yarn presence and quality sensor
	7	yarn presence sensor
10	8	winding mechanism
	9	traversing mechanism
	10	driving roller
	11	tube
	12	package
15	13	suction tube
	14	yarn brake
	15	yarn presence sensor
	16	means for yarn end preparation
	17	introducing head
20	18	auxiliary bobbin
	19	yarn breaker
	20	underpressure compensator
	21	underpressure yarn reservoir
	22	guiding tube of auxiliary yarn
25	23	feeding device of auxiliary yarn
	24	pressure air inlet
	25	means for yarn breakage
	26	multifunction nozzle
	27	longitudinal suction opening of multifunction nozzle
30	28	shutter of section of the width of longitudinal suction opening of multifunction nozzle
	29	knife
	30	yarn transposer to tooth plate
	31	tooth plate of winding mechanism in operating unit
35	32	catching hook
	33	auxiliary yarn
	34	fibre material
	35	outlet of auxiliary yarn guiding tube
	36	swing arm
40	37	yarn
	38	auxiliary draw-off rollers

CLAIMS

1. Attending device for attending of operating unit of the jet spinning machine, the attending device is adjustable along a row of operating units of the jet spinning machine, while the attending device comprises the working means out of which at least some can be displaced between their rest position and at least one working position, **characterised in that the** attending device is in its lower section on level under the spinning nozzle (1) in operating unit of the machine provided with an adjustable suction tube (13), which is on its mouth provided with yarn brake (14), and which is further provided with yarn presence sensor (15) in cavity of suction tube (13) and with means (16) for yarn end preparation, while above the suction tube (13) is arranged an adjustable introducing head (17) of the spinning-in yarn end equipped with clamp, while to the introducing head (17) there is assigned the adjustable yarn breaker (19) and swing arm (36) and above the introducing head (17) is arranged the adjustable underpressure compensator (20) and adjustable underpressure yarn reservoir (21), above which is situated the guiding tube (22) of auxiliary yarn (33), to whose inlet of auxiliary yarn (33) is assigned the feeding device of auxiliary yarn (33), and auxiliary bobbin (18) of auxiliary yarn (33) and guiding tube (22) of auxiliary yarn (33) is further provided with inlet (24) of pressure air and with means (25) for yarn breakage, while the attending device further comprises the adjustable multifunction nozzle (26) with longitudinal suction opening (27) on which there is mounted the adjustable shutter (28) of a section of width of longitudinal suction opening (27), the knife (29) for yarn breakage and yarn transposer (30) onto the tooth plate (31) of winding device (8) in the operating unit, while the attending device and/or each operating unit is equipped with adjustable catching hook (32) and auxiliary draw-off rollers (38).

2. The method of manipulation with yarn by means of the attending device in operating unit of the jet spinning machine, at which the attending device stops at the operating unit and by its working means in a time sequence and in cooperation with means of operating unit performs the attending

operation, while all participating elements of the operating unit as well as of attending device are in their initial positions, in the attending device the auxiliary yarn is introduced into the guiding tube and in the operating unit is in the winding mechanism inserted the empty tube, in the drafting device of fibre material is the fibre material and the draw-off rollers of the yarn draw-off device are lifted off one from another, **characterised in that** to the outlet (35) of guiding tube (22) of auxiliary yarn the multifunction nozzle (26) approaches, the shutter (28) of section of width of longitudinal suction opening (27) of multifunction nozzle (26) covers a section of width of longitudinal suction opening (27), multifunction nozzle (26) connects to the source of underpressure and sucks the first end of auxiliary yarn (33), the auxiliary yarn (33) is caught by the hook (32), the shutter (28) lifts off from the longitudinal suction opening (27) of multifunction nozzle (26) and the catching hook (32) deflects the auxiliary yarn (33) aside, the introducing head (17) swings and it transfers upwards above the auxiliary yarn (33), the catching hook (32) returns back and introducing head (17) returns down into its initial position, at the same time it catches the auxiliary yarn (33) and pulls it down before the underpressure compensator (20), which moves forwards, it catches the auxiliary yarn (33) and directs it into the yarn presence sensor (7), after then the arm (36) on introducing head (17) swings and directs the auxiliary yarn (33) into the clamp on the introducing head (17), the adjustable yarn breaker (19) interrupts the auxiliary yarn (33) between the introducing head (17) and the multifunction nozzle (26), by which is created the spinning-in end of auxiliary yarn (33) held by the clamp on the introducing head (17) and the remaining portion of auxiliary yarn (33) is sucked into waste, after which the underpressure compensator (20) begins suction and the introducing head (17) transfers forwards above the outlet opening of the spinning nozzle (1), the auxiliary yarn (33) is directed into the yarn draw-off device (4) and in underpressure compensator (20) a reserve of auxiliary yarn (33) is created from the auxiliary bobbin (18), the catching hook (32) releases the auxiliary yarn (33), which is introduced into the spinning nozzle (1), through which the auxiliary yarn (33) passes as far as to the mouth of suction tube (13), into which the auxiliary yarn (33) is sucked as far as behind the level of the yarn presence sensor (15) and the device (16) for preparation of

spinning-in end of auxiliary yarn (33), the introducing head (17) returns into its initial position, the auxiliary yarn (33) is grasped between rollers of the draw-off device (4) and the spinning nozzle (1) including the feeding device (2) of fibre material is prepared for spinning, after then the yarn brake (14) on mouth of the suction tube (13) grasps the auxiliary yarn (33) under the spinning nozzle (1), in the guiding tube (22) of auxiliary yarn (33) by the means (25) for yarn breakage the auxiliary yarn (33) is interrupted, through which the second end of auxiliary yarn (33) is created, which after then transfers into the multifunction nozzle (26) connected to the source of underpressure, the multifunction nozzle (26) transfers to the bobbin by the winding mechanism (8) in operating unit, the yarn draw-off device (4), the spinning nozzle (1) and the feeding device (2) of fibre material gets moving, by which from the suction tube (13) through the yarn brake (14) the auxiliary yarn (33) with the spinning-in end begins to draw-off and the empty tube (11) in the winding mechanism (8) of operating unit is laid on the driving roller (10) and it starts to rotate, the yarn traversing mechanism (9) gets moving and after passage of spinning-in end of auxiliary yarn (33) in the suction tube (13) through the yarn presence sensor (15) in the suction tube (13) the drafting device (3) of fibre material gets moving, by which into the feeding device (2) of fibre material and the spinning nozzle (1) the fibre material begins to be transported for spinning into the yarn, which in the spinning nozzle (1) spins-in onto the spinning-in end of auxiliary yarn (33) pulled out from the suction tube (13), and further a normal spinning by the spinning nozzle (1) continues, simultaneously the newly spun yarn (37) is sucked off into the multifunction nozzle (17) and suction off into the underpressure compensator (20) is initiated, while the multifunction nozzle (17) approaches to the tube (11) in the winding mechanism (8), and the yarn transposer (30) deflects the yarn (37) into the track of teeth of the tooth plate (31) of winding mechanism (8), which catches the yarn (37) and the newly spun yarn (37) begins to be wound on the tube (11), it is distributed by the traversing mechanism (9), while by the tooth plate (32) separated end of the yarn (37) sucked-in in the multifunction nozzle (17) is sucked off into the waste, the tube (11) begins to rotate gradually and the yarn loop in underpressure compensator (20) is consumed and the multifunction nozzle (17) returns into its initial position, at the same time after

the yarn loop from the underpressure compensator (20) is consumed, the underpressure compensator (20) returns into its initial position and yarn spinning-in on the empty tube (11) with usage of the auxiliary yarn (33) is finished.

5

3. The method according to the claim 2, **characterised in that** the second end of auxiliary yarn (33) from the guiding tube (22) is blown out into the space before the suction opening (27) of multifunction nozzle (26), where it is by suction of the multifunction nozzle (26) caught and sucked into the multifunction
10 nozzle (26).

4. The method of manipulation with yarn by means of the attending device in operating unit of the jet spinning machine, at which the attending device stops at the operating unit and by its working means in a time sequence
15 and in cooperation with means of operating unit performs the attending operation, while all participating elements of operating unit as well as of attending device are in their initial positions, the end of interrupted yarn is wound on the bobbin in the winding mechanism in operating unit of the machine, the spinning is stopped **characterised in that** to the bobbin, which
20 rotates counter the rotation direction at the yarn winding with its longitudinal suction opening (27) approaches the multifunction nozzle (26) connected to the source of underpressure and the yarn end on the bobbin is sucked, the multifunction nozzle (26) distances from the bobbin and it sucks the unwound yarn, which between the bobbin and the multifunction nozzle (26) is caught by
25 the catching hook (32), by which the yarn is deflected to the side, the introducing head (17) swings and transfers upwards above the yarn, the catching hook (32) returns the yarn back into the straight path, in which the yarn is under the introducing head (17), which returns back downwards, catches the yarn and directs it downwards before the underpressure compensator (20),
30 the swing arm (36) on the introducing head (17) swings and directs the yarn into the clamp on the introducing head (17), the underpressure compensator (20) transfers forward to the operating unit and directs the yarn into the yarn

presence sensor (7), the yarn in the sector between the clamp on the introducing head (17) and the multifunction nozzle (26) is interrupted and the separated yarn end is sucked out into waste, the introducing head (17) transfers above the outlet opening of the spinning nozzle (1), the yarn is
5 directed in between the distanced rollers of the draw-off device (4) of spun yarn and by the underpressure compensator (20) the yarn for creating of yarn reserve begins to be sucked in, by the catching hook (32) the yarn in sector between the catching hook (32) and the yarn presence sensor (7) is directed in between mutually distanced auxiliary draw-off rollers (38), which draw near one
10 to another and begin to support the backward yarn unwinding from the bobbin, yarn end is introduced into outlet opening of the spinning nozzle (1) and passes through the spinning nozzle (1) as far as to the mount of suction tube (13) connected to the source of underpressure, into which it is sucked into as far as behind the yarn presence sensor (15) and the means (16) for yarn end
15 preparation, the brake (14) grasps the yarn on mouth of the suction tube (13), the yarn begins to be sucked into the underpressure yarn reservoir (21), through which the yarn reserve is created and with the means (16) for yarn end preparation the yarn in the suction tube (13) is interrupted, through which spinning-in yarn end is formed and the cut off yarn end is by the suction tube
20 (13) sucked off into waste, then after depositing of required yarn length into reserve in the underpressure yarn reservoir (21) backward yarn unwinding from bobbin in the winding mechanism (8) of operating unit is stopped, the draw off rollers of yarn draw-off device (4) grasp the yarn and begin to rotate in direction of yarn drawing-off from the spinning nozzle (1) by which they start to draw the
25 yarn from the suction tube (13), the catching hook (32) releases yarn and the bobbin in the winding mechanism (8) begins to rotate in direction of winding and begins to consume the yarn reserve in the underpressure yarn reservoir (21), at the same time the traversing mechanism (9) gets moving and in a time sequence to passage of yarn spinning-in end through the yarn presence sensor
30 (15) the feeding device (2) gets moving, into the spinning nozzle (1) pressure air is brought like at spinning and the drafting device (3) of fibre material gets moving, through which into the spinning nozzle (1) the fibre material for yarn spinning begins to be transported, which in the spinning nozzle (1) spins in onto

the yarn spinning-in end drawn from the suction tube (13), further on normal spinning by the spinning nozzle (1) is performed from fibre material delivered into the nozzle (1) by the drafting device (3) and feeding device (2), while the yarn reserve in the underpressure yarn reservoir (21) is consumed gradually by winding on bobbin in the winding mechanism (8) in operating unit and the participating elements on the attending device return into their initial positions.

5. The method of manipulation with yarn by means of the attending device in operating unit of the jet spinning machine, at which the attending device stops at the operating unit and by its working means in a time sequence and in cooperation with means of operating unit performs the attending operation, while all participating elements of operating unit as well as of attending device are in their initial positions, there continues spinning and winding of the spun yarn on bobbin in the winding mechanism of operating unit, **characterised in that** to yarn on operating unit under the traversing mechanism (9) the multifunction nozzle (26) approaches connected to the source of underpressure and with the covered section of the width of its suction opening (27), the underpressure compensator (20) transfers forwards and retains the yarn in the yarn presence sensor (7), by the multifunction nozzle (26) the yarn is sucked in, which in place between the multifunction nozzle (26) and the bobbin is interrupted, the spun-in yarn is continuously sucked out into the multifunction nozzle (26) and the interrupted end is wound on the bobbin, which stops by lifting above the driving roller (10) and is replaced by an empty tube (11), then after inserting the empty tube (11) into the winding mechanism (8) the tube (11) is laid on the driving roller (10) and starts rotating, the multifunction nozzle (26) approaches to the rotating tube (11), sucking off the spun yarn into underpressure compensator (20) for creating the yarn reserve is initiated and the transposer (30) mounted on the multifunction nozzle (26) deflects the spun yarn in sector between the yarn draw-off device (4) and the multifunction nozzle (26) into the track of teeth of the tooth plate (31) of the winding mechanism (8), by which the yarn is caught and interrupted, while the section of yarn leading from the spinning nozzle (1) is wound on the tube (11), and the yarn section sucked in by the multifunction nozzle (26) is sucked off into waste,

the yarn is directed into the traversing mechanism (9) and the yarn reserve in underpressure compensator (20) is consumed, after which the participating elements of attending device return into their initial positions and the continual doffing is finished.

5

6. The method of manipulation with yarn by means of the attending device in operating unit of the jet spinning machine, at which the attending device stops at the operating unit and by its working means in a time sequence and in cooperation with means of operating unit performs the attending operation, while all participating elements of operating unit as well as of attending device are in their initial positions, the end of interrupted yarn is wound on bobbin in the winding device in operating unit of the machine and spinning is stopped, **characterised in that** to bobbin in the winding mechanism (8) of operating unit and rotating counter the direction at the yarn winding the multifunction nozzle (26) approaches, which sucks in the yarn end on bobbin, after which the nozzle (26) distances from the bobbin, the yarn between the bobbin and nozzle (26) is caught by the catching hook (32), which deflects the yarn aside, the introducing head (17) swings upward and transfers above yarn level between the bobbin and nozzle (26), after which the catching hook (32) returns the yarn back into straight path under the introducing head (17), which transfers back down, at the same time it catches the yarn and directs it down, after which the swing arm (36) swings on the introducing head (17) and directs the yarn into not represented clamp on the introducing head (17), the underpressure compensator (20) shifts forwards in direction to operating unit and directs the yarn into the yarn presence sensor (7), the yarn in the sector between the clamp on the introducing head (17) and the multifunction nozzle (26) is interrupted by the yarn breaker (19), by which the yarn spinning-in end is created held on the introducing head (17) and the separated yarn end being sucked in by the multifunction nozzle (26) is sucked off into waste, the introducing head (17) transfers above the outlet opening of the spinning nozzle (1), it directs yarn in between the distanced rollers of the draw-off device (4) of spun yarn and the underpressure compensator (20) starts to suck in the yarn for creation of yarn reserve in underpressure compensator (20), the catching hook

(32) by its motion directs the yarn in the sector between itself and the yarn presence sensor (7) between mutually distanced auxiliary draw-off rollers (38), the auxiliary draw-off rollers (38) draw near one to another and begin to rotate in direction of yarn unwinding from the bobbin, into air nozzle on the introducing head (17) and into the spinning nozzle (1) the pressure air is introduced and the yarn end is introduced into the spinning nozzle (1), through which the yarn passes to the mouth of suction tube (13) connected to the source of underpressure, into which the yarn end is sucked as far as behind the yarn presence sensor (15) and the means (16) for yarn end preparation, by which the yarn reserve in underpressure compensator (20) is consumed and underpressure compensator (20) transfers back into its initial position, at the same time the yarn remains in sensors (6, 7), to the yarn in the sector between the sensors (6, 7) and the yarn draw-off device (4) from lateral side approaches the underpressure yarn reservoir (21) connected to the source of underpressure, and the brake (14) on mouth of the suction tube (13) grasps the yarn and at ongoing yarn unwinding from bobbin, the yarn begins to be sucked in into the underpressure yarn reservoir (21), where it is deposited into the new yarn reserve and simultaneously the yarn is laterally pulled out from space between the rollers of the yarn draw-off device (4), while after the yarn grasping by the brake (14) by the means (16) for the yarn end preparation the yarn in suction tube (13) is interrupted, by which the yarn spinning-in end is formed and the yarn cut off end by the suction tube (13) is sucked off into the waste, after which the backward yarn unwinding from bobbin in the winding mechanism (8) of operating unit is stopped, the lifted off draw-off roller of the yarn draw-off device (4) draws near to the second roller of the yarn draw-off device (4) and the yarn draw-off device (4), without yarn between the rollers, begins to rotate in direction of the spun yarn drawing-off from the spinning nozzle (1), the catching hook (32) releases the yarn and the yarn winding mechanism (8) begins to rotate the bobbin in direction of yarn winding, which itself transfers to the track of traversing mechanism (9), and starts yarn traversing along the bobbin width, while the yarn reserve in the underpressure yarn reservoir (21) is gradually consumed by winding onto the bobbin at keeping the yarn outside the yarn draw-off device (4), then after the yarn reserve from the underpressure yarn

reservoir (21) is consumed the yarn between sensors (6, 7) straightens and transfers itself laterally between the compressed rollers of the yarn draw-off device (4) and yarn drawing-off from the spinning nozzle (1) is initiated, by which the yarn spinning-in end in the suction tube (13) begins to move in
5 direction to spinning nozzle (1) and in a time sequence to passage of the yarn spinning-in end through the yarn presence sensor (15) the feeding device (2) gets moving, into the spinning nozzle (1) the pressure air is brought like as at spinning and the drafting device (3) of fibre material is activated, through which into the spinning nozzle (1) the fibre material for yarn spinning is delivered,
10 which spins-in onto the yarn spinning-in end, all participating elements in operating unit return to their initial positions and spinning-in after breakage is finished.

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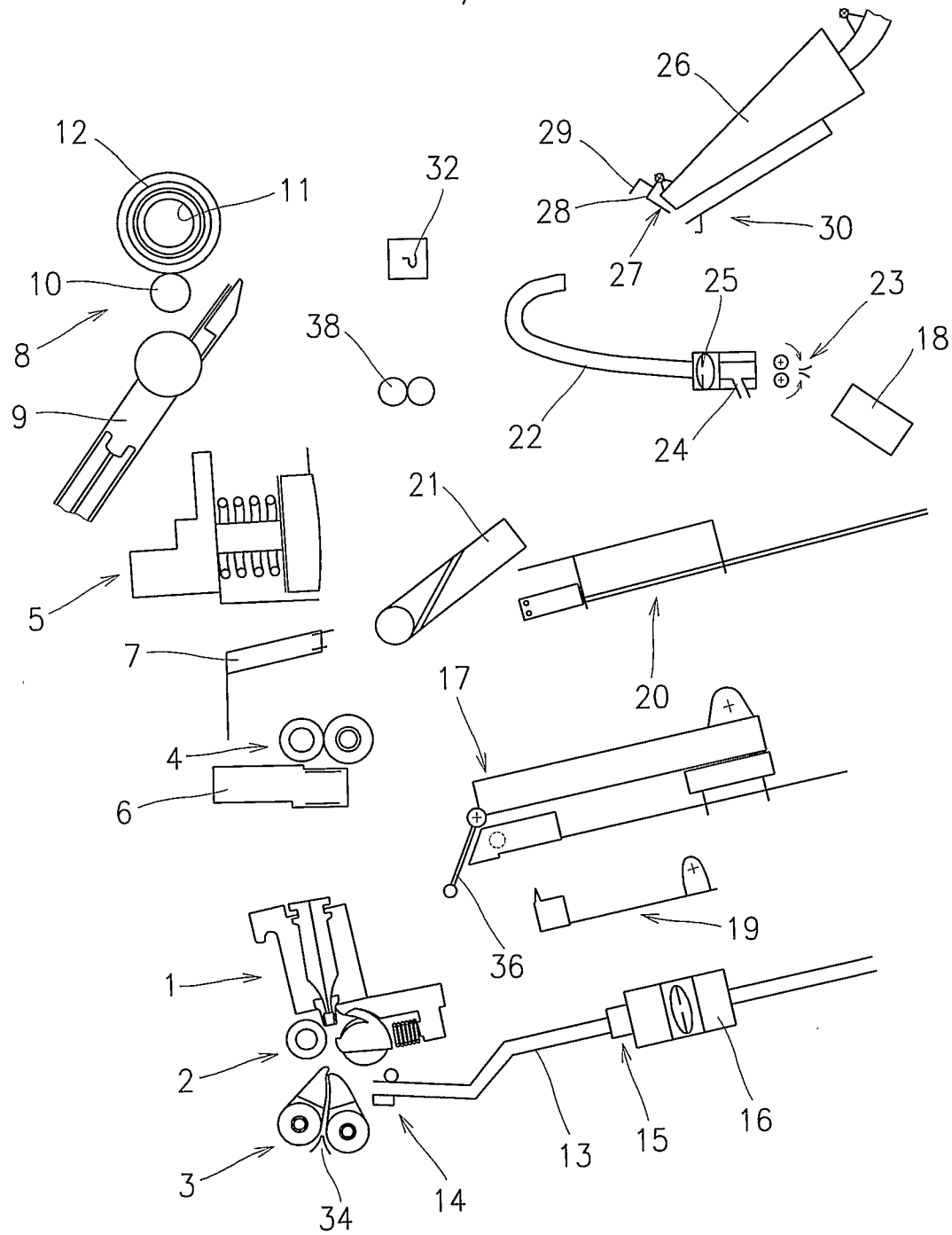


Fig. 00

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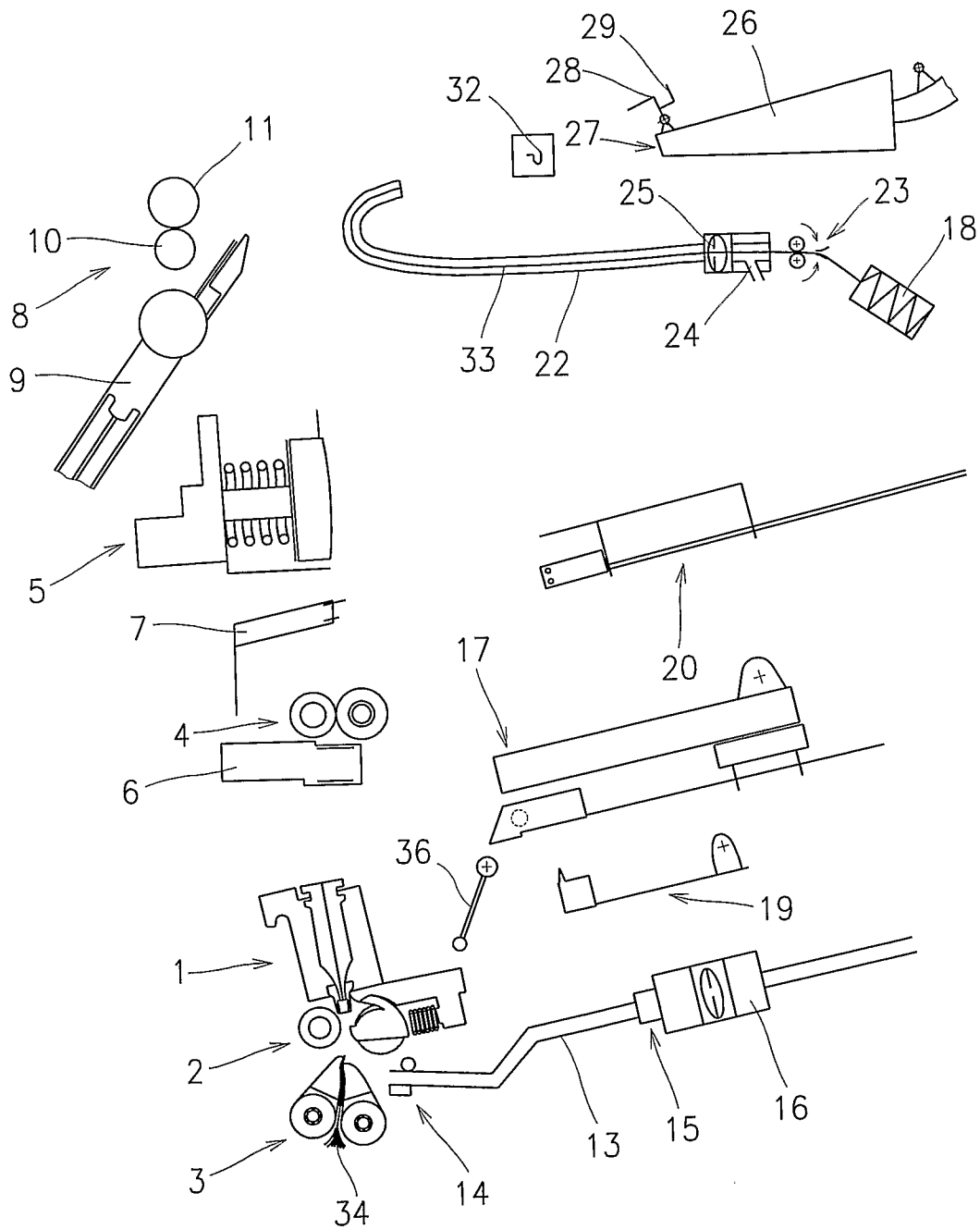


Fig. 0

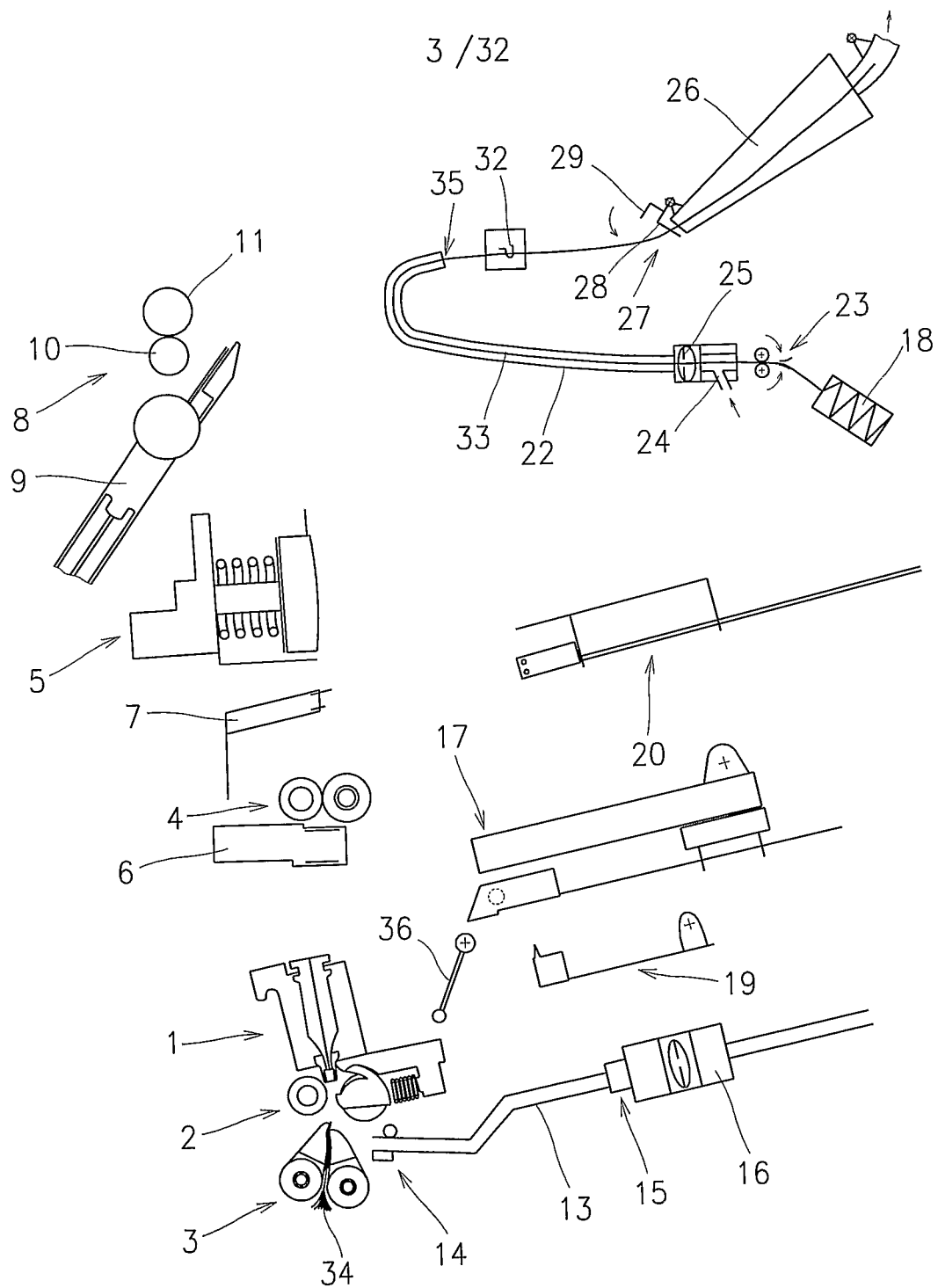


Fig. 1

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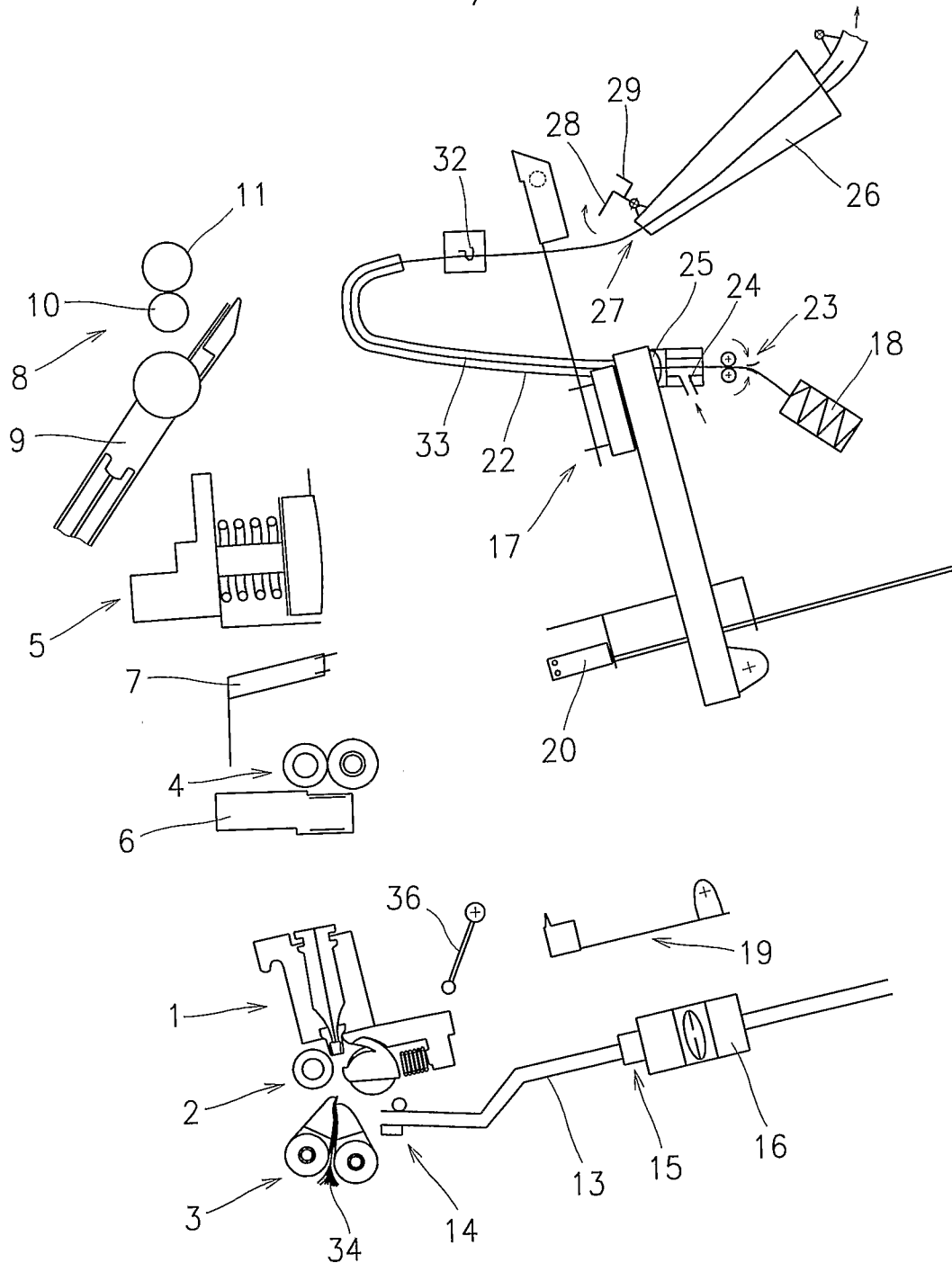


Fig. 2

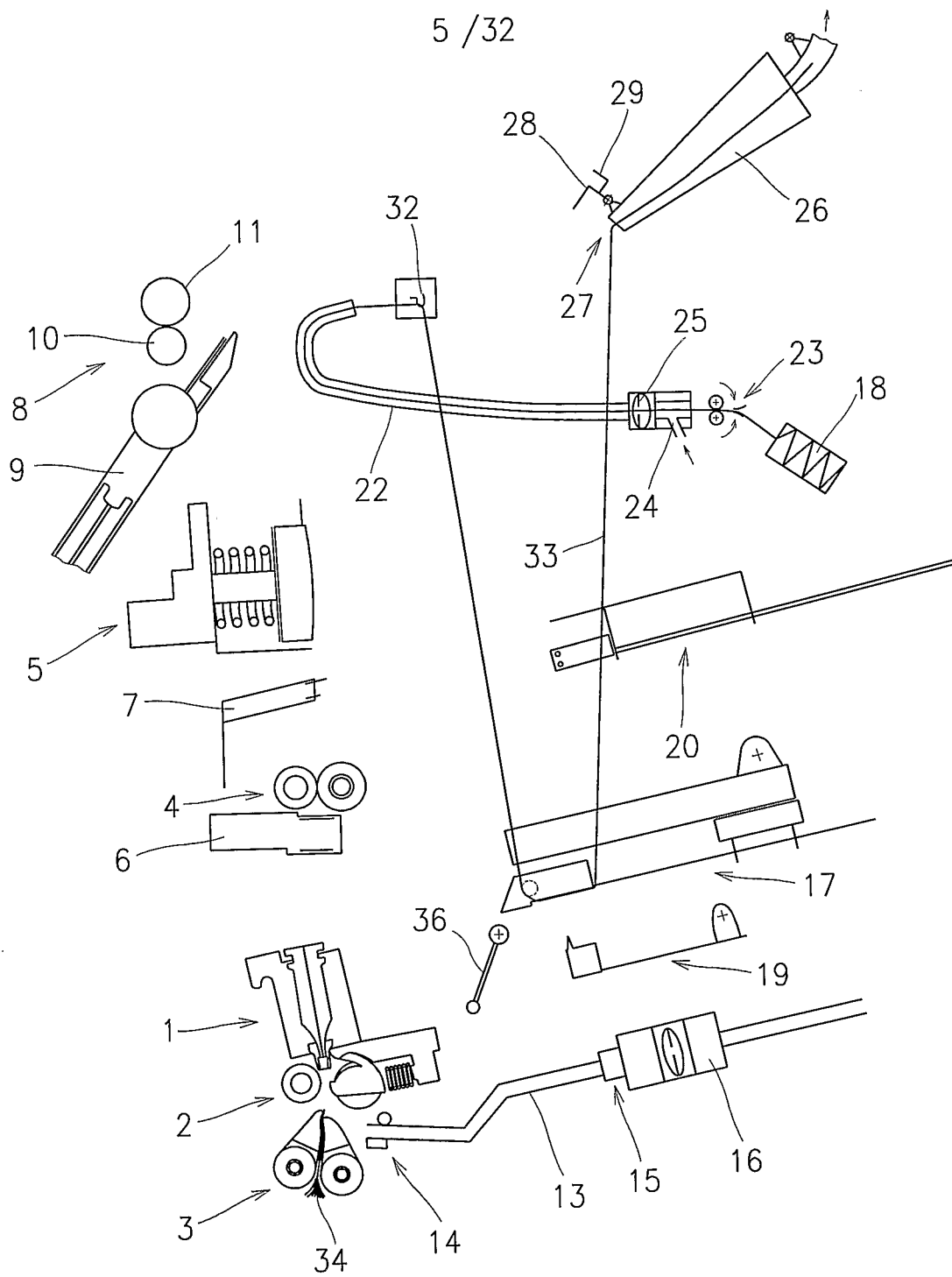


Fig. 3

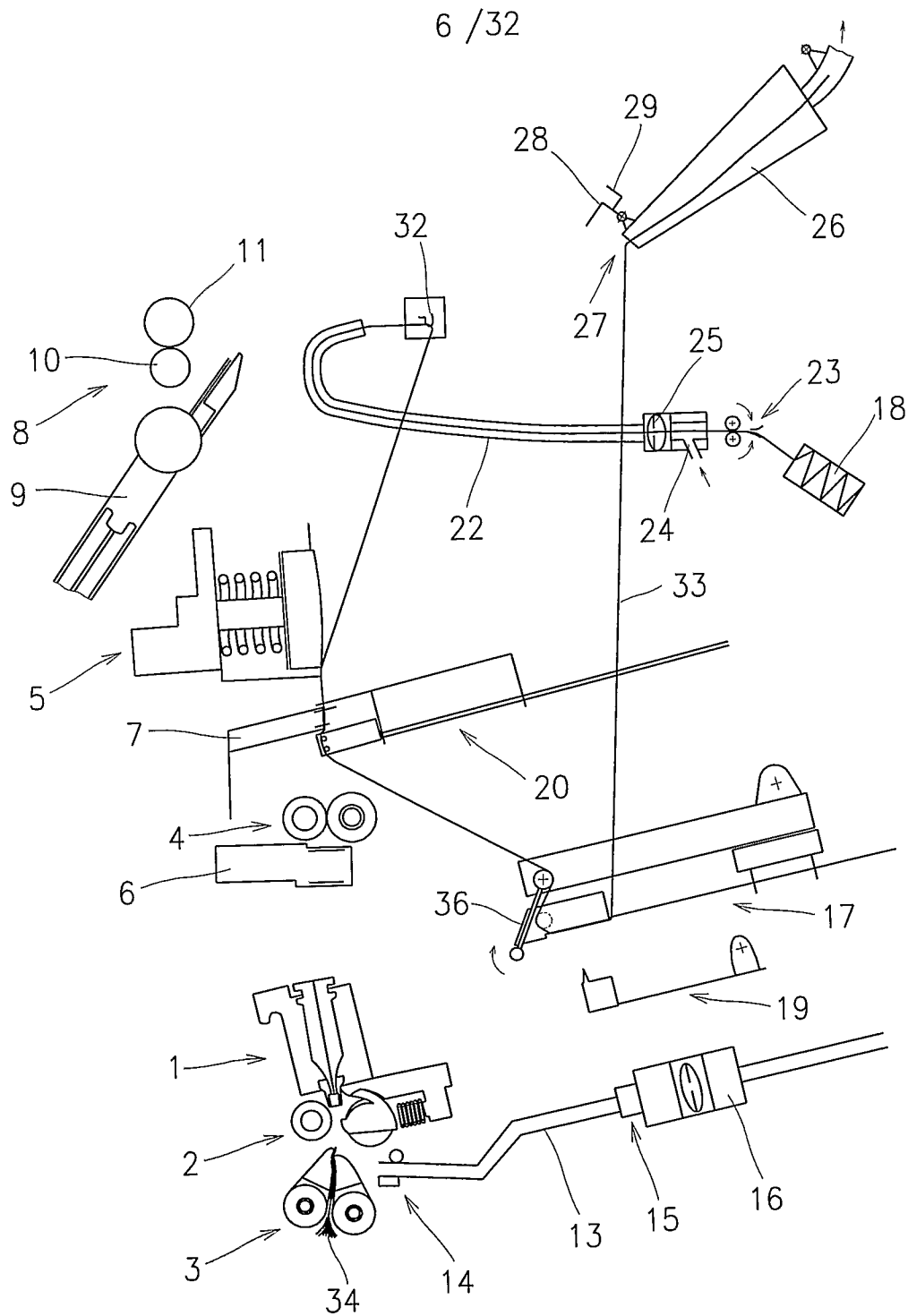


Fig. 4

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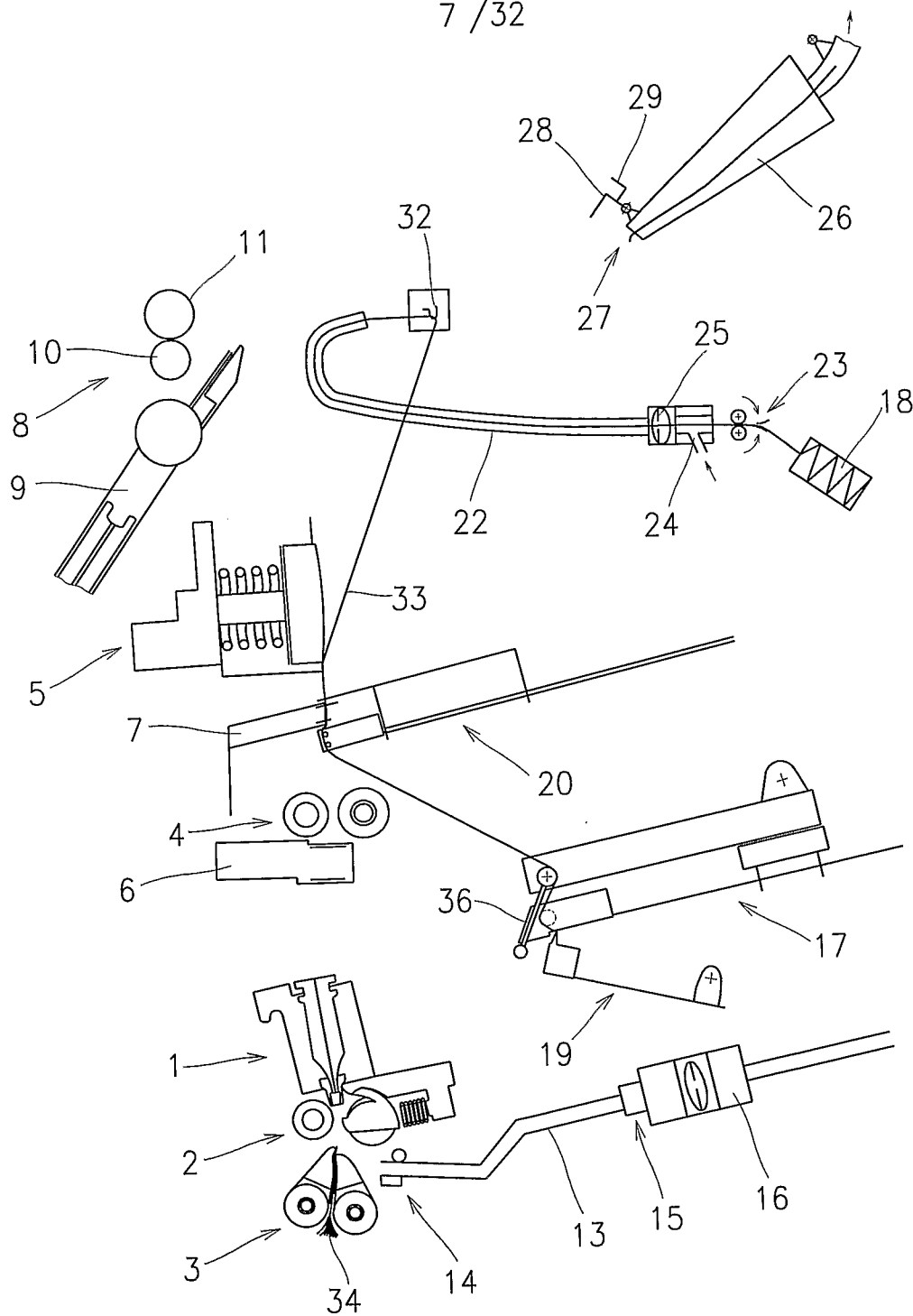


Fig. 5

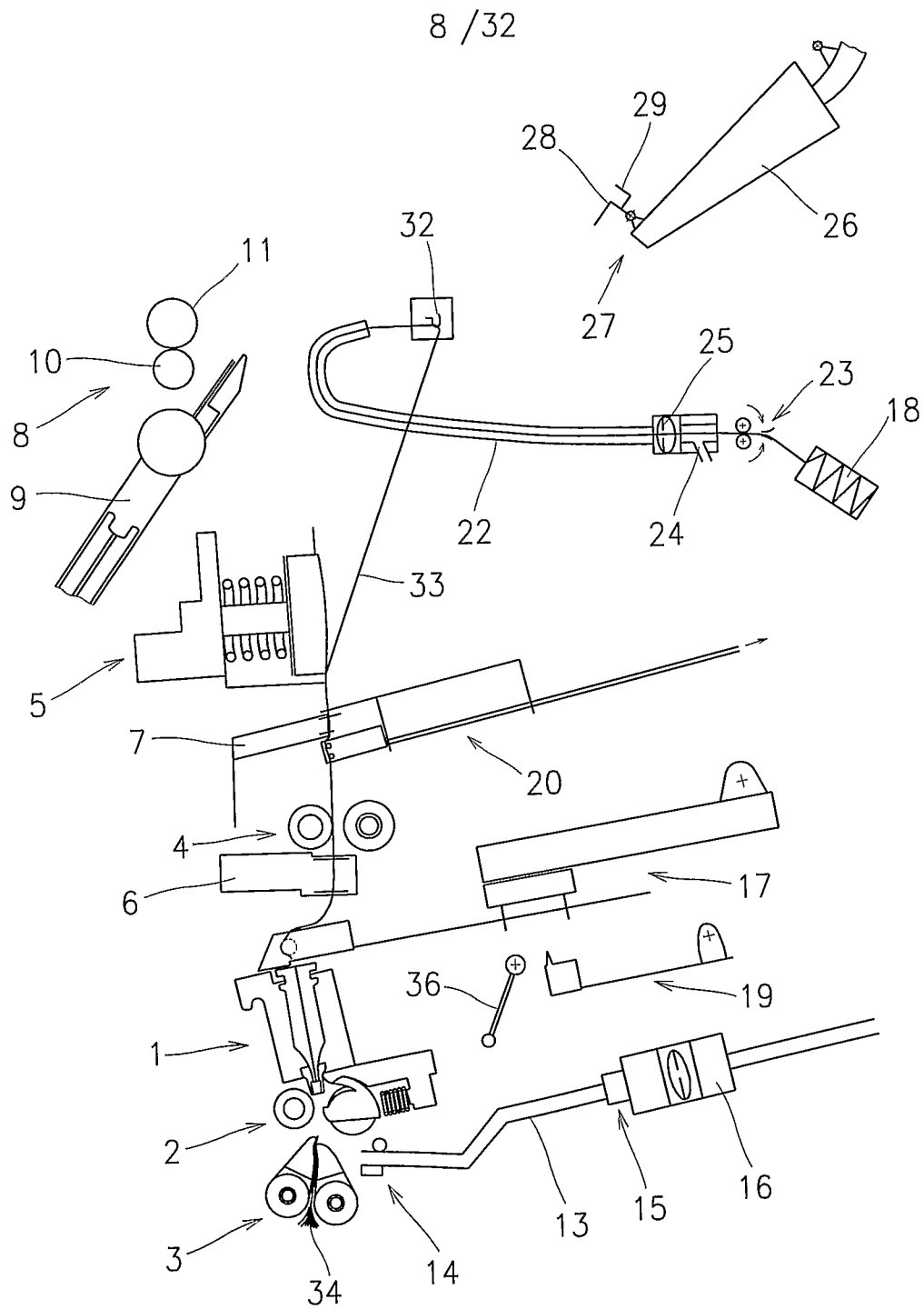


Fig. 6

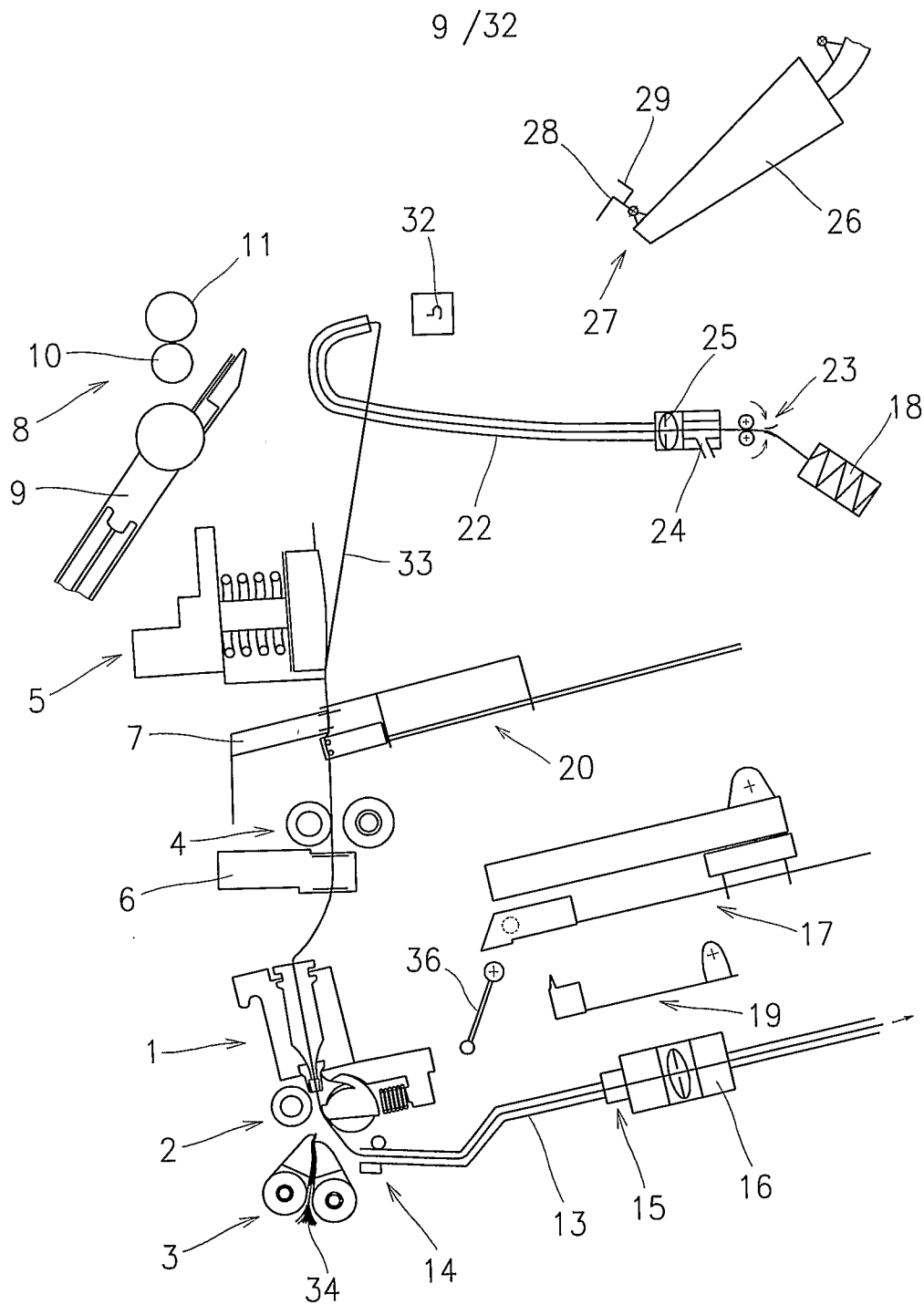


Fig. 7

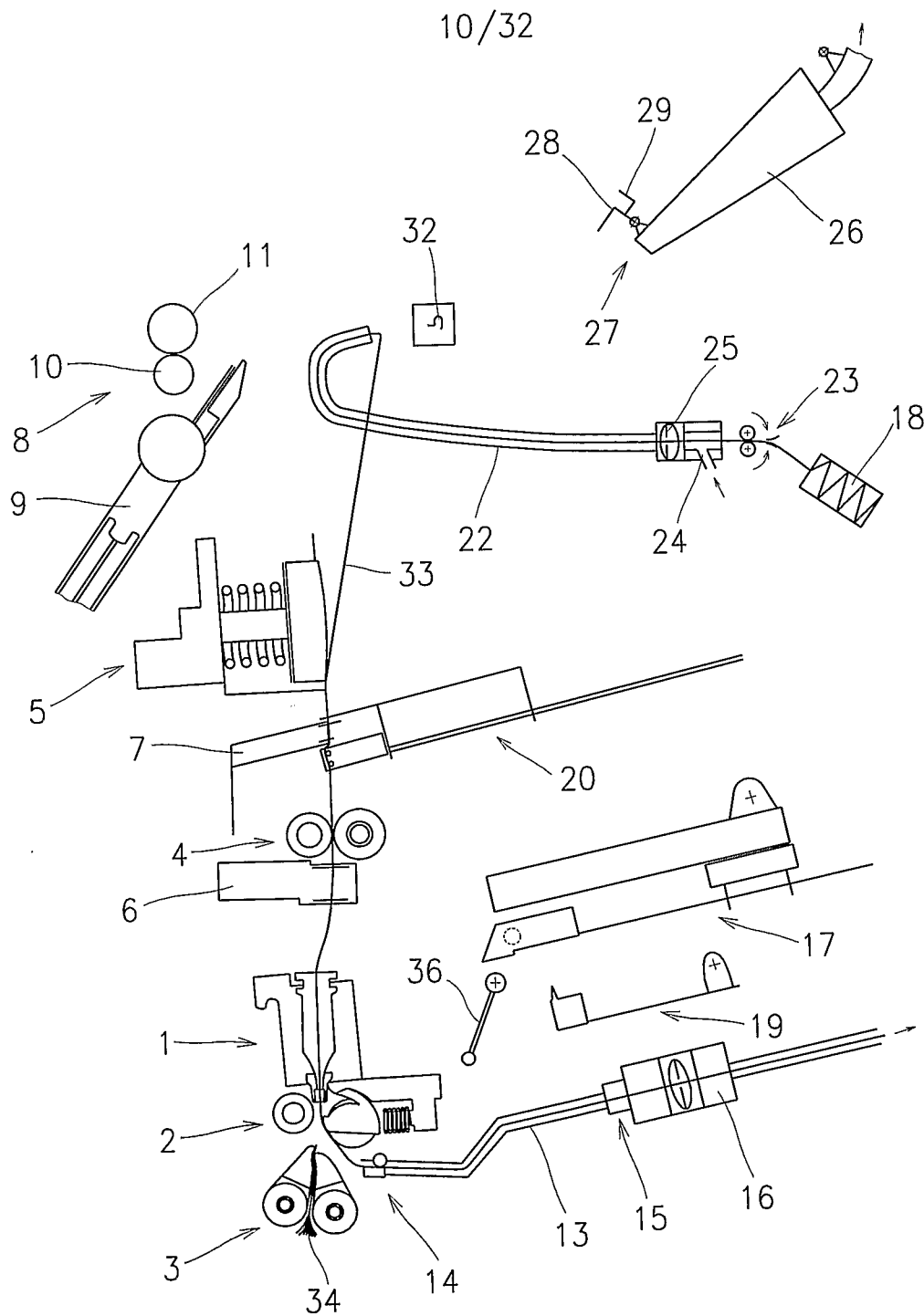


Fig. 8

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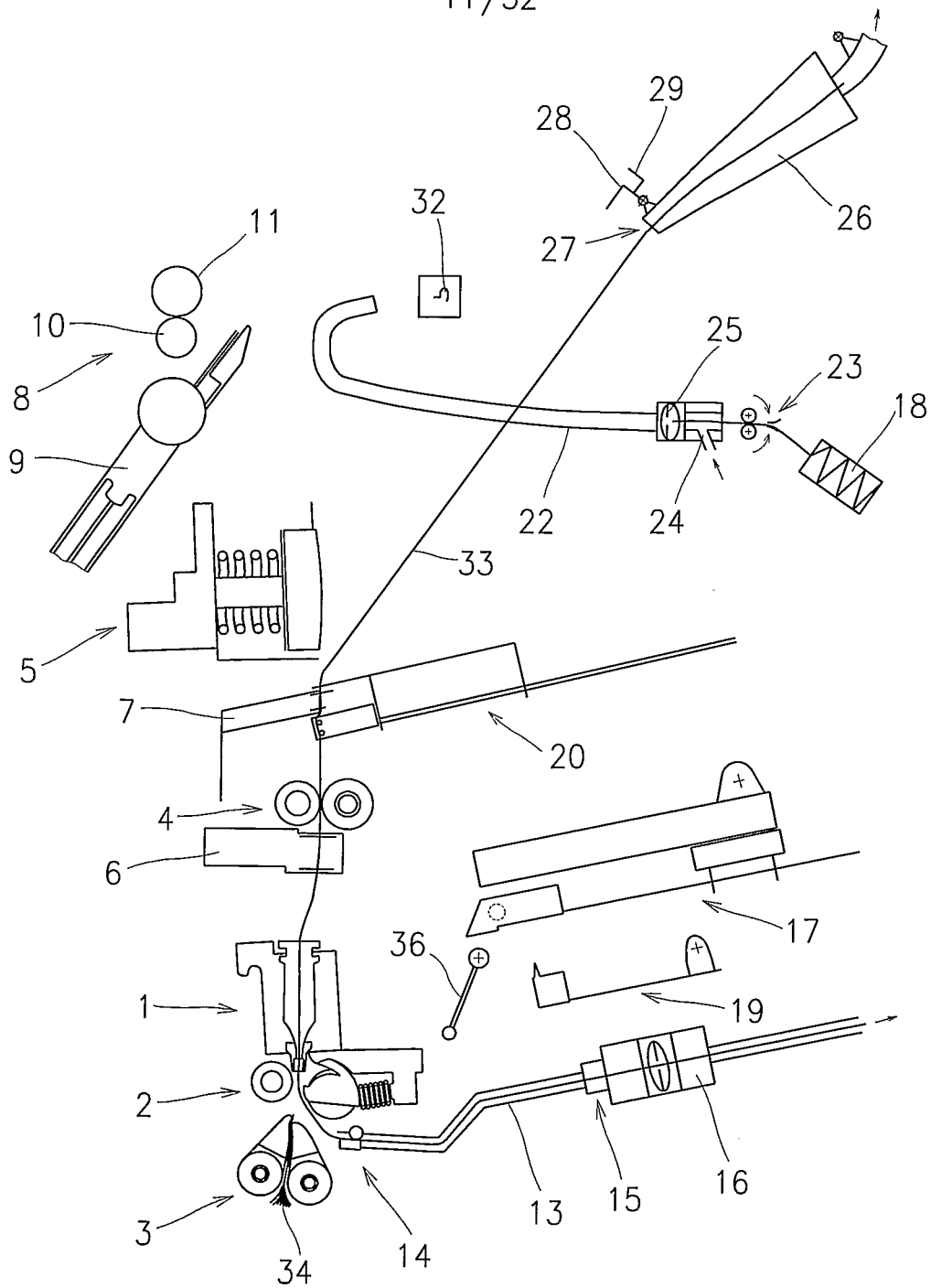


Fig. 9

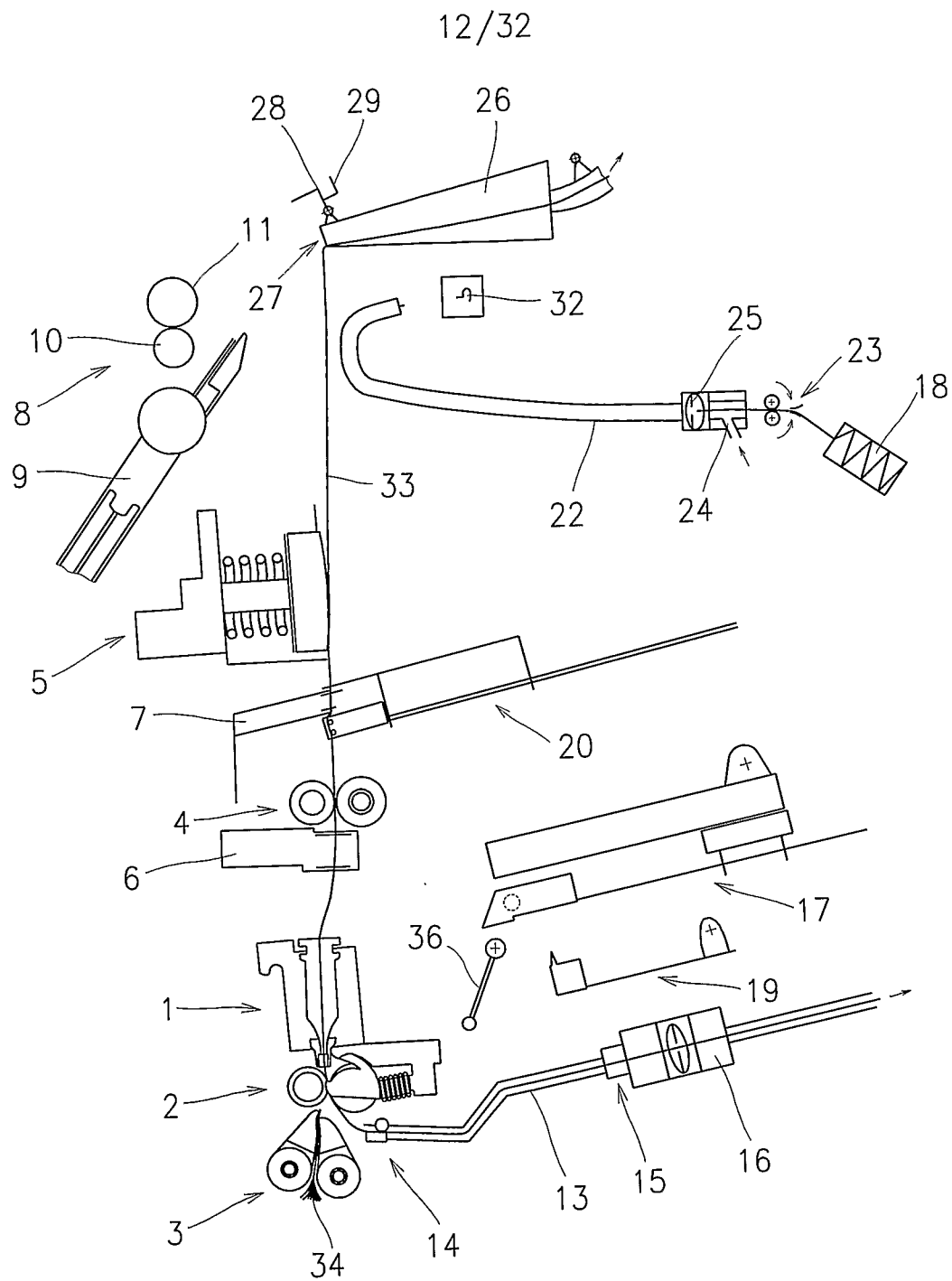


Fig. 10

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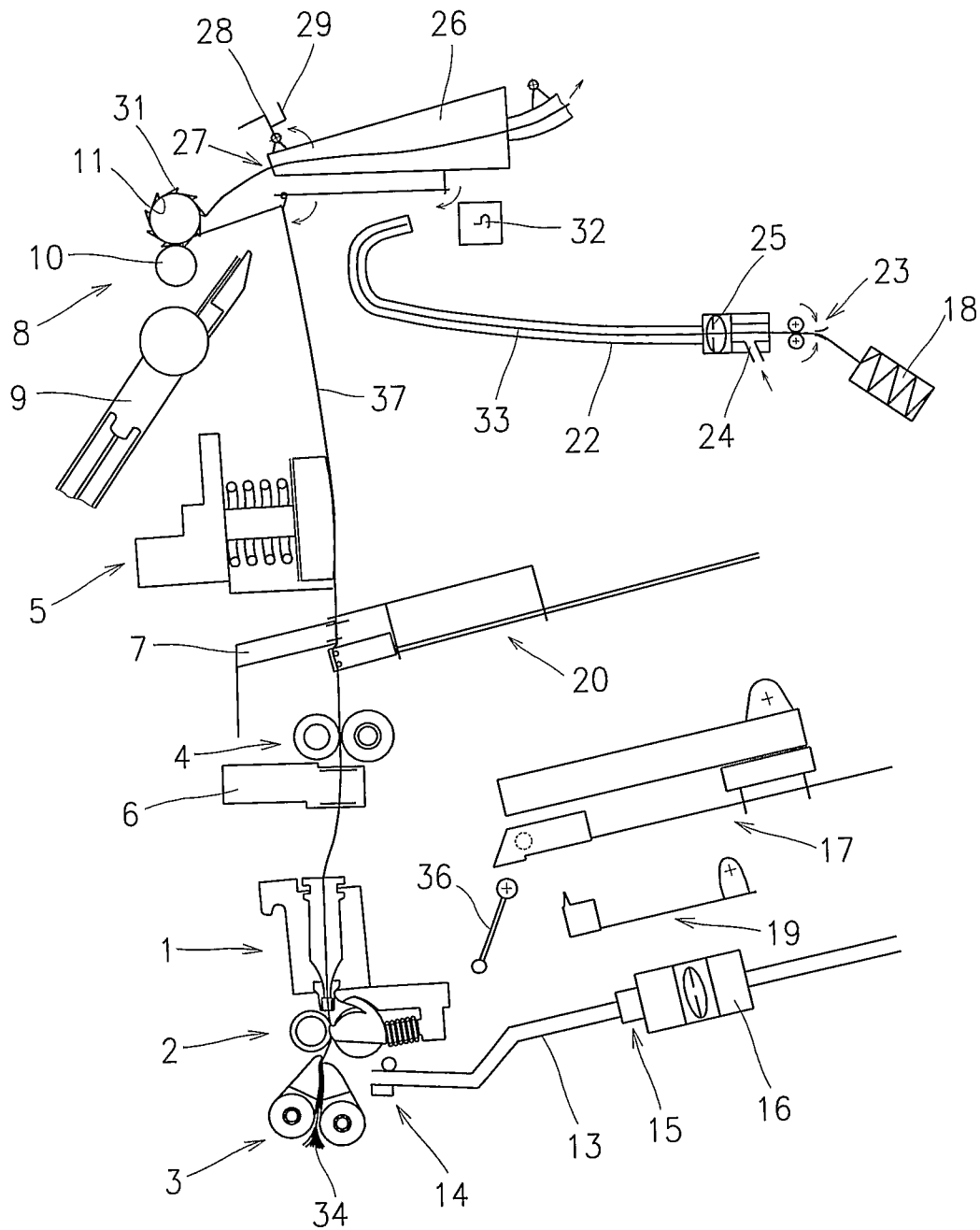


Fig. 11

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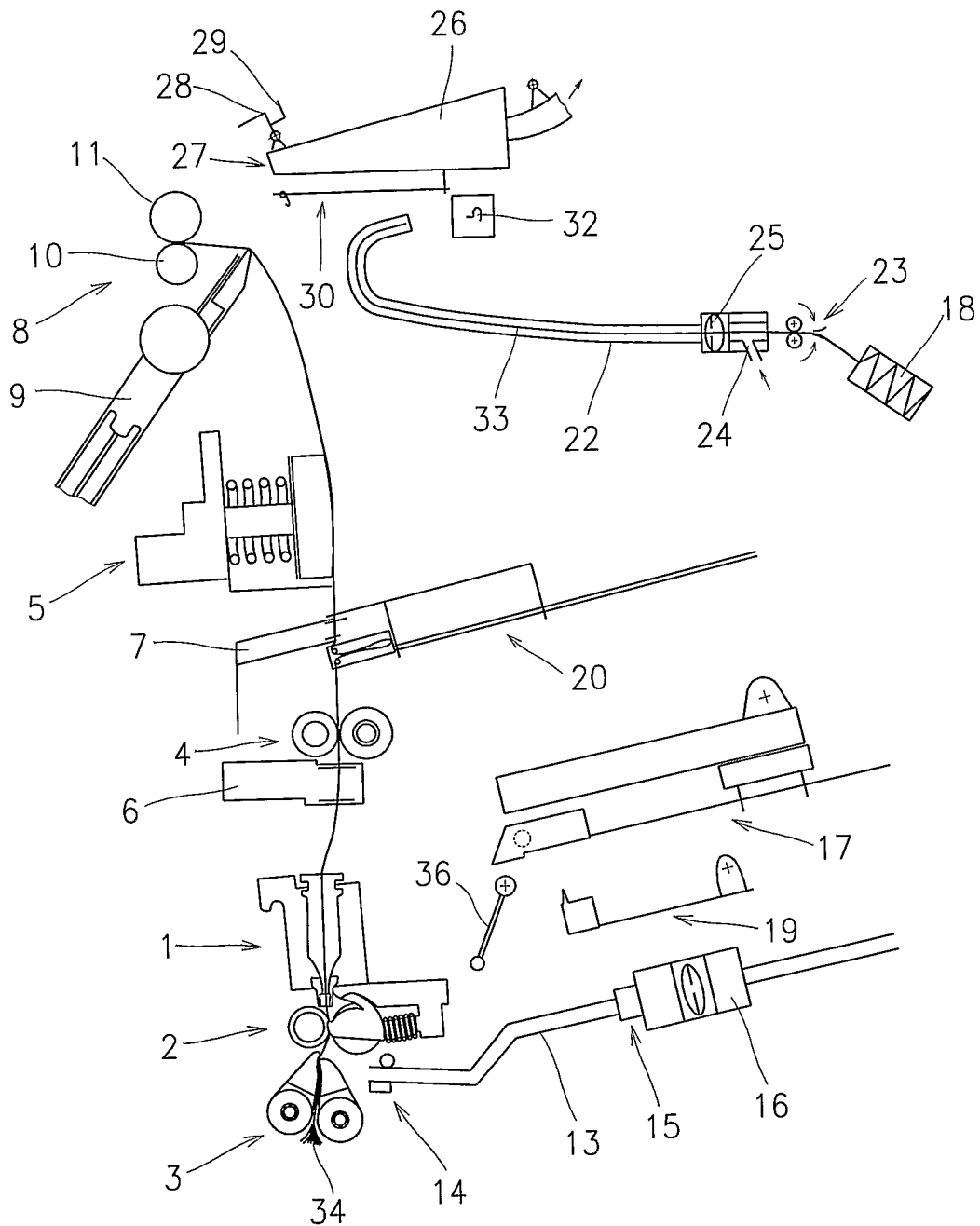


Fig. 12

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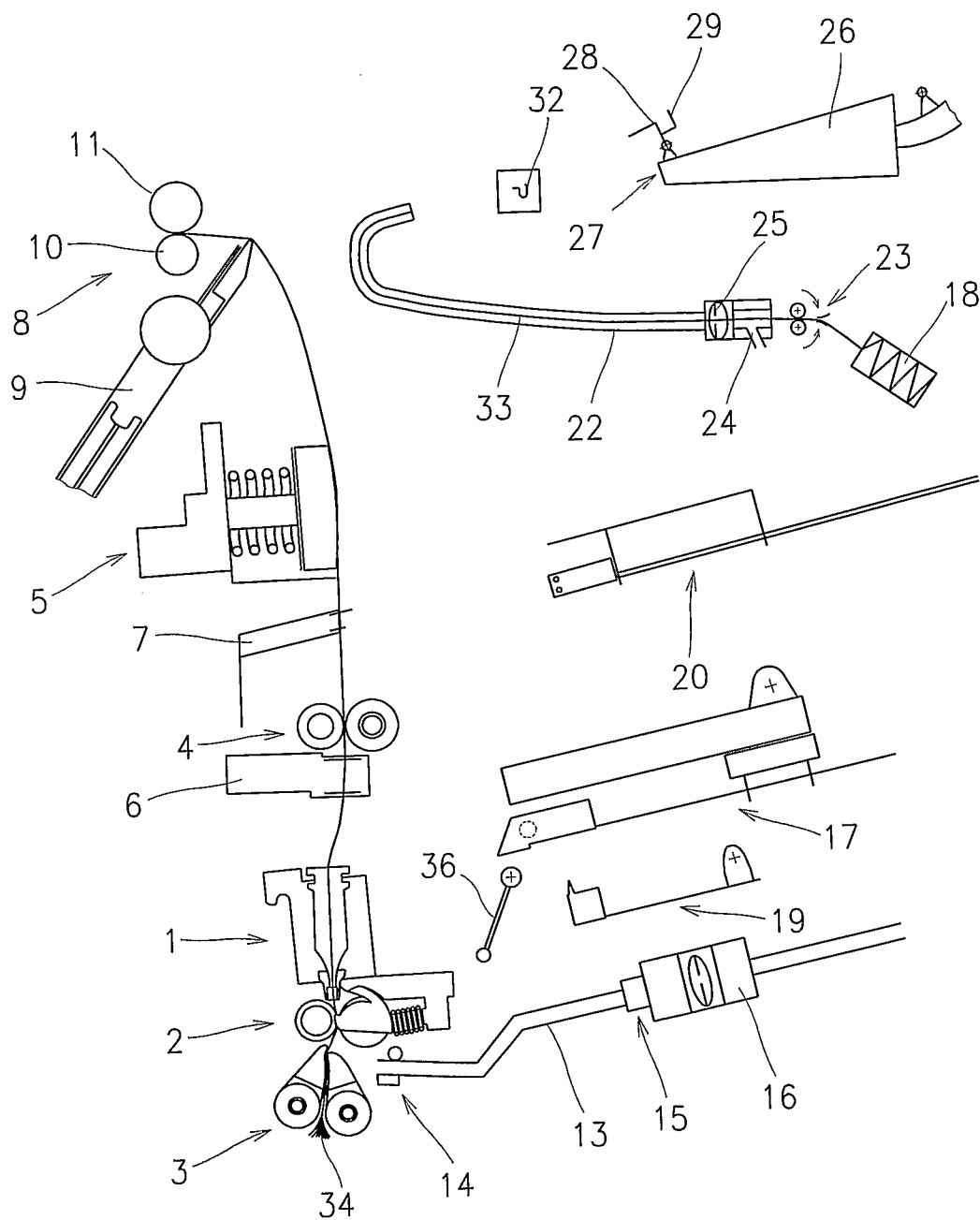


Fig. 13

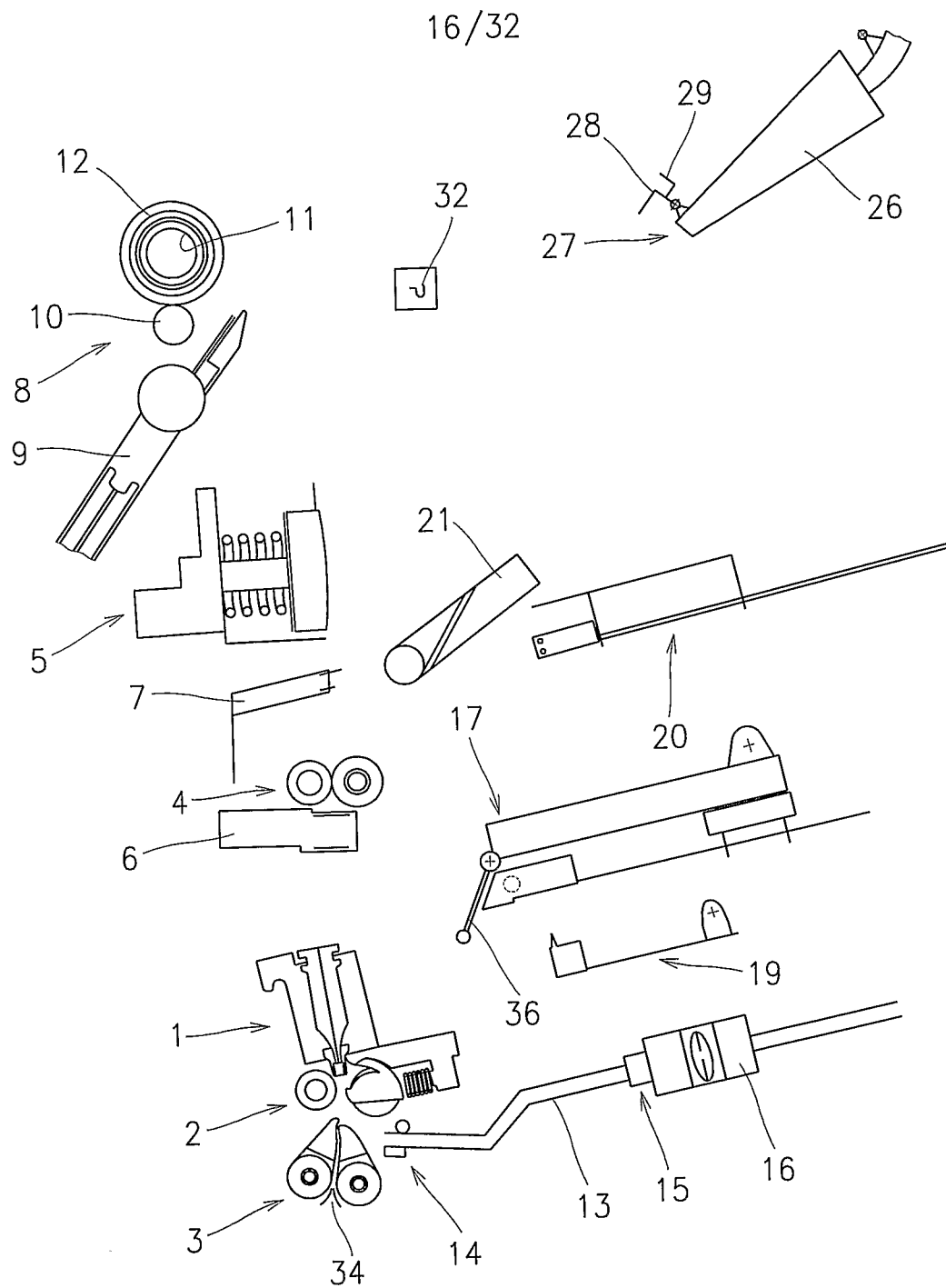


Fig. A0

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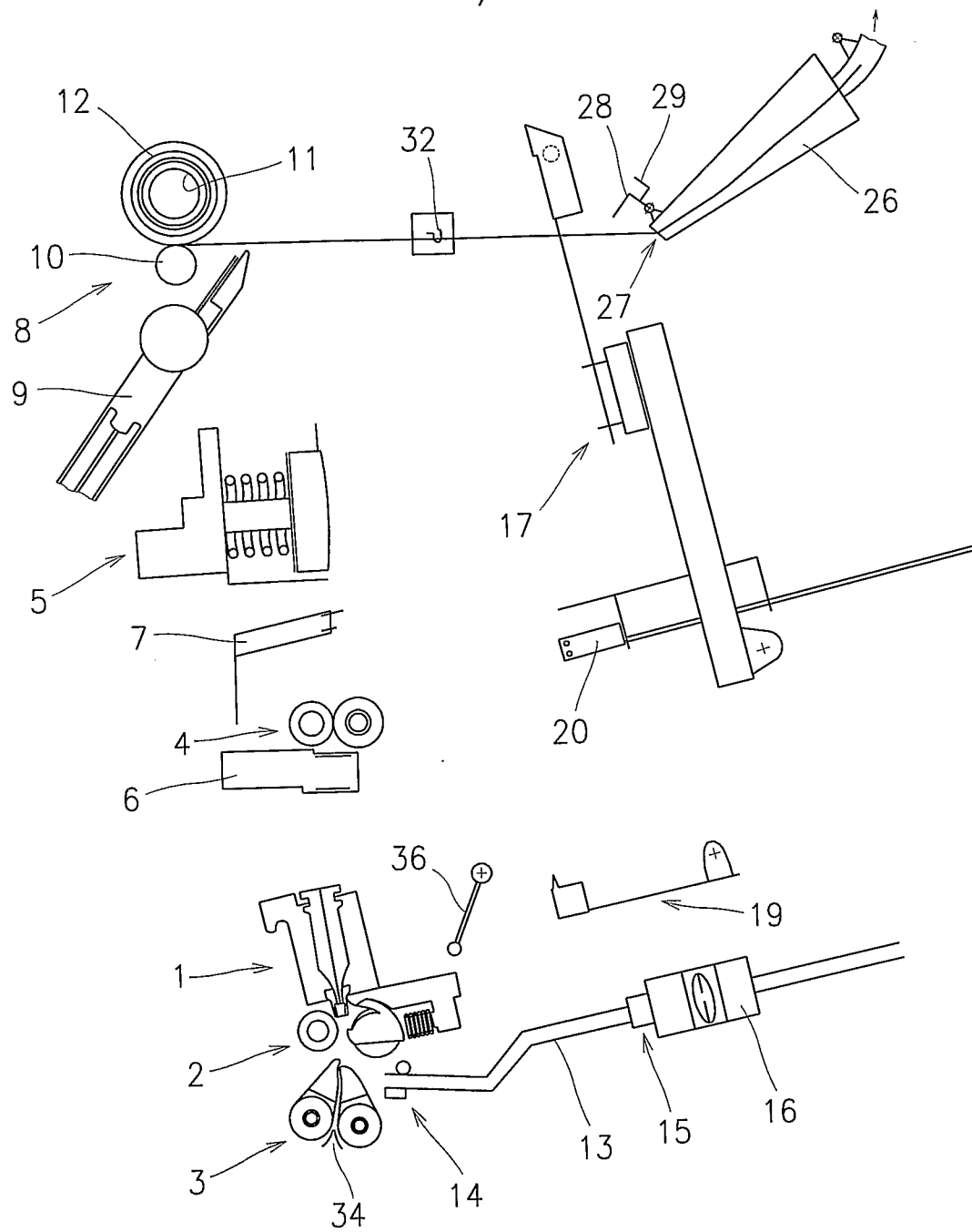


Fig. A1

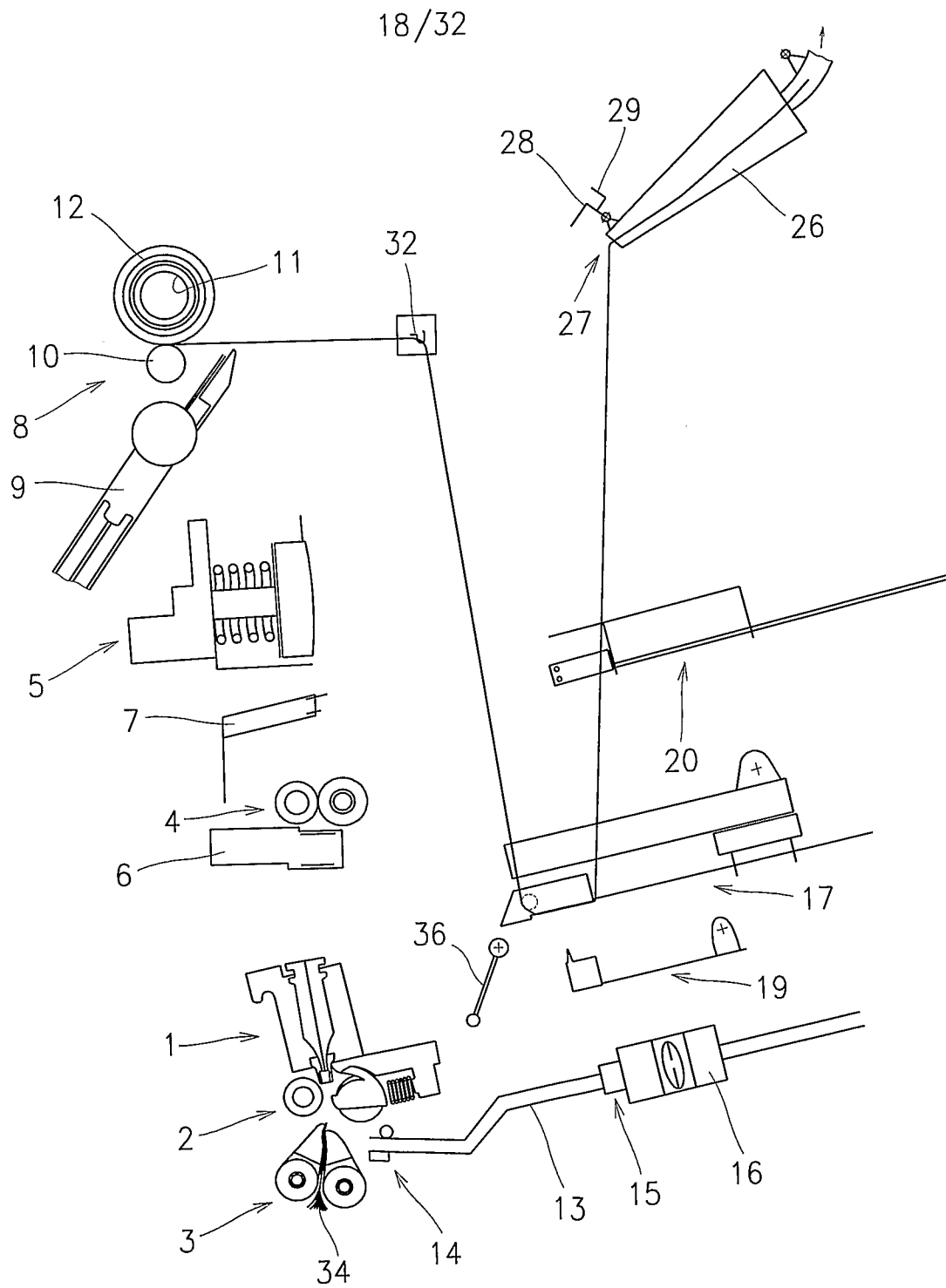


Fig. A2

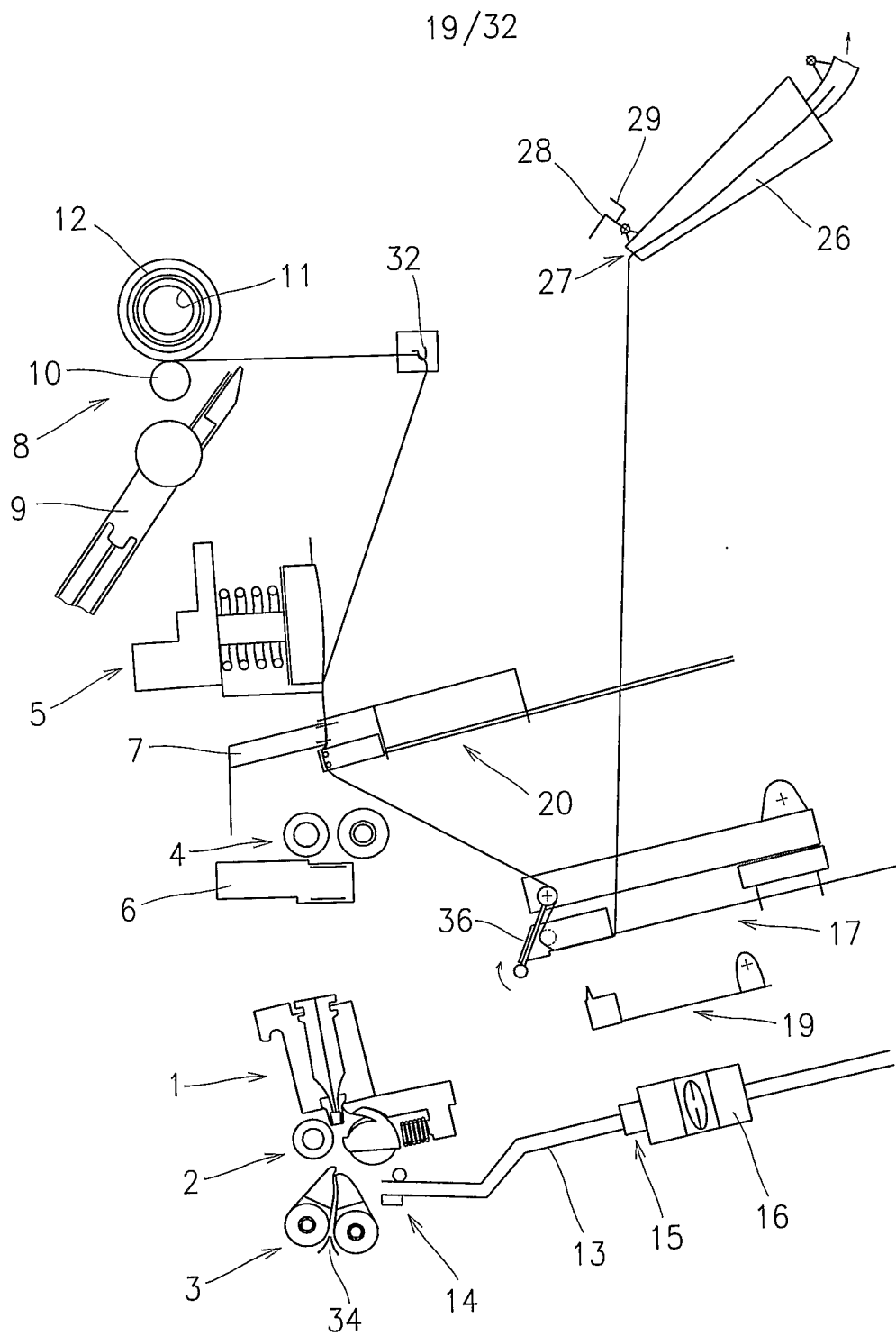


Fig. A3

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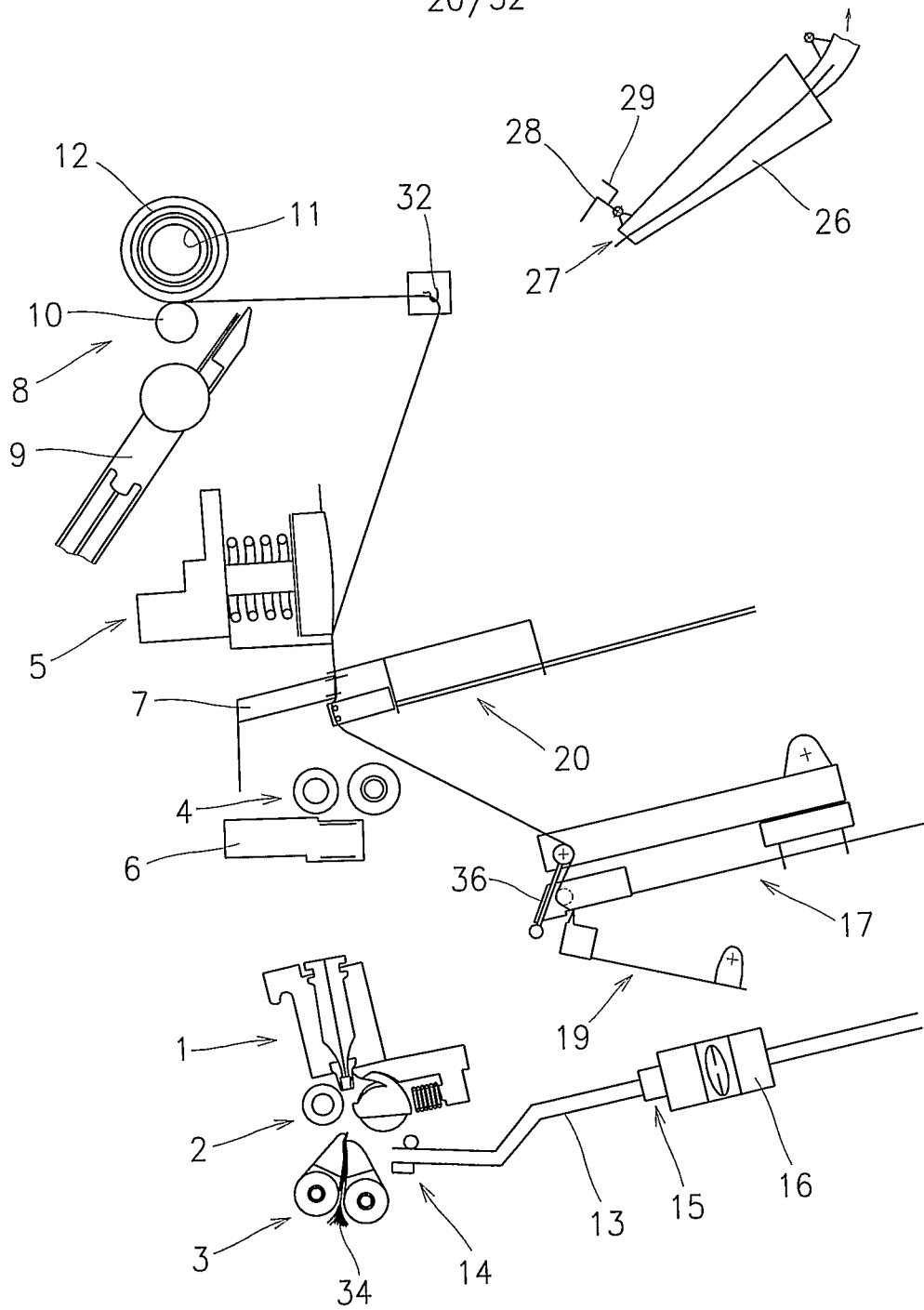


Fig. A4

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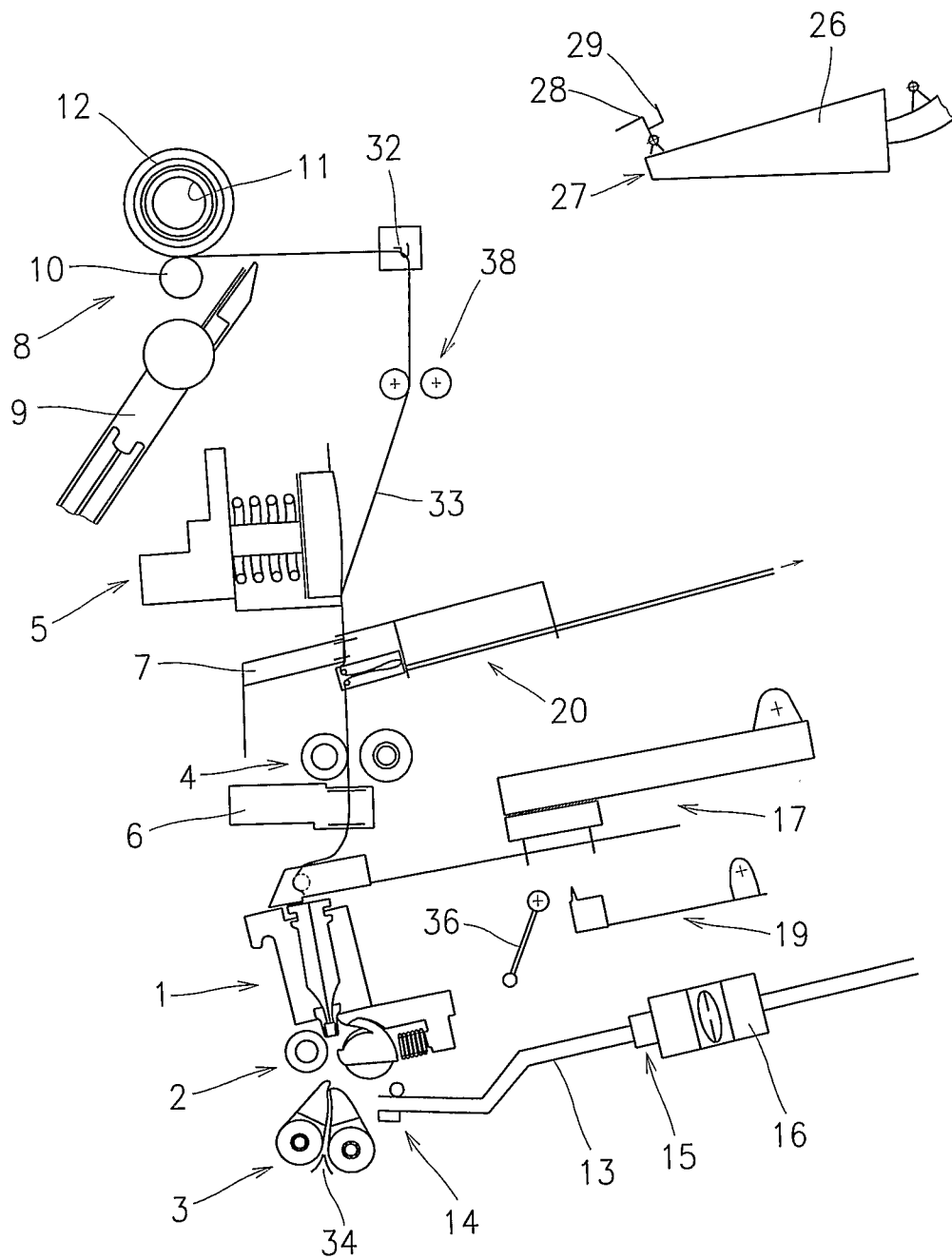


Fig. A5

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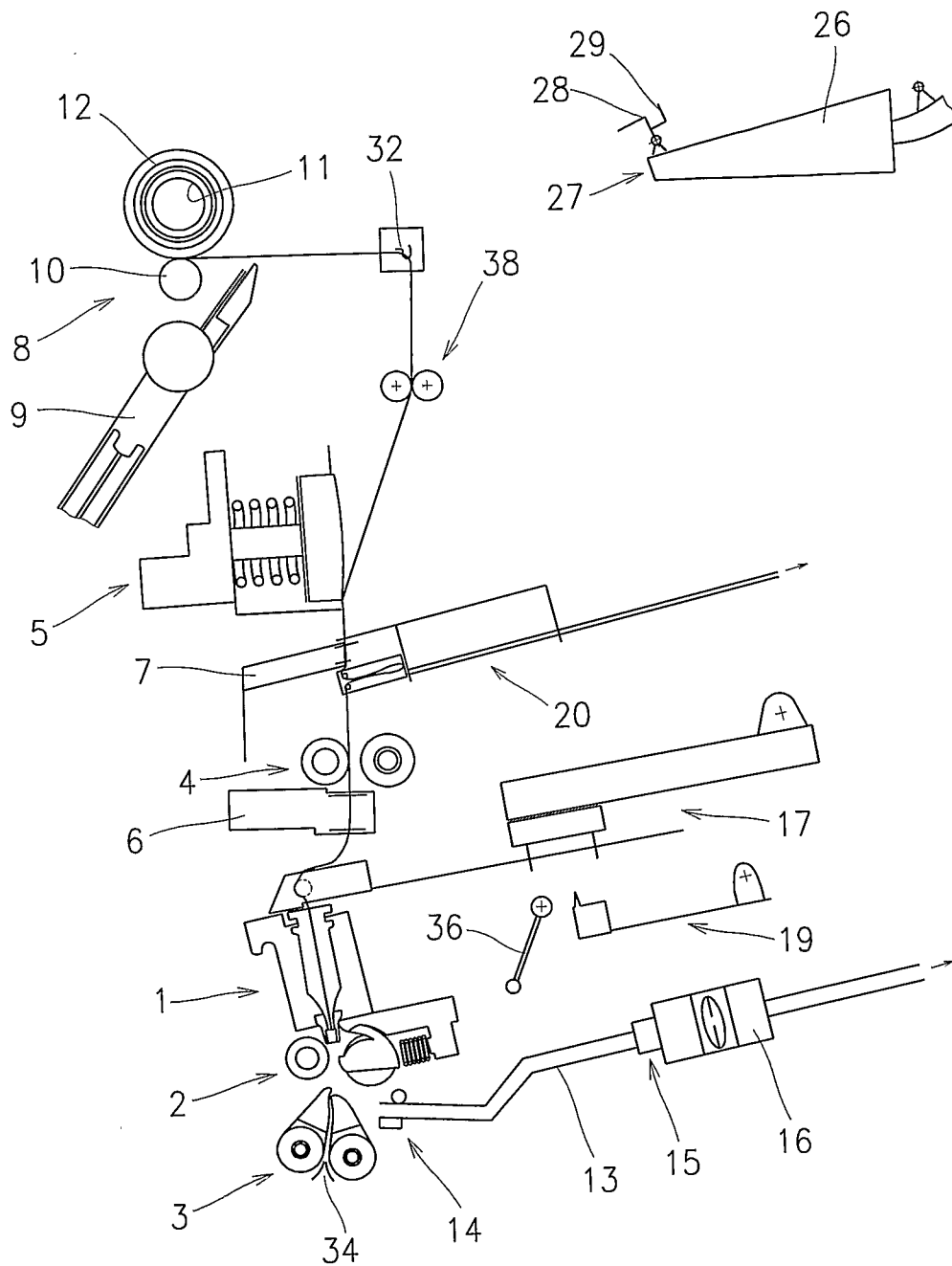


Fig. A6

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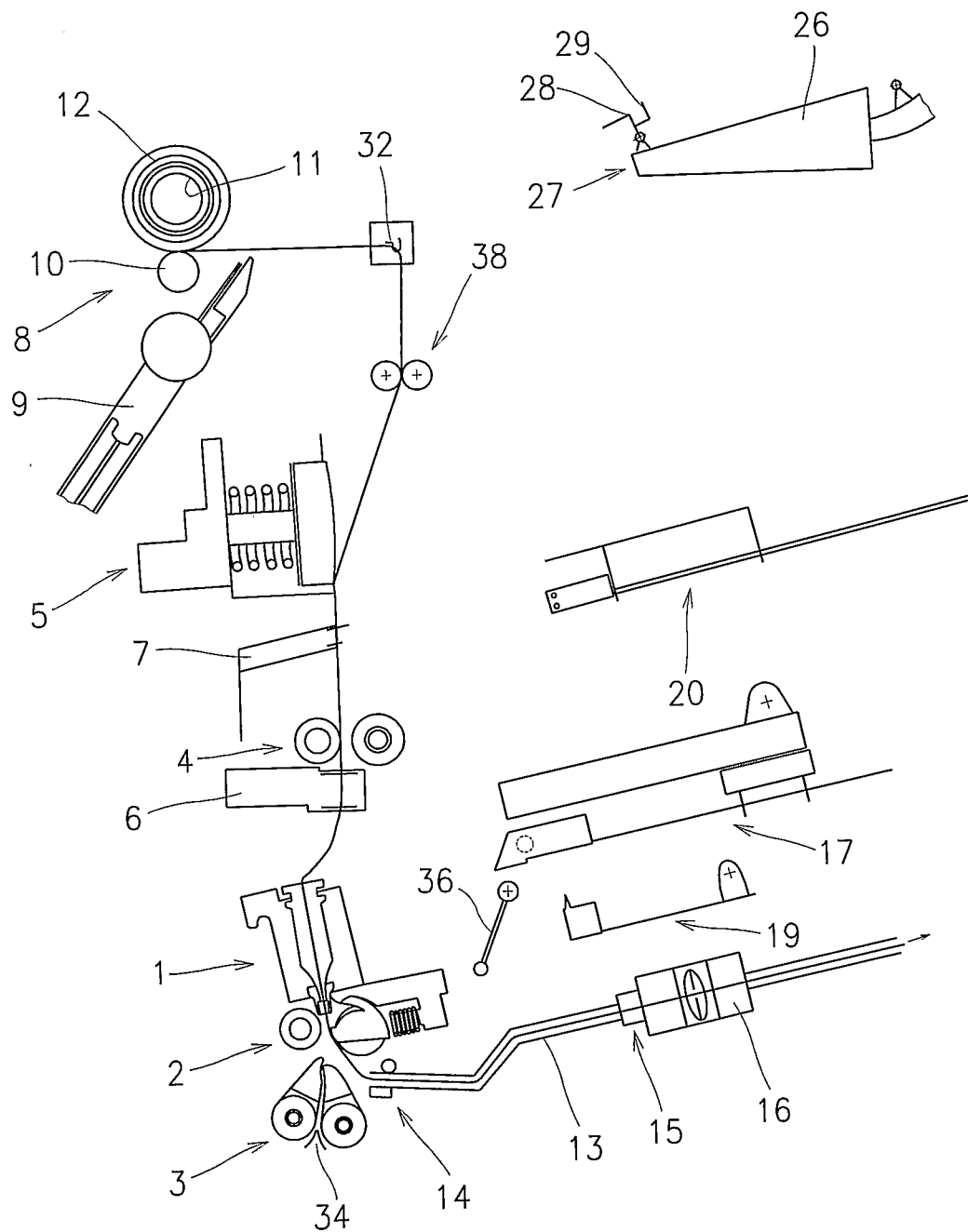


Fig. A7

24/32

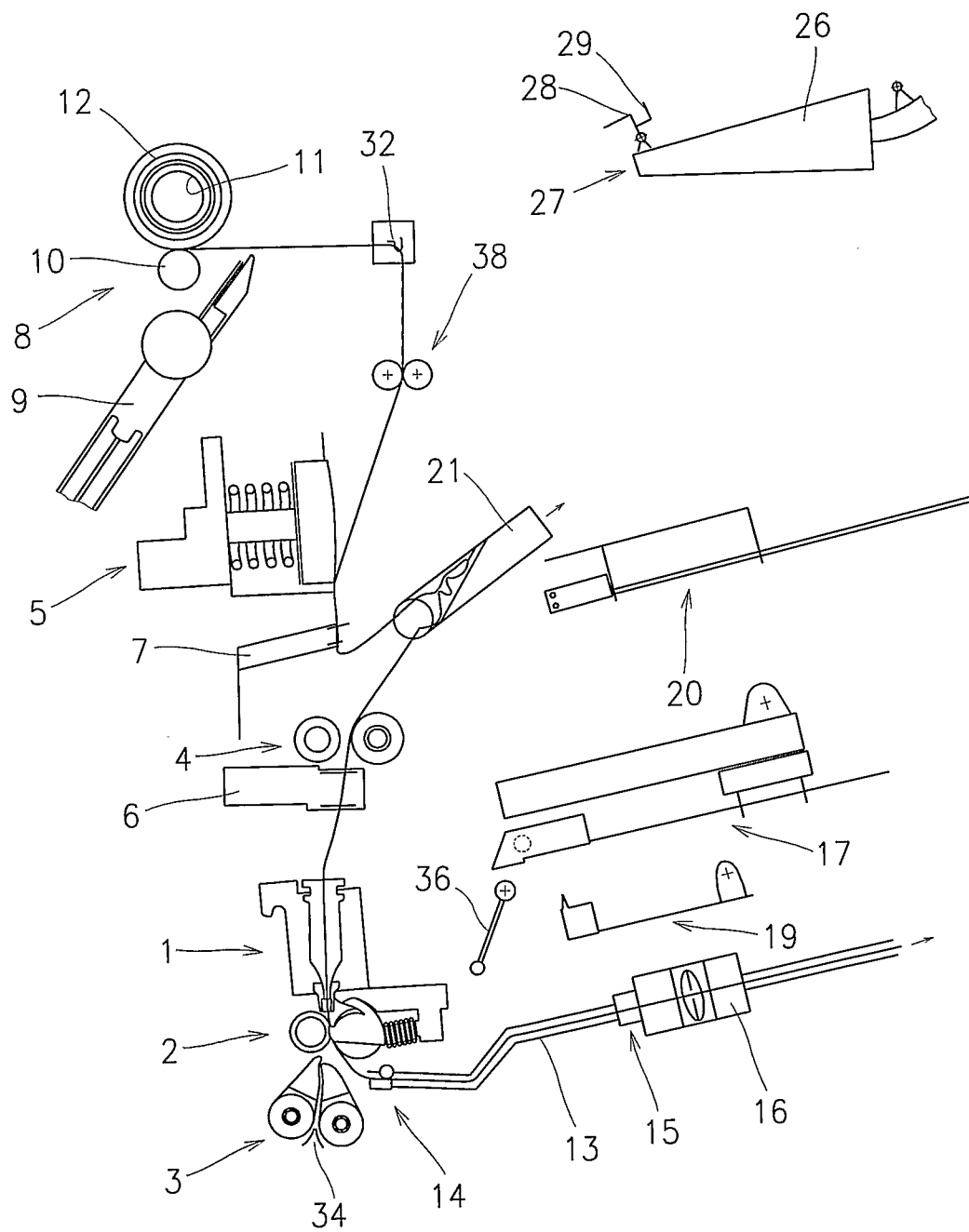


Fig. A8

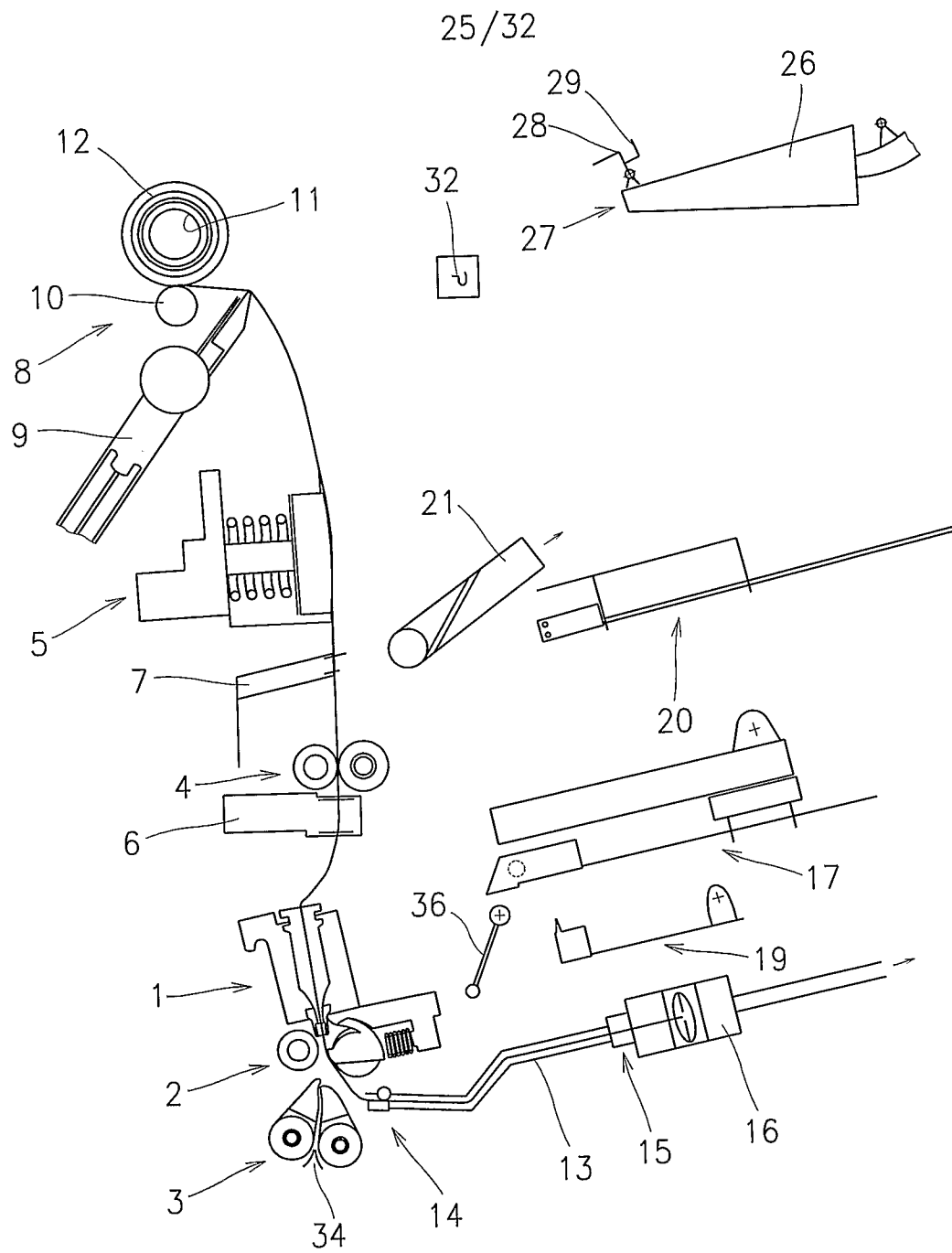


Fig. A9

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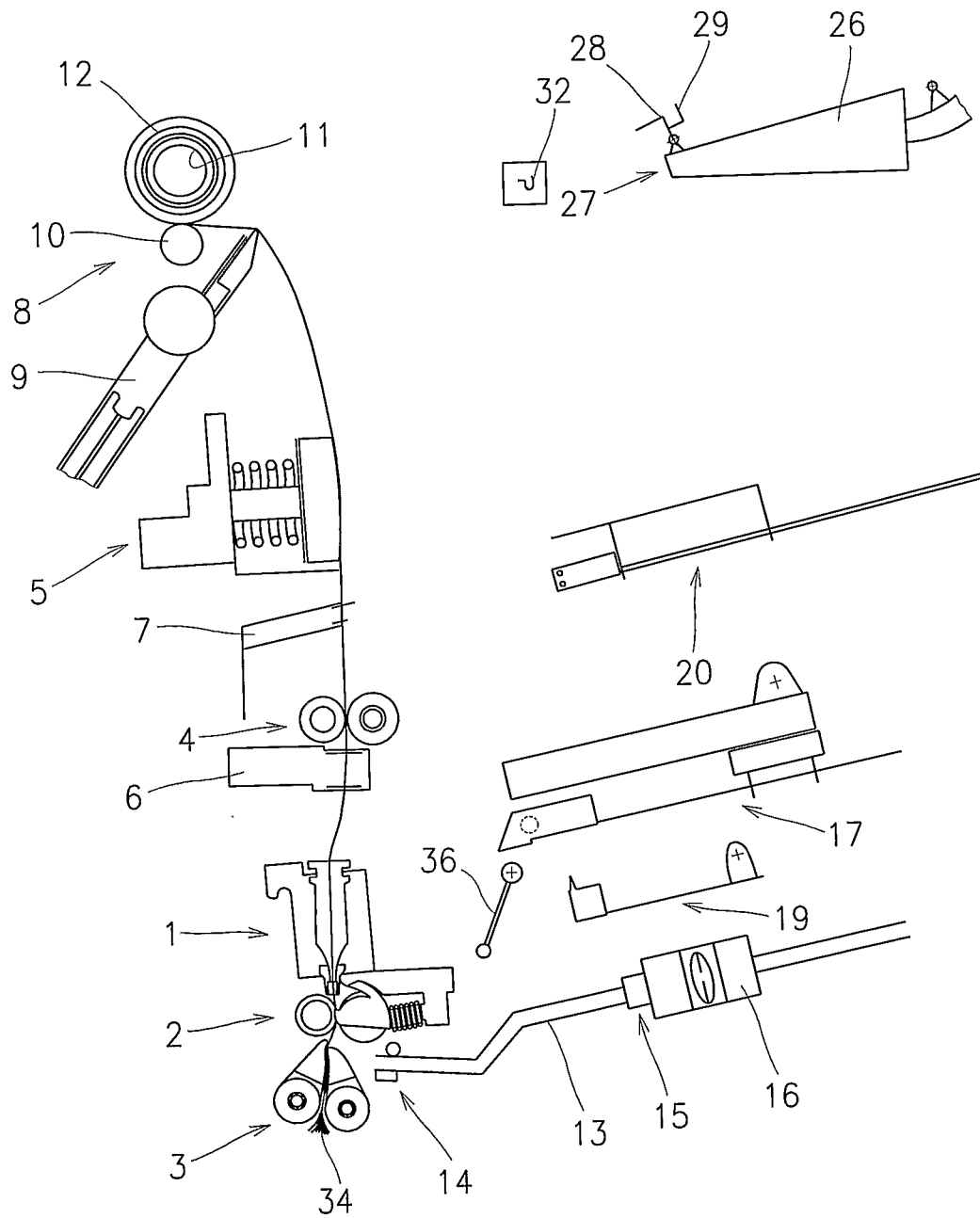


Fig. A10

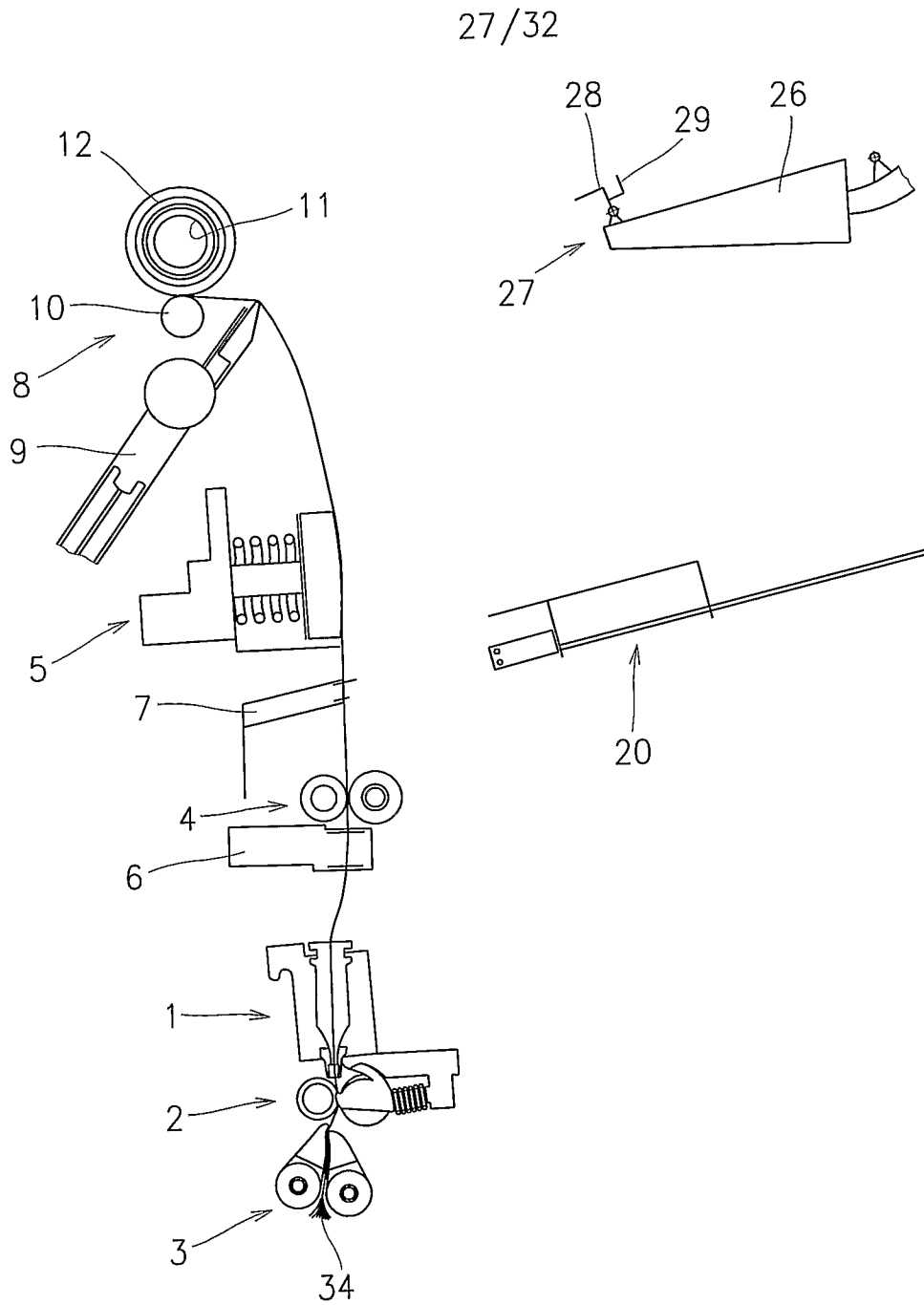


Fig. B0

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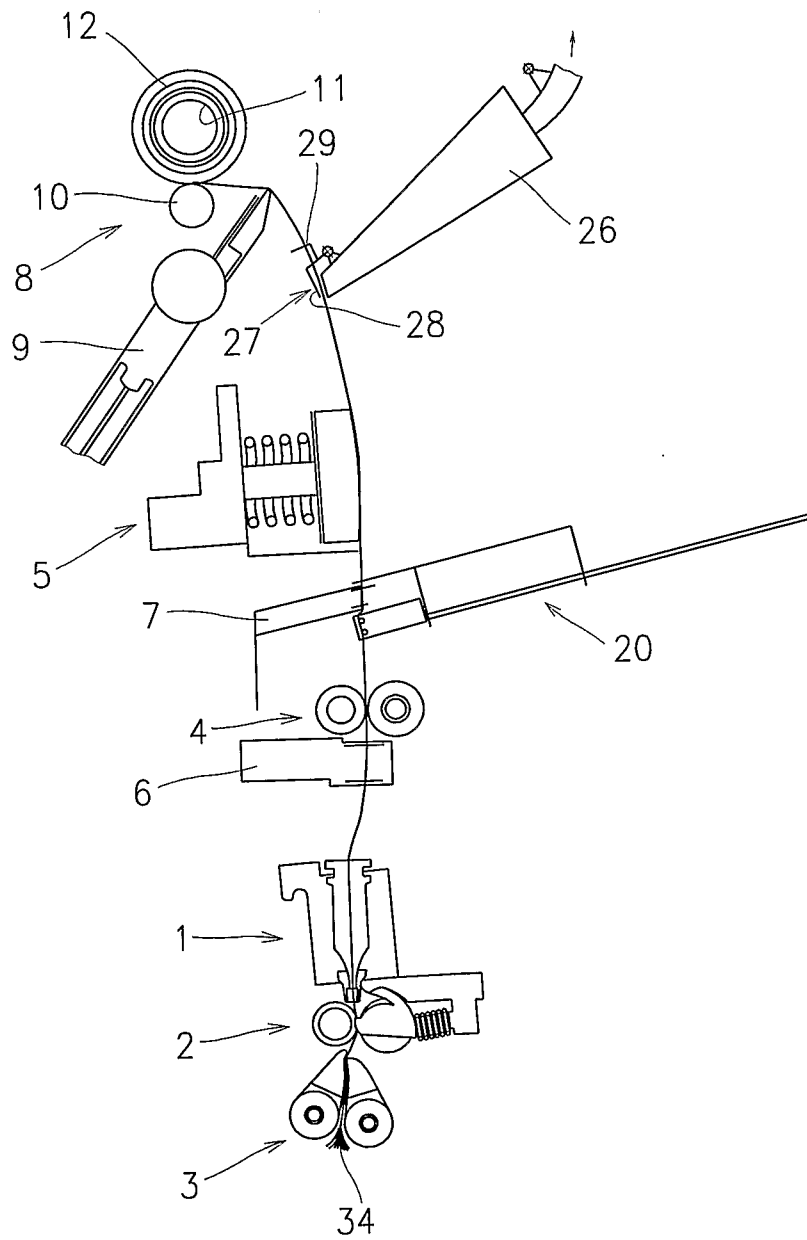


Fig. B1

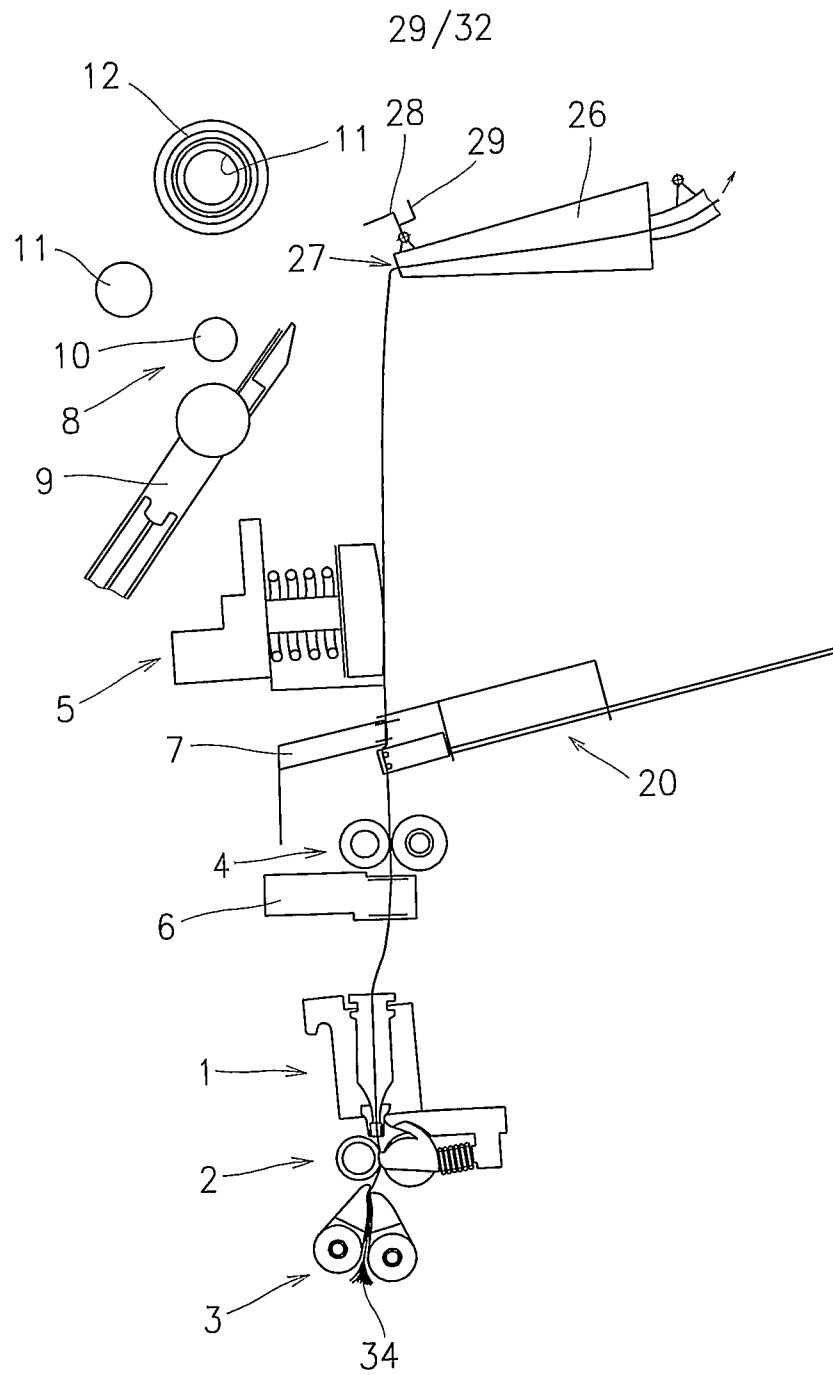


Fig. B2

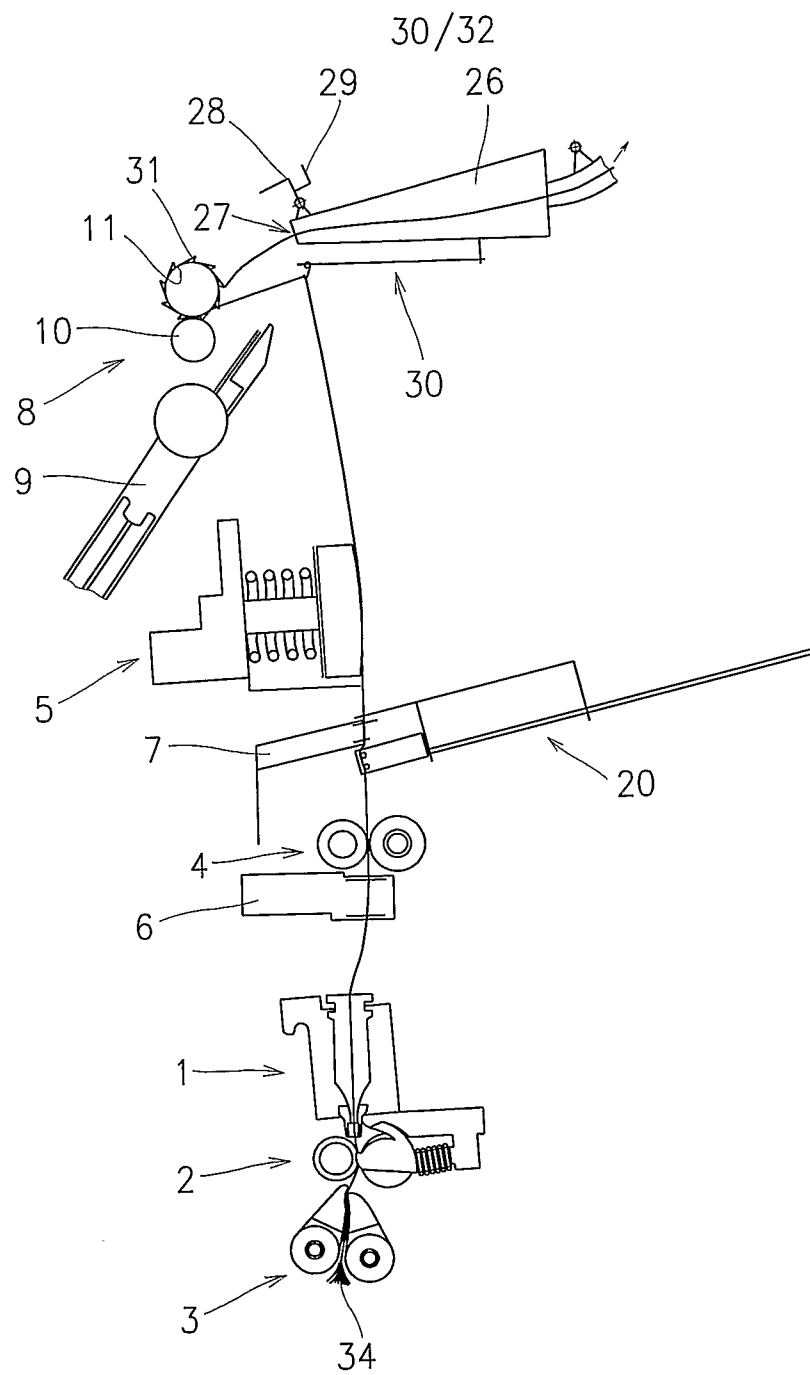


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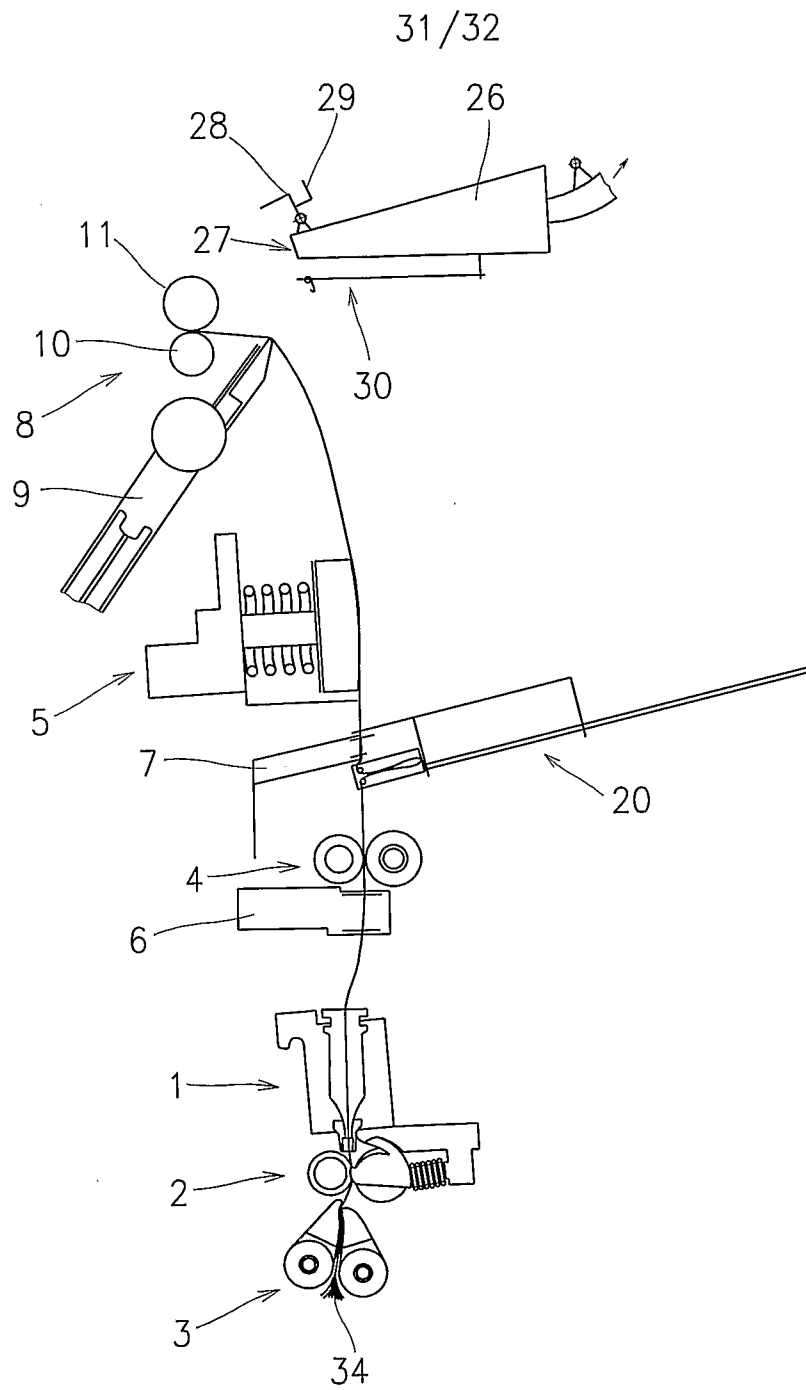


Fig. B4

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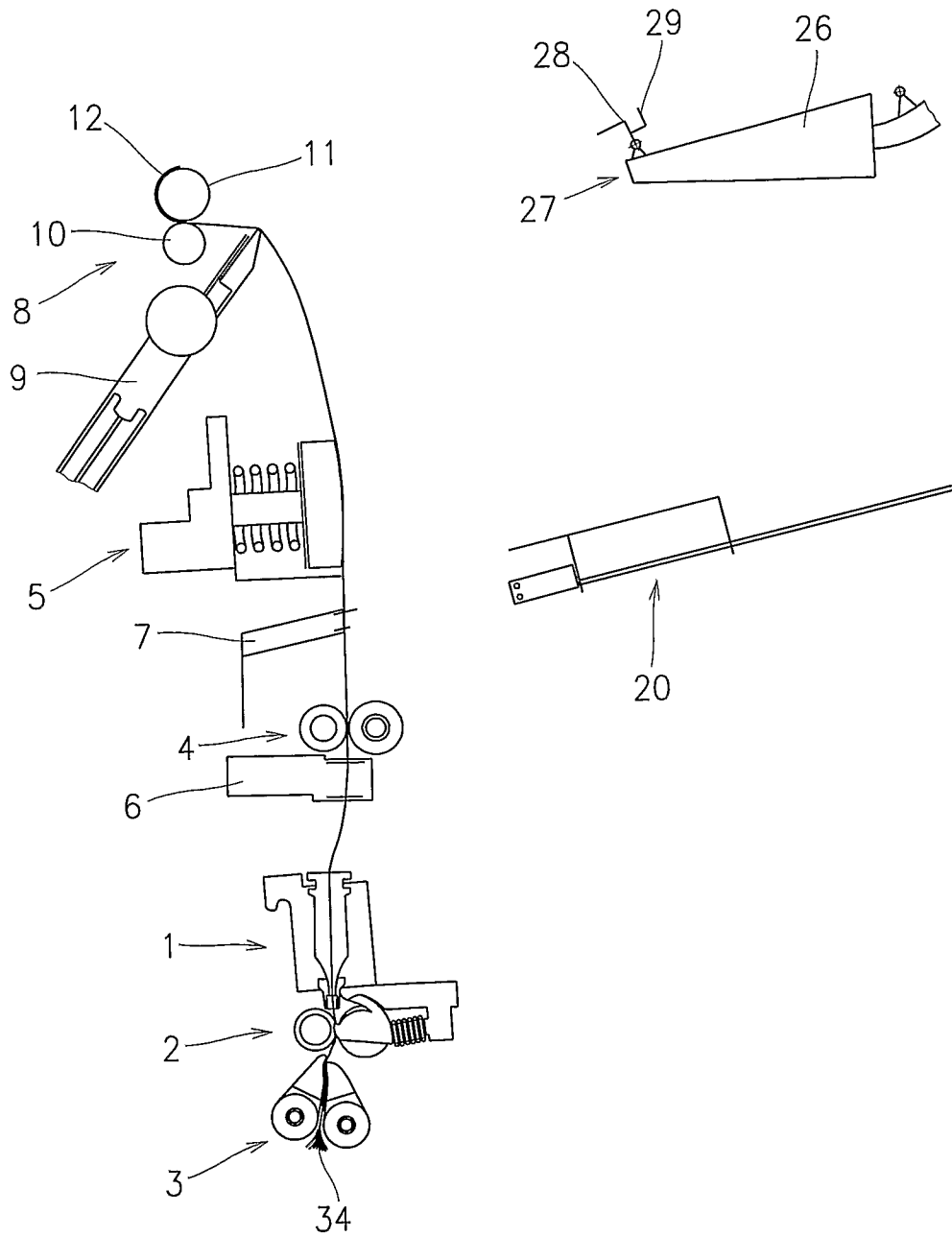


Fig. B5