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(71) Applicant: **DUSKIN CO., LTD.**
Suita-shi, Osaka 564 (JP)

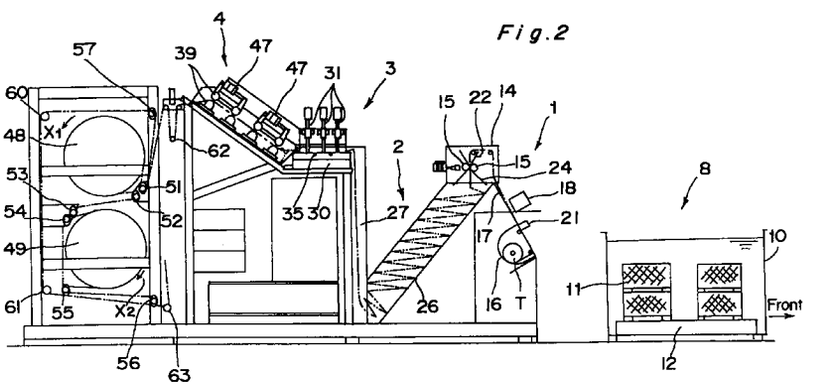
(72) Inventors:
- **Shimono, Kikuo**
  Suita-shi, Osaka 564 (JP)
- **Fukamachi, Shigeki**
  Suita-shi, Osaka 564 (JP)
- **Gosho, Motonobu**
  Suita-shi, Osaka 564 (JP)

(74) Representative:
Stoner, Gerard Patrick et al
MEWBURN ELLIS
York House
23 Kingsway
London WC2B 6HP (GB)

(54) Cleaning processing equipment

(57) A purpose of this invention is to improve a cleaning effect in a cleaning processing equipment which continuously cleans a long band cloth (T). A cleaning processing equipment composed of a continuous feed device (1) continuously feeding a long band cloth (T), an accumulating device (2) storing and accumulating the fed band cloth in zigzag manner, a washing device (3), a rinsing device (4), and a drying device (5), which are all arranged successively along a transfer path of the band cloth. The washing device (3) includes a water tank (30) storing a fixed quantity of water, a transfer mechanism has ultrasonic oscillators (31) which are so disposed that bottom oscillating portions (31a) are in contact with the band cloth (T) being transferred.

Fig.2



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Description

This invention relates to a cleaning processing equipment e.g. which continuously cleans a cabinet towel etc. utilized for washrooms etc. in hotels and restaurants etc.

Fig. 9 shows a conventional cleaning processing equipment, in which a continuous feed device 101, an accumulating device 102, a washing or cleaning device 103, a rinsing device 104 and a drying device 105 are installed along a transfer path.

The accumulating device 102 is formed into a V-shaped structure and cleaning solvent is stored in it. The washing device 103 is composed of a pair of cage rotors 110 & 110 and water jet nozzles 111 & 111 facing on the cage rotors 110 & 110 respectively. The rinsing device 104 is so constructed that vertically plural arranged pairs of transfer rollers 112 are installed in longitudinal direction with some spaces left between them, water pipes 113 are put between the rollers from above, and water is dropped from holes made on the water pipes 113 onto a surface of a cloth T being transferred.

In order to carry out the cleaning work, the rolled towel T already used is placed in a pocket 115 of the continuous feed device 101, its initial end is sewed with a sewing machine to the terminal end of the foregoing towel, and then the equipment is operated.

The towel T pulled out of the pocket 115 is fed to the accumulating device 102 by a feed roller 117 of the continuous feed device 101. In the accumulating device 102, a proper quantity of towels are dipped in the rinsing solvent and stored there in zigzag manner.

The towel is fed from the accumulating device 102 through a rise-up connecting pipe 118 into the washing device 103. In the washing device 103, the towel is transferred on surfaces of the upper and lower cage rollers 110 along S-shaped path. Thus, both front and back faces of the towel being transferred are cleaned by flowing down (dropping down) hot water from the respective nozzles 111 in mid way of transfer process.

In the rinsing device 104, residual cleaning solvent is removed by water dropped from above while the towel is transferred by the transfer rollers 112.

In the washing device 103 of Fig. 9, soils of towels can not be removed enough by merely flowing down (dropping down) the hot water onto the surfaces of towel T wetted with the cleaning solvent. Further, soils etc. might remain on towel portions corresponding to portions other than mesh holes of the cage rotors 110 because the hot water is flown down (dropped down) onto the towel T under a state of contacting with the surfaces of cage rollers.

When the cleaning solvent is stored in the accumulating device 102 located in midway of the continuous transfer line initiating from the continuous feed device 101 and the towel is to be dipped with the cleaning solvent by the accumulating device 102, a sufficient dipping time can not be acquired because there is a limit to a storage quantity of the accumulating device 102. The dipping time is about five minutes, for example. The cleaning solvent can not be wetted enough within such a short time. Therefore, the cleaning mechanism is not perfect by merely flowing down (dropping down) the hot water using the washer 103 as described above, so that an improvement of cleaning effect can not be accomplished.

In the rinsing device 104, the cleaning solvent may remain because the cleaning solvent is removed by dropping water.

It is now proposed to provide a cleaning processing equipment composed of or comprising a continuous feed device continuously feeding a long band cloth, an accumulating device storing and accumulating the fed band cloth, a washing device, a rinsing device, and a drying device, which are all arranged successively along a transfer path of the band cloth; characterized by that the cleaning equipment includes a water tank storing a fixed quantity of water, a transfer mechanism transferring the band cloth at a depth of water in the vicinity of a water level, and ultrasonic oscillators which are so disposed that bottom oscillating portions are in contact with the band cloth being transferred.

Preferably a dipping device storing cleaning solvent is installed as a preprocessing of the feed process provided by the continuous feed device.

Additionally, or alternatively cleaning solvent may be stored in the accumulating device so that the cleaning solvent is infiltrated into the band cloth in the accumulating device.

Preferably jet nozzles injecting high-pressure water onto a towel being transferred are installed as the rinsing device.

Exemplary embodiments of the invention are described below with reference to the drawings, in which:

Fig. 1 is a general schematic plan view of the cleaning processing equipment

Fig. 2 is a schematic side view (viewed in a direction of arrow II of Fig. 1) of Fig. 1.

Fig. 3 is an enlarged side view of the washer and rinsing device.

Fig. 4 is a view viewed in a direction of arrow IV of Fig. 3.

Fig. 5 is a view taken on a line V - V of Fig. 3.

Fig. 6 is an example of the drive mechanism.

Fig. 7 is a schematic side view (viewed in a direction of arrow VII of Fig. 1) of the take-up device.

Fig. 8 is a schematic side view showing another example of the invention of this application.

Fig. 9 is a schematic side view of conventional equipment.

(Embodiment 1)

Fig. 1 is a schematic general plan view of the cleaning processing equipment to which the invention of this application is applied. A continuous feed device 1, an

accumulating device 2, a washing or cleaning device 3 and a rinsing device 4 are arranged on a straight line in order. A drying device 5 having a large width is disposed at an outlet portion of the rinsing device 4, and the processing line turns back like an U-shape. Thus, a take-up side second accumulating device 6 and a take-up device 7 are arranged in order. A side where the feed device 1 is disposed is assumed as a front side of the equipment and a side where the drying device 5 is disposed is assumed as a rear side of the equipment, in descriptions hereafter. Therefore, the towel is fed to the rear side in a going line starting from the feed device 1 to the drying device 5, and it is fed to the front side in a returning line starting from the drying device 5 to the take-up device 7.

Independently from the respective devices 1, 2, 3, 4, 5, 6 & 7, continuously arranged on the transfer line of going and returning ways, a dipping device 8 for wetting processing is separately arranged in front of the feed device 1.

The dipping device 8 has three solvent tanks 10 in which cleaning solvent is stored. The respective tanks 10 connect to a not-shown solvent circulation device through a cleaning solvent supply pipe 10a. Filtration, circulation and supplement functions of the solvent circulation device maintain a fixed amount of cleaning solvent of desired concentration in each solvent tank 10. Such a cleaning solvent is used that includes unify having sodium metasilicate, sodium carbonate and sodium tripolyphosphate as its major components and oxygen-group bleaching agent having sodium percarbonate as its major component. In concrete, a cleaning solvent comprising water mixed with the unify and the bleaching agent at a rate of about 1 to 5 is put in the solvent tank 10.

Plastic cage containers 11 laid on a pallet 12 in plural stages are dipped in each solvent tank 10, and plural rolled towels (after use but before cleaning) are housed in each cage container 11.

In Fig. 2 showing a side view, the continuous feed device 1 includes a pair of feed rollers 15 in a feed box 14 located at a specified height, and a towel holding pocket 16 at a front lower position of the box 14. It also includes an inclined guide plate 17 connecting the pocket 16 to the feed box 14 at a position between the both 16 & 14, and a sewing machine 18 which is movable by hand in a lateral direction to sew both ends of towels, in midway of the guide plate 17.

The pocket 16 is formed into a half-cut cylinder using a metal punching plate so that one rolled towel T can be housed in it in a rotatable manner.

A photo sensor 21 is provided at an upper end of the pocket 16 to detect a break of terminal end of the towel T pulled out of the pocket 16 to the guide plate 17, so that the feed rollers 15 are stopped to revolve through an appropriate control mechanism when the break of towel T is detected.

The feed rollers 15 are interlocked to the appropriate control mechanism so as to discharge the towel, which is fed from an upper V-shaped hopper 22 in between the feed rollers 15, into the lower accumulating device 2 continuously.

An oscillation plate 24 is installed at a lower part of the feed rollers 15, which oscillates back and forth at its bottom end with its top end as a fulcrum. Therefore, the towel can be discharged into waved shapes positively. Thereby, the towel T can be stored and accumulated in an accumulating portion 26 in the zigzag manner.

The accumulating device 2 is composed of the above-mentioned inclined duct-like storing and accumulating portion 26 extending from a bottom opening of the feed box 14 to a rear lower part, and a connecting pipe 27 rises up roughly perpendicularly from a rear bottom part of the accumulating portion 26. A flow sectional area of the accumulating portion 26 is made larger than a flow sectional area of the connecting pipe 27, so that the towel T can be sufficiently housed in it in the zigzag manner.

In Fig. 3 showing an enlarged view of the washing device 3, the washing device 3 connects to a top outlet of the connecting pipe 27. The washing device 3 is composed of a water tank 30 in which water is filled up to a specified level, three ultrasonic oscillators 31 installed at an upper part of the water tank 30 in a manner as movable up and down, and rotatable transfer rollers 35 disposed at a water depth in the vicinity of water level of the water tank 30.

A pair of front and rear transfer rollers 35 are so disposed that their upper ends are positioned at a water depth of about 0.3 to 1.0 cm, and a plane created by connecting the upper ends of the both transfer rollers 35 composes a towel transfer plane located at the above water depth. Guide rollers 36 for transferring the towel to the rinsing device 4 of next process at a level higher than the water level are installed rotatably at rear end parts of the water tank 30. The water tank 30 connects to a water supply through water supply pipe 32 and has a discharge water tank 37 for receiving overflown liquid or water around it. New cleaning water is fed from the water supply pipe 32 into the water tank 30 without interruption, so as to cause water used for cleaning in the vicinity of water level to overflow onto the discharge water tank 37. Thereby, the water level can be maintained at a fixed level height and water can be cleaned.

The three ultrasonic oscillators 31 are installed facing downward, and attached to one elevation frame 33 at the same height with same spaces put between them in transfer direction, so that they can be moved up and down together with front and rear guide projections 34 integrally. Under a state where the ultrasonic oscillators 31 move down, bottom oscillating portions (horns) 31a is set to contact with the towel T on the transfer plane in the vicinity of water level. When the bottom oscillating portions 31a contact with the towel surface at the water depth in the vicinity of water level and vibrate, the towel also vibrates to be cleaned while dissolving the cleaning solvent.

The rinsing device 4 includes four pairs of upper

and lower transfer rollers 39 for serving as a transfer mechanism, and also includes two high-pressure water supply pipes 40 and one neutralizer supply pipe 41 from front side in this order at upper parts between the transfer rollers 39. Further, it includes a discharge tank 43 at lower sides of the transfer rollers 39, and the discharge tank 43 joins the discharge water tank 37 of the washer 3 to connect a discharge water pipe 42. The respective transfer rollers 39 are gradually located at higher positions as they get to the rear side.

As shown in Fig. 5, six hot water jet nozzles 45 are installed on each high-pressure water supply pipe 40 with spaces left between them in the lateral direction, connects to a high-pressure pipe 44, and designed to inject water at a high pressure of 5.0 kg/cm^2 with a capacity of 3.21 litters/min. In each pair of transfer rollers 39, a lower roller is designed for driving purpose and has a drive pulley 39a. In Fig. 2, upper side driven rollers 39 are coupled to piston mechanisms 47 through link mechanisms, and they can be moved close to and apart from the lower rollers 39 by extension and contraction movements of the piston mechanisms 47.

The neutralizer supply pipe 41 of Fig. 3 connects to a not-shown neutralizer tank through a delivery pump 46 and can inject the neutralizer with a capacity of 12 litters/min. max.

The drying device 5 shown in Fig. 2 includes a pair of upper and lower rotatable drying drums 48 & 49 made of stainless steel. Insides of the both drums 48 & 49 are connected to a heated steam supply device. Therefore, drum surfaces can be heated up to about 120°C by supplying high temperature steam to the drum insides.

Around the both drums 48 & 49, there are installed bar-like long guide rollers 51, ..., 57 & 58 surrounding these drums and a pair of rear-side upper and lower inclined bars 60 & 61. A drying transfer path, which proceeds plural times in spiral ways around surfaces of the both upper and lower drums 48 & 49, is composed of these guide rollers 51, ..., 57 and the inclined bars 60 & 61. The inclined bars 60 & 61 are so inclines that their right sides go down (back sides of Fig. 2 go down).

Composition of this transfer path for drying will be described in concrete hereunder. The towel T sent from the rinsing device 4 through a cushioning roller 62 elastically urged downward turns back upward via the first guide roller 51 located at a front lower side of the upper drum 48. It is wound around the surface of the upper drum 48 for almost one circle in a direction of X1 and reaches the second guide roller 52 to turn back rearward. Then, it turns back forward via the rear third guide roller 53, and is wound around a surface of the lower drum 49 for almost one circle in a direction of X2 and reaches the fourth guide roller 54. It is wound around the rear lower inclined bar 61 from the fourth guide roller 54 through the lower fifth guide roller 55 and the front six guide roller 56. It then extends in an inclined right-upper direction to the front top seventh guide roller 57 through the upper inclined guide bar 60, and is again wound around the first guide roller 51 at a position slightly deviated to right side relative to the towel T of first turn.

The towel is wound around the upper and lower drying drums 48 & 49 through such an S-shaped transfer path five to six times in spiral forms. Finally, the towel is extended upward from the sixth guide roller 56 through a take-out roller 63, and then downward through the cushioning roller 64 as shown by Fig. 7. It is thus transferred into the second take-up side accumulating device 6 through the drive roller 65.

Fig. 7 is a schematic view of the second accumulating device 6 and the take-up device 7. The second accumulating device 6 is formed into a duct-like shape inclined downward in the transfer direction (front side), and a smoothing mechanism 67 comprising plural rollers 66 is installed on the device.

The take-up device 7 includes a pair of guide rollers 68 and a take-up shaft 69. A photo-type seam detecting sensor 70 is attached to the guide roller 68 in order to stop revolution of the take-up shaft 69 when a seam between a terminal end of foregoing towel T and an initial end of next towel T is detected.

Fig. 6 shows an example of a drive mechanism of the rinsing device 4, in which each pulley 39a of each towel transfer roller 39 is coupled to and interlocked with a drive motor 72 through a transmission belt 71 and all the transfer rollers 39 are revolved in the same speed and same direction. Further, the drive motor 72 is also coupled to and interlocked with the drive roller 65 of the second accumulating device 6 through the transmission belt 71, a reduction intermediate pulley 75 and a transmission belt 76. A transmission speed created by the drive roller 65 is set to a slightly larger than a transmission speed created by the transmission roller 39 of the rinsing device 4.

The cleaning work process will be described.

(1) In Fig. 2, the rolled towel T 20 cm (or 27 cm) wide and about 20 m long is used. Plural rolled towels after use are housed in the container 11, double-stage six containers 11 for example are placed on the pallet 12, and the pallet 12 is dipped in the solvent tank 10 with the containers placed on the pallet as they are. After being dipped for about three hours, the containers are taken out of the solvent tank 10 under the condition of being placed on the pallet 12, and left as they are for about one hour to drain water.

(2) An operator takes the rolled towels T out of the container and set them in the pocket 16 of the continuous feed device 1. The initial end of the rolled towel T is pulled out of the pocket 16, led onto the guide plate 17 through the photo sensor 21, and sewed by the sewing machine 18 to the terminal end of the foregoing towel remaining on the guide plate 17.

In case where the foregoing towel does not remain in the equipment because of first operation of the equipment etc., a pick-finding dummy towel is

previously set in the transfer path ranging from the continuous feed device 1 to the take-up device 7, and the initial end of the next rolled towel T is sewed to the terminal end of the dummy towel T.

(3) The feed roller 15 is driven, and the towel is taken out of the pocket 16 to be supplied into the accumulating device 2. When the terminal end (cut line) of the towel T is detected by the sensor 21, the feed roller 15 is stopped. Then, the next towel T is set in the pocket 16, and its initial end is connected to the terminal end of the foregoing towel T. In this manner, the towels are connected continuously and an appropriate number of towels (seven, for example) are stored and accumulated in the accumulating portion 26 in zigzag manner.

(4) When the towels of appropriate number have been stored and accumulated, the entire cleaning line is operated. Even during the operation, the towel T in the pocket is exchanged continually to feed the towel from the feed device 1 continuously.

(5) The towel T stored and accumulated in the accumulating portion 26 is fed through the connecting pipe 27 to the washer 3 and transferred to the rear side on the transfer plane about 0.3 cm to 1.0 cm below the water level of the water tank 30. In the midway of transfer, the towel T is vibrated at high speed through means of successive contact with the bottom tip oscillating portion 31a of the ultrasonic oscillator 31 vibrating as shown in Fig. 3. In other words, the towel is cleaned as if it is subjected to super high-speed pound washing in water dissolving the cleaning solvent so that soils can be removed efficiently.

(6) In the rinsing device 4, the towel T is transferred to inclined rear side by the transfer rollers 39 and rinsed by high-pressure jet water from the high-pressure water jet nozzles 45 at two midway spots. After that, cleaning solvent remaining in the towel is neutralized by neutralizer sprayed from the nozzles 41a of the neutralizer supply pipe 41.

(7) In the drying device 5, the towel goes round the surfaces of the upper and lower drying drums 48 & 49 several times in spiral forms along the S-shaped transfer path as shown in Fig. 2. The towel is dried by heat of the drums 48 & 49 during this going round.

After completion of drying, in the second accumulating device 6 of Fig. 7, the dried towel T is positively supplied by the feed drive roller 65 and a fixed amount of towel is stored and accumulated in it. The accumulated towel T is successively smoothed by a smoothing mechanism 67 and taken up by the revolving take-up shaft 69 through the rollers 68.

When a seam between the foregoing and next towels T is detected by the sensor 70 during the taking-up, the take-up shaft is stopped. After stopping, sewing thread of the seam is removed, and the rolled towel T is pulled out of the take-up shaft 69 in an axial direction. An initial end of the next towel T is wound around the take-up shaft several times, and the take-up shaft 69 is driven and revolved again to take up the next towel T.

(Embodiment 2)

Fig. 8 is an example of equipment having an U-shaped storage or accumulating device 2. The accumulating portion 26 extends from a lower opening of the feed box 14 to an approximately perpendicular lower side, and its bottom portion is curved upward like an arc to be connected to the connecting pipe 27. The other components are similar to those of Fig. 2, and the same components are attached with the same symbols.

As mentioned above, even the towel already wetted in the previous process can be easily stored and accumulated in zigzag manner by installing the accumulating portion 26 extending from the feed box 14 to the perpendicular lower side. There is no possibility that the towel T adheres to inside surfaces of the accumulating portion 26.

(Embodiment 3)

In the structures of Fig. 2 and Fig. 8, the dipping device independent from the continuous transfer line is installed as the preprocessing to provide a sufficient dipping time. However, the structure may also be employed wherein the cleaning solvent is stored in the accumulating device and the towel is wetted with the cleaning solvent while the towel is stored in the accumulating portion.

In this case, the quantity of the ultrasonic oscillator of the washing device is increased to acquire a sufficient cleaning effect.

(Other Embodiments)

(1) The quantity of the ultrasonic oscillator 31 of the washing device 3 is not limited to three, but it may be one or a quantity other than three.

(2) In Fig. 2, the third nozzle counting from the front side is used for the neutralizer jet nozzle in the rinsing device 4, however, all the nozzles in the rinsing device 4 may be used for the high-pressure jet water nozzle.

As described above, the following effects may be possible using the proposed apparatus.

(1) The ultrasonic oscillators 31 are installed in the washing device 3, and the oscillators 31 are vibrated under the state of contacting with the towel T transferred in water in the vicinity of the water level. Therefore, the towel is cleaned as if it is subjected to the super high-speed pounding wash so that the cleaning effect can be improved as compared with a washer merely spraying water.

(2) The dipping device 8 is installed as the preproc-

essing independently from the continuous transfer line initiating from the continuous feed device 1.

Therefore, sufficiently long dipping time can be acquired and the cleaning effect can be improved further. In addition, it becomes unnecessary to supply the cleaning solvent into the equipment composing the continuous transfer line.

(3) The cleaning solvent is stored in the accumulating device 2 to wet the band cloth with the cleaning solvent in the accumulating device 2.

Therefore, an installation space of the equipment can be saved.

(4) The high-pressure jet water is injected onto the towel T for serving as the rinsing device 4, as described in the invention set forth in claim 4. Therefore, a rinsing effect can be improved.

The invention of this application is not limited to the cleaning processing equipment for use in the cleaning of the long towel, but it may be used for continuous cleaning of various band cloths such as band cloths for dress and breached cottons etc.

As is apparent from the forgoing, in one aspect the present invention is seen to provide a cleaning apparatus for long band cloth, the apparatus having a washing device comprising a water bath through which the cloth passes and one or more oscillators which contact the cloth to vibrate it as it passes through the water bath at or adjacent the water surface. Preferably the cloth is pre-soaked in cleaning solvent.

In another aspect the invention proposes a cleaning apparatus for long band cloth in which the cloth is pre-processed in dipping device containing cleaning solvent before being fed via a continuous feed device to further cleaning devices.

In a further aspect a cleaning apparatus for long band cloth has a rinsing device comprising one or more high pressure jet nozzles which direct high pressure water onto cloth fed through the apparatus.

The invention also provides a method of cleaning long band cloth in which the cloth is passed through a cleaning bath, preferably just below the surface of liquid in the bath, while being vibrated by oscillators, and/or the cloth is pre-soaked in cleaning solvent in a dipping device before being fed via a continuous feed device to further cleaning apparatus, and/or the cloth is rinsed by moving it past one or more jet nozzles which direct high pressure water at the cloth.

Claims

1. A cleaning processing equipment composed of a continuous feed device continuously feeding a long band cloth, an accumulating device storing and accumulating the fed band cloth, a washing device, a rinsing device, and a drying device, which are all arranged successively along a transfer path of the band cloth; characterized by that the cleaning equipment includes a water tank storing a fixed quantity of water, a transfer mechanism transferring the band cloth at a depth of water in the vicinity of a water level, and ultrasonic oscillators which are so disposed that bottom oscillating portions are in contact with the band cloth being transferred.

2. A cleaning processing equipment as set forth in claim 1, in which a dipping device storing cleaning solvent is installed as a preprocessing of the feed process provided by the continuous feed device.

3. A cleaning processing equipment as set forth in claim 1, in which the cleaning solvent is stored in the accumulating device so that the cleaning solvent is infiltrated into the band cloth in the accumulating device.

4. A cleaning processing equipment as set forth in claim 1, 2 or 3, in which jet nozzles injecting high-pressure water onto a towel being transferred are installed as the rinsing device.

Fig. 1

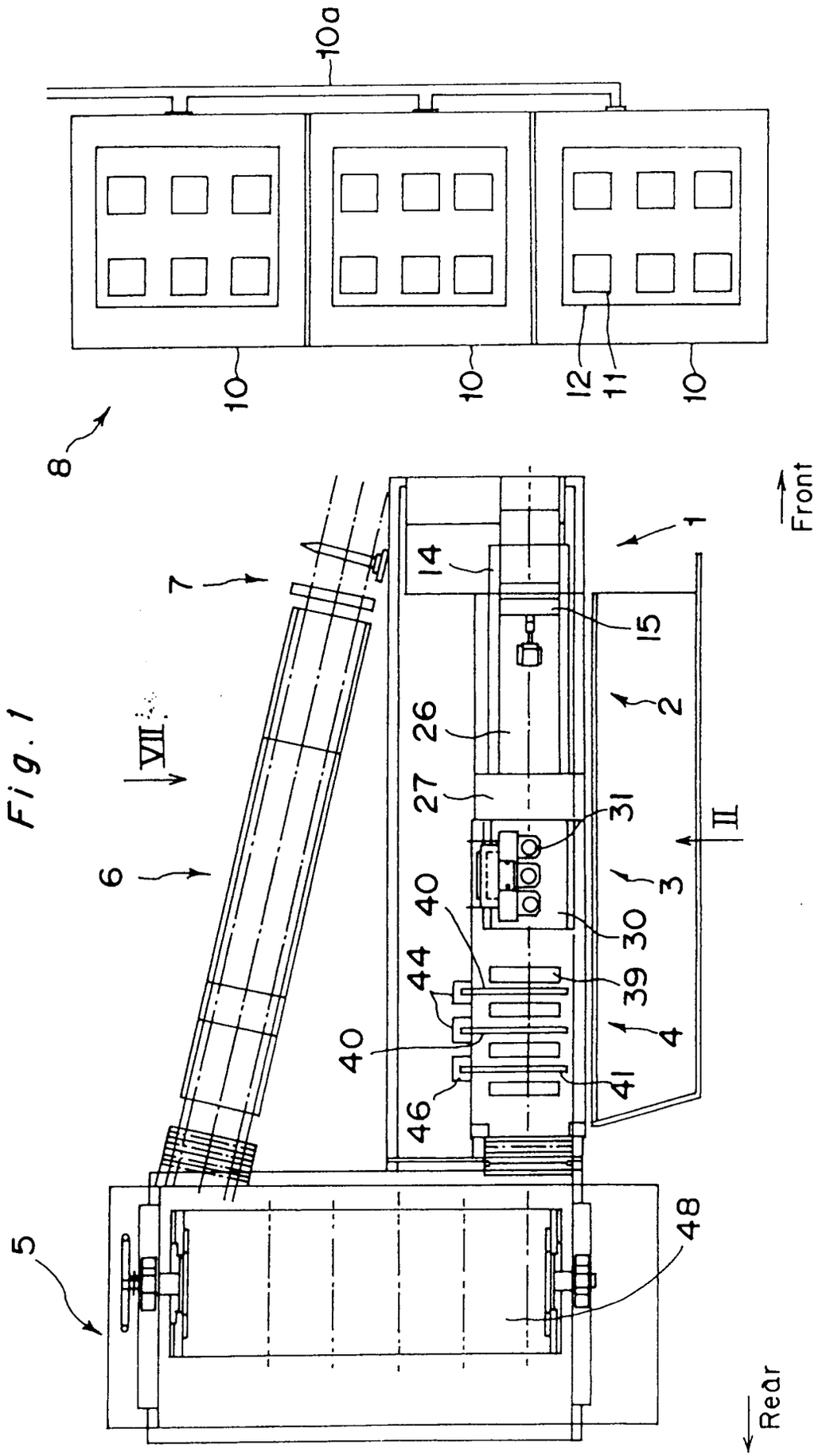
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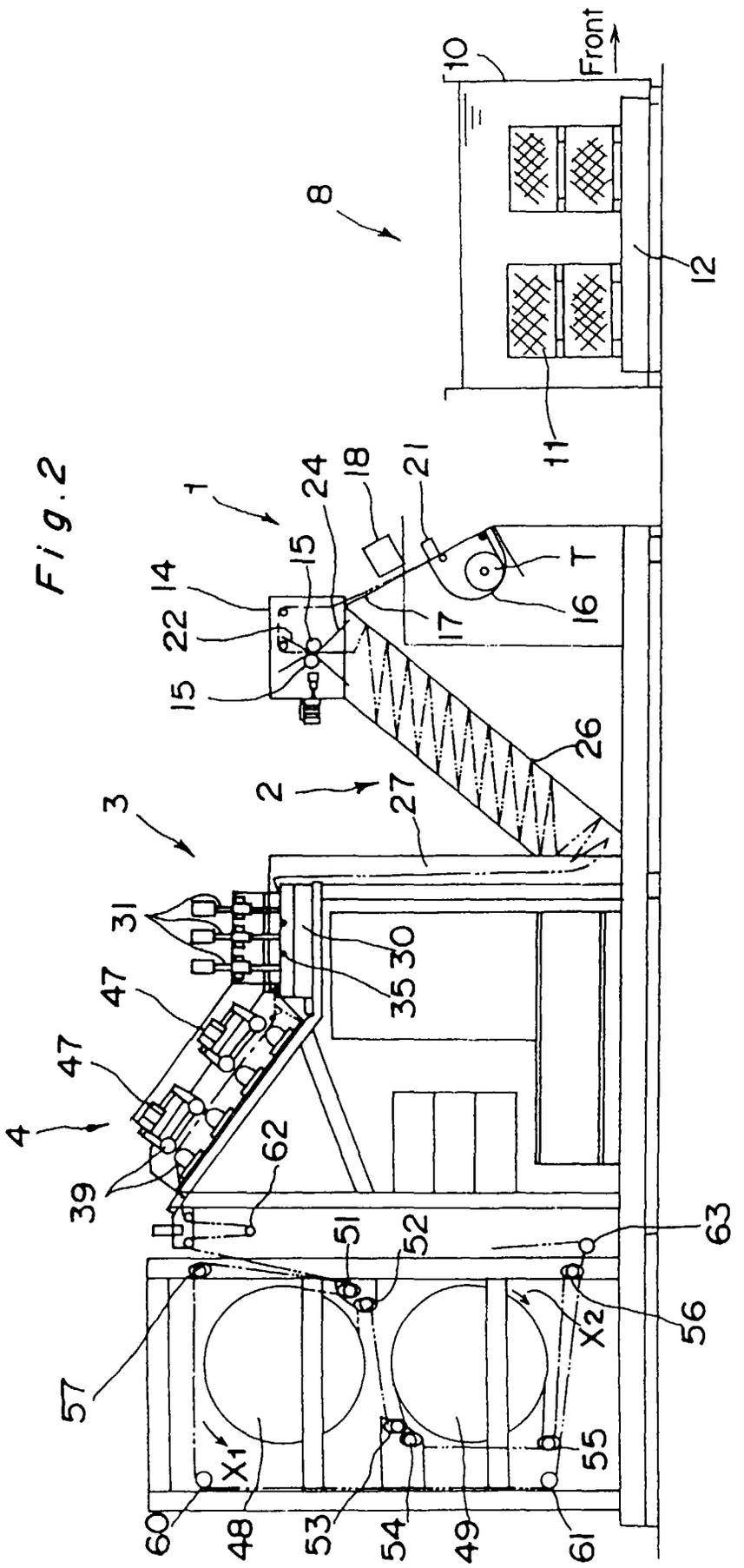
Fig.2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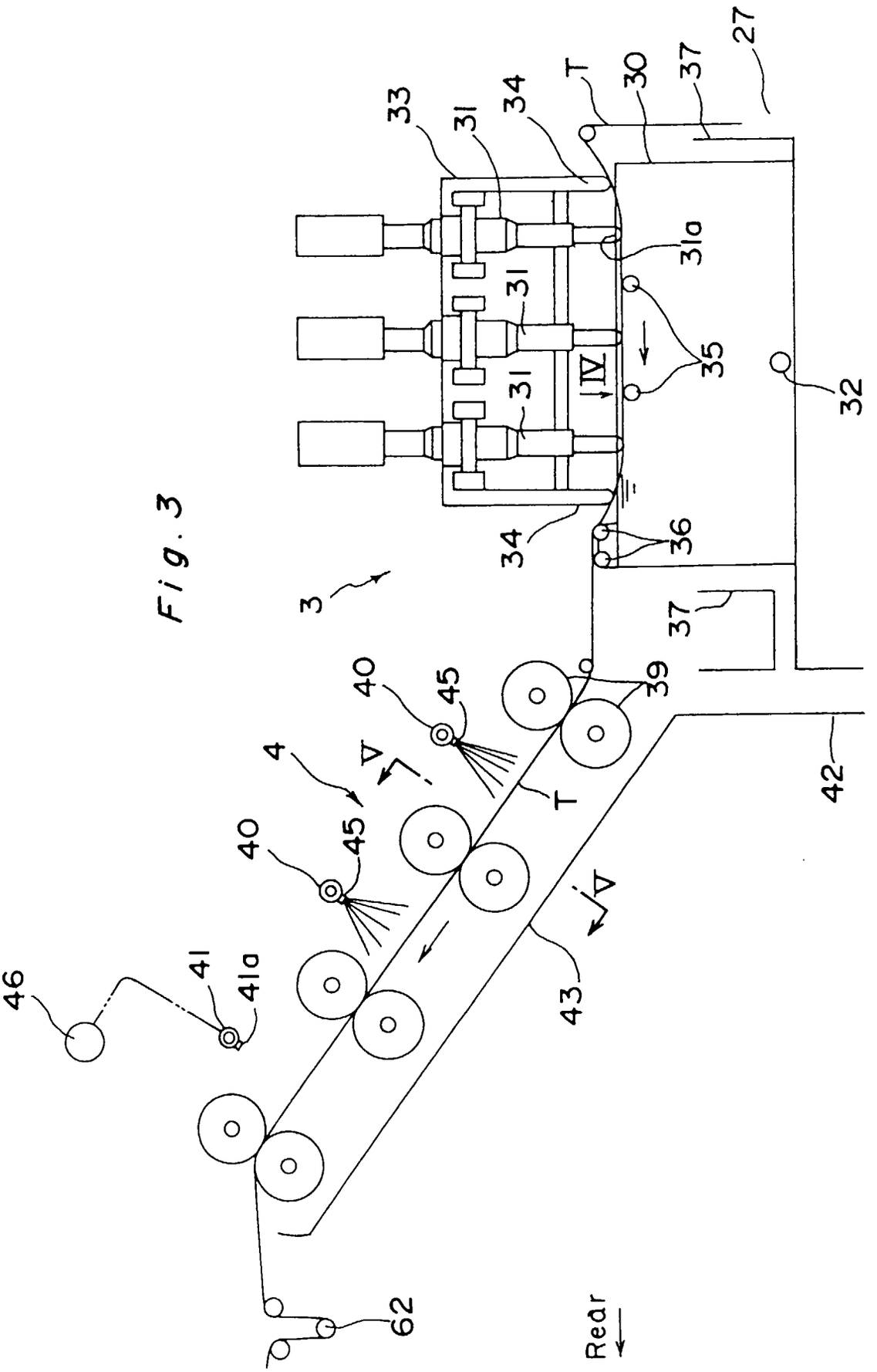
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Fig. 3

Fig. 4

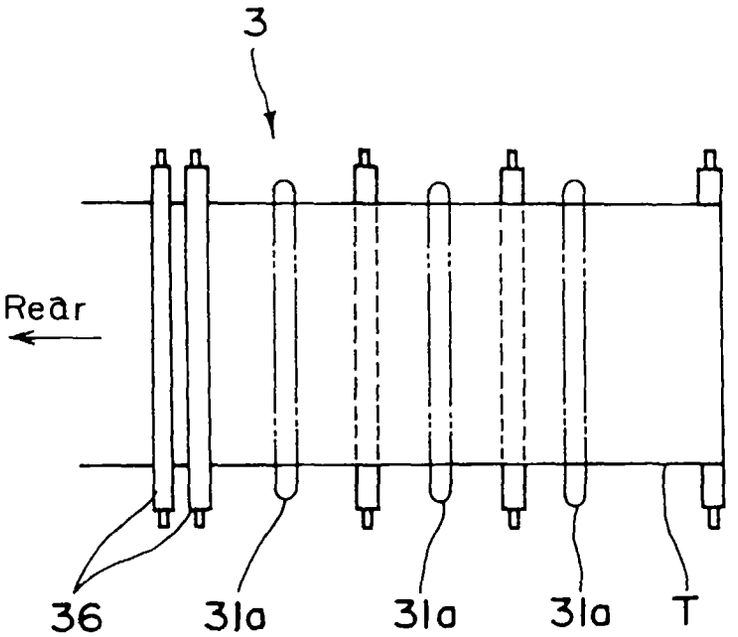


Fig. 5

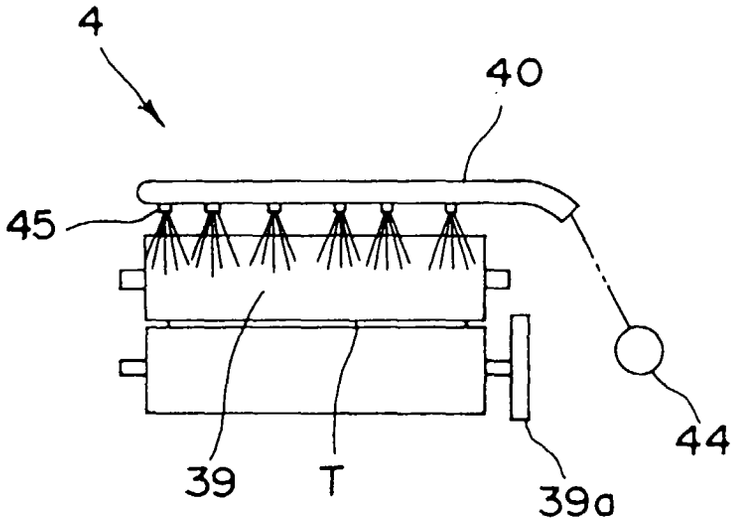
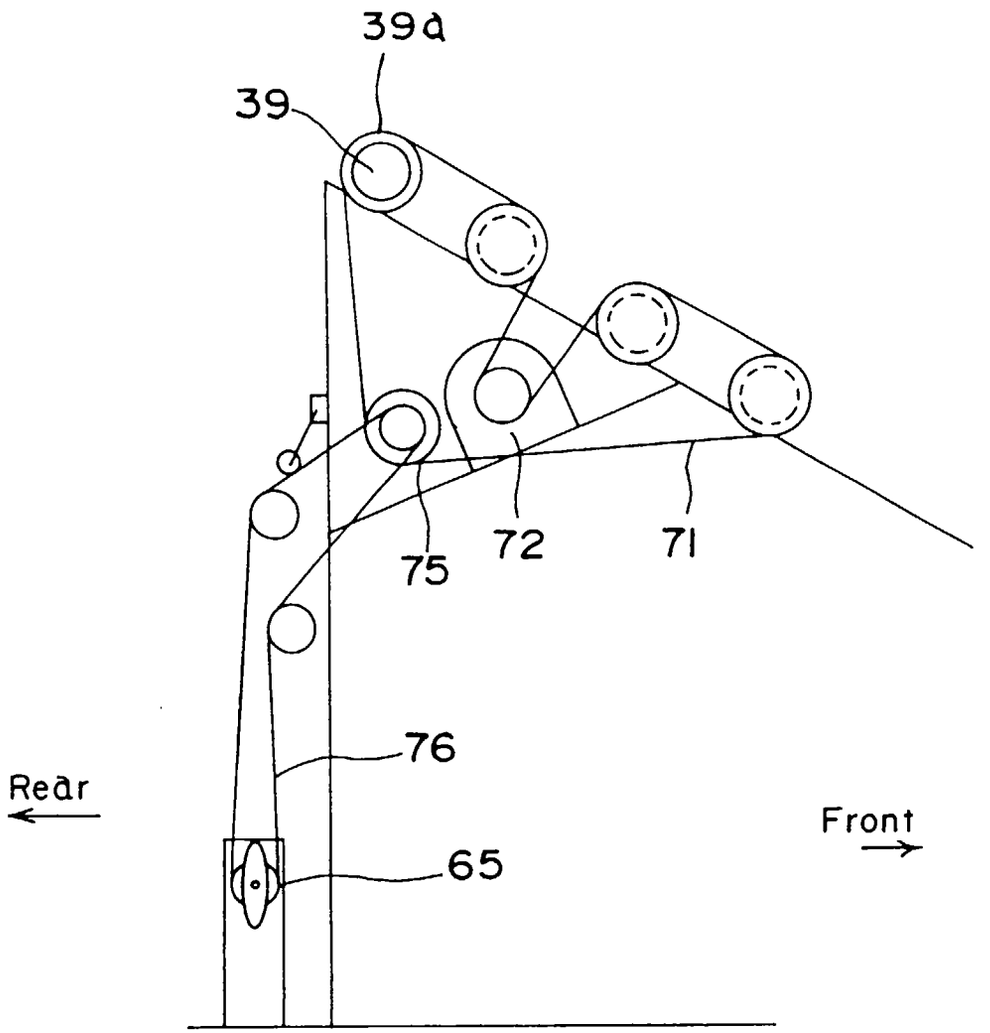


Fig. 6



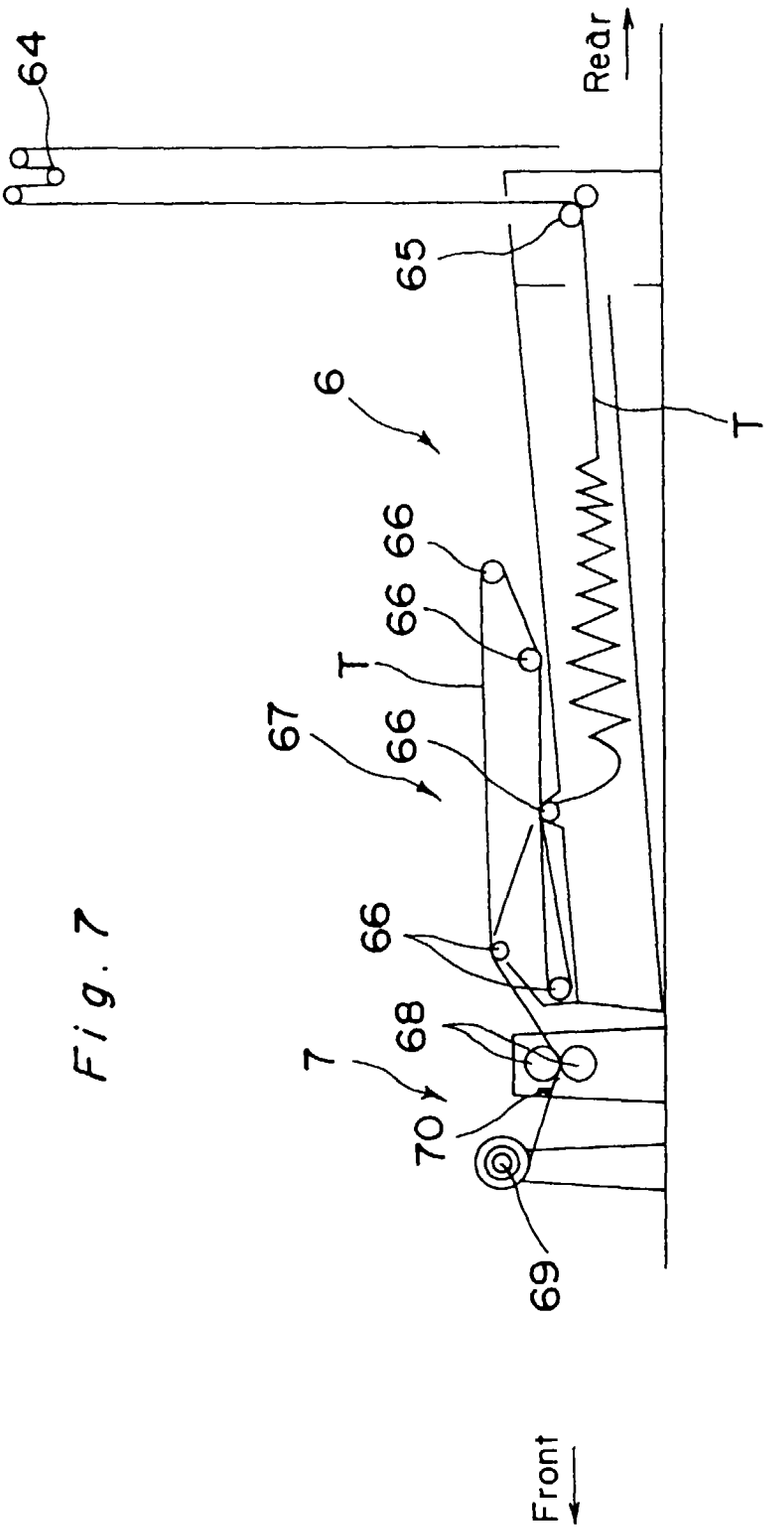
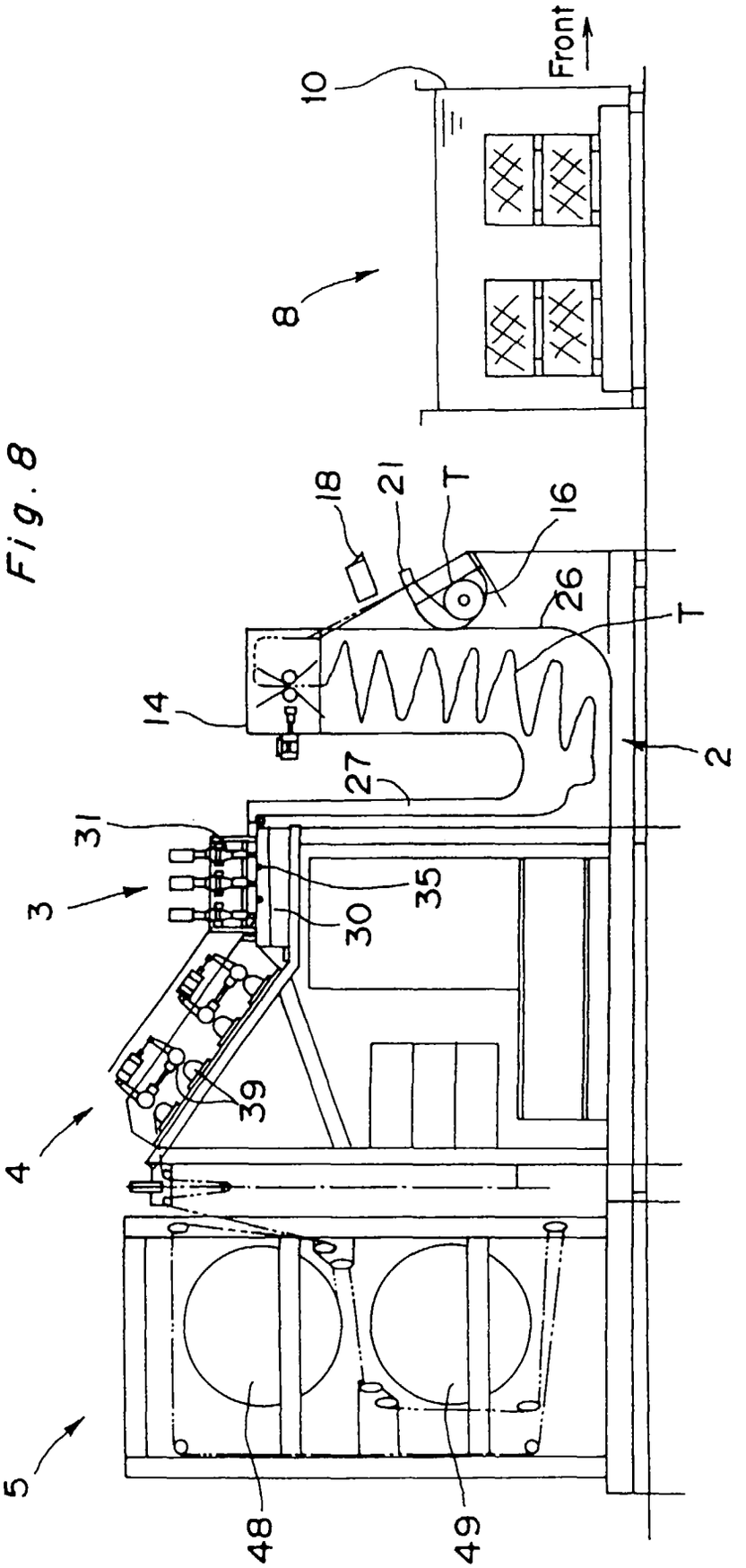


Fig. 7

Fig. 8



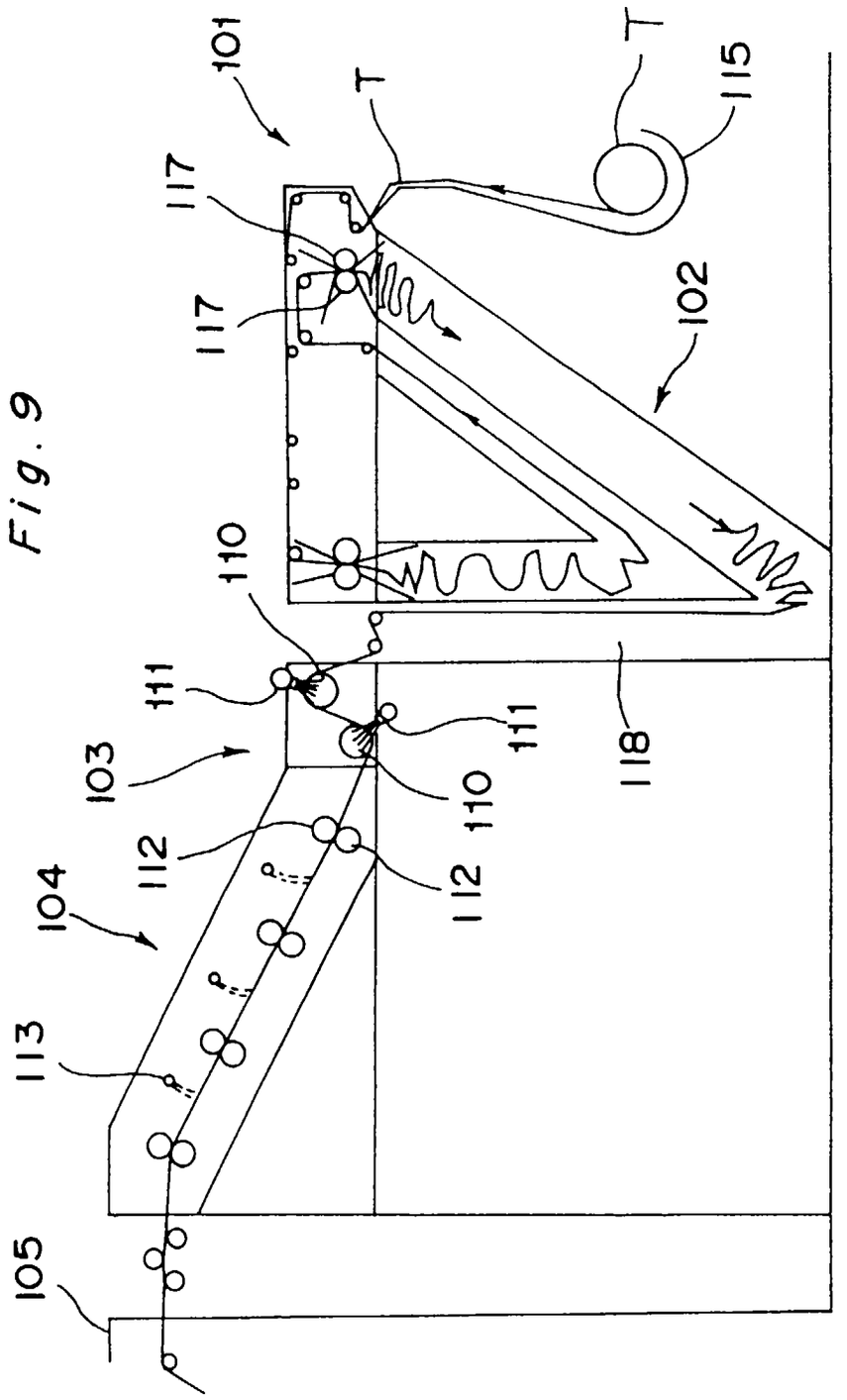

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Fig. 9