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Description

The present invention relates to a method of activating down and fiber materials, and more particularly to a method of activating down and fiber materials in which ionized air is brought into contact with materials to be treated.

A conventional method, in which air ionized by corona discharge is blown on down or feathers to neutralize electrostatic charge of the dust attached to the down so that the dust for a down-filled quilt may be removed, is known in Japanese Patent Publication No. 33482/81.

However, this method merely removes dust attached to down, but any futher object, operation and effect thereof are not considered.

A quilt filled with cotton shrivels becomes hard as it is used. The quilt becomes soft and bulky when it is dried in the sun, but when the quilt is used again it becomes thin and hard. The reason why the quilt becomes thin and hard is that cotton fibers are oxidized and lose their original elasticity.

Further, woollen fabrics, silk fabrics, paper or the like also lose their original elasticity and bulkiness as used. It is very difficult to activate such fiber materials which are folded and shrivelled.

On the other hand, the feathers and down for down-filled quilts are stuffed into bags imported from South-east Asia. Accordingly, the feathers and down are compressed and intertwined with each other. The feathers and down are further folded in a degreasing process, washing process and drying process. In the process of selecting down from feathers after a dust removal process, the selection ratio of down is as low as about 60% since the shrivelled down interwines about the feathers and fibers. Accordingly, the selection process must be repeated again and again.

The folded and shrivelled down cannot recover to a sufficiently bulky state. The worn-out down cannot become bulky enough when dried.

FR—A—2 390 536 discloses a method of treating feathers in which ionised air is applied to the external surface of the feathers via a plurality of nozzles followed by applying normal (i.e. unionised) air to the external surfaces of the feathers via another plurality of nozzles.

Accordingly, in view of the above problems, it is an object of the present invention to provide a method of activating down and fiber materials and refreshing folded and shrivelled fiber materials.

According to the present invention, there is provided a method of treating down and fiber materials, comprising the steps of applying ionized air to the external surfaces of down and fiber materials; and applying immediately thereafter normal air to said external surfaces of the down and the fiber materials; characterised by repeating alternately the steps of applying ionized air and applying immediately thereafter normal air to said external surfaces of the down and fiber materials; whereby said external surfaces of the down and fiber materials effectively recover their original elasticity but the down and fiber materials are prevented from being rapidly oxidized by the ionized air.

Preferably the method comprises the step of transferring the down and fiber materials through a plurality of chambers filled alternately with ionized air and normal air, said plurality of chambers being separated from each other by a plurality of air curtains.

Preferably the method comprises the step of stationing the down and fiber materials in each of the plurality of chambers for a predetermined duration of time.

In operation, the materials to be treated, for example down, are brought into contact with the ionized air for ionization and then brought into contact with the normal air for normalization stopping oxidation. This process is repeated so that the surface of the materials is subjected to gradual and intensive ionization to activate the materials deep into the inside. More particularly, even if the material is shrivelled and folded by degreasing and washing processes, the repeated operations by which the material is ionized in ionized air and then brought into contact with normal air (stopping rapid oxidation) several times lead the material to gradual and progressive ionization. The refreshed material is activated and recovers its original elasticity as if it were covering living fowl (if down). The fiber texture turns into an expanded state.

In this manner, down recovers its original state such that it can float. Floating down can be easily selected from feathers which are difficult to float. Likewise, even worn-out down can be activated to be soft and bulky in the same manner as reprocessed cotton.

In accordance with the present invention, such gradually and progressively repeated ionization of the materials prevents the materials from rapid oxidation caused by high concentration of ozone. The sufficient extent of progress of ionization causes the cellular tissues to be effectively activated.

Embodiments of this invention will now be described with reference to the accompanying drawings of which:—

Fig. 1 is a front view of a down activating apparatus for use in implementation of the present invention;

Fig. 2 is a side view of an air ionizer;

Fig. 3 is a cross-sectional view of a nozzle for ionized air of the ionizer;

Fig. 4 is a plan view of an activating apparatus for use in a method of a second embodiment; and

Fig. 5 is a cross-sectional view of an activating apparatus for use in a method of a third embodiment.

Fig. 1 is a cross-sectional view of an apparatus for use in implementation of the present invention. A down activating apparatus 1 includes a metal box 2 which is divided into a primary treating chamber 3 and a collection chamber 4 by means of a partition wall 2a.

The primary treating chamber 3 includes a grate 3a which is disposed at a position near the bottom and spaced by a predetermined distance from the bottom; a set of lower rotatable feeding blades 5 are disposed above the grate 3a. Upper rotatable feeding blades 6 are disposed above the lower rotatable feeding blades 5 and the upper rotatable feeding blades 6 are surrounded by a partition wall 2b in the form of a substantially U-shape as view from the front direction to form a secondary treating chamber 7.

An inlet 3c is formed at an upper end of a right outer wall 3b of the chamber 3 and a down and feathers feeding hose 8a is coupled with the inlet 3c. The outer end of the hose 8a is coupled with the down and feathers feeding device 8. Thus, a predetermined space between the secondary treating chamber 7 and the outer wall 3b forms an incoming path 3d and a predetermined space between the secondary treating chamber 7 and the partition wall 2a forms an up-path 3e.

A partition plate 2c is extended above the secondary treating chamber 7 to form a ceiling and to form an exhaust outlet 2d at a right side of the partition plate 2c. An exhaust path 9 is formed between an upper wall of the box 2 and the partition plate 2c. The partition plate 2c is provided with a vertical wall 2e which hangs down from the partition plate 2c into the secondary treating chamber 7 so that the upper portion of the secondary treating chamber 7 is divided into an incoming path 7a and an outgoing path 7b.

Air ionizers 10^1 and 10^2 are disposed at a lower right corner of the chambers 3 and 7, respectively, so that both nozzles 10a thereof are directed to the chamber 3.

Referring to Figs. 2 and 3, the air ionizers 10^1 and 10^2 are provided with an air compressor 10b which is coupled with a base end of branched blower pipes 10c. The blower pipes 10c are provided with a plurality of injection pipes 10d. The injection pipe 10d includes a pair of positive and negative corona electrodes 10e and 10f. When a voltage is applied between both the corona electrodes, a corona discharge is generated between both the electrodes 10e and 10f. When air is blown from the air compressor 10b, ionized air is injected into the chamber 3 from the nozzles 10a.

A nozzle 11^1 is disposed in a lower left corner of the chamber 3 (Fig. 1) so that the nozzle (11^1) blows out normal air toward the upper right direction. The base end of the nozzle 11^1 is coupled with an air compressor, not shown, outside of the chamber 3 so that normal air is sent into the chamber 3. Thus, the nozzles 10a for ionized air and the nozzles 11^1, 11^2, 11^3 and 11^4 for normal air are alternately disposed in the path of the materials from the chamber 3 to the outlet 2d of the chamber 7 at proper intervals as shown in Fig. 1.

A suction fan 4a is disposed at the lower portion of the collection chamber 4. An exhaust pipe 4b which communicates with the exhaust path 9 is disposed at the upper portion of the partition wall 2a, and a collection bag 4c is attached to an outlet of the exhaust pipe 4b. In Figure 1, numeral 4d denotes a grate which separates the collection bag 4 from the suction fan 4a.

The down feeding device 8 feeds 20 kg of down into the chamber 3 in ten minutes by 12 m^3 per second of air.

The air ionizers 10^1 and 10^2 in the chamber 3 blow out 4 m^3 per second of ionized air into the chamber 3. The other air ionizers 10^3, 10^4 and 10^5 each possess a capacity of blowing out 1 m^3 per second of ionized air. The nozzles 11^1 to 11^4 for normal air each can blow out 1 to 2 m^3 per second of fresh air.

The suction fan 4a of the collection chamber 4 possesses a suction capacity of about 16 m^3 per second to suck the down in the chamber 7 and collect the down into the collection bag 4c. The collection bag 4c accommodates 20 kg of the down.

In the present apparatus 1 constructed above, the down and feathers sent out from the down feeding device 8 enter the chamber 3 through the hose 8a and the incoming path 3d. The chamber 3 is filled with the ionized air generated by the corona discharge of the air ionizers 10^1 and 10^2. When the down and feathers come into contact with the ionized air, the surface of the down and feathers is ionized. The lower rotatable feeding blades 5 agitate the down and feathers within the chamber 3 and the down with a good floatability goes up into the up-path 3e while the feathers which are difficult to float stay in the bottom. The down going up into the path 3e is immediately brought into contact with normal air sent out from the nozzle 11^1 preventing precipitous oxidation of the down by ozone and then is blown upward. The down blown upward is brought into contact with ionized air and normal air, alternately, blown out of the nozzles 10a for ionized air and the nozzles 11^2 and 11^3 for normal air to be repeatedly subjected to ionization and normalization (which stops rapid oxidation) alternately until the down enters the chamber 7. When the down enters the chamber 7, the down is agitated by the upper rotatable feeding blades 6 and is further ionized by the ionized air blown out of the nozzle 10a and is floated. Then, the down comes into contact with normal air blown out of the nozzle 11^4 and reaches the outlet 2d. The down reaching the outlet 2d is sucked into the exhaust path 9 by the suction fan 4a in the collection chamber 4 and is collected into the bag 4c through exhaust pipe 4b.

Corona discharge by means of the air ionizers 10^1 to 10^5 ionizes air. The ozone O_3 in the ionized air is decomposed into O_2 and O of which two atoms are easily converted into an oxygen molecule O_2. The surface of the down is subjected to strong oxidization when oxygen atoms generated from ozone become oxygen molecules. Accordingly, the surface of the down once ionized to be activated is subjected to acute oxidization but it is then normalized by normal air so that the progress of oxidation is stopped. The down is then further ionized by contact with ionized air.

Thus, the down is subjected to repeated ionization through gradual ionization instead of a single ionization on which oxidation due to ozone is limited. The down thus ionized is restored to its original shape, is activated and recovers its original elasticity if shrunk, folded, stretched or entangled. Down which is intertwined with each other is separated from each other by ionization. The down easily floats in the breeze, while the feathers are difficult to float in the breeze and fall down. The selection rate of the down from the feathers becomes 99% according to the present method while the selection rate of the prior art method is about 60%, which necessitates that the selection process be repeated.

In addition, since the activated down (which previously had aged to become shrunk, stretched or folded) recovers its original shape and increases its bulkiness, the collection bag 4c accommodates only 9 kg of down, while the bag 4c can accommodate 20 kg of down treated by conventional methods. Accordingly, while the down-filled quilt according to conventional methods contains 1.5 kg of down, the quilt which is filled with 1 kg of the activated down according to the present invention is too bulky for the quilt. Therefore 700 to 800 g of the activated down is enough to assure the same bulkiness as the quilt filled with the down according to conventional methods.

The present invention is not limited to the above construction. The materials to be treated may be contained in a bucket to pass through a tunnel and nozzles may be disposed so that ionized air and normal air are alternately blown out.

The present invention is not limited to the treatment of down as described above and can also be utilized to activate cotton, chemical fibers, silk and the like.

Fig. 4 is a plan view of an apparatus used in a method of a second embodiment.

A down activating device 12 includes a conveyor 14 disposed at the bottom of a plane and rectangular housing 13 and moved in the longitudinal direction. A carrying-in conveyor 15 and a carrying-out conveyor 16 are disposed in series before and behind the conveyor 14.

Air curtain units 17^1, 17^2...17^6 are disposed in the housing 13 at predetermined intervals and air curtains 17a are used to define ionized air chambers 18^1 to 18^3 and normal air chambers 19^1 and 19^2, alternately.

Each of the ionized air chambers 18^1 to 18^3, is provided with an ionized air nozzle 18a of an air ionizer which is identical with that shown in Fig. 3 and described in the first embodiment. In Fig. 4, numeral 18b denotes an air pipe and numeral 18c denotes an air pump.

Each of the normal air chambers 19^1 and 19^2 is provided with an air nozzle 19a coupled with an air pump 19c through an air pipe 19b, and an exhaust pipe 20 is further connected between the normal air chambers 19^1 and 19^2 and to an exhaust 19.

When the materials such as silk thread, woollen yarn, chemical fiber yarn, cotton, blankets, paper and wood are carried into the housing 13 by means of the carrying-in conveyor 15, the materials are moved in the housing 13 by the conveyor 14 at a predetermined speed. The housing 13 is divided into the ionized air chambers 18^1 to 18^3 and the normal air chambers 19^1 and 19^2, which are alternately disposed, by the air curtains 17a. The ionized air is blown into the ionized air chambers 18^1 to 18^3 from the nozzles 18a. The materials have their surface ionized while passing through the ionized air chamber 18^1. Subsequently the materials are moved to the normal air chamber 19^1 to be normalized by fresh normal air, stopping oxidation by ozone. The materials are then transferred to the ionized air chamber to be ionized therein again. In this manner, the ionized air chambers 18^1 to 18^3 and the normal air chambers 19^1 and 19^2 are alternately disposed within the housing 13 so that the materials passing through the housing 13 are ionized and then normalized with normal air (stopping oxidation) alternately and repeatedly, resulting in gradually intensified ionization. The conveyor 16 carries out the materials. In the above construction, the ionized air was blown into the ionized air chambers 18^1 and 18^3 at the rate of 4 m^3 per second. The conveyor 14 is stationed in each chamber for three minutes to treat 20 kg of silk thread. The treated silk thread was thicker than before treatment and had a feeling like fluffy floss silk. The silk thread seemed to have increased its volume by about 20% or more.

Worn-out neckties each made of silk, polyester fiber and wool recovered their bulkiness as if they had been new ones, when treated under the same conditions, although they had had flat folded edges before treatment.

Fig. 5 is a cross-sectional view of an apparatus for use in a method of the third embodiment.

An activating device 21 includes ionized air nozzles 23^1 and 23^2 coupled with an air ionizer and air nozzles 24^1 and 24^2 for feeding normal air which are disposed in a rectangular box 22.

The box 22 is further provided with an exhaust device 25. In the figure, numerals 23a and 24a denote air pipes, 23b and 24b denote air pumps, 26 denotes a pedestal and 27 denotes a hanger. The activating device 21 can interchange the ionized air and the normal air at predetermined intervals alternately. A basket which contains cotton yarn, quilts, paper, books, wood or the like is laid on the pedestal 6 and blankets, clothes, coats, quilts or the like are hung on the hanger 27 for treatment.

Used cotton-filled quilts were hung on the hanger 27. The ionized air nozzles 23^1 and 23^2 blew out the ionized air at the rate of 5 m^3 per second for five minutes and the ionized air was then evacuated by the exhaust device 25. The air pipes 24^1 and 24^2 blew out normal air for four minutes and the normal was then evacuated. Then again, the nozzles 23^1 and 23^2 blew out the ionized air at the rate of 5 m^3 per second for five

minutes and the same conditions as above were thus repeated five times. Consequently, cotton shrivelled hard recovered its original elasticity and became bulkier and softer than that dried in the sun for three hours. The cotton was thus activated and refreshed.

Further when a worsted suit was treated on the same conditions, the hard shrivelled worsted cloth was restored to its bulkiness and softness and was activated as it if had been new.

Claims

1. A method of treating down and fiber materials, comprising the steps of applying ionized air to the external surfaces of down and fiber materials; and applying immediately thereafter normal air to said external surfaces of the down and the fiber materials; characterised by repeating alternately the steps of applying ionized air and applying immediately thereafter normal air to said external surfaces of the down and fiber materials; whereby said external surfaces of the down and fiber materials effectively recover their original elasticity but the down and fiber materials are prevented from being rapidly oxidized by the ionized air.

2. A method according to claim 1, characterised by comprising the steps of feeding the down and fiber materials preliminarily into a passage (3d); stirring the down and fiber materials simultaneously with the steps of applying ionized air and normal air; and collecting the down and fiber materials subsequently after the steps of applying ionized air and normal air are completed.

3. A method according to claim 1, characterised by comprising the step of transferring the down and fiber materials through a plurality of chambers (18^1, 19^1, 18^2, 19^2, 18^3) filled alternately with ionized air and normal air, said plurality of chambers being separated from each other by a plurality of air curtains (17a).

4. A method according to claim 3, characterised by comprising the step of stationing the down and fiber materials in each of the plurality of chambers for a predetermined duration of time.

Patentansprüche

1. Verfahren zur Behandlung von Daunen und Fasermaterial mit den Verfahrensschritten: Behandeln der äußeren Oberflächen der Daunen und des Fasermaterials mit ionisierter Luft; und unmittelbar anschließend Behandeln dieser äußeren Oberflächen der Daunen und des Fasermaterials mit normaler Luft, gekennzeichnet durch abwechselndes Wiederholen der Schritte des Behandelns mit ionisierter Luft und unmittelbar anschließenden Behandelns dieser äußeren Oberflächen der Daunen und des Fasermaterials mit normaler Luft, wodurch diese äußeren Oberflächen der Daunen und des Fasermaterials ihre ursprüngliche Elastizität zurückgewinnen, die Daunen und das Fasermaterial aber davor geschützt sind, durch die ionisierte Luft schnell oxidiert zu werden.

2. Verfahren nach Anspruch 1, gekennzeichnet durch die Verfahrensschritte: zunächst Einfüllen der Daunen und des Fasermaterials in einen Durchlaß (3d); Durchmischen der Daunen und des Fasermaterials gleichzeitig mit den Schritten des Behandelns mit ionisierter Luft und normaler Luft; und Sammeln der Daunen und des Fasermaterials anschließend an die Beendigung der Schritte des Behandelns mit ionisierter Luft und normaler Luft.

3. Verfahren nach Anspruch 1, gekennzeichnet durch den Schritt des Durchführens der Daunen und des Fasermaterials durch eine Vielzahl von Kammern (18^1, 19^1, 18^2, 19^2, 18^3), die abwechselnd mit ionisierter Luft und normaler Luft gefüllt sind, wobei diese Vielzahl von Kammern durch eine Vielzahl von Luftvorhängen (17a) voneinander getrennt sind.

4. Verfahren nach Anspruch 3, gekennzeichnet durch den Schritt des Verweilens der Daunen und des Fasermaterials in jeder der Vielzahl von Kammern über eine vorbestimmte Zeitspanne.

Revendications

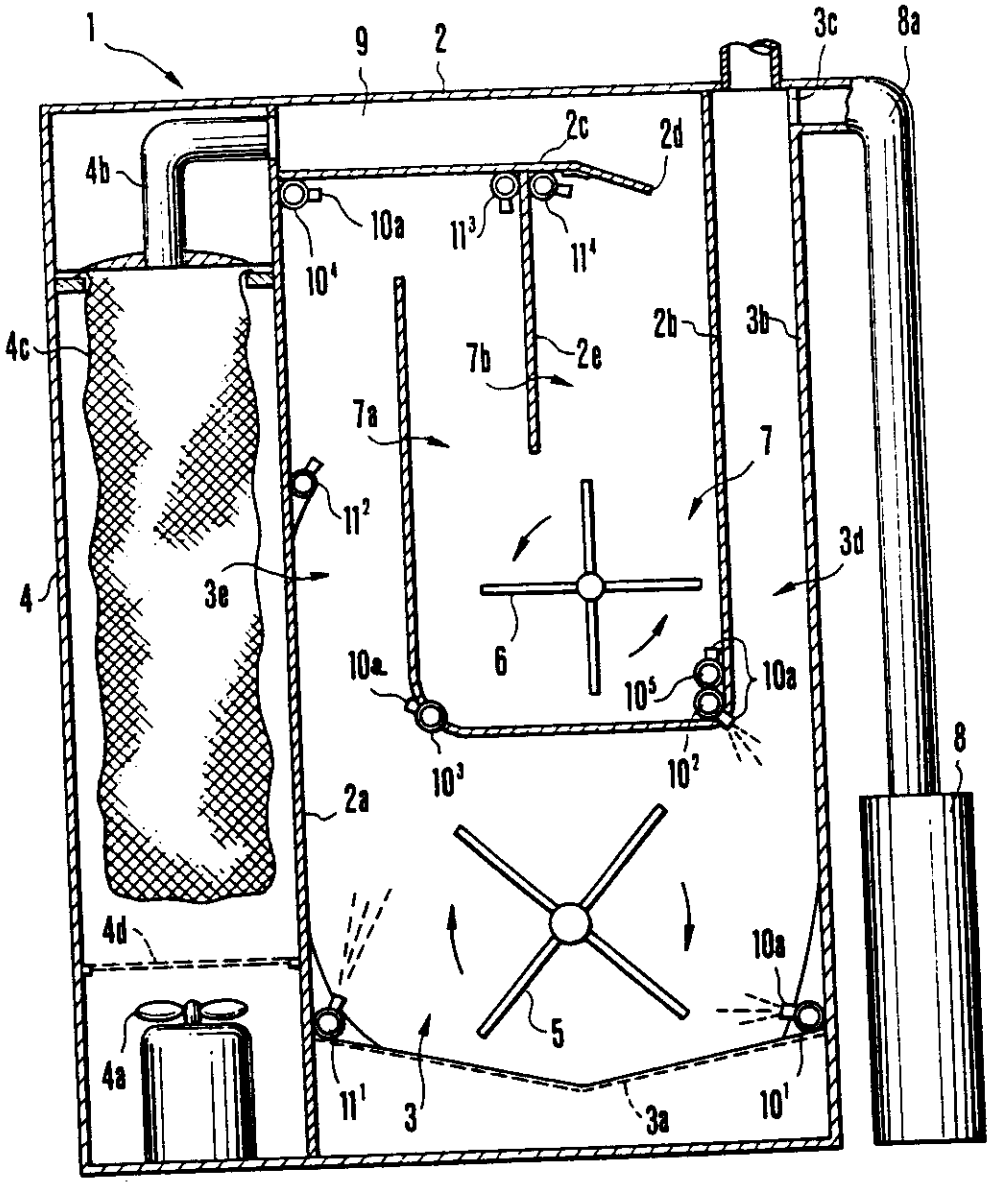
1. Procédé de traitement du duvet et des matières fibreuses comprenant les opérations d'appliquer de l'air ionisé aux surfaces extérieures du duvet et des matiéres en fibres, et d'appliquer immédiatement après de l'air normal auxdites surfaces extérieures du duvet et des matières en fibres, caractérisé en ce qu'on répète alternativement les opérations d'appliquer de l'air ionisé et d'appliquer immédiatement après de l'air normal auxdites surfaces extérieures du duvet et des matières en fibres, de sorte que ces surfaces extérieures du duvet et des matières en fibres récupèrent effectivement leur élasticité initiale mais que le duvet et les matières en fibres sont préservés d'être rapidement oxydés par l'air ionisé.

2. Procédé selon la revendication 1, caractérisé en ce qu'il comprend les opérations de fournir le duvet et les matières en fibres préliminairement à un passage (3d), d'agiter le duvet et les matières en fibres simultanément avec les opérations d'appliquer de l'air ionisé et de l'air normal, de recueillir le duvet et les matières en fibres après que les opérations d'appliquer de l'air ionisé et de l'air normal ont été terminées.

3. Procédé selon la revendication 1, caractérisé en ce qu'il comprend l'opération de transférer le duvet et les matières en fibres à travers une pluralité de chambres (18^1, 19^1, 18^2, 19^2, 18^3) remplies alternativement d'air ionisé et d'air normal, cette pluralité de chambres étant séparées les unes des autres par une pluralité de rideaux d'air (17a).

4. Procédé selon la revendication 3, caractérisé en ce qu'il comprend l'opération de faire stationner le duvet et les matières en fibres dans chaque chambre de la pluralité de chambres pendant une durée prédéterminée de temps.

FIG.1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3c
8a
2c
2d
4b
10a
11^3
11^4
10^4
2b
3b
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7b
2e
7a
7
11^2
3d
4
3e
6
10a
10^5
10a
8
10^3
10^2
2a
4d
10a
4a
5
11^1
3
3a
10^1

FIG.2

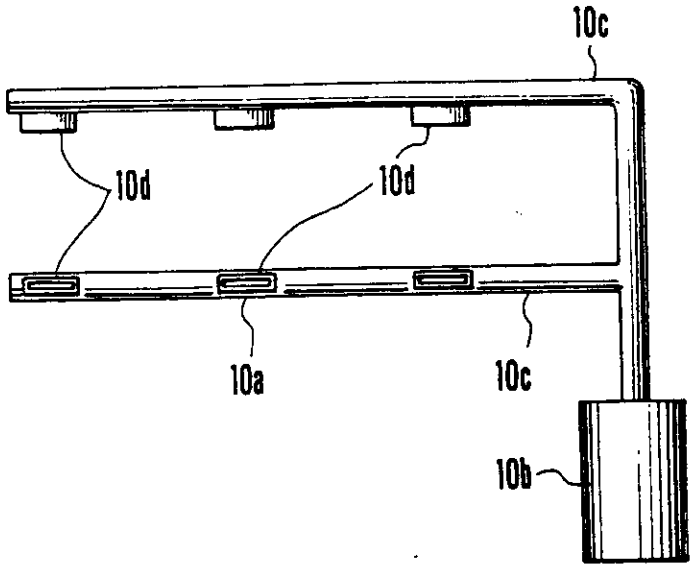


FIG.3

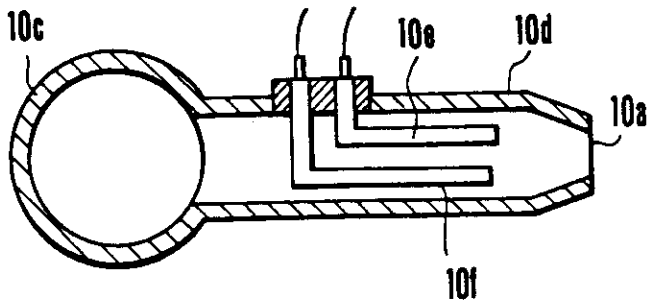
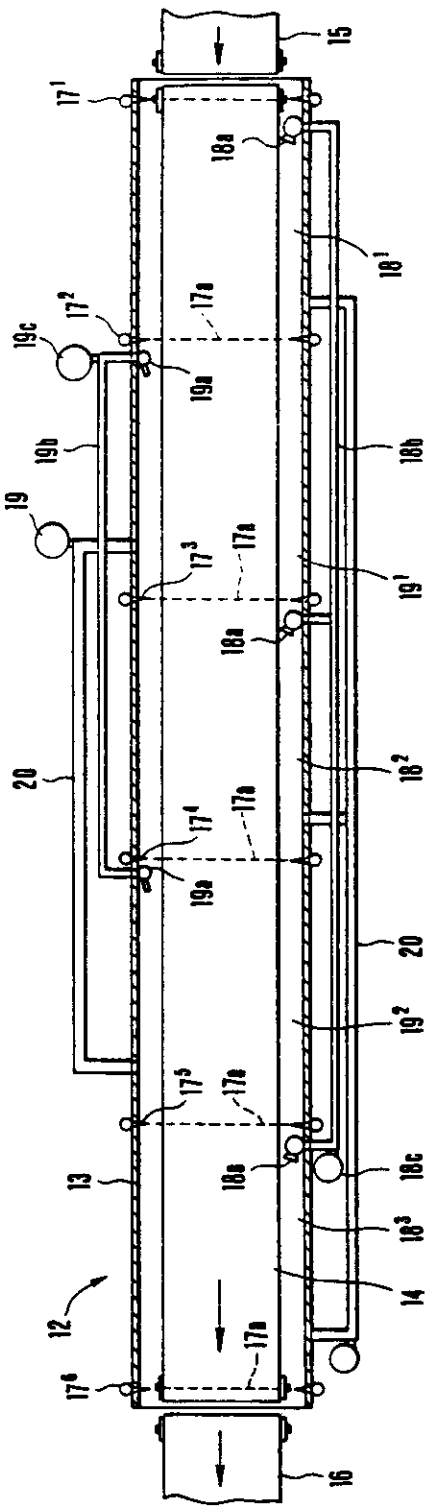


FIG.4


15
17^1
18a
18^1
17^2
17a
19c
19a
19b
18b
19
17^3
17a
19^1
18a
18^2
20
17^4
17a
19a
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19^2
17^5
17a
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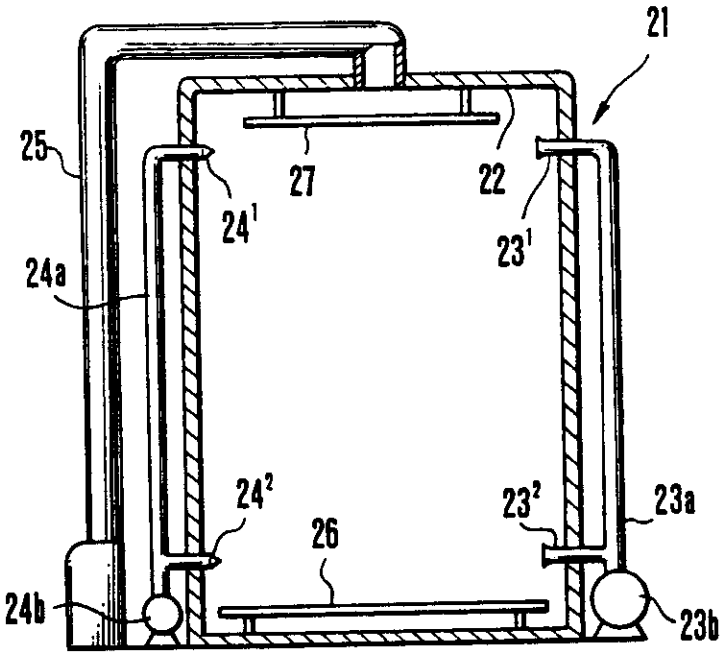
18a
18c
18^3
14
12
17a
17^6
16

FIG.5



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