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(54) A METHOD FOR THE ROLLER AIR SUSPENDING CARDING AND A SPECIFIC ANIMAL FINE HAIR COMBINED CARDING MACHINE

(57) A suspension dehairing method by airflow generated by roller of this invention is based on the aerodynamics principle, takes advantage of suspension action of buoyancy of airflow sphere generated at the surface of roller above critical speed to suspension-dehair the scattering flocks coming into airflow sphere, the method is enable the heavy impurities and coarse fibres to descend and to be separated, in order to attain the subject of anticipate dehairing. The combined dehairing machine includes a set of dehairing unit with double cylinder opening and coarse-fibre-throwing; two or more sets of dehairing unit with coarse fibre separating by roller, condensing by doffer and airflow combined; a set of unit with centrifugal coarse fibre separating by parallel rollers, airflow suspension separating, transferring and delivering by dust cage; and two set of units with successive carding, stripping of flat-strips by vacuum stripping, automatic separating of dandruff, automatic circulation of reusable flat-strips, droppings by air taking and sending.

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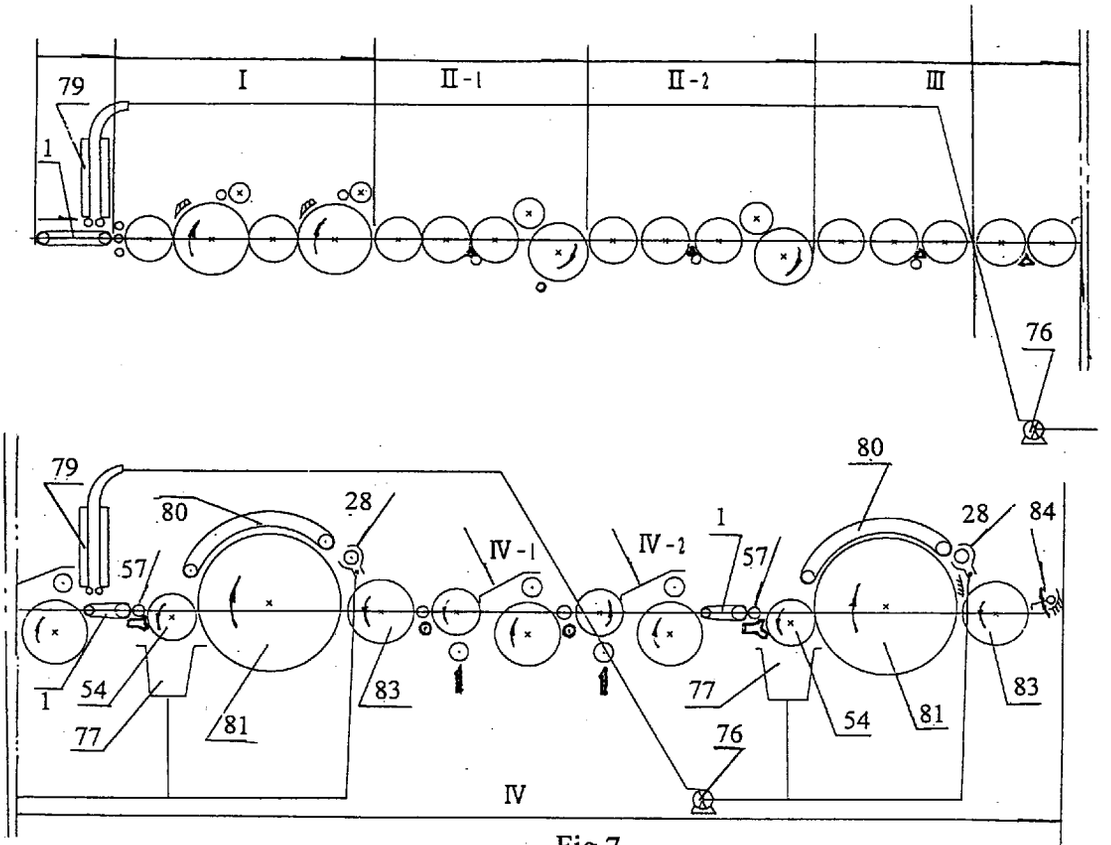
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Fig.7

Description

TECHNICAL FIELD

The invention relates to a dehairing method and its equipment for special downs in textile industry. Especially, it relates to a suspension dehairing method by airflow generated by roller(S. D. A. R.)and its combined dehairing machine for special downs.

BACKGROUND ART

At present, the conventional roller dehairing equipment used in the dehairing process in textile industry, especially in the dehairing technology of special downs such as cashmere, yak down, lambs-down, is classified into " equipment with principle of three rollers, doffer transferring, centrifugal dehairing " , " equipment with principle of three rollers, fancy transferring , centrifugal dehairing " and " equipment with principele of taker-in centrifugal dehairing, fan suction transferring " .

A first kind of dehairing equipment: after receiving flocks from a front intake roller, a coarse-fiber-throwing dehairing roller separates coarse fibres by means of centrifugal force, the dehaired flocks are then collected at the card clothing by doffer condensing roller and are tranferred to a guide roller, thereafter are submitted to the next process, a second kind of dehairing equipment: coarse-fiber-throwing dehairing roller picks up the flocks from a front intake roller and separates coarse fibers by means of centrifugal force, the dehaired flocks are then collected at the card clothing by a fancy transferring roller and are transferred to a guide roller, thereafter are submitted to the next process. The dehairing principle makes use of the centrifugal force generated by the dehairing roller in certain technological revolving speed. When the flocks reach the lower part, the material being held at the card clothing of the dehairing roller begins to be separated. The medullated wools, fine bristles, large impurities, the other kinds of coarse fibres with good straightness and the burrs which have relatively large mass which are not easy to be held by the clothing are separated from the clothing by the centrifugal force, but the flocks with little mass and certain degree of crimps and other substances are not easy to be separated and are continuously held by the clothing and to be transferred , in the former equipment relay-transfer of the flocks is performed under the action between the doffer condensing roller and the coarse-fiber-throwing dehairing roller. In the latter equipment relay-transfer of the flocks by raising is performed under the intrelock action of the needle between the fancy transferring roller and the coarse-fiber-throwing dehairing roller. But the dehairing equipment with principle of taker-in centrifugal dehairing, fan suction transferring conducts centrifugal dehairing by the severe beat of the taker-in, the downs at the surface of the clothing are then transferred in negative pressure by fan. This dehairing equipment has such problem:the action under the severe dehairing force and many times of mechanical beating dehairing lead to high cutting rate and severe fibre damage. Not only more downs are cut and stretch-broke, but also the heterotypical fibres, fine bristles are being cut. Thus these coarse fibres are more difficult to be separated and a large part of the cut downs and the heterotypical fibres, fine bristles which cann't be separated are mixed into waste blends and can't be separated, become the unqualified products(short fiber, second-class product)and waste(waste blends).

The dehairing machine made in Japan is a typical equipment with principle of taker-in centrifugal dehairing, fan suction transferring. It adopts the severe dehairing mechanism with feed plate, taker-in and fancy transferring as the main part. Its drawing rate is 85%, fibre damage rate is 15%, rate of coarse fibre content is 0.2%, rate of impurity content is 0.3%. (provided by its directions)

The dehairing machine made is England adopts the roller dehairing mechanism with two feed rollers, taker-in and fancy transferring as the main part, Its drawing rate is 93%, fibre damage rate (and first-class product rate) is not considered, rate of coarse fibre content of end product is 0.4%, rate of impurity content is 0.2%.

LFN 241 cashmere combined dehairing machine made in China adopts the roller dehairing mechanism with roller coarse-fibre-throwing, fancy transferring as the main part. A taker-in, flat dehairing unit is provided to it. Its drawing rate is 8.5%, fibre damage rate is 15%, rate of coarse fibre content is 0.2%, rate of impurity content is 0.2%.

It's testified in practice that this dehairing unit has good effect on the separating of coarse medullated wools that differ greatly from cashmere in mass, coarse fine wools with good straightness and large impurities in clean wools for dehairing, There's no good effect on the separating of fine bristles that differ slightly from cashmere, coarse wools with certain degree of crimps and heterotypical fibres contained in raw cashmere. This unit has some drawbacks; lapping, abrasion of the clothing, sagging of the needle, bad technological reliability of the unit, serious damage of the fibre, relatively low general dehairing efficiency. The delivering way also has certain drawback.

DISCLOSURE OF THE INVENTION

It's an object of the invention to provide a S. D. A. R. method and its combined dehairing machine for special downs which has capabilities of not only removing coarse medullated fibres and impurities as the conventional roller dehairing

unit, but also removing heterotypical fibres, fine bristles, coarse wools that differ slightly from cashmere in mass. It is also capable of drawing cashmere for the second time from suspending materials and has good dehairing efficiency and little fibre damage.

Another object of the invention is to provide a kind of S. D. A. R. method and its combined dehairing machine for special downs with doffer transferring, guide roller collecting of cashmere.

Another object of the invention is to provide a S. D. A. R. method and its combined dehairing machine for special downs which has separating function as down removing knife, separates downs from dehairing roller, delivers and collects downs by big and small filter-net-roller.

The objects of the invention are fulfilled according to the following technical solutions.

The S. D. A. R. method of the invention includes:

1. the flocks are being dehaired on the dehairing roller, coarse medullated wools, impurities and downs in single fibre are separated from the clothing and become the suspending materials, the flocks that haven't been dehaired are held on the dehairing roller, characterized in that the method is also including;
2. the airflow formed between two adjacent rollers dehairs the flocks between them, loosens the flocks, the impurities, fine bristles, heterotypical fibres, coarse fine wools with few crimps are separated again from roller and become the suspending materials;
3. the flocks held on the dehairing roller are transferred from the dehairing roller to the delivering unit and delivered;
4. the suspending materials are being dehaired by suspension action by the roller airflow sphere below the dehairing roller formed by the rotation of the dehairing roller(dehairing for the second time), the coarse fibres, heterotypical fibres, coarse wools, impurities descend and become the droppings, the downs in the suspending materials suspend in the roller airflow;
5. the downs suspending in roller airflow are gathered at the down collecting unit by the flow of roller airflow;
6. the downs on the down collecting unit are transferred to the delivering unit and are delivered;
7. the filter-net-roller (also called filter-net dust cage) collects roller airflow with dust and lead it to the outside of the machine.

In S. D. A. R. method above metioned , said method of transferring the flocks held on the dehairing roller from dehairing roller to the delivering unit adopts the way of doffer transferring, stripping and delivering by guide roller, said method of gathering the downs suspending in roller airflow to down collecting unit by flow of roller airflow is that the roller airflow flows to the guide roller and filter-net-roller, the downs are gathered at the guide roller, the airflow is led out by filter-net-roller, the downs and said flocks are then delivered together.

In S. D. A. R.method, said method of transferring the flocks held on the dehairing roller from dehairing roller to delivering unit is that flocks are removed under the airflow separating action of down removing knife, and the flocks are held and delivered by airflow, big and small filter-net-roller. Said method of gathering the downs suspending in roller airflow to down collecting unit by the flow of roller airflow is that roller airflow flows to big and small filter-net-roller, downs are gathered at the surface of big and small filter-net-roller, the airflow is led out by the filter-net-roller, the downs and said flocks are then delivered together.

The combined dehairing machine for special downs which is designed according to the S. D. A. R. method of this invention comprises units that are set in sequence from the front to the rear:

1. a set of dehairing unit with double cylinder opening and coarse-fibre-throwing;
2. two or more sets of dehairing unit with coarse fibre separating by roller, condensing by doffer and airflow transferring combined;
3. a set of unit with centrifugal coarse fibre separating by parallel rollers, airflow suspension separating, transferring and delivering by dust cage;
4. two sets of units with successive carding, stripping of flat-strips by vacuum stripping, automatic separating of dandruff, automatic circulation of reusable flat-strips, droppings by air taking and sending.

The structure is described one by one as follows.

1. a set of dehairing unit with double cylinder opening and coase-fibre-throwing comprises three feed rollers, opening and transferring roller, breast cylinder, transferring and coarse-fibre-throwing roller and cylinder roller which are placed horizontally in sequence and behind feed lattice, it also comprises a dehairing plate placed in the front of breast cylinder and cylinder roller respectively, above the dehairing plate is a dehairing knife which lies on the entering side of the dehairing plate, at the rear-upper side of breast cylinder and cylinder roller, a stripper roller is provided respectively, behind the stripper roller is the working roller. The working surfaces of all the rollers abovementioned and the dehairing plate are covered with clothing, the density of clothing is different, fewer in the front

and denser in the rear, three feed rollers are positioned vertically, the middle feed roller rotates clockwise, the other two rollers rotate anticlockwise, the others rotate clockwise except for the breast cylinder and cylinder roller, there is certain clearance(10-43 ‰") between the rollers and between the dehairing mechanism;

the set of dehairing unit with double cylinder opening and coase-fibre-throwing constitutes a first unit of the combined dehairing machine, the main function is to open in advance the feed material after the materials are fed into this unit, meanwhile, throw out part of coarse medullated wools and impurities, the arrangement of two cylinders, the selection of special saw-tooth clothing and use of the dehairing plate enable it to have less fibre damage rate and better action of opening and impurities removing;

the conventional LFN241 cashmere combined dehairing machine provides two carding units consisting of stripper roller and working roller above the single cylinder roller, the two carding units are adjacent to one another and because of the effect of airflow, the unopened flocks which should return back in working process can't return regularly and result in unsufficient opening, in addition, the single cylinder roller can't satisfy the anticipated opening requirement, to have more ideal opening effect, the denser clothing must be used, thereby increasing the breakage of fibres, resulting the damage of raw materials and affect the quality of final cashmere product;

the density of the clothing on the cylinder for the unit with double cylinder opening and coase-fibre-throwing is different with fewer in the front and denser in the rear, enable the flocks being dehaired to be opened step by step, above the cylinder, a dehairing plate takes the place of the conventional (LFN241 cashmere combined dehairing machine) carding unit (one working unit) consisting of stripper roller and working roller, a dehairing knife is provided above the dehairing plate , the action of impurities removal by dehairing is added here in the working process, the impurities such as burrs are being separated by means of striking action of the airflow and the dehairing knife, afterwards, the coarse wools, burrs and the like impurities are being separated by the centrifugal force of transferring and coarse-fibre-throwing roller between the two breast cylinders, the unit achieves the effect of more sufficient opening and low fibre damage rate;

2. two or more sets of dehairing unit with coarse fibre separating by roller, condensing by doffer and airflow transferring combined is located behind the dehairing unit with double cylinder opening and coarse-fibre-throwing, each dehairing unit with the combination of coarse-fibre-throwing by roller, condensing by doffer, and transferring by airflow, consists of three or five dehairing rollers set horizontally in sequence from the front to the rear with clothing round the roller, characterized in that the unit includes also a delivering unit mounted at the upper-rear of the last dehairing roller, a collecting unit of suspending downs and a small filter-net dust cage positioned under the last dehairing roller, in the lower-rear of the dehairing roller rotating clockwise is a fixed dehairing triangle, below which or at the lower-rear of which is provided an airflow adjusting roller rotating anticlockwise, the clothing is round the roller, the first roller and the spaced dehairing roller rotate anticlockwise, the others rotate clockwise; said delivering unit includes a doffer roller rotating clockwise in the upper-rear of the last dehairing roller with clothing wrapped round it; said collecting unit of suspending downs includes a down guide roller which locates behind the last dehairing roller, rotates clockwise and is wrapped with the clothing, it contains also a small filter-net dust cage which locates below the guide roller and rotates clockwise;

3. a set of unit with centrifugal coarse fibre separating by parallel rollers, airflow suspension separating, trans ferring and delivering by dust cage locates behind above-mentioned two or more sets of dehairing unit, which contains five dehairing rollers set in sequence from the front to the rear with the clothing round each roller, the first dehairing roller and the spaced dehairing roller rotate anticlockwise, the others rotate clockwise, in the upper-rear of the last dehairing roller is a delivering unit which contains a delivering knife located in the upper-rear of the last dehairing roller and the guide cover adjoining the delivery knife, further contains a collecting unit of suspending downs located behind the last dehairing roller, the collecting unit includes a big filter-net dust cage rotating clockwise and located behind the last dehairing roller and a small filter-net dust cage rotating anticlockwise thereupon, below the place between the second and the third dehairing roller, as well between the fourth and the fifth dehairing roller, a dehairing triangle is provided respectively, under the dehairing triangle positioned below the place between the second and the third dehairing roller, there is an airflow controlling roller rotating clockwise with clothing round it, said five dehairing rollers have arcuated airflow cover at the upper side;

4. two sets of units with successive carding, stripping of flat-strips by vacuum stripping, automatic separating of dandruff, automatic circulation of reusable flat-strips, droppings by air taking and sending locate behind above-mentioned set of unit 3,each consists of a feed lattice, a dehairing unit with double-nose-like side feed plate positioned horizontally behind the feed lattice, the dehairing taker-in covered with clothing rotating anticlockwise, a main cylinder rotating clockwise, a doffer roller rotating anticlockwise, on the working surface above the main cylinder there is a dehairing flat with clothing, a set of unit with vacuum stripping of flat-strips, automatic separating of dandruff, is positioned at the droppings outlet of the dehairing flat, a set (or two sets) of dehairing unit with feed roller,

taker-in, beat roller and airflow transferring or the oscillating type unit of stripping by stripper bar (this unit must be provided in the delivering end of the entire machine) is provided after the doffer;

said dehairing unit with double-nose-like side feed plate comprises a dehairing plate with working surface in special shape, feed roller, the special working surface in the front end of the dehairing plate, characterized in that said working surface has a first working area and a second working area, the first working area comprises an upper inclined plane and a lower inclined plane, the upper plane is inclined to the vertical plane at an angle 10-14°and the lower plane is inclined to the vertical plane at an angle 15-20°, said second working area,comprises an inclined plane of the second working area, which is inclined to the vertical plane at an angle 24-26°, an arc adjoins the inclined plane of the second working area with the lower inclined plane, the arc forms a groove between two planes, said upper inclined plane, lower inclined plane, the inclined plane of the second working area incline in the same direction to the vertical plane;
said first working area may comprise only the upper inclined plane, an arc adjoins this plane with the second working area and a groove is formed;
behind the double-nose-like side feed plate lies the dehairing taker-in, after which a main cylinder roller rotating clockwise is located, above the main cylinder is the dehairing flat, the working surface of the main cylinder roller and the dehairing flat are covered with clothing, at the droppings outlet of the dehairing flat lies the unit with vacuum stripping of flat-strips and automatic separating of dandruff, which comprises the stripper roller which is covered with clothing and rotates anticlockwise, the stripping of the clothing at the surface of the stripper roller and the main cylinded forms stripping form, outside the stripper roller is an airflow cover, the lower side wall of which forms the lower airflow guide plate, the upper part of the airflow cover has an upper cover plate which is telescopically adjustable, an airflow guide knife is provided below the stripper roller in the airflow cover, the lower part of the airflow cover has an outlet from which the air and the reusable downs are drawn out and negative pressure is formed in the airflow cover, said clothing teeth of the main cylinder and the stripping roller incline backwardly with respect to the direction of rotation, said airflow guide knife is a column or plate with triangle section, a doffer roller is provided behind the main cylinder, a set (or two sets) of dehairing unit with feed roller, taker-in beat roller, airflow transferring or the oscillating type unit of stripping by stripper bar (this unit must be provided in the delivering end of the entire machine)is provided after the doffer;
in said one set (or two sets) of dehairing unit with feed roller, taker-in beat roller,airflow transferring, each comprises two feed rollers, taker-in, dust cage unit, beat roller under the taker-in and airflow guide knife under the beat roller, which are positioned in sequence behind the doffer, further comprises down removing knife located in the upper-rear of the taker-in ,and airflow guide cover which is positioned above the dust cage unit and is connected to the down removing knife, two feed rollers are covered with clothing and located vertically and rotate oppositely and inwardly, the taker-in is covered with clothing and rotates anticlockwise, the dust cage unit includes a big dust cage rotating clockwise and a small dust cage rotating anticlockwise thereupon.

The working principle of one set or two sets of dehairing unit with feed roller, taker-in beat roller, airflow transferring is that under the action of high-speed reverse airflow formed at the surface of beat roller, the coarse fibres and impurities at the outer part of taker-in airflow sphere are beaten out, turning passive coarse-fibre-separating into positive separaitng, after the coarse fibres have been separated, the fibre layer gathers along the airflow cover at the dust cage and is delivered out from the outlet by transferring, its coarse-fibre-separating efficency, the ability to remove fine bristles and bristles is only inferior to the unit with feed plate, taker-in, beat roller, dust cage transferring, but its unique fairly low damage rate of fibres enables to reach the object improving the capacity of the entire machine of remove the coarse fibres and to further reduce fibre damage rate.

The oscillating type unit of stripping by stipper bar can be provided directly behind the doffer(this unit must be provided in the delivering end of the entire machine).

In addition, the combined dehairing machine provides unit with circulation of flat-strips and droppings by air taking and sending, which comprises down collecting bin, fan, funnel connected to fan pipeline and flat stripping cover. The collecting bin lies in a suitable place above the feed lattice. The top of the bin and the fan pipeline are connected. A pair of filter-net feed rollers which are set in horizontal and rotate in opposite direction are provided under the collecting bin. The funnel connected with the fan pipeline is provided under the dehairing taker-in behind the dehairing unit with double-nose like side feed plate. After adopting this unit, the reusable flat-strips in which the dandruffs have been separated and the droppings under the taker-in are being filtered of dusts by independent air taking and sending, automatic circulation unit and are passed to the feed lattice in the preceding process to rejoin the technological cycle of the process. The drawing rate of the down is improved further and the enviroment of the workshop is improved.

Except for the above-mentioned main machine, the combined dehairing machine is provided with an auxiliary machine, namely an unit of disposing of the droppings, which comprises the feed lattice, after which is, in sequence, the dehairing unit with double-nose-like side feed plate, the dehairing taker-in, big and small dust cage, a pair of feed

rollers, the dehairing taker-in, big and small dust cage and beat rollers set below the two dehairing taker-in respectively. Below the beat roller is a discharging knife. Its specific structure has been described above and will not be described here. This unit can be used jointly with the main machine or be used individualy. Its working principle and object are in the following.

The droppings containing more coarse fibres and impurities are fed into the auxiliary machine after the raw materials have been dehaired by the combined dehairing machine. The most part of coarse fibres, impurities and dandruffs are separated by the puncturing, carding, beating action between double-nose-like side feed plate and the taker-in, and by the counteraction of the airflow sphere below the taker-in and above the beat roller. The downs having been separated are gathered to the big and small dust cage with the airflow sphere along the guide cover, condensed and transferred to two rollers taker-in unit. With the weak dehairing action between the two rollers and the taker-in, and with the counteraction of the airflow sphere below the taker-in and above the beat roller, a part of coarse fibres, impurities, fine bristles, dandruffs and heterotypical fibres in the downs are being separated again. The downs that have been separated for two times are condensed to the big and small dust cage with the airflow sphere around the taker-in along the airflow cover and are transferred out and drop into down collecting bin. This part of droppings participate in the technological cycle of the main machine again.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic block diagramm illustrating the working process of S. D. A. R. method of this invention.

Fig.2 is a first embodiment of S. D. A. R. method of this invention.

Fig.3 is a second embodiment of S. D. A. R. method of this invention.

Fig.4 is a schematic drawing for the structure of dehairing unit with double cylinder opening and coarse-fibre-throwing.

Fig.5 is a schematic drawing of dehairing unit with coarse-fibre-separating by seven rollers, condensing by doffer and airflow transferring combined.

Fig.6 is a schematic drawing of delivering unit with coarse-fibre-separating by five parallel rollers. airflow suspension separating, transferring by filter-net-roller.

Fig.7 is a schematic drawing for the structure of this combined dehairing machine for special downs.(an embodiment)

Fig.8 is a schematic drawing for the structure of dehairing unit with double-nose-like side feed plate.

Fig.9 is a schematic drawing for the structure of the unit with vacuum stripping of flat-strips, automatic separating of dandruff.

Fig.10 is a schematic drawing for the structure of the dehairing unit with feed roller, taker-in beat roller, airflow transferring.

Fig.11 is a schematic drawing for the structure of the unit with automatic circulation of reusable flat-strips, droppings by air taking and sending.

Fig.12 is a schematic drawing for the structure of auxiliary machine, namely an unit for disposing the droppins.

1 - feed lattice
2 - feed roller
3 - opening and transferring roller
4 - dehairing plate
5 - breast cylinder
6 - transferring and coarse-fibre-throwing roller
7 - cylinder roller
8 - stripper roller
9 - working roller
11、13、15、29、31、33、35、37 - dehairing roller
12、14、16、19、22、26、30、32、34、36、38、47、58、62 - clothing
17 - delivering unit
18 - doffer roller
20 - collecting unit of suspensing down
21 - down guide roller
23 - filter-net small dust cage
24, 43, 45 - hole
25 - airflow adjusting roller
27 - dehairing triangle
39 - airflow cover
40 - down removing knife
41 - guide cover
42 - big dust cage
10 - delivering unit
44 - small dust cage
46 - airflow controlling roller
48 - dehairing triangle

49 - collecting unit of suspending down
50 - dehairing plate
51 - feed roller
52, 53, 56-inclined plane
54 - dehairing taker-in
55 - groove
57 - dehairing unit with double-nose-like side feed plate
58 - flat clothing
59 - teeth
60 - flat carrier disc
61 - stripper roller
62 - stripping clothing
63 - outlet
64 - lower guide plate
65 - airflow guide knife
66 - airflow cover
67 - outlet cover
28 - unit with vacuum stripping of the flat-strips, automatic separating of dandruffs
68 - feed roller
69 - taker-in
70 - beat roller
71 - airflow dischange knife
73 - stripper roller
74 - stripper bar
75 - airflow guide cover
76 - fan
77 - funnel
79 - down collecting bin
80 - dehairing flat
81 - main cylinder
83 - doffer
D - first working area
E - second working area
α - inclined angle between plane 52 and vertical plane
β - inclined angle between plane 53 and vertical plane
θ - inclined angle between plane 56 and vertical plane
A.B - clearance
84 - oscillating type unit of stripping by stripper bar

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The dehairing method by airflow produced by roller and the combined dehairing machine for special downs provided by the invention are further described with reference to the drawings and embodiments.

Fig.1 illustrates the technological process of the (S. D. A. R.) method of the invention. The flocks are fed by feed roller and are held by the dehairing roller (the number of the dehairing roller is determined according to technological requirment, generally three or five). First of all, the flocks are being dehaired by the centrifugal force produced by rotating of dehairing roller and are combed and dehaired by action of clothing. The coarse medullated fibres, heterotypical

fibres, fine bristles, coarse fine fibres, large impurities and other coarse fibre with good straightness which have large mass and are not easy to be held by clothing are being separated and become suspension materials which also contain downs in single fibre form that are not held by clothing and descended loosely. The flocks on the dehairing roller are being dehaired by strike force of airflow formed between two adjacent rollers. The flocks are loosened and the impurities, fine bristles, hyterotypical fibres, coarse fibres with little crimp, downs in single fibre form contained in the flocks are being dehaired out again and drop from the roller, become suspension materials. The flocks remained on the dehairing roller are delivered by delivering unit, held by doffer or stripped by removing knife. Because of the rotating action of the dehairing roller, through a certain machine design, an airflow sphere for the roller which is moved in the same direction with the flocks (Fig.7 right) is produced around the roller, especially under the roller. The airflow sphere suspension-dehairs the separated materials from the dehairing roller (dehairing for the second time), wherein the light downs are suspending in airflow sphere and move to the right along with airflow sphere, are finally collected by collecting unit of suspending downs such as guide roller or big filter-net-roller and are blended and delivered with the flocks transferred from the taker-in. Whereas the heavy coarse medullated wool, large impurities and other coarse fibres, hyterotypical fibres, fine bristles, coarse fine wools, dandruffs as separated materials by airflow, then drop to the lower part of machine as droppings. The airflow in airflow sphere goes into hollow filter-net-roller(i. e. filter-net dust cage), thereafter dusts are separated and the air is led out of the machine.

Fig.2 illustrates a first embodiment of this method which is a S. D. A. R. method to dehair, deliver downs using a combination of transferring by doffer with transferring by airflow. It can be used in the main dehairing part in cashmere dehairing process. The technological process is as below. The flocks are held by the dehairing roller (it may be three or five set in sequence) and rotate, then are combed by clothing, and the coarse medullated wool, large impurities, downs in single fibre form are being separated by centrifugal force, thereafter, are being dehaired by the strike action of airflow between two rollers once more. The flocks on the last dehairing roller are held and transferred by doffer of the delivering unit and then are held by guide roller and transferred to the dehairing roller of next process and the suspension materials are being suspension-dehaired by the airflow sphere produced by the dehairing roller. The coarse medullated fibres, large impurities drop as droppings. The downs move to right with airflow and are finally gathered to the guide roller of the collecting unit and the airflow containig dusts goes into the inner part of the filter-net-roller through the hole at the surface of the filter-net-roller and led out of the machine.

Fig.3 illustrates a second embodiment of this method which is a S. D. A. R. methed using big, small filter-net-roller as unit of collecting downs, delivering downs, It can be used for delivering process in cashmere dehairing process. The former part of the technological process is similar to the first embodiment. The difference is that the flocks on the last dehairing roller are removed from the dehairing roller by airflow separating action of down removing knife and are discharged between big and small filter-net-roller under the guide of airflow of guide cover and the suspending downs in the airflow formed by the dehairing roller are gathered at the surface of big filter-net-roller of unit for collecting suspending downs and then are delivered by big, small filter-net-roller. The positive pressure airflow containing dusts is led out through the mess of big and small filter-net-roller.

The airflow separating action of down removing knife depends on an airflow formed at the surface of the roller when the last dehairing roller rotates in high speed. When meeting with the edge of down removing knife, the airflow produce an airflow which moves toward the outer side of blade, which enables the flocks held by the roller to separate from the roller and are led to the big and small filter-net-roller along the guide cover to be discharged. At the same time, the airflow leads the downs in the suspension dehairing airflow to big and small filter-net-roller, make them to be gathered on it. Therefore, this delivering method doesn't break the downs.

In a word, S. D. A. R.method provided by the invention is mainly based upon aerodynamics principle, which takes advantage of buoyancy of airflow sphere generated at the surface of roller above critical speed to separate by airflow suspension. In this method, with the suspension action of airflow sphere at the surface of roller on scattered flocks coming into airflow sphere, heavy impurities and coarse fibres are descended and are separated in order to attain the object of anticipated dehairing.This method brokes through the conventional principle and technology of " roller centrifugal dehairing " ,the problem of dehairing lose effectiveness existed in conventional technology and equipment of roller centrifugal dehairing (when dehairing below critical speed, heterotypical fibres, fine bristles, fine coarse wools are not easy to be separated. Lapping is easily; when dehairing above critical speed, part of downs, impurities and all kinds of coarse wools are descended and become droppings under the action of airflow and strong centrifugal action) is solved. The dehairing technique for cashmere, yak down, lambs-down and the like special downs is improved to a new phase. The drawing rate reaches above 95%. The damage rate of fibre is reduced by 10%.

Fig.4 is a schematic drawing of dehairing unit with double cylinder opening and coarse-fibre-throwing.

The unit is positioned in the front of the entire machine shown in Fig.7. Section I comprises the following parts set horizontally in sequence: three feed rollers 2 with slight degree of arc in vertial direction arranged behind feed lattice 1 and around the opening and transferring roller 3, opening and transferring roller 3, breast cylinder 5, transferring and coarse-fibre-throwing roller 6, cylinder roller 7, further includes the dehairing plate 4 positioned at the upper-left of the breast cylinder 5 and cylinder roller 7 respectively, above the dehairing plate 4 is dehairing knife which lies above the

entrance face of the dehairing plate, and has the function of striking and removing impurities. At the upper-right of the breast cylinder 5 and cylinder roller 7 are the stripper roller 8 and the working roller 9 arranged in the right of the stripper roller 8. All rollers and working surface of the dehairing plate are wrapped with clothing. The density of teeth is different, fewer in the front and denser in rear. The feed roller in the middle rotates clockwise, the other two feed rollers rotate anticlockwise. Other rollers rotate clockwise except that the breast cylinder and cylinder roller rotate anticlockwise.

Fig. 5 is a schematic drawing of dehairing unit (embodiment) with coarse-fibre-separating by seven rollers, condensing by doffer and airflow transferring combined. The embodiment is suitable for preliminary dehairing technology of special downs dehairing. The unit positioned in section II -1 and II -2 of the entire machine shown in Fig.7 comprises three dehairing roller, i. e. a first dehairing roller 11, a second dehairing roller 13, a third dehairing roller 15, of course, the number of the dehairing roller can be changed according to working requirment, delivering unit 17 including a doffer roller 18, unit 20 for collecting suspending downs including a down guide roller 21, a dehairing triangle 27 and a filter-net small dust cage 23. Except for the dehairing triangle 27, other rollers can be mounted rotatably on frame, and driven by gearing to rotate. The dehairing triangle is fixed on the plane of frame. Three dehairing rollers 11、13、15 are set in horizonal. The dehairing roller 11 is in the front. The rollers are furnished with clothing 12、14、16 respectively. The dehairing triangle 27 is fixed below the plane between roller 13、15. At the lower-right of the dehairing triangle 27 is the airflow abjusting roller 25. The upper-right of the dehairing roller 15 (the last dehairing roller) is the doffer roller 18, the lower-left of which, i. e. the lower-right of the last dehairing roller 15 is down guide roller 21. The doffer 18 and the down guide roller 21 is covered with clothing 19、22. At the lower-left of the down guide roller 21 is a filter-net-roller 23, at the surface of which there are holes 24 connected with the hollow inner part.

The first dehairing roller 11 rotates anticlockwise, the clothing 12 thereon is inclined forwardly with respect to the direction of rotation. The second dehairing roller 13 rotates clockwise, the clothing 14 thereon is inclined forwardly to the direction of rotation. The last dehairing roller 15 rotates anticlockwise, the clothing 16 thereon is inclined forwardly to the direction of rotation. The doffer rotates clockwise, the clothing 19 thereon is inclined backwardly. The down guide roller 21 rotates clockwise, the clothing 22 thereon is inclined forwardly. The filter-net dust cage 23 rotates clockwise, which is a hollow column, the holes 24 at the surface of which connects the inner and outside of column and which extends out of frame and leads out air and dust in the airflow sphere.

The working principle of this embodiment is as follows: after being transferred from a preceding dehairing unit, flocks are under the opening and dehairing action of three dehairing rollers 11,13,15, because of the effect of the bigger centrifugal force and the lower triangle airflow area of the rollers, flocks mixed with dehaired in single fibre form enter continuously into airflow sphere under the unit, according to the aerodynamics principle, in these flock mixtures, the coarse fibres and impurities which have larger mass and inertia overcome the effect of forces such as the airflow sphere resistance and airflow buoyancy to move outward the airflow sphere, till they separate and drop from the airflow sphere as droppings, the lighter downs are wrapped in the airflow sphere and gathered toward the down guide roller and the filter-net small dust cage, the mixtures containing dust are transmitted out of the machine by the airflow through the filter-net small dust cage, in the transmitted process on the rollers, through the holding action of these three dehairing rollers, the unopened down flocks are continuously opened until they are condensed and transmitted to the down guide roller by the doffer roller, then conveyed with the downs which are separated through suspension separating area on the roller and transmitted to the next dehairing unit to be re-dehaired, because of dehairing roller 13 has different rotating direction, in the triangle area which is under roller 13、15, there will be an airflow whirl which can affect the suspension separating action, the dehairing triangle 27 is taken to destroy the airflow whirl state formed in the triangle area, so that fibres can be moved with the airflow direction given by the technological requirement in order to take suspension separating, at the back of dehairing triangle 27 and the lower left of dehairing roller 15, on the other word, at the back of the dehairing roller which rotates clockwise and the lower part to the next dehairing roller, it would be preferably to set up an airflow adjusting roller 25 which rotates clockwise or anti clockwise(according to the concrete different raw materials), the outer surface of roller 25 is also wrapped with clothing 26, the effect is to control the size of the airflow sphere produced by dehairing roller 15, in order to form a suitable suspension airflow sphere which would be benefit for the dehairing of different materials.

When this embodiment is applied to cashmere dehairing, its technical parameters may be:

dehairing roller 11, diameter 252mm, revolution 230~300rpm
dehairing roller 13, diameter 252mm ,revolution 300~450rpm
dehairing roller 15, diameter 252mm, revolution 480~620rpm

The dehairing roller under above-mentioned diameter and revolution can produce roller airflow which is enough to suspend cashmere.

Compared this unit with the LFN 241 roller dehairing and fancy transferring dehairing unit, there are many great changes in principles and effects. First, the transferring form is not that fibres in ball-like are thrown into the guide roller (this kind of ball-like fibres are both unfavorable to dehairing and easy to become droppings), but that the normal and

well-distribute fibre layer can be obtained through the condensing action of doffer and the direct stripping action by down guide roller. In addition, transferring of this unit is contactless, but in fancy transferring, fancy wires are inserted into roller's wires, the both wires are easy to be worn, so the revolving stability may be influenced.

More over, the unique design of this unit is that an airflow suspending-separating area is formed under the dehairing roller, so it's possible to get the more powerful function of coarse impurity-removing and the ability to control the down content in droppings. This principle brokes through the traditional centrifugal dehairing principle.

Fig. 6 is a set of unit with coarse fibres separating by five parallel rollers, airflow suspension separating, transferring and delivering by filter-net-roller, which is on the part III of Fig. 7 which shows the whole machine. The unit consists of five dehairing rollers 1、2、3、4、5, i.e. dehairing roller 29、31、33、35、37, and relevent clothing 30、32、34、36、39 which are covered at the surface of these rollers. Dehairing roller 29、33、37 rotate anti- clockwise, teeth of the clothings incline forwardly toward the rotating direction, and dehairing roller 31、35 rotate clockwise, teeth of the clothings incline forwardly toward the rotating direction. Delivering unit 10 is at the upper right of dehairing roller 37(the last dehairing roller), which includes down removing knife 40. There is a certain clearance between down removing knife 40 and dehairing roller 37(e.g. 0.1~0.5 mm), down removing knife 40 is adjoined with a guide cover 41. At the back of dehairing roller 37 is installed down collecting unit 49 for the process of down dehairing, which includes big filter-net roller 42 (big dust cage). The big filter-net roller is a hollow tube with an opening 43 interlinking inner and outside. Above big filter-net roller 42 is a small filter-net roller 44, and there is also an opening 45 interlinking inner and outside on the small filter-net roller. The clearance between this two filter-net roller is 3~7 mm, the big filter-net roller rotates clockwise, the small filter-net roller rotates anti-clockwise. Below the place between dehairing roller 31、33, it would be preferably to set up an airflow controlling roller 46, the clearance between airflow controlling roller 46 and dehairing roller 31 is 0.2 ~ 0.4 mm. Below the place between dehairing rollers 31、37 and the place between dehairing rollers 35、37 are provided a dehairing triangle 48 respectively.

The principle of this embodiment is as follows:after the initial dehairing, fibres are further combed, resolved, centrifugally separated through the relay-transferring of the dehairing roller against fibres on the former four dehairing rollers, and at the same time, when fibres are transferred by the dehairing roller to the lower half-part, the combed in single fibre-like flocks with high impurities content are stricken and dehaired by the airflow produced between the two adjacent rollers and then separated from the surface of clothings and become suspension separating matter, finally, moved into the roller airflow area, under the influence of gravity, the flowing airflow sphere and through the suspending action of the carrying fibre by airflow sphere, fine bristles, heterotypical fibres are separated and dropped, downs are continuously moved along the airflow sphere, thereafter under the action of the high centrifugal force of the fifth roller and the airflow sphere formed at the surface of this roller, dandruffs series (bundle of fibres coexisting dandruffs and fibres) which are difficult to be opened via combing and the impurities in the flocks are separated rapidly from the airflow sphere to be dehaired through suspension dehairing, downs purified through airflow suspension dehairing are guided by the airflow sphere to be condensed on the surface of the big & small filter-net rollers, and then transferred by the filter-net roller to deliver, the positive pressure airflow containing dust are discharged by holes on the big and small filter-net rollers.

Flocks held by dehairing roller 37 are removed through the airflow exchanging action of the down removing knife, and guided with airflow below the guide cover in a space between the big and small filter-net roller, then conveyed with downs condensed on the filter-net roller to be delivered.

When this embodiment is applied to cashmere procedure, its technical parameters may be:

dehairing roller 27, diameter 252 mm, revolution 230 ~ 300 rpm
dehairing roller 29, diameter 252 mm, revolution 430 ~ 470 rpm
dehairing roller 31, diameter 252 mm, revolution 550 ~ 580 rpm
dehairing roller 33, diameter 252 mm, revolution 680 ~ 750 rpm
dehairing roller 35, diameter 252 mm, revolution 1160 ~ 1220 rpm
dehairing roller 27, diameter 252 mm, revolution 230 ~ 300 rpm
small filter-net roller 21, diameter 120 mm, revolution 4.5 ~ 6 rpm
big filter-net roller 39, diameter 380 mm, revolution 1.5 ~ 2 rpm
under above-mentioned diameter and revolution, the suspension airflow with enough strength can be produced around dehairing rollers.

For this part, mainly by use of the centrifugal coarse-fibre removing action of the parallel rollers and the suspension separating action of the airflow sphere the subject of removing coarse, dandruffs, impurities is attained. And by use of the air-filter, condensing action of the big and small dust cage fibres are transferred to the second dehairing part. This kind of dehairing unit has no teeth-to-teeth dehairing action, so the damage to fibres is very little.

Through appropriate adjustment of the technological parameters, down content in droppings are also very little. In design, the dehairing triangle is provide for destroying the airflow whirl formed in the triangle area, which can affect coarse-fibre separating in order to oblige the fibres in a moving state to move along the determined direction in order

guarantee the technological requirement. Compared with the traditional doffer stripper-bar delivering mode, this unit has simple structure, little damage to fibres, better droppings effects, and avoids the doffer-transferring deactivation caused by trapping burrs and sagging needle.

Fig. 8 is a schematic drawing for the structure of the dehairing unit with double-nose-like side feed plate 57, the unit is positioned at a part with reference number 57 in the whole machine shown in Fig.7. This unit consists of dehairing plate 50 fixed on the machine frame and the working surface at the end of dehairing plate 50. At working time, there are a feed roller 51 above the plate and a dehairing taker-in 54 cooperated with the working surface of dehairing plate. There are two working area on the working surface of feed dehairing plate 51, which is facing taker-in roller 54, namely a first area D and a second area E. The first area D consists of an upper inclined plane 52 and a lower inclined plane 53, the second area E consists of the inclined plane 56 which is under plane 53, an arc is connected between plane 53 and plane 56, the arc forms a groove 55 between plane 53 and plane 56, it is called the second nose-like groove which separates the first area from the second area. Plane 52、53、56 have the same inclined direction relative to the vertical plane, the inclined angles relative to the vertical plane are α, β, θ respectively. In the first working area D can also set up only one plane 52, there is also an arc to connect plane 52 and 56 and which forms a groove 55. In the first working area D, plane 52 is inclined to the vertical plane at an angle α which is 10 ~14°, preferably 11 ~ 12°, the vertical length is 22 ~ 28 mm (when there is only one plane 52, the length is 32 ~ 38 mm); plane 53 is inclined to the vertical plane at an angle β which is 15 ~ 20°, preferably 16 ~ 17° , the vertical length is 10 ~ 15 mm, plane 56 is inclined to the vertical plane at an angle θ which is 24 ~ 26°, preferably 24.5 ~ 25°, the vertical length is 18 ~ 22 mm. The above-mentioned vertical length of each plane should be changed with the diameter of taker-in roller. Values of the above-mentioned embodiment are values as the taker-in diameter which is 250 mm (the normal value).

When work, the clearance between plane 52、53 and dehairing taker-in roller 54 is 4.3 ‰" ~ 3.1 ‰", the clearance between plane 56 and dehairing taker-in roller 54 is 1.2 ‰" ~ 1.0 ‰". In the first working area, taker-in teeth first make the puncturing and dehairing to fibre groups and put these fibres in order. When the first working area has two planes, the effect of puncturing and dehairing is better than which of only one plane. Then dehaired fibre groups move into the second working area, the taker-in teeth make more full puncturing and dehairing to the dehaired fibre groups. The while, the longer fibre-groups holden by feed roller 51 are dehaired and stricken in the second working area, and the shorter fibres with a curved end move into the second nose-like groove, which are imaginarily holden by the fibre-layer, its other end is dehaired and stricken by the dehairing taker-in in the second working area. Because distance from pressing point of the feed roller to the striking ponit of the second working area with small clearance is double times more than the average feeding down length, theoretically, the stretching force to longer fibres in dehairing and striking process is very small, the stretching force and striking force to fibres with less than average length are approaching to zero, so the fibre-damage rate is highly decreased, it can be decreased above 54% than the feed plate of the prior art.

This unit adopts the form of the working surface of double-nose-like side feed plate, the whole dehairing process is finished through the puncturing, combing and dehairing, striking action by taker-in clothings to fibres under the practically holding action by the feed roller and the imaginarily holding action by the second nose-like groove. This unit has the advantage of full dehairing, small striking force, little fibre damage and high efficiency of impurity-removing.

Fig. 9 shows a schematic drawing for the structure of the unit with vacuum stripping of flat-strips and automatic separating of dandruffs, the unit is positioned at a part with reference number 28 in the entire machine shown in Fig. 7.

The flat clothing 58 as shown in Fig. 9 is supported by a flat carrier disc 60, which is rotated with the flat carrier disc 60 anticlockwise and moved. There are teeth 59 on the flat clothing 58, its inclined direction is backwardly toward the moving direction, there is also a stripper roller 61 which rotates anti clockwise. Flat carrier disc 60 and stripper roller 61 are supported by the machine frame and rotated by driving unit. There is a stripper clothing 62 on stripper roller 61, the inclined direction of its teeth is backwardly toward the rotating direction, teeth of clothing 62 and clothing 58 are opposed. There is a funnel-shape airflow cover 66 covered at outside of stripper roller 61, the lower part of airflow cover 66 becomes a lower guide plate 64. Clearance between the end of lower guide plate 64 and flat clothings 58 should be adjusted with the suction capacity, such that dandruffs dropped by the vibrating and striking force can be dropped and not to be sucked into airflow cover 66. There is an outlet cover 67 above airflow cover 66 which can be adjusted telescopically. There is a clearance A between end of outlet cover 67 and flat clothing 58, the clearance should not be too big, in order to avoid that the negative pressure be too low or can not be formed within airflow cover. The clearance can make the negative pressure to be formed on the lower guide plate, and it can also avoid that downs on the stripper roller 61 are thrown onto flat clothing 58. This clearance is generally about 3 mm. There is also a clearance B between end of outlet cover 67 and stripping clothing 62 of stripper roller 61, the action of clearance B is as same as of clearance A, clearance B is generally about 1 ~ 2 mm.

Airflow guide knife 65 is installed in a proper position inside airflow cover 66. If extracting air from airflow cover 66, the air is extracted from the lower outlet 63 (along the direction of arrow C) in order to make negative pressure within airflow cover. Airflow guide knife 65 is an column with triangle section or a plate, its action is that downs sucked between the stripper roller and the lower guide plate are guided to the outlet 63 and not came into the gap between roller 61 and cover 66.

The principle of this unit with vacuum stripping of flat-strips and automatic separating of dandruffs is as follows:

fibre blends containing impurities attached on the flat clothing 58 as rotating anti clockwise meet clothing 62 of stripper roller 61, the while, one end of fibre blends is holden by the flat clothing, the other end is dehaired and struck by the high-speed rotating stripper clothing 62 so downs can be separated from impurities and dandruffs due to caused vibration, at the same time, under the action of the airflow suction with negative pressure between the lower guide plate 64 and stripper roller 61, dandruffs and burrs are separated from flocks, then drop down from the outside of the end of lower guide plate 64 and become droppings. The reusable downs are moved into airflow cover with the airflow between the surface of stripping clothing 62 and lower guide plate 64 along the surface of airflow guide knife 65, then absorbed from outlet 63 by the negative pressure within airflow cover and transferred to the technical feed point to join the process of the last procedure, through air-conveying pipeline, to adjust the size of clearance A、B can prevent downs on the stripper roller from being thrown to the flat clothing of the entrance.

This unit with vacuum stripping of flat-strips and separating of dandruff increases the capability of dandruff dehairing and drawing-rate of downs for the equipment. The stripper-bar which strips downs is cut, so the service life of the unit is longer, the unit run well, the labour intensity is reduced.

Fig. 10 shows a schematic drawing for the structure of the dehairing unit with feed roller, taker-in beat roller, airflow transferring, which locates on parts IV-1 and IV-2 of the whole machine shown in Fig. 7.

A pair of feed roller 68 rotate with opposite direction, taker-in roller 69 rotates anti clockwise, on which there is a clothing. Under taker-in 69 there is a beat roller 70, under beat roller 70 there is a airflow discharge knife 71, above upper right of taker-in 69 there is a stripper bar 74 close to it, in front of taker-in 69 is a dust cage unit, this unit consists of the big dust cage 42 which rotates clockwise and the small dust cage 44 thereon which rotates anti clockwise, on the small dust cage is an airflow guide cover 75 which connects with stripper bar.

Under the action of the high-speed airflow with opposite direction, which is formed on the beat roller surface, the passive coarse-fibre removing is changed into initiative coarse-fibre removing. The fibre layer after purifying are moved with the airflow along the airflow guide cover and condensed onto dust cage, then transferred out of the unit. The capability to remove fine bristles and bristles of this structure is second-best only to the capability of feed plate, taker-in roller, beat roller and dust cage transferring unit, but because of the unique and very low fibre damage rate, this unit is fit for being the auxiliary unit of removing fine bristles, heteor typical fibres and dandruffs, so it can strengthen the capability of coarse-fibre removing, but not increase the fibre-damage rate too more. The fibre-damage rate of this unit is normally below 0.6%, but this dehairing mode needs the feeding materials in single fibre form, unless it will be easy to drop fibre blocks.

Fig. 11 shows automatic circulation unit of flat strips, droppings by air taking and sending, which consists of a down collecting bin 79, fan 76, funnel 77 via pipeline connected with fan 76 and airflow cover 66. The down collecting bin 79 locates in position above each feed lattice 1, its upper part is connected with the pipeline of fan 76, on its lower part there is a pair of filter-net feed rollers 68 positioned horizontally with opposite rotating direction, funnel 77 via pipeline connected with fan 76 is positioned under dehairing taker-in which is behind each dehairing unit with double-nose-like side feed plate, from entrance side of airflow cover 66 to its inner part where are success ively positioned stripper roller 61 and airflow guide knife 65, the entrance of airflow cover confronts to flat carrier dise 60 which is on the delivering end of dehairing flat 80.

Fig. 7 shows the schematic drawing for the structure of an embodiment of this combined dehairing machine, from left to right successively, it consists of a feed lattice 1, a set of double cylinder opening and coarse-fibre-throwing dehairing unit shown in Fig. 4(I in Fig. 7), two sets of dehairing unit with coarse-separating by seven rollers, condensing by doffer and airflow-transferring combined shown in Fig. 5 (II-1 and II-2 in Fig. 7), a set of unit with coarse separating by five parallel rollers, airflow suspension separating, transferring and delivering by filter-net-roller shown in Fig. 6 (III in Fig. 7), and two sets of unit with successive carding, stripping of flat strips by vacuum stripping , automatic separating of dandruff, automatic circulation unit IV of reusable flat strips, droppings by air taking and sending , which are positioned successively behind part III and consist of feed lattice 1, the dehairing unit with double-nose-like side feed plate 57 shown in Fig. 8, dehairing taker-in 54, big cylinder 81 (above which is a dehairing flat 80, the unit 28 with successive carding and vacuum stripping of the flat strip, which is shown in Fig. 9 and located on the delivering end of dehairing flat), doffer roller 83, two sets of dehairing unit with feed roller and taker-in beat roller airflow transferring shown in Fig. 10 (IV-1 and IV-2 in Fig. 7); feed lattice 1, dehairing unit with double-nose-like side feed plate 57, dehairing taker-in 54, big cylinder 81(above which is a dehairing flat 80, an unit 28 with successive carding, stripping of flat strips by vacuum stripping), a doffer roller 83, an end oscillating type unit of stripping by stripper bar 84, and an unit with automatic circulation of flat strips, droppings by air sending and taking shown in Fig. 11, the funnel of this unit is set up below dehairing taker-in 54 behind the dehairing unit with double-nose-like side feed plate.

Working principle is as below.

Scoured cashmere is evenly fed into the dehairing unit with double cylinder opening and coarse-fibre-throwing and

opened slightly and carded by this unit under the middle transferring roller, parts of coarses, kemps, medullated fibres are thrown out, then entered into two sets of dehairing unit with seven rollers airflow suspension. Through further opening and dehairing, with the action of the lower part of coarse-fibre-throwing roller and the action of airflow suspension separating, most of coarse fibres and heterotypical fibres are removed. And then transferred to the unit with five rollers opening airflow suspension separating, continuously being opened and coarse-removed, the other parts of longer bristles, heterotypical fibres, part of fine bristles and big block of dandruffs, burrs are removed. And then condensed to the big and small dust cage with the high-speed airflow, airflow discharge from the dust cage nets, and downs are transferred to the first set of unit with successive carding and flat vacuum stripping and dandruff separating through the condensing action of the dust cage. Depend on feeding of feed lattice, through the dehairing action between feed plate and taker-in as well between flat and cylinder, airflow action between taker-in and triangle area of the big grid, most of coarses, bristles, middle dandruff blocks and parts of fine bristles are removed, downs are delivered out by doffer, stripper bar or dust cage. After then, downs are fed into feed lattice and moved into second set of unit with vacuum flat stripping, dandruff separating for successive dehairing, duplicate the working principle of the first set, and with the change of technical parameters, the remaining bristles, fine bristles, little dandruff blocks and parts of short fibres are removed. The finished products are transferred by doffer, then stripped and delivered from doffer roller by the oscillating stripping unit. At the same time, after most of dandruffs blocks are separated by the striking action of stripper roller, the reusable flat-strips and the droppings of the taker-in are returned through an independent air taking and sending unit to the feed lattice of the last process, then are fed to join in the technological circulation again.

Fig. 12 shows a schematic drawing of the auxiliary machine, it consists of feed lattice 1, behind feed lattice 1 are successively the dehairing unit with double-nose-like side feed plate 57, dehairing taker-in 54, big and small filter-net dust cages 42、44, a pair of feed roller 68, dehairing taker-in 54, big and small filter-net dust cages 42、44, and beat roller 70 under each dehairing taker-in 54 and airflow discharge knife 71.

The working principle of the auxiliary machine is as follows.

Droppings with high impurity content which can not be processed by the main machine are fed into auxiliary machine, punctured, dehaired, struck by taker-in of the double-nose-like side feed plate, and with the aid of the reaction of airflow layer which is below taker-in and above beat roller, most of coarse-fibres, impurities, dandruffs are separated. The separated downs are gathered onto the big and small dust cage along the guide cover by airflow sphere, and condensed, then transferred to the second unit -- double roller taker-in unit. With the aid of the slight dehairing action between double roller and taker-in, and the reaction of airflow sphere which is below taker-in but above the beat roller, the other parts of coarses, impurities, fine bristles, dandruffs, heterotypical fibres etc. in downs are separated out continuously. The separated for the second time downs are condensed to the big and small dust cage along the guide cover of the second unit through the airflow sphere on the taker-in, then transferred out of the unit, and drop into down collecting bin. This part of droppings join in the technological circulation of the main machine again.

Claims

1. A suspension dehairing method by airflow generated by roller (S. D. A.R.),comprising:

   1) the flocks are being dehaired on the dehairing roller, coarse medullated wools, impurities and downs in single fibre form are separated from the clothing and become suspending materials, the flocks that haven't been dehaired are held on the dehairing roller, characterized in that the method is also including:
   2) the airflow formed between two adjacent rollers dehairs the flocks between them, loosens the flocks, the impurities, fine bristles, heterotypical fibres, coarse fine wools with few crimps are separated again from roller and become the suspending materials;
   3) the flocks held on the dehairing roller are transferred from the dehairing roller to the delivering unit and delivered;
   4) the suspending materials are being dehaired by suspension action by the roller airflow sphere below the dehairing roller formed by the rotation of the dehairing roller (dehairing for the second time), the coarse fibres, heterotypical fibres, coarse wools, impurities descend and become the droppings, the downs in the suspending materials suspend in the roller airflow;
   5) the downs suspending in roller airflow are gathered at the down collecting unit by the flow of roller airflow;
   6) the downs on the down collecting unit are transferred to the delivering unit and delivered;
   7) the filter-net-roller(also called filter-net dust cage) collects roller airflow with dust and lead it to the outside of the machine.

2. The S. D. A. R. method as claimed in claim 1, characterized in that said method of transferring the flocks held on the dehairing roller from dehairing roller to the delivering unit adopts the way of doffer transferring, stripping and delivering by guide roller, said method of gathering the downs suspending in roller airflow to down collecting unit by

flow of roller airflow is that the roller airflow flows to the guide roller and filter-net-roller, the downs are gathered at the guide roller, the airflow is led out by filter-net-roller, the downs and said flocks are then delivered together.

3. The S. D. A. R. method as claimed in claim 1, characterized in that said method of transferring the flocks held on the dehairing roller from dehairing roller to delivering unit is that flocks are removed under the airflow separating action of down removing knife, the flocks are held and delivered by airflow, big and small filter-net-roller, said method of gathering the downs suspending in roller airflow to down collecting unit by the flow of roller airflow is that roller airflow flows to big and small filter-net-roller, downs are gathered at the surface of big and small filter-net-roller, the airflow is led out by the filter-net-roller, the downs and said flocks are then delivered together.

4. A combined dehairing machine for special downs as claimed in said method of claim 1, characterized in that the combined dehairing machine comprises units that are set in sequence from the front to the rear: 1) a set of dehairing unit with double cylinder opening and coarse-fibre-throwing: 2) two or more sets of dehairing unit with coarse fibre separating by roller, condensing by doffer and airflow transferring combined :3) a set of unit with centrifugal coarse fibre separating by parallel roller, airflow suspension separating, transferring and delievering by dust cage :4) two sets of units with successive carding, stripping of flat-strips by vacuum stripping, automatic separating of dandruff, automatic circulation of reusable flat-strips, droppings by air taking and sending, wherein

1) a set of dehairing unit with double cylinder opening and coase-fibre-throwing comprises three feed rollers, opening and transferring roller, breast cylinder, transferring and coarse-fibre-throwing roller and cylinder roller which are placed horizontally in sequence and behind feed lattice, it also comprises a dehairing plate placed in the front of breast cylinder and cylinder roller respectively, above the dehairing plate is a dehairing knife which lies on the entering side of the dehairing plate, at the rear-upper side of breast cylinder and cylinder roller, a stripper roller is provided respectively, behind the stripper roller is the working roller, the working surfaces of all the roller above-mentioned and the dehairing plate are covered with clothing, the density of clothing is different, fewer in the front and denser in the fear, three feed rollers are positioned vertically, the middle feed roller rotates clockwise, the other two rollers rotate anticlockwise, the others rotate clockwise except for the breast cylinder and cylinder roller, there is certain clearance (10-43 ‰") between the rollers and between the dehairing mechanism;

2) two or more sets of dehairing unit with coase fibre separating by roller ,condensing by doffer and airflow trans ferring combined is located behind the dehairing unit with double cylinder opening and coarse-fibre-throwing, each dehairing unit with the combination of coarse fibre throwing by roller, condensing by doffer, and transferring by airflow, consists of three or five dehairing rollers set horizontally in sequence from the front to the rear with clothing round the roller, characterized in that the unit includes also a delivering unit mounted at the upper-rear of the last dehairing roller, a collecting unit of suspending downs and a small filter-net dust cage positioned under the last dehairing roller, in the lower-rear of the dehairing roller rotating clockwise is a fixed dehairing triangle, below which or at the lower-rear of which is provided an airflow adjusting roller rotating anticlockwise, the clothing is round the roller, the first roller and the spaced dehairing roller rotate anticlockwise, the others rotate clockwise, said delivering unit includes a doffer roller rotating clockwise in the upper-rear of the last dehairing roller with clothing wrapped round it, said collecting unit of suspending downs includes a down guide roller which locates behind the last dehairing roller, rotates clockwise and is wrapped with the clothing, it contains also a small filter-net dust cage which locates below the down guide roller and rotates clockwise;

3) a set of unit with centrifugal coase fibre separating by parallel rollers, airflow suspension separating, trans ferring and delivering by dust cage locates behind above-mentioned two or more set of dehairing unit, which contains five dehairing rollers set in sequence from the front to the rear with the clothing round each roller, the first dehairing roller and the spaced dehairing roller rotate anticlockwise, the others rotate clockwise, in the upper-rear of the last dehairing roller is a delivering unit which contains a delivering knife located in the upper-rear of the last dehairing roller and the guide cover adjoining the delivery knife, further contains a collecting unit of suspending downs located behind the last dehairing roller, the collecting unit includes a big filter-net dust cage rotating clockwise and located behind the last dehairing roller and a small filter-net dust cage rotating anticlockwise thereupon, below the place between the second and the third dehairing roller, as well between the fourth and the fifth dehairing roller, a dehairing triangle is provided respectively, under the dehairing triangle positioned below the place between the second and the third dehairing roller, there is an airflow controlling roller totating clockwise with clothing round it, said five dehairing rollers have arcuated airflow cover at the upper side ;

4) two set of units with successive carding, stripping of flat-strips by vacuum stripping, automatic separating of dandruff, automatic circulation of reusable flat-strips, droppings by air taking and sending locate behind above-

mentioned set of unit 3, each consists of a feed lattice, a dehairing unit with double-nose-like side feed plate positioned horizontally behind the feed lattice, the dehairing taker-in covered with clothing rotating anticlockwise, a main cylinder rotating clockwise, a doffer roller rotating anticlockwise, on the working surface above the main cylinder there is a dehairing flat with clothing, a set of unit with vacuum stripping of flat-strips, automatic separating of dandruff, is positioned at the droppings outlet of the dehairing flat, a set (or two sets) of dehairing unit with feed roller , taker-in beat roller and airflow transferring or the oscillating type unit of stripping by stripper bar (this unit must be provided in the delivering end of the entire machine) is provided after the doffer;

said dehairing unit with double-nose-like side feed plate comprises a dehairing plate with working surface in special shape, feed roller, the special working surface in the front end of the dehairing plate, characterized in that said working surface has a first working area and a second working area, the first working area comprises an upper inclined plane and a lower inclined plane, the upper plane is inclined to the vertical plane at an angle 10-14° and the lower plane is inclined to the vertical plane at an angle 15-20°, said second working area comprises an inclined plane of the second working area, which is inclined to the vertical plane at an angle 24-26°, an arc adjoins the inclined plane of the second working area with the lower inclined plane, the arc forms a groove between two planes, said upper inclined plane, lower inclined plane, the inclined plane of the second working area incline in the same direction to the vertical plane;
said first working area may comprise only the upper inclined plane, an arc adjoins this plane with the second working area and a groove is formed;
said unit with vacuum stripping of flat-strips and automatic separating of dandruff comprises the stripper roller which is covered with clothing and rotates anticlockwise, the stripping of the clothing at the surface of the stripper roller and the main cylinder forms stripping form, outside the stripper roller is an airflow cover, the lower side wall of which forms the lower airflow guide plate, the upper part of the airflow cover has an upper cover plate which is telescopically adjustable, an airflow guide knife is provided below the stripper roller in the airflow cover, the lower part of the airflow cover has an outlet from which the air and the reusable downs are drawn out and negative pressure is formed in the airflow cover, a doffer roller is provided behind the main cylinder, a set (or two sets) of dehairing unit with feed roller, taker-in beat roller, airflow transferring or the oscillating type unit of stripping by stripper bar (this unit must be provided in the delivering end of the entire machine) is provided after the doffer;
in said one set (or two sets) of dehairing unit with feed roller, taker-in beat roller, airflow transferring, each comprises two feed rollers, taker-in , dust cage unit, beat roller under the taker-in and airflow guide knife under the beat roller, which are positioned in sequence behind the doffer, further comprises down removing knife located in the upper-rear of the taker-in, and airflow guide cover which is positioned above the dust cage unit and connected to the down removing knife, two feed rollers are covered with clothing and located vertically and rotate oppositely and inwardly, the taker-in is covered with clothing and rotates anticlockwise, the dust cage unit includes a big dust cage rotating clockwise and a small dust cage rotating anticlockwise thereupon.

5. The combined dehairing machine for special downs as claimed in claim 4, characterized in that the upper inclined plane in the first working area of said dehairing unit with double-nose-like side feed plate is inclined to the vertical plane at an optimum angle of 11-12°.

6. The combined dehairing machine for special downs as claimed in claim 4, characterized in that the lower inclined plane in the first working area of said dehairing unit with double-nose-like side feed plate is inclined to the vertical plane at an optimum angle of 16-17°.

7. The combined dehairing machine for special downs as claimed in claim 4, characterized in that the upper inclined plane in the second working area of said dehairing unit with double-nose-like side feed plate is inclined to the vertical plane at an optimum angle of 24.5-25°.

8. The combined dehairing machine for special downs as claimed in claim 4, characterized in that the length in vertical direction of the upper inclined plane, the lower inclined plane in the first working area and the inclined plane in the second working area of said dehairing unit with double-nose-like side feed plate is 22-28mm, 10-15mm and 18-22mm, respectively.

9. The combined dehairing machine for special downs as claimed in claim 4, characterized in that, in the unit with vacuum stripping of flat-strips, automatic separating of dandruff, the clothing on the main cylinder and stripper roller is inclined backwardly to the direction of rotation.

10. The combined dehairing machine for special downs as claimed in claim 4, characterized in that, in the unit with vacuum stripping of flat-strips, automatic separating of dandruff, the guide knife is a column or plate with triangle section.

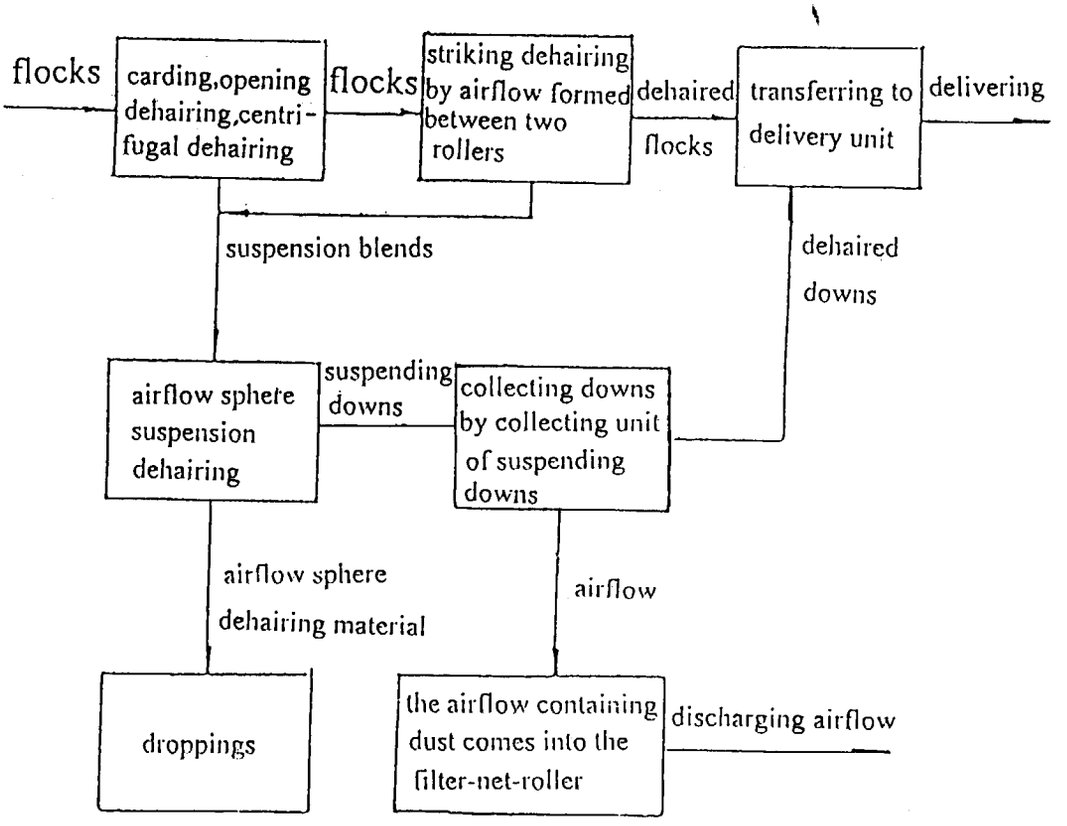
flocks
carding,opening dehairing,centri-fugal dehairing
flocks
striking dehairing by airflow formed between two rollers
dehaired flocks
transferring to delivery unit
delivering
suspension blends
dehaired downs
airflow sphere suspension dehairing
suspending downs
collecting downs by collecting unit of suspending downs
airflow sphere dehairing material
airflow
droppings
the airflow containing dust comes into the filter-net-roller
discharging airflow

Fig.1

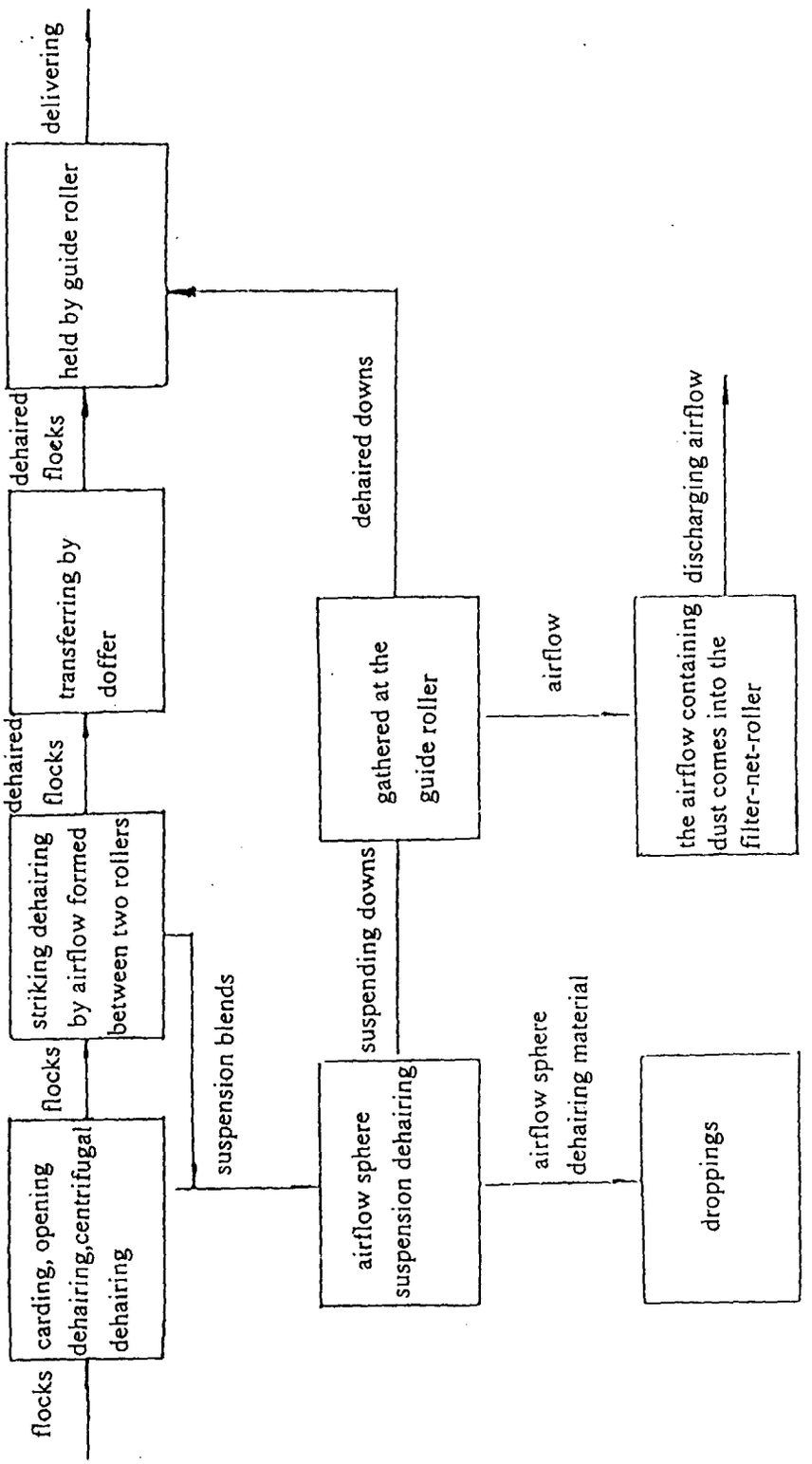
flocks
carding, opening dehairing,centrifugal dehairing
flocks
striking dehairing by airflow formed between two rollers
dehaired flocks
transferring by doffer
dehaired flocks
held by guide roller
delivering
suspension blends
airflow sphere suspension dehairing
suspending downs
gathered at the guide roller
dehaired downs
airflow sphere dehairing material
droppings
airflow
the airflow containing dust comes into the filter-net-roller
discharging airflow

Fig.2

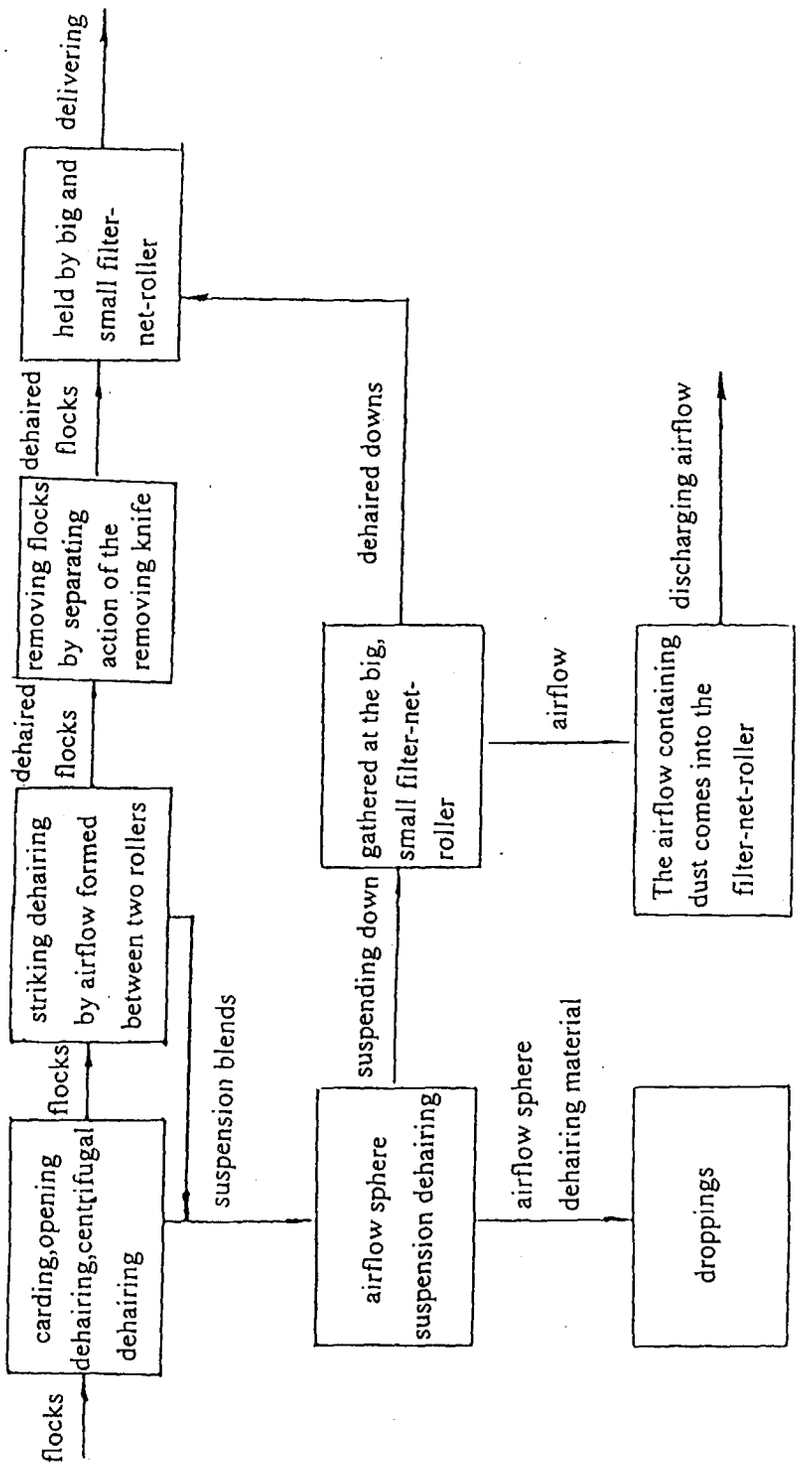
flocks
carding,opening dehairing,centrifugal dehairing
flocks
striking dehairing by airflow formed between two rollers
dehaired flocks
removing flocks by separating action of the removing knife
dehaired flocks
held by big and small filter-net-roller
delivering
suspension blends
airflow sphere suspension dehairing
suspending down
gathered at the big, small filter-net-roller
dehaired downs
airflow sphere dehairing material
droppings
airflow
The airflow containing dust comes into the filter-net-roller
discharging airflow

Fig.3

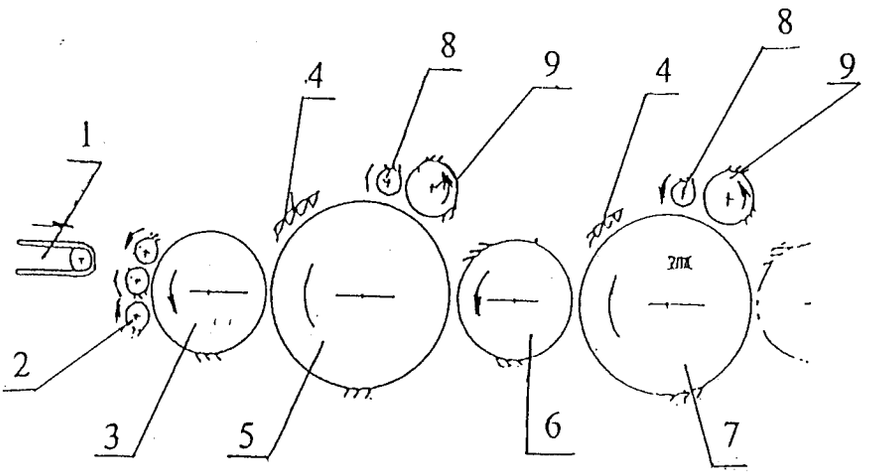

Fig.4

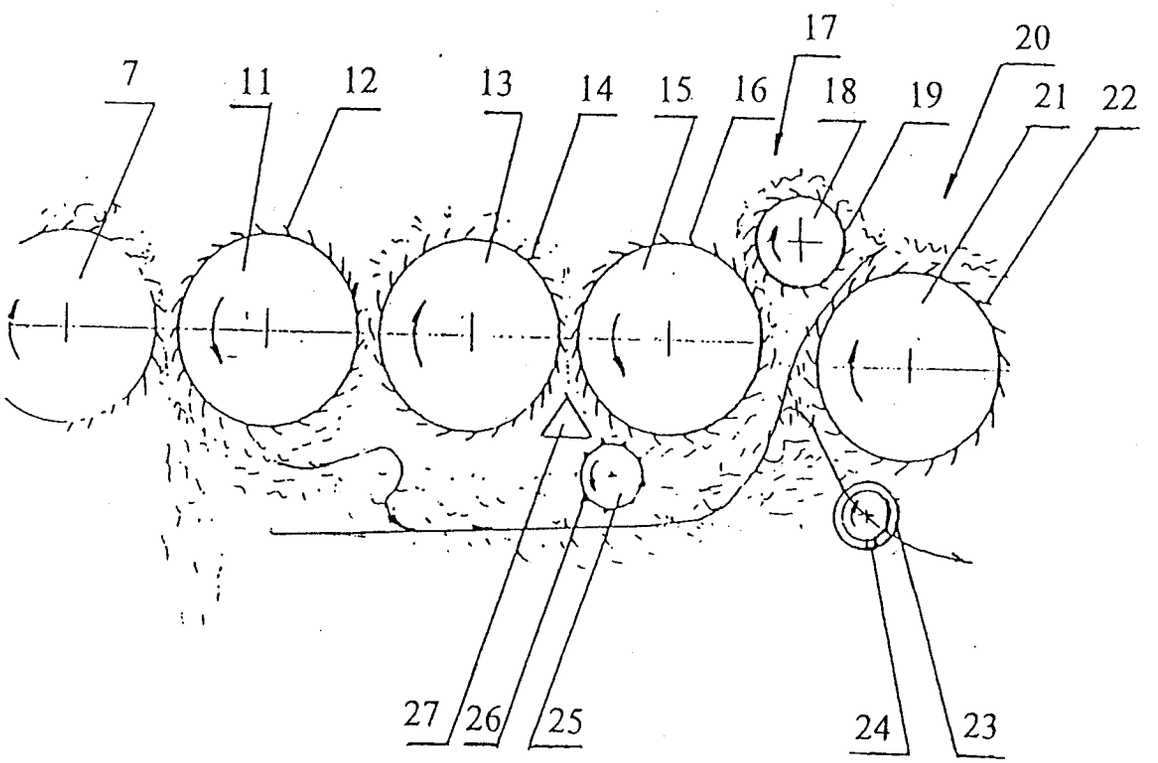

Fig.5

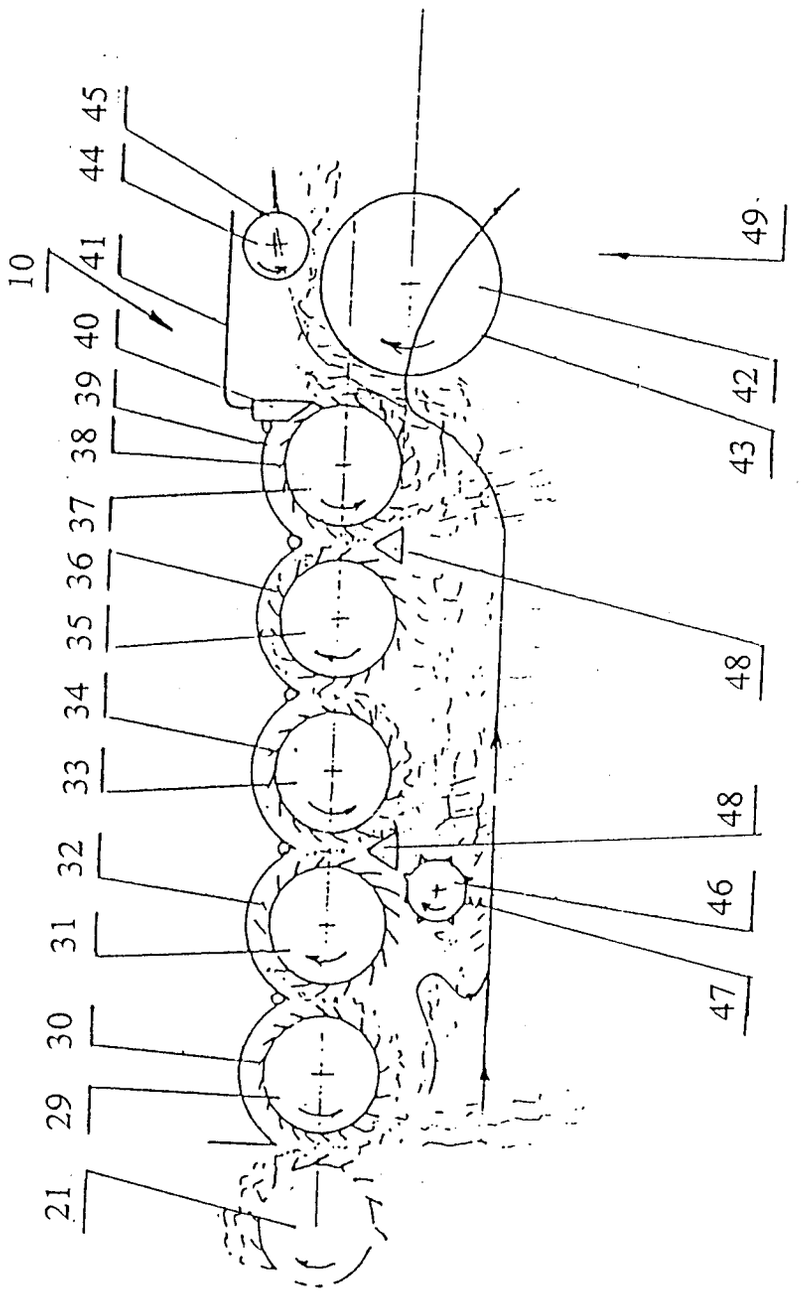

Fig.6

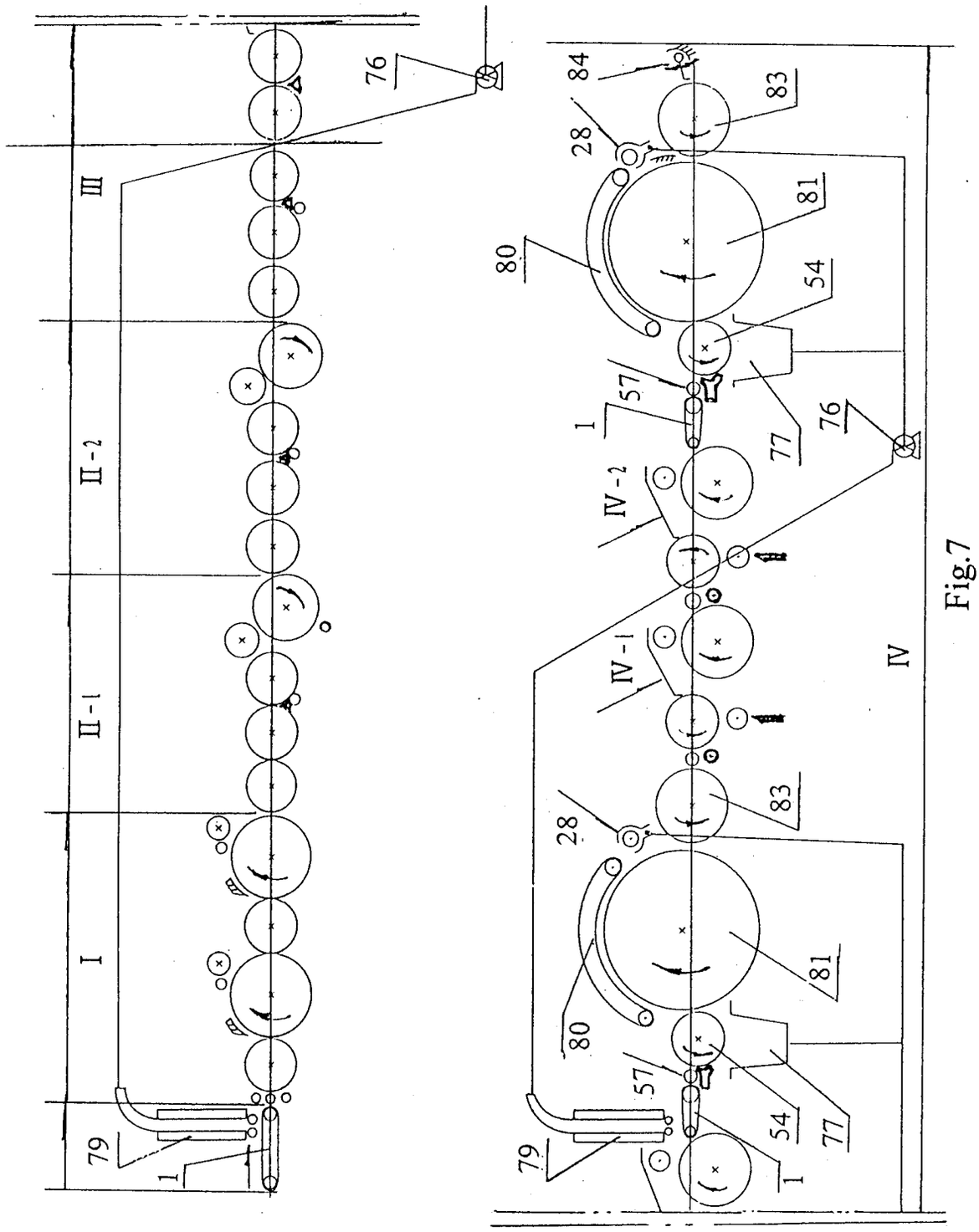

Fig.7

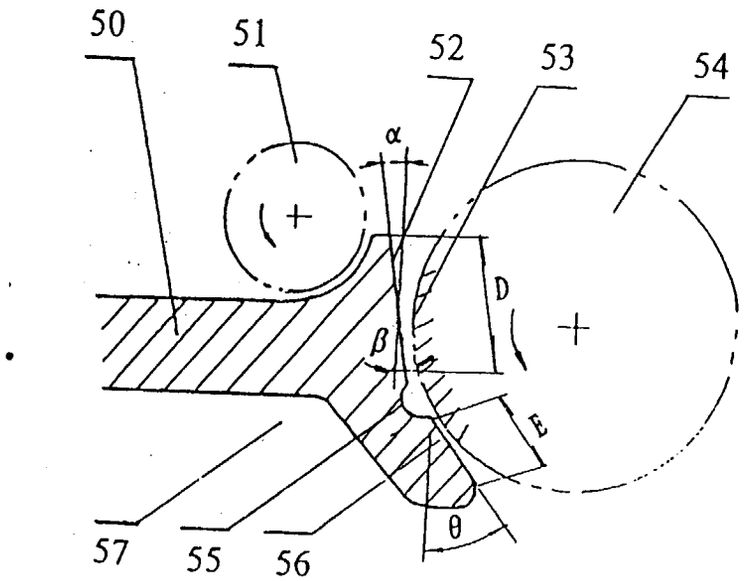

Fig.8

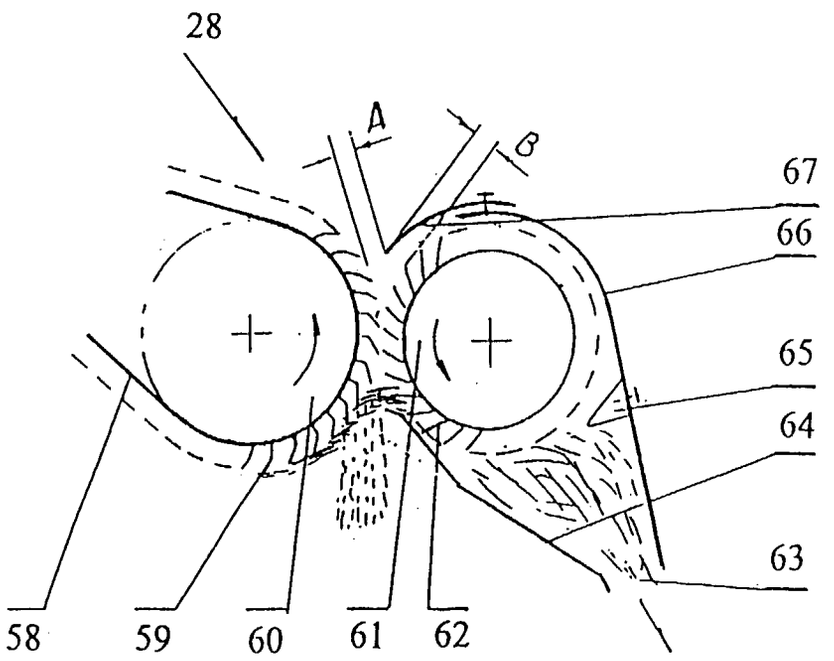

Fig.9

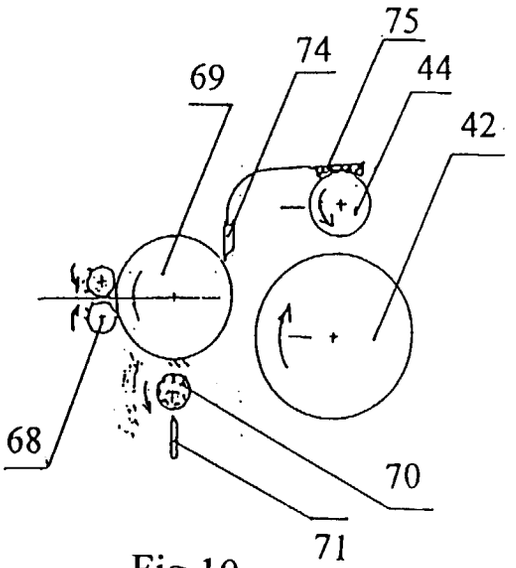

Fig.10

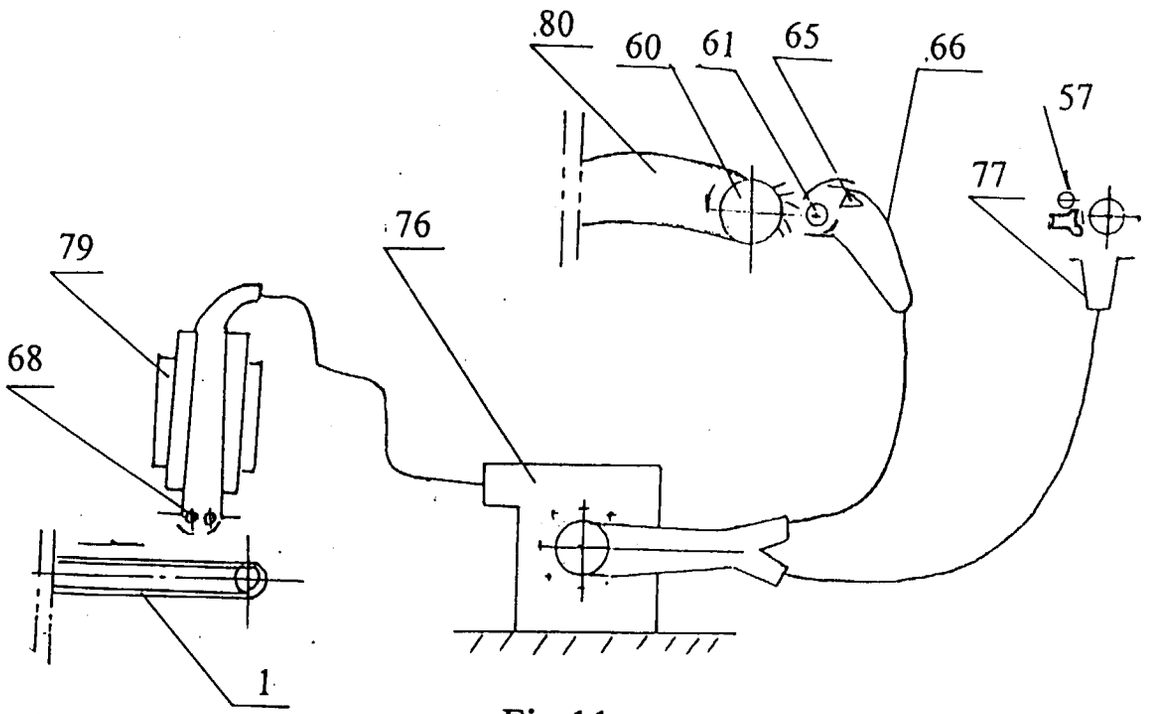

Fig.11

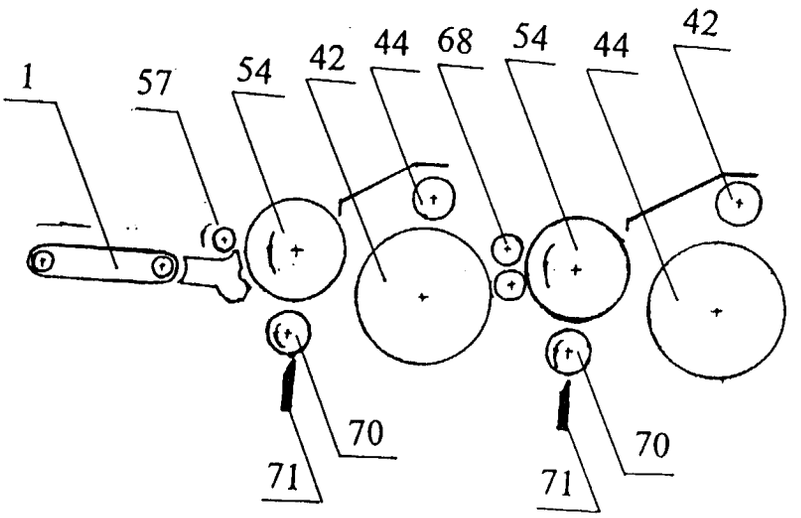

Fig.12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN 97/00020

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6] D01G 15/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6] D01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Patent published or issued by the C. P. O since 1985

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, CPRS, CNPAT, card, air suspend

C. DOCUMENTENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,470,586(Robert et. al) 07. Oct. 1969(07. 10. 97) Whole document	1,4
A	US 2,936,495(Roger et al) 17. May. 1960(17. 05. 60) Whole documnet	1,4
A	US 3,051,996(Andre et al) 04. Sept. 1962(04. 09. 62) Whole document	4
A	US 5,255,415(Fordinand Leifeld et al) 26. Oct. 1993(26. 10. 93) Whole document	1,4

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claims(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12. June. 1997(12. 06. 1997)	03 JUL 1997 (03. 07 97)
Name and mailing address of the ISA/ Chinese Patent Office, 6 Xitucheng Rd. Jimen Bridge, Haidian District, 100088 Beijing, China Facsimile No. (86-10)62019451	Authorized officer MAO Hong Telephone No. (010)62093741

Form PCT/ISA/210(second sheet)(July 1992)

INTERNATIONAL SEARCH REPORT
Information patent family members

International application No.
PCT/CN 97/00020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5,255,415	26. 10. 93	DE 4130093	19. 03. 92
		GB 2249561	27. 04. 94
		CH 683530	31. 03. 94
		JP 5140823	08. 06. 93

Form PCT/ISA 210(patent family annex)(July 1992)