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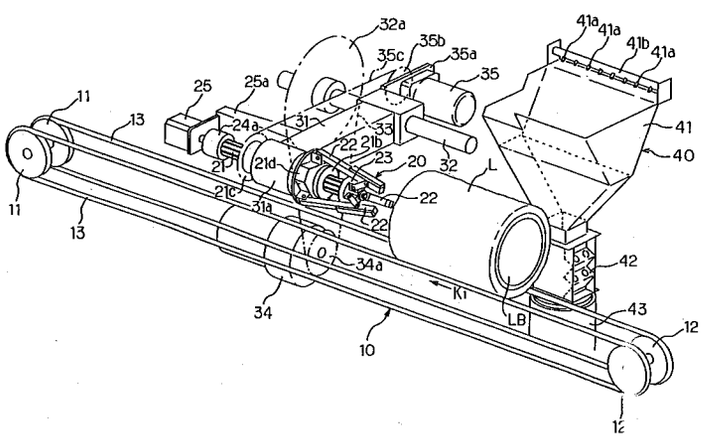
(54) Residual lap removing apparatus.

(57) A residual lap removing apparatus for efficiently removing a residual lap from a lap bobbin. A swing arm swings around a rotary shaft, a lap bobbin conveyor disposed on one side of the rotary shaft conveys a lap bobbin, a residual lap removing unit disposed on the other side of the rotary shaft blows jet of air against the residual lap on the lap bobbin, a lap bobbin holding mechanism mounted on the free end of the swing arm axially holds and then rotates the lap bobbin, and a driving mechanism turns the rotary shaft so that the lap bobbin held by the lap bobbin holding mechanism is disposed alternately at a lap bobbin catching position corresponding to the lap bobbin conveyor and a residual lap removing position corresponding to the residual lap removing unit.

FIG. 1



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BACKGROUND OF THE INVENTION

(Field of the Invention)

The present invention relates to a residual lap removing apparatus for efficiently removing a residual lap from a lap bobbin for winding a ribbon lap or a sliver lap (hereinafter referred to simply as "lap").

(Description of the Prior Art)

In a spinning mill, raw cotton is first opened and foreign matters are removed and then formed into a sheet-like lap by an opening and picking machinery. In the final stage of the opening and picking process, the lap is wrapped on a bobbin having a large diameter, i.e., a spool (hereinafter referred to as "lap bobbin") by a lap machine in lap bobbins to facilitate the handling of the lap.

In a carding process subsequent to the opening and picking process, a sliver lap machine or a ribbon lap machine produces a sliver lap or a ribbon lap and wraps the same on lap bobbins in sliver lap bobbins or ribbon lap bobbins for transport.

In those processes, empty lap bobbins are returned from the succeeding process to the preceding process to use the lap bobbins repeatedly. Therefore, the empty lap bobbins must be cleared perfectly of residual laps before the lap bobbins are used on the lap machine or the like for wrapping the lap thereon. A residual lap removing apparatus for such a purpose, comprising, in combination, a drafting mechanism and air nozzles is disclosed in Japanese Patent Publication No. 54-22528.

This known residual lap removing apparatus holds a lap bobbin with a residual lap on a pair of parallel rollers included in the drafting mechanism, applies jets of air through the air nozzles to the lap bobbin in a tangential direction of the lap bobbin while the lap bobbin is rotated in a lap unwinding direction to effect pick-finding and unwinding of the residual lap.

Another residual lap removing apparatus disclosed in Japanese Patent Laid-open No. 3-79563 presses a rotary brush against the surface of a lap bobbin with a residual lap to strip of the residual lap from the lap bobbin mechanically.

The former known residual lap removing apparatus rotates the lap bobbin with a residual lap on the parallel rollers by friction gearing. Therefore, the lap bobbin is not necessarily rotated smoothly, and the known residual lap removing apparatus is unable to clear all the residual lap completely particularly when the lap bobbin has a relatively large amount of residual lap. The latter known lap removing apparatus strips the residual lap mechanically off from the lap bobbin, the fibers of the lap are greatly damaged and the damaged fibers of the recovered lap unavoidably deteriorates the quality of yarns when reused together with virgin fibers.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a residual lap removing apparatus comprising, in combination, a lap bobbin holding mechanism capable of axially holding a lap bobbin with a residual lap and of positively rotating the lap bobbin, and a lap removing unit of an air jet system for completely removing all the residual lap of the lap bobbin without damaging the fibers of the residual lap even if the lap bobbin has a large amount of residual lap.

To achieve the object, the present invention provides a residual lap removing apparatus comprising: a swing arm having a base end fixed to a rotary shaft, a lap bobbin conveyor disposed on one side of the rotary shaft for conveying a lap bobbin, a residual lap removing unit of an air jet system disposed on the other side of the rotary shaft, a lap bobbin holding mechanism mounted on the free end of the swing arm for axially holding and for rotating a lap bobbin with a residual lap, and a driving mechanism for turning the rotary shaft so that the lap bobbin held by the lap bobbin holding mechanism is disposed alternately at a lap bobbin catching position corresponding to the lap bobbin conveyor and a residual lap removing position corresponding to the residual lap removing unit.

The residual lap removing unit may be provided with a hopper provided with air nozzles. The hopper may be connected through an opening mechanism to a lap recovering unit.

According to the above-mentioned arrangement, the lap bobbin holding mechanism holds a lap bobbin with a residual lap which is transported by the lap bobbin conveyor in its axis direction, the swing arm transports the lap bobbin held by the lap bobbin holding mechanism to the residual lap removing unit and then the lap bobbin holding mechanism rotates the lap bobbin at the residual lap removing position, and the residual lap removing unit removes all the residual lap from the lap bobbin. Thus, the residual lap can be surely and completely removed from the lap bobbin.

When the residual lap removing unit is provided with the hopper with the air nozzles, jets of air blown through the air nozzles are applied to the lap bobbin placed in the hopper, so that the residual lap can be easily removed from the lap bobbin.

When the hopper is connected through the lap opening mechanism to the lap recovering unit, well

opened fibers are sent into the lap recovering unit, and the well opened fibers can be easily reused in the carding process or the lapping process.

The above and other objects, features and advantages of the present invention will become apparent from the following description when read in conjunction with the accompanying drawings, in which like or corresponding parts are denoted by the same reference characters.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a residual lap removing apparatus in a preferred embodiment according to the present invention;

Fig. 2 is a sectional view of a lap bobbin holding mechanism included in the residual lap removing apparatus of Fig. 1;

Fig. 3 is a diagrammatic view of assistance in explaining the motion of a swing arm included in the residual lap removing apparatus of Fig. 1;

Fig. 4 is a sectional view of a lap opening mechanism and a lap recovery unit embodying the present invention; and

Fig. 5 is a diagrammatic view of assistance in explaining the disposition of an air nozzle relative to a lap bobbin.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, a residual lap removing apparatus in a preferred embodiment according to the present invention comprises, as principal mechanisms, a lap bobbin conveyor 10, a lap bobbin holding mechanism 20, and a residual lap removing unit 40.

The lap bobbin conveyor 10 comprises a pair of first pulleys 11, a pair of second pulleys 12, and a pair of endless round belts 13 extended in parallel to each other between the pair of first pulleys 11 and the pair of second pulleys 12 so as to turn along guide members, not shown. The pair of first pulleys 11 are coaxial and the pair of second pulleys 12 are coaxial. Either the pair of first pulleys 11 or the pair of second pulleys 12 are drive-pulleys driven by a driving motor, not shown, and the other pulleys are driven-pulleys. A lap bobbin LB holding a lap L is conveyed by the lap bobbin conveyor 10.

The lap bobbin holding mechanism 20 is mounted on the free end of a swing arm 31 having a base end fixed to a rotary shaft 32 extended with its axis in parallel to the direction of extension of the pair of endless round belts 13 of the lap bobbin conveyor 10 and supported for swing motion in bearings, not shown. A sprocket wheel 32a is fixed to the rotary shaft 32, a sprocket wheel 34a is fixed to a rotary shaft of a motor 34, and a chain 33 is wound around the sprocket wheels 32a and 34a to turn the rotary shaft 32 by the motor 34. The lap bobbin holding mechanism 20 will be described in detail hereinafter.

Referring to Fig. 2, the lap bobbin holding mechanism 20 comprises, as principal components, a spline shaft 21 extended with its axis in parallel to the direction of extension of the pair of endless round belts 13 of the lap bobbin conveyor 10, and swing levers 22 pivotally supported on the point of the spline shaft 21. A cylindrical bearing housing 31a is fixed to the free end of the swing arm 31, and bearings 31b are housed in the bearing housing 31a. A flanged sleeve 21a is inserted in the bearings 31b. Front and rear internally splined bushes 21b are fitted respectively in the front and rear ends of the flanged sleeve 21a, and the spline shaft 21 is extended through the front and rear internally splined bushes 21b. A sprocket wheel 21c is fixed to the rear internally splined bush 21b, and a base bracket 21d for pivotally supporting the swing levers 22 at their base ends is fixed to the front internally splined bush 21b. The base bracket 21d is fixedly held between the flange of a flanged spacing bracket 21e and the flange of the front bush 21b.

A bracket 23 is attached to the front end of the spline shaft 21, and the swing levers 22 are connected respectively by links 23a to the bracket 23. Cushion members 22a are attached respectively to the front portions of the outer surfaces of the swing levers 22. In case that look at the swing levers 22 from its front side, the swing levers 22 are arranged at equal angular intervals on the base bracket 21d and bracket 23 respectively. The swing levers 22, the cushion members 22a and links 23a form a chucking mechanism.

The spline shaft 21 is supported at its rear end in bearings 24 housed in a bearing housing 24a. A short-stroke cylinder actuator 25 is disposed behind the spline shaft 21 and fixed to the swing arm 31. The operating rod of the cylinder actuator 25 is connected to the rear end of the bearing housing 24a. Cylinder actuator 25 is fixed through a bracket 25a to the swing arm 31.

A motor 35 is fixed to a bracket 35a which is fixed to the base end of the swing arm 31 so as to project behind the base end with respect to the rotary shaft 32. A sprocket wheel 35b is fixed to the rotary shaft of the motor 35, a sprocket wheel 21c is mounted on the spline shaft 21, and a chain 35c is extended between the sprocket wheels 35b and 21c to rotate the spline shaft 21 by the motor 35.

Referring to Figs. 1 and 3, the residual lap removing unit 40 comprises a hopper 41 and a lap opening mechanism 42 disposed under the hopper

41. The position of the residual lap removing unit 40 is symmetrical with that of the lap bobbin conveyor 10 with respect to the rotary shaft 32, so that the spline shaft 21 is located directly above the lap bobbin conveyor 10 when the swing arm 31 is half turned in one direction to a lap bobbin chucking position, and the spline shaft 21 is located directly above the residual lap removing unit 40 when the swing arm 31 is half turned in the opposite direction to a residual lap removing position. A manifold 41b is supported on one side of the upper end of the hopper 41, and air nozzles 41a are connected to the manifold 41b in a range corresponding to the entire length of the lap bobbin LB. The residual lap removing unit 40 is of an air jet system which uses jets of air for removing the residual lap from the lap bobbin LB. As shown in Fig. 4, the hopper 41 is joined to the lap opening mechanism 42, which in turn is connected by an air duct 43 to a lap recovery unit B.

The lap opening mechanism 42 has a square duct having side walls, and air nozzles 42a fixedly held on the opposite side walls of the duct. The air nozzles 42a are directed obliquely downward to blow jets of air obliquely downward. An adapter 42b is joined to the lower end of the duct of the lap opening mechanism 42 and fitted in the upper end of the duct 43.

The lap recovering unit B has a box B1, an exhaust blower B2 mounted on top of the box B1, and a net B3 extended horizontally within the box B1. The outlet end of the duct 43 is joined to one side wall of the box B1.

The operation of the residual lap removing apparatus will be described hereinafter.

As is obvious from Fig. 2, the swing levers 22 of the lap bobbin holding mechanism 20 can be simultaneously and radially moved by axially moving the operating rod of the cylinder actuator 25. When the operating rod of the cylinder actuator 25 is retracted to move the spline shaft 21 backward, the links 23a pulls the front portions of the swing levers 22 radially inward as indicated by continuous lines in Fig. 2, so that the swing levers 22 can be inserted in and removed from the lap bobbin LB. When the operating rod of the cylinder actuator 25 is stretched out to advance the spline shaft 21, the swing levers 22 are turned radially outward as indicated by alternate long and two short dashes lines in Fig. 2, so that the swing levers 22 expands and the swing levers 22 are pressed firmly against the inner circumference of the lap bobbin LB to hold the lap bobbin LB coaxially with the spline shaft 21.

As shown in Figs. 1 and 2, the spline shaft 21 of the lap bobbin holding mechanism 20 can be rotated through the sprocket wheel 35b, the chain 35c and the sprocket wheel 21c by the motor 35 to rotate the lap bobbin LB held on the spline shaft 21 by the swing levers 22. The spline shaft 21 is supported for rotation in the bearings 31b housed in the bearing housing 31a and driven for rotation through the sprocket wheel 35b, the chain 35c, the sprocket wheel 21c and the rear bush 21b by the motor 35 to rotate the lap bobbin LB supported on its front end. When the spline shaft 21 is rotated, the bearing housing 24a and the cylinder actuator 25 connected to the rear end of the bearing housing 24a are not rotated because the spline shaft 21 is supported at its rear end in the bearings 24 housed in the bearing housing 24a.

The rotary shaft 32 is turned by the motor 34 to turn the swing arm 31 above the rotary shaft 32 in an angular range of about 180° so that the lap bobbin LB held on the spline shaft 21 is moved between the position indicated by solid lines in Fig. 3 opposite to the lap bobbin conveyor 10 and the position indicated by alternate long and two short dashes lines in Fig. 3 opposite to the residual lap removing unit 40.

In operation, the lap bobbin holding mechanism 20 is held above the lap bobbin conveyor 10 with the swing levers 22 turned radially inward to their inner positions, the lap bobbin LB with a residual lap L is conveyed in the direction of the arrow K1 (Fig. 1) by the lap bobbin conveyor 10 to receive the swing levers 22 therein, and the lap bobbin conveyor 10 is stopped upon the arrival of the lap bobbin LB at a predetermined position, where the swing levers 22 are received deep in the lap bobbin LB as shown in Fig. 2. Then, the swing levers 22 are turned radially outward to hold the lap bobbin LB, therefore the lap bobbin holding mechanism 20 will hold the lap bobbin LB. Then, the motor 34 is actuated to turn the swing arm 31 so that the lap bobbin LB is located at the position indicated by alternate long and two short dashes lines in Fig. 3 above the residual lap removing unit 40.

Subsequently, the motor 35 is actuated to rotate the lap bobbin LB and jets of air are blown through the air nozzles 41a of the residual lap removing unit 40. The blower B2 of the lap recovering unit B is actuated beforehand to produce downward air currents within the hopper 41. The residual lap L held on the lap bobbin LB is unwound by the jets of air blown through the air nozzles 41a against the entire length of the lap bobbin LB. Then, pieces of the residual lap fall into the hopper 41, then the pieces of the residual lap are opened by jets of air blown through the air nozzles 42a, and then, the opened pieces of laps are delivered to the box B1 of the lap recovering unit B.

When the lap bobbin LB is placed on the endless round belts 13 of the lap bobbin conveyor

10, the direction of the lap bobbin is fixed so that the lap bobbin LB can be rotated in a counterclockwise direction, or in a lap unwinding direction as viewed in Fig. 3, i.e., the direction of the arrow K2 (Fig. 5). The lap bobbin LB held on the spline shaft 21 and positioned on the residual lap removing unit 40 is rotated counterclockwise as viewed in Fig. 3, i.e., the direction of the arrow K2 (Fig. 3) so that the residual lap L unwound by the jets of air blown through the air nozzles 41a, hangs down from the lap bobbin LB within the hopper 41 and can be smoothly transported downward by the air currents produced by the blower B2. It is preferable that the air nozzles 41a are arranged on the same level as the axis of the lap bobbin LB held on the spline shaft 21 which is positioned at the residual lap removing position and directed so as to blow jets of air against the residual lap L horizontally or slightly downward with respect to a horizontal direction.

After all the residual lap L held on the lap bobbin LB has been completely removed from the lap bobbin LB, the operation of the air nozzles 41a is stopped, the motor 35 is stopped to stop rotating the lap bobbin LB, the motor 34 is actuated to return the empty lap bobbin LB to the lap bobbin conveyor 10 by half turning the swing arm 31.

Then, the swing levers 22 of the lap bobbin holding mechanism 20 are turned radially inward to release the lap bobbin LB. Then, the lap bobbin conveyor 10 is reversed so that the upper sides of the endless round belts 13 move in a direction opposite to the direction of the arrow K1 (Fig. 1) to remove the empty lap bobbin LB from the lap bobbin holding mechanism 20 and to convey the empty lap bobbin LB to an outside of the residual lap removing apparatus. Then, the foregoing residual lap removing cycle is repeated for another lap bobbin LB holding a residual lap L.

As is apparent from the foregoing description, the residual lap removing apparatus comprises, in combination, the lap bobbin holding mechanism which holds the lap bobbin with a residual lap in the axis direction and rotates it, and the residual lap removing unit of an air jet system. The lap bobbin holding mechanism tansports the lap bobbin over the residual lap removing unit and rotates positively the lap bobbin with a residual lap, and the residual lap removing unit strips off the residual lap smoothly from the lap bobbin. Thus, all the residual lap can be completely removed from the lap bobbin regardless of the amount of the residual lap held on the lap bobbin. Since the residual lap is not removed mechanically from the lap bobbin, the component fibers of the residual lap are not damaged at all.

Claims

1. A residual lap removing apparatus comprising:

   a swing arm having a base end fixed to a rotary shaft;

   a lap bobbin conveyor disposed on one side of the rotary shaft for conveying a lap bobbin;

   a residual lap removing unit of an air jet system disposed on the other side of the rotary shaft;

   a lap bobbin holding mechanism mounted on the free end of the swing arm for axially holding and for rotating the lap bobbin with a residual lap; and

   a driving mechanism for turning the rotary shaft so that the lap bobbin held by the lap bobbin holding mechanism is disposed alternately at a lap bobbin catching position corresponding to the lap bobbin conveyor and a residual lap removing position corresponding to the residual lap removing unit.

2. A residual lap removing apparatus according to claim 1, wherein said residual lap removing unit has a hopper, and air nozzles arranged on the hopper.

3. A residual lap removing apparatus according to claim 2, wherein said hopper is connected through a lap opening mechanism to a lap recovery box.

4. A residual lap removing apparatus according to claim 1, wherein said lap bobbin holding mechanism has a spline shaft extended with its axis along the direction of the lap bobbin tranrsport, and a chucking mechanism, mounted on one end of the spline shaft, capable of fixing or unfixing with a innner surface of the lap bobbin.

5. A residual lap removing apparatus according to claim 2, wherein said air nozzles are disposed on the substantially same level as that of the axis of the lap bobbin disposed at the residual lap removing position, and said lap bobbin holding mechanism holding the lap bobbin with a residual lap rotates the lap bobbin in a lap unwinding direction.

FIG. 1

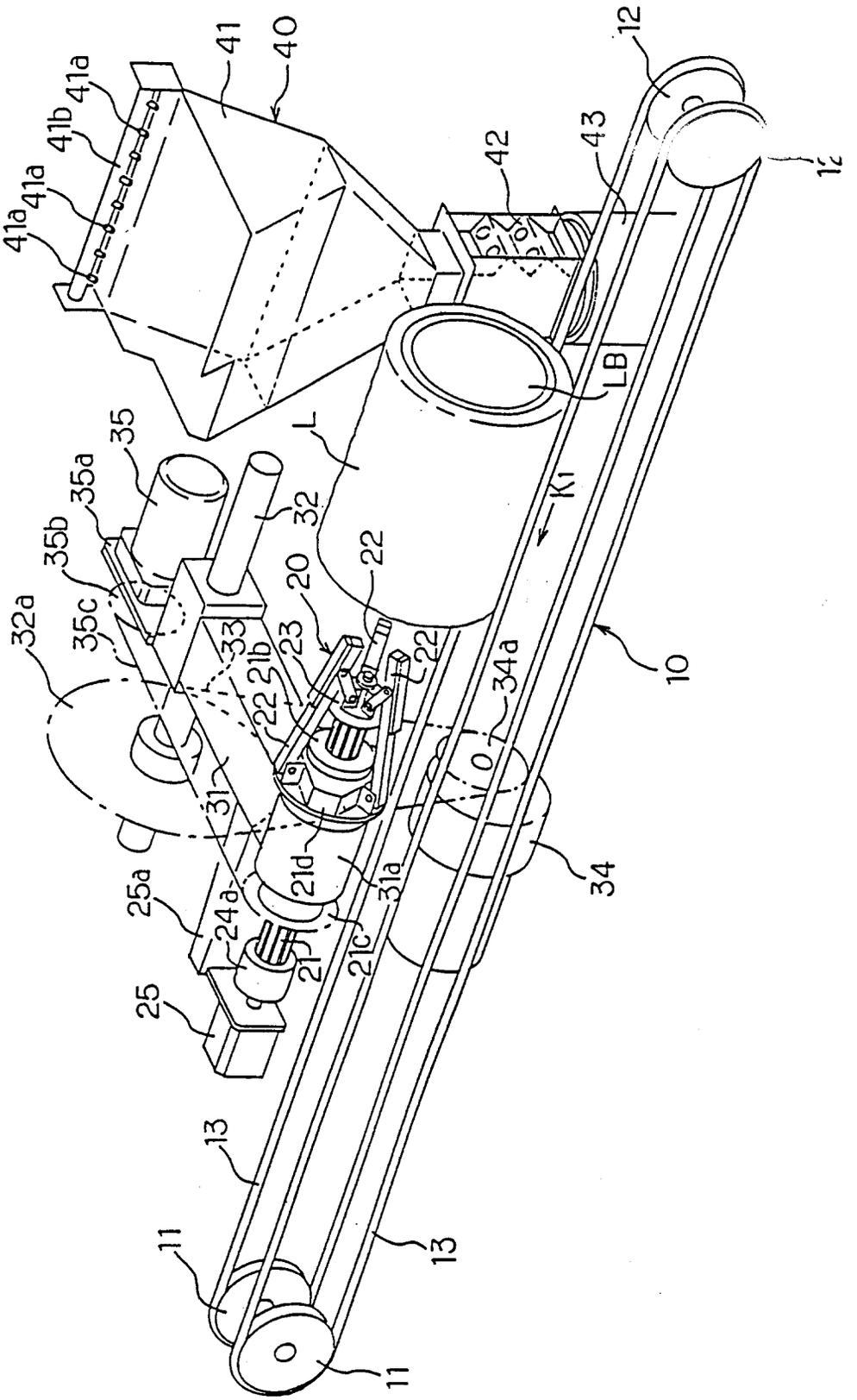
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FIG. 2

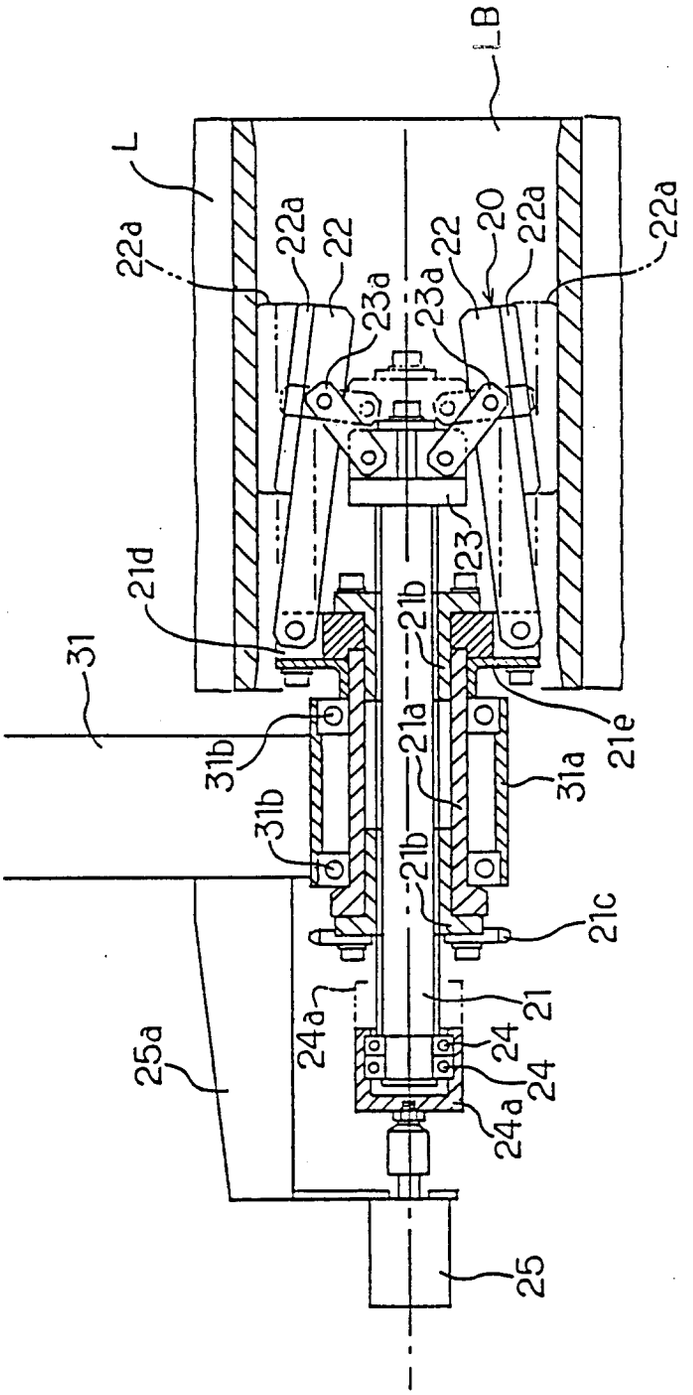
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FIG. 3

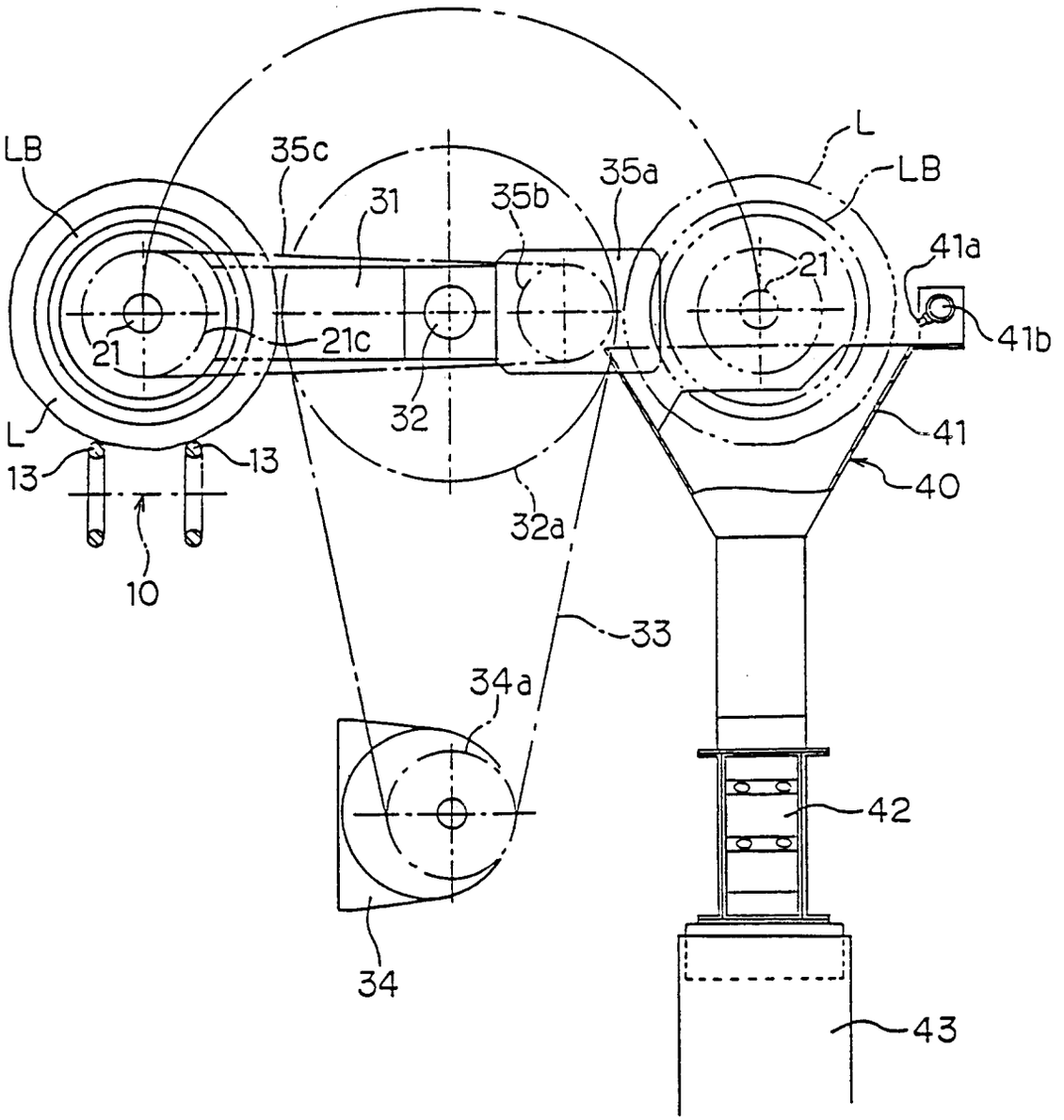
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FIG. 4

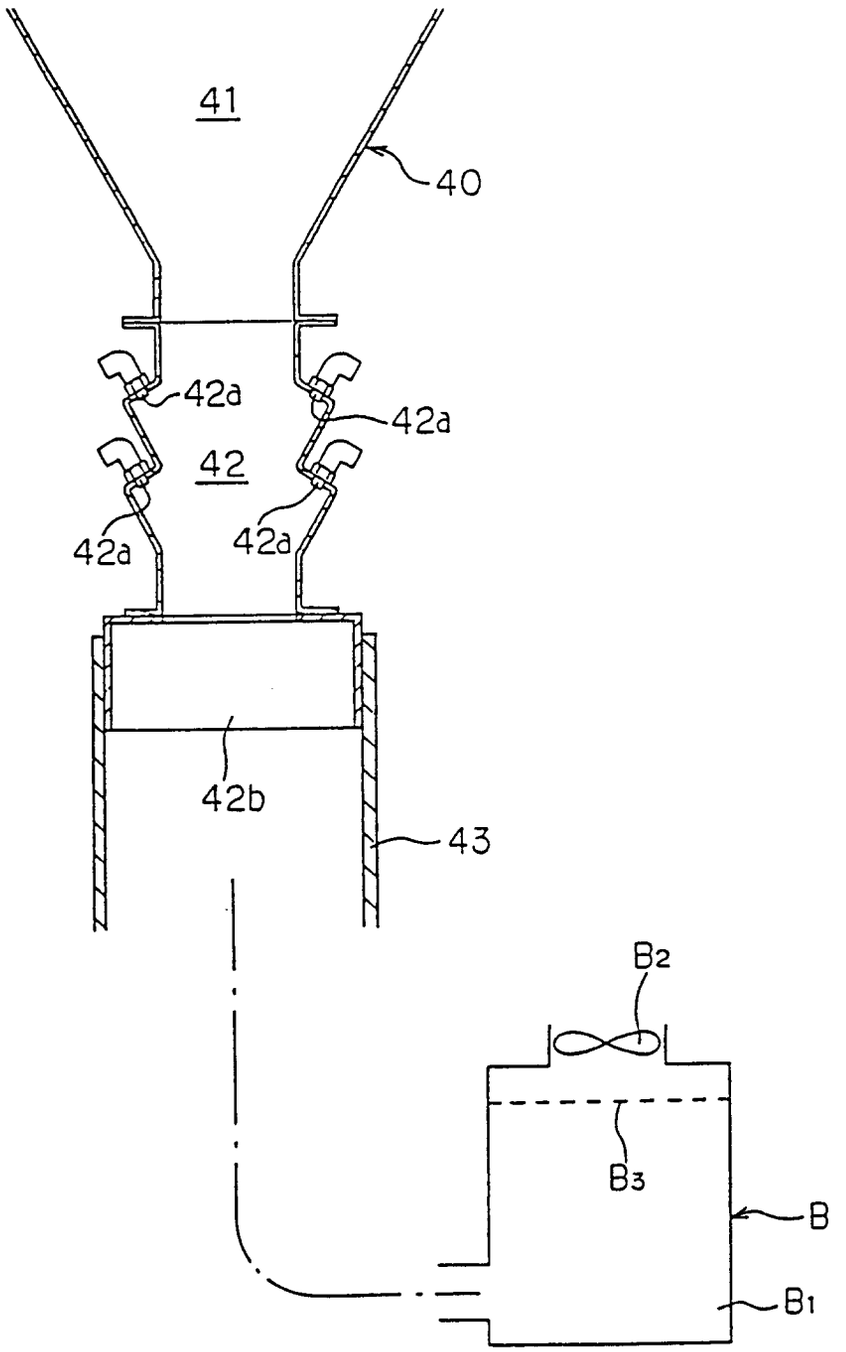
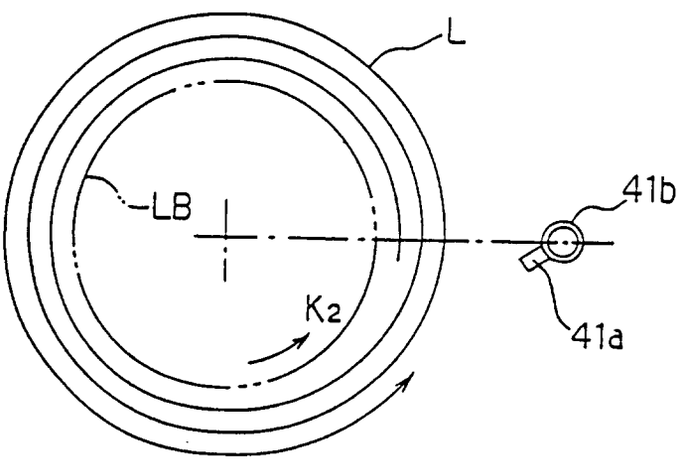


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 0206

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y,D	JP-A-3 079 563 (K.K.MURAO AND COMPANY) * figures *	1	B65H73/00
Y,D	JP-A-54 022 528 (...) * figures *	1	
A	FR-A-1 343 418 (THE TERRELL MACHINE COMPANY) * page 4, left column *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B65H
D01H
D01G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05 OCTOBER 1993	TAMME H.-M.N.

CATEGORY OF CITED DOCUMENTS

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