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(54) **Bobbin handling system.**

(57) Textile processing apparatus including:
at a first station, one or more machines having a plurality of spindles, for use in winding drawn slivers on to bobbins;
at a second station, a plurality of spinning machines (a-h) and, if desired, bobbin reservoirs (39a-39h) therefor;
means for indicating the present or future requirement for a type of sliver to be spun;
an endless conveyor (31) for the transport of the bobbins (6) between the first station and the second station;
a variable reference indicator on each bobbin;
means which sets each indicator as an identification of the type of sliver wound on that bobbin;
detection means (94a, 94b) which can detect the transport of indicator-identified bobbins; and
at the second station, bobbin displacement means (35a-35h) which can act in association with the detection means (33a-33h) so as selectively to transfer bobbins from the conveyor towards spinning machines, or reservoirs (39a-39h) therefor, for which the types of sliver on the bobbins are required.

Description

BOBBIN HANDLING SYSTEM

Field of the Invention

This invention relates to the spinning of yarns from sliver drawn from bobbins.

Background of the Invention

In a drawing head, sliver is first drawn and then wound with a very slight twist on to large flanged bobbins in preparation for the subsequent spinning, instead of being fed to cans as has been traditional in the past. The sliver is given a very small degree of twist to provide sufficient cohesion for handling purposes and although, strictly speaking, such twists converts the sliver into rove, the terms "sliver" and "rove" are used without distinction in the present specification to define the same basic material. One such machine for drawing and winding the slivers on to bobbins is described in our co-pending European patent Application No. 88308525.0 (EP-A-) and is referred to herein as a sliver packaging machine.

The bobbins of sliver are creeled at the spinning frames and serve as the feed source for the spinning machines on which they are further drafted and twisted into yarn. Although the slivers have been drafted at the sliver packaging machine, they will still be comparatively heavy when wound on to bobbins at the delivery side of the machine. A heavy bobbin of sliver is thus produced in a very much shorter time than on a spinning machine on which the sliver from the packaging machine is subjected to a very high draft.

It is established practice in the textile industry to doff bobbins of yarn automatically after one stage of processing and to move them on conveyors to the next processing stage. However, the position is more complicated when the first processing stage comprises a processing stage comprises a number of spinning machines.

A typical spinning room may comprise eight machines, each having in excess of two hundred spindles, and each machine may be spinning a different type of yarn, e.g. different in yarn count, quality, colour or fibre, from that adjacent to it. Under these circumstances, the benefits of automatic doffing and donning of full and empty bobbins, and their movement from the packaging machines upstream, can be greatly reduced by the manual operations involved in ensuring that the different materials are kept apart and are supplied to the respective, correct machines. Furthermore, time and material are wasted in running off the ends of the bobbins rather than storing them for the next time that the same material will be spun. By contrast, if the bobbins are stored, there is a likelihood that some of them will be largely depleted and, when creeled on the spinning machine, will have only a short duration before becoming completely exhausted.

Summary of the Invention

The invention is based on the idea of simultaneously conveying bobbins of sliver of different determined characteristics, i.e. types, on a common conveyor between a first processing station comprising one or more sliver packaging machines to a second processing station where the bobbins provide the feed source for a number of spinning machines spinning yarns of the different determined characteristics, while automatically ensuring that each bobbin is fed to the respective correct machine. This idea is realised in accordance with the invention by means of a system in which the conveyor moves the bobbins in an endless path between the first and second processing stations, the bobbins of sliver wound at the first station are provided with identification means which equates with the type of sliver wound upon the respective bobbin, and detection means which can identify the bobbins is provided in advance of the particular spinning machine or machines in the second station that is spinning that particular sliver.

In addition, bobbin displacement means at the second processing station cooperates with the detection means for sensing the identification means, referred to herein as "variable reference indicators", and operates to transfer a bobbin of the correctly identified sliver from the conveyor towards the spinning machine spinning that particular sliver or its bobbin reservoir. "Towards" means any path such that the bobbin eventually reaches the appropriate spinning machine or its reservoir, only on receipt from that machine, or apparatus associated with that machine, of a signal denoting its requirement or future requirement for such a bobbin. In other words, each bobbin doffed at the first processing station is received by the conveyor and if not required remains on the conveyor until called for by a spinning machine spinning that particular sliver as the result of a signal from the spinning machine or, for example, its bobbin reservoir, in cooperation with a signal from the detection means identifying the bobbin on the conveyor. As a result, the removal of the bobbins from the first processing station and their delivery to the correct spinning machine at the second processing station at the required time is automatically controlled and, until the bobbin is required, it can circulate on the conveyor. The signal may be a negative signal in that, provided the spinning machine or its reservoir is not full, then the bobbin displacement means may be powered to operate each time a bobbin of the required type is sensed by the detection means but, when it is full, the power will be interrupted.

Description of the Invention

While it would be possible to have one bobbin displacement mechanism movable, automatically, along the path of the conveyor adjacent to or leading to the various spinning machines in response to a signal from a machine or its bobbin loading device or

its reservoir that a bobbin was required, preferably there is a bobbin displacement mechanism for each spinning machine so as to avoid delay should a number of machines or their reservoirs require bobbins at the same time. Similarly, while one detection sensor in advance of the first spinning machine could signal ahead to each bobbin displacement means when a respective bobbin was moving towards it, preferably there is one bobbin detection sensor per machine.

Preferably, essentially the same system is used for returning empty bobbins from the spinning machines to the sliver packaging machines. The empty bobbins from the spinning machines may be discharged directly on to the conveyor or a short feed conveyor leading to the main conveyor, and mechanism may be provided adjacent the packaging machine or machines in the first processing station displacing empty bobbins from the conveyor towards the machine or machines or their respective bobbin reservoirs.

To automate the system further, automatic bobbin doffing and donning apparatus is preferably provided at the spinning frames, to load the large bobbins of sliver supplied by the conveyor on to the creels of the spinning machines and to move the empty bobbins and return them to the conveyor or to a path leading to the conveyor. Preferably, each spinning machine has its own travelling doffing and donning device which moves along the bobbin creel in either direction, as required, taking bobbins from the conveyor or a reservoir leading from the conveyor and loading them on to the creel. The doffing and donning device may move to a particular point on the creel in response to a signal from the creel that a bobbin is required at that point. Alternatively, it may traverse along the creel and have its own detector which detects the requirement for a bobbin and signals the displacement means to move a bobbin from the main conveyor to the spinning machine or its bobbin supply station. As a further alternative, the device may itself remove the bobbin from the main conveyor and take it to the creel of the spinning machine.

Preferably, the doffing and donning device (or "robot") has its own storage compartment, e.g. a tray or trays, for carrying a number of bobbins, so as not to have to return to the conveyor or bobbin reservoir each time a bobbin is required. The storage compartment may be integral with or separate from the robot. In the latter case, when it is empty of full bobbins, the compartment may automatically move to the supply conveyor or bobbin reservoir, fill up with full bobbins, discharge its empty bobbins and then return to the robot wherever that is located along the creel. The storage device may itself constitute a bobbin reservoir. If the robot and/or the storage compartment is designed so as to pick up the bobbins directly from the conveyor, it may itself constitute the bobbin displacement mechanism, and the storage compartment may constitute the bobbin reservoir.

Automatic bobbin doffing and donning apparatus is preferably also provided, at the first station, to doff the full bobbins from the machine(s) and replace

them with empty bobbins. The apparatus may service a number of machines, or each machine may have its own. In one particular arrangement, as described in the co-pending application specified above, the apparatus moves on rails above the machine which is doffed alternately on either side. Grippers of the doffing apparatus lower, grip the full bobbins on the spindles of the bobbin carrier and then rise with the bobbins and move to deposit them on a conveyor which leads to the main circulating conveyor which takes them past the spinning machines. The doffing and donning device then lifts a set of empty bobbins off a bobbin support leading from the circulating conveyor and places them on the spindles of the idle bobbin carriage in readiness for the next doffing cycle.

The identification means on each bobbin is preferably mechanical rather than, for example, magnetic, so as to avoid any damage due to possible rough handling. In order that such mechanical identification should not interfere with the operation of the bobbin, it is preferably located within the bore of the bobbin. If any one bobbin is to be used with any of the types of sliver to be spun, the identification means on each bobbin needs to be adjustable in order to equate with any of the slivers which it may be required to carry. In other words, when a bobbin is to be wound with a particular type of sliver, its identification means needs to be adjusted accordingly to equate with that sliver. The apparatus for setting the identification means, i.e. the bobbin reference indicator, is also most conveniently located at the first station.

Preferably, the conveyor system also includes a siding or sidings alongside one or more runs of the main circulating conveyor. In the event that it is desired to withdraw some bobbins from the main conveyor and take them out of circulation, they are transferred to the siding. This is particularly useful if, for example, a spinning machine completes its production quota of a particular yarn and the supply bobbins of sliver on the creel of the spinning machine are not depleted of sliver. In such event, a signal may, for example, be given from a microcomputer controlling the spinning cycle and operation of the spinning machine, or by a supervisor operating a switch, which will in turn provide a signal at the creel of that spinning machine, indicating to the travelling doffing and donning device at the spinning machine creel that the bobbins are to be doffed from the creel. The travelling automatic doffing and donning device will then move along the creel, removing each of the bobbins from the creel and breaking the sliver between the bobbins and the feed roller of the spinning machine, and transferring them to the main conveyor or to a feed conveyor leading from the machine to the main conveyor. The conveyor will then circulate those bobbins past the siding and, each time they pass it, displacement mechanism positioned adjacent the siding will transfer those particular bobbins to the siding or to paths leading to the siding. The displacement mechanism will be operated in much the same manner as those leading to the spinning machines, in that bobbin identifying (detection) sensors will be positioned to cooperate

with the displacement mechanism to ensure that the appropriate bobbins are moved to the siding. The bobbins in the siding may be left or transferred to other storage areas until next required by the spinning machines.

In the event that more than one spinning machine in the system is using the same type of bobbin (sliver) as that used by the spinning machine that has completed its production quota, then the bobbins doffed from that spinning machine may be transferred to the circulating conveyor and, instead of being transferred to the siding, the bobbins may be used, as required, by the other spinning machines so as to enable them to complete their production quota without the necessity of calling upon full bobbins. This is particularly useful when each spinning machine is completing its quota and requires only a limited amount of sliver.

Description of the Drawings

The invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 illustrates one form of bobbin for use with a system in accordance with the invention;

Figure 1A is a sectional view of the top end of the bobbin shown in Fig. 1, including a reference indicator;

Figure 2 is a view of a setting spindle for use with the bobbin of Figure 1, in order to adjust its identification means (reference indicator);

Figure 3 is a side view of part of automatic doffing and donning apparatus for a sliver packaging machine, and the apparatus for moving the reference indicators to the zero position;

Figures 4A and 4B should be considered in juxtaposition, in which case (herein described as Fig. 4) there is a diagrammatic view of a complete system in accordance with the invention; and

Figure 5 is a simplified view of an alternative conveyor track.

Figs. 1 and 1A show a bobbin 6 having an upper flange 1, a lower flange 2 and a hollow barrel 3 with a central bore 4. The upper flange 1 is formed with a groove 5 around which the last turn or turns of sliver is/are wound at the completion of winding, so as to trap the sliver end before it is broken when the bobbins are displaced from their winding position for doffing and, hence, prevent it from unwinding from the bobbin when it is being conveyed between the first and second processing stations.

At its upper end, the bobbin 6 has a spigot 7 which has an external recess 9 enabling the bobbin to be gripped by the automatic doffing and donning apparatus for the sliver packaging machines at the first station and by the travelling automatic doffing and donning devices for the spinning machines at the second station. The upper part of the bore of the bobbin is fitted with a fixed plug 13 which has a series of spaced annular grooves 15 along its bore for locating a bobbin reference indicator 17 which has spring-loaded ball catches 19, spaced around its circumference, for locating in any one of the grooves

15. An expandable spring wire clip or rubber O-ring may, for example, be used as an alternative to the spring-loaded ball catch and may be fixed in a single groove in the wall of the bore of the plug, the reference indicator being provided with a series of annular grooves which may in turn be engaged with the clip to position the indicator. Each axial position of the reference indicator 17 identifies a different sliver carried by the bobbin, referred to as the "bobbin type", the bottom groove representing the zero position. The indicator is movable axially of the plug from groove to groove, the balls being compressed when the indicator is moved to a different setting.

In the particular construction illustrated, there are five settings, but the reference indicators may take various forms and have considerably more settings. For an indicator of the type described and illustrated, detection sensing devices which may, for example, be of the laser type or operate on a magnetic field, provide a signal which identifies the bobbin type in accordance with the height of the plug. Therefore, before the full bobbins are delivered to the conveyor 31, their reference indicators must first be moved to the zero position and then set to the reference position denoting the type of sliver being carried by the bobbin, i.e. the setting that will react with the sensor 33 at the spinning machine or machines processing that particular sliver. The indicators may be zeroed at the spinning machine when empty or when they are being delivered on to the return conveyor 43 or main conveyor 31 but, most conveniently, they are zeroed and reset to the appropriate setting at the first station.

Figure 4 (which is purely diagrammatic and is not intended to illustrate actual mechanisms) is a simple example of a system in which there are only two sliver packaging machines A and B, each of which combs and drafts the feed slivers, and flyer-winds them with a very low twist on to bobbins 6 such as those just described with reference to Figures 1 and 1A. In Figure 4, full bobbins are denoted by a cross (x).

In accordance with the previously-used terminology, this represents the first processing station. In a particular example, each packaging machine A and B has six spindles, so that six bobbins are wound for each doff. The time taken to wind each batch of bobbins is approximately 15 minutes. Each bobbin will hold about 5 kg sliver. There may be twelve feed slivers per machine (two doublings per spindle), each sliver weighing 15 g/m (30 g/m doubling) with a draft of six to provide a low twist 5 g/m sliver on each bobbin. The bobbins are approximately 425 mm long by 200 mm in diameter.

The bobbins are supplied to eight ring spinning machines a-h, each of which has more than 200 spindles. The sliver on the bobbins from the sliver packaging machine is highly drafted on the spinner, e.g. by a factor of x 50, and twisted 260 t/m to provide a 10⁸ metric yarn. Each bobbin will comprise 600 g of yarn and will require approximately 2 hours to wind. Therefore, each sliver package bobbin will provide the sliver to produce 8-9 packages of yarn at the ring spinner, i.e. the sliver package bobbin that is

wound in 15 minutes will last in the region of 17 hours at the spinning machine.

At the outset of a completely new spinning cycle, with all the spinning frames empty and ready to spin four different colours of yarn, the sliver packaging machines A and B may, if desired, each process a different sliver from the other. As seen in Figure 4 and as represented by dots at one end of each spinning machine, machines a and d will be spinning a first type of yarn, machines c, f and g a second type of yarn, machines e and h a third type, and machine b a fourth type. If the sliver packaging machine A is drafting a one-dot sliver, the bobbins doffed from the sliver packaging machine by apparatus such as described in the co-pending application specified above, and with the reference indicators set as described, are deposited on a conveyor 29 which supplies them to a main roller-type conveyor 31 which is driven to move the bobbins continuously in an endless path from the first station C and encircles the eight spinning machines in the second station D. In the system illustrated, the conveyor 31 moves the bobbins in an anti-clockwise direction and takes the bobbins around to the far end of the spinning frame a. For illustration purposes, the spinning machines are shown to be very much shorter than is actually the case; for example, they may be more than ten times the length of the sliver packaging machine.

A bobbin identifying detection device 33 adjacent the far end of the spinning machine a, which senses the height of the reference indicators, is set specifically to cooperate with the indicators on the bobbins from machine A. For simplicity of illustration, the bobbin sensing devices are shown at the side of the conveyor 31 but, in practice, they extend over the top of the conveyor so that the bobbins on the conveyor pass below them. Accordingly, as each of the bobbins passes below the sensing device, it sends a signal to the bobbin displacement mechanism which may, for example, be a pneumatic ram 35 which is timed to cooperate with the speed of the conveyor and operates to push the bobbin on to a further take-off conveyor 37 which moves towards a storage reservoir 39 comprising a platform of freely rotatable rollers, so that each bobbin leaving the conveyor 37 pushes the preceding bobbin along the platform.

In order to ensure that only the required bobbin is dislodged from the conveyor by the ram, a dividing plate 34, also adjacent the conveyor, there being one plate per ram, is operated by the signal from the sensor 33 so as to move across the conveyor when the indicated bobbin passes and block the passage of the following bobbin which then slips on the driven rollers of the conveyor 31. The ram will not, in fact, operate until its control mechanism also receives a signal from a scanning device 41 at the reservoir platform 39 signifying that there are fewer than a predetermined number of bobbins in the reservoir. The complete operation of the ram is very fast and, as soon as the indicated bobbin has been displaced from the main conveyor 31 to the feed conveyor 37, the plate and ram retract to their inoperative positions. The bobbins supplied to the reservoir 39 are then taken by a travelling automatic

doffing and donning device (hereinafter described as a robot) 47 at each frame, which acts in response to signals from the creel, as shall be described below, to load the bobbins, where required, on to the creel, to provide the feed source for the spinning machine.

The spinning frame d is spinning the same yarn as the frame a and, when the frame a has been completely supplied, the frame d will be similarly supplied by way of a respective sensor 33d and pneumatic ram 35d; when supply to the frame d is complete, the packaging machine A stops to enable it to be changed over to process a different material. During the time when the machine A is processing one-dot material, the machine B processes two-dot material; the movement of the bobbins to the appropriate spinning machine b is effected in the same way, the reference indicators on the bobbins from machine B being set differently from those of machine A, and the sensor 33b at the conveyor 31 adjacent the end of the spinning machine b being timed to cooperate with those reference indicators and to transmit a corresponding signal.

The system continues until all the spinning machines have been supplied with sliver feed bobbins. When this is complete, the sliver packaging machines A and B are changed to process the slivers that will be first required when the feed bobbins expire, and the resultant back-up bobbins will, when wound, simply be supplied, as described, to the conveyor 31 and allowed to circulate until needed. In addition, as the feed bobbins on the creels of the spinning machines expire they will be removed from the creels by the respective travelling robots 47 and placed on the respective return conveyors 43 which moves the bobbins to the conveyor 31 on which they circulate until required by the sliver packaging machines. As the empty bobbin reaches the end of the conveyor 43 adjacent to the main conveyor 31, a sensor 59 provides a signal to operate a pivoting arm 57 so as to cause it to engage the bobbin and sweep it on to the main conveyor.

The sliver packaging machines, spinning machines, conveyors and other equipment illustrated in plan view in Fig. 4 are not to be taken as true outlines of the actual machines etc., as the drawing is intended solely for describing one possible embodiment of the system. The front of each spinning machine is denoted by a heavy line and they face each other in pairs. The yarn bobbins 49 of spun yarn produced by the spinning machines are pitched lengthwise of the front of the machine, only a few being represented towards one end of spinning machine f.

The creel sliver feed bobbins 6 are mounted on rotatable hangers on the creel in double rows, and the robots 47 traverses the length of the creel between the rows. The creels may be provided, at each bobbin, with a sensing device which reacts with the material from which the bobbin barrel is made, so as to send a signal to the robot when the sensing device senses the bare barrel. Alternatively, a sensing device for sensing the diameter of the bobbin may be used to provide a signal to the robot whenever the yarn on the bobbin is finished or

almost finished. On receipt of the signal, the robot will travel to that winding station, remove the empty bobbin and replace it with a full bobbin. As a safeguard, a lightbulb may be fitted at each creel station and arranged to come on when the sensing device detects an empty bobbin, and the robot may be designed to react with the lightbulb, so as to remove the empty bobbin and replace it with a full one.

The robot 47 is represented only at spinning machine f in Figure 4. Preferably, there will be at least one robot per machine and, depending on the length of the machine, two may be justified so as to load and unload bobbins from each end of the machine. In such a case, it is desirable also to have bobbin take-off and return conveyors 37, 43 respectively leading from and to the main conveyor 31, at each end of the machine; indeed, this may also be desirable when using only one robot per machine. However, for the purpose of this description, there are only one set of take-off and return conveyors and one robot per spinning machine.

Preferably, the robot 47 has two articulated arms 51, 53 when can engage and hold the spigot 7 of the bobbin, so as to remove empty bobbins from the creel and place them on the return conveyor 43, or if desired directly on to the conveyor 31, to lift full bobbins from the take-off conveyor 37 or bobbin reservoir 39 at the end of the take-off conveyor, or directly from the main conveyor 31, and to locate the full bobbins on the creel. At the creel, the robot unwinds the end of the sliver which is trapped in the groove 5 in the top flange of the bobbin and automatically feeds it to the back rollers of the spinning frame, so as to cause the sliver to pass unassisted to the drafting zone of the spinning frame. It may also effect a cleaning operation. Preferably, it will have at least one tray 55 for holding a number of bobbins, so as not to have to return to the end of the spinning machine each time it removes an empty bobbin and requires a full one.

The robot may take the full bobbin from, and return the empty one to, the main conveyor 31. Separate displacement mechanisms for moving the bobbin off and on to the conveyor 31 will not then be required. However, preferably, to work in conjunction with the main conveyor 31, there are at the end of each spinning machine a take-off conveyor 37 and a bobbin reservoir 39 comprising a platform of freely rotatable rollers upon which the bobbins removed from the conveyor by the operation of the pneumatic ram 35, rest.

A scanning device 41 scans the number of bobbins at the reservoir and, if the requisite number is not present, it sends a signal to the controls of the ram to operate the next time a bobbin of the required type arrives. When such a bobbin arrives at the detection device 33 for that spinning frame, the device sends a signal to the controls of the ram, hence completing the circuit, and the ram is operated to push that bobbin off the conveyor 31 and on to the driven take-off conveyor 37 which moves the bobbin on to the roller platform of the reservoir 39. This sequence will be repeated until the reservoir is full, and each time a bobbin is removed

from it by the robot.

Also at the end of each spinning machine is a driven return conveyor 43 upon which the robot places empty bobbins removed from the creel. At the end of the conveyor 43 adjacent the main conveyor 31 is a pivoted arm 57 and a cooperating sensor 59. When an empty bobbin reaches the end of the conveyor 43, the sensor 59 signals the arm 57 to pivot and engage the bobbin to transfer it to the main conveyor, whereupon the arm moves vertically, so as not to dislodge any following empty bobbin, and pivots back to the rest position.

The empty bobbins returned to the conveyor 31 will remain on it and circulate past the first and second stations until called for by a sliver packaging machine. At the side of the conveyor 31 at the first station are rams 61A, 61B, dividing plates 63A, 63B and sensors 65A, 65B which operate in the same manner as at the spinning machines, except that the sensors 65A, 65B sense if a bobbin has yarn on the barrel and, if not, send a signal to the controls of its respective ram to operate if a parallel signal is received indicating that an empty bobbin is required at its sliver packaging machine. Take-off conveyors 67A, 67B take the empty bobbins to a park position 71A, 71B at which they are automatically spaced to coincide with the pitch of the spindles of the sliver packaging machine. Parallel with the park position 71A, 71B are scanners 73A, 73B which, when the requisite number of empty bobbins are present, signal the rams 61A, 61B so as to neutralise them and render them inoperative, thus permitting following empty bobbins to remain on the conveyor 31 and to pass unhindered by the first station.

Each time an empty bobbin is doffed from the spinning frame creel, before being placed on the sliver packaging machine, the reference indicator is automatically pushed down to the zero position, i.e. to locate the indicator in the bottom groove, and then reset to denote the type of sliver being wound on to the bobbin at the sliver packaging machine. This may, very conveniently, be effected by the automatic doffing and donning apparatus at the first station. While each sliver packaging machine may be equipped with its own doffing and donning apparatus, it is also possible for the one unit to service a number of machines. In the system illustrated in Figure 4, one unit services two machines.

The automatic doffing and donning apparatus comprises a motorised carriage 80 which is mounted to move on wheels 81 along rails 82, 82' supported by pillars 84, 84' and extending across the top of both machines. The total height of the unit is, for example, approximately 2.5 metres. The bobbin grippers 86, 86' extend between two telescopic arms 88, 88' and can simultaneously lift all six bobbins off the spindles. When inoperative, the telescopic arms are retracted so that the grippers are positioned above the machine, and the travelling carriage 80 is stationary at the position at which the previous doffing sequence is completed.

As described in the co-pending Application specified above, the sliver packaging machine has two bobbin carriages 24, 24' which can sit side-by-side on floor rails 26, 26' which are at right angles to

the machine and extend beyond both sides of the machine. At the outset of a spinning cycle, one bobbin carriage 24 complete with empty bobbins is moved to be directly underneath the flyers while the other 24' is displaced to one side. The carriage with the bobbins is then raised to the winding position. Empty bobbins are loaded on to the spindles of the displaced carriage 24' in readiness for the next winding cycle. When the sliver bobbins are wound, the full bobbins are automatically lowered on to the rails 26, 26', and the bobbin carriages are moved on the rails; the full bobbins are displaced to the side of the machine opposite to that at which the empty bobbin carriage 24' has been, while, simultaneously; that bobbin carriage with the empty bobbins is moved underneath the flyers.

On the arrival of the full bobbin carriage at the side of the machine to which it is doffed, it operates a switch which signals the drive of the motorised carriage 80 to move it to that side of the machine. The telescopic arms 88, 88' then lower so as to position the bobbin grippers over the spigots 7 of the row of full bobbins, and close to grip them. The telescopic arms then retract again to lift the bobbins above the height of the machine, and the motorised carriage then moves to be above the respective delivery conveyor 29A, 29B. The arms lower the bobbins on to the conveyor and release them so that the conveyor can move them to the main conveyor 31. The speed of the conveyor 29A, 29B is timed to cooperate with a rotating arm 92A, 92B which is operated when the first of the six full bobbins arrives at a sensor 94A, 94B on the conveyor 90A, 90B, so as to sweep each of the bobbins on to the main conveyor 31. In order that the bobbins being moved on to the conveyor 31 do not displace bobbins that are already on it, a stop plate 96A, 96B is triggered by sensor 94A, 94B so as to extend across the conveyor 31 and temporarily block any bobbins on the conveyor 31. While this is going on, the motorised automatic doffing and donning carriage 80 moves across the rails 82, 82' so as to be above the park position 71A, 71B of the respective take-off conveyor 67A, 67B in readiness for transferring a set of empty bobbins from the park position to the spindles of the displaced bobbin carriage from which the full bobbins have been doffed. In the event of the two sliver packaging machines completing a winding cycle at much the same time, the automatic doffing and donning device may be controlled so as to remove the full bobbins from both machines before donning empty bobbins on to the spindles of the displaced bobbin carriages. This can be effected during the next winding cycle of the respective sliver packaging machines.

It is whilst the six empty bobbins are being transferred on to the spindles of the inoperative displaced bobbin carriage 24' that the reference indicator in each of the bobbins is first set to the zero position (in which the indicator is held in the bottom groove 15 of the bobbin plug 13), and then reset in the appropriate groove to represent the type of sliver about to be wound on to those bobbins. This will now be described with reference to the sliver packaging machine A.

At the relevant point, the bobbin carriage 24'A with the full bobbins has just been displaced to the right-hand side of the machine, and the six full bobbins have been doffed from its spindles and placed on to the return conveyor 28A by the doffing and donning apparatus 21, in the manner described above. The next winding cycle has already started: the bobbins of the other bobbin carriage 24A are in the winding position, to cooperate with the flyers of the machine. The motorised automatic doffing and donning carriage 80 moves to a position above the park position 71A at the end of the take-off conveyor 67A which lies parallel with the machine. The empty bobbins which have been delivered to that position by the conveyor 31 and ram 61A, as has already been described, are spaced along the conveyor 67A at the park position to coincide with the pitch of the spindles on the bobbin carriage.

With reference to Figures 2, 3 and 4, provided that the scanner 73A provides a signal signifying that all six empty bobbins are in the park position, the telescopic arms 88, 88' of the automatic doffing and donning apparatus 21 lower so as to locate the grippers 86, 86' over the spigots 7' of the row of empty bobbins and close so as to grip them. In a fixed position extending downwardly from a plate carried by the housings 87, 87' of the telescopic arms 88, 88', a row of spigots 83 are pitched so as to align with the bobbins, axes. As the telescopic arms retract so as to move the bobbins upwardly, the bobbins are pulled on to the spigots which are of a length such as to push the reference indicators in the bobbins down to the zero position. The telescopic arms then extend again to withdraw the bobbins from the spigots, and the motorised carriage then moves to a position above a dummy spindle rail 26A which has six spindles 25 pitched to coincide with the pitch of the bobbins, along the rail.

With reference to Figure 2, the dummy spindle comprises a base 29 which is fixed to the rail 26A, a main spindle shank 25, the diameter of which coincides with the bore of the bobbin, and a changeable spigot 27 which is set into an axial bore of predetermined length at the top of the spindle. There is a set of such spigots, of lengths to suit the different settings of the bobbin reference indicators. The bobbins are lowered on to these spindles, and the top of the spigot of each spindle engages the underside of the reference indicator and pushes it upwardly to locate in the appropriate groove denoting the particular sliver about to be wound on to the bobbins. The telescopic arms 88, 88' then retract again, lifting the bobbins off the dummy spindles. The motorised carriage 80 moves the bobbins to a position above the spindles of the displaced bobbin carriage 24'A, and lowers to place and release the empty bobbins on to the bobbin carriage in readiness for the next doffing cycle. The telescopic arms then retract again to the inoperative position, and the motorised carriage parks at that position until next signalled by the doffing of a set of full bobbins of one of the sliver packaging machines to move to that side. The sequence of doffing that batch of full bobbins, setting the reference indicators in the empty bobbins, and donning the bobbins

on to the idle bobbin carriage, is then repeated.

Instead of the dummy spindle having changeable spigots and variable length, it may be of fixed length and the stroke of the auto doffing and donning apparatus when lowering the bobbins on to the dummy spindles, may be automatically adjusted to suit the required bobbin setting.

Figure 4 shows a siding 100 comprising a driven roller conveyor 102 with a static holding bench 104 made up of a series of freely rotatable rollers at the end of which is a stopper plate 108. In the event that it is desired to take any full bobbins or partly full bobbins out of circulation temporarily, a sensor 110 which cooperates with a ram 112 is activated so as to operate the ram each time bobbins of the type to be removed are in line with it. The ram 112 then pushes those bobbins on to a driven take-off conveyor 114 which feeds the bobbins on to the conveyor 102 which, in turn, moves them to the holding bench 104; each successive bobbin pushes its predecessor along the holding bench.

In the event that a spinning machine has completed its production quota, the robot 47 at the spinning machine may be directed so as to remove the partly-depleted sliver bobbins from the creel. In the process, the slivers extending between the bobbins and the back rollers of the spinning machines are broken, and each end of the sliver extending from the bobbin is wound around the groove 5 in the bobbin so as to trap it. The robot then places the bobbins on the respective return conveyor 43 which delivers them to the main circulating conveyor 31 which, in turn, conveys the bobbins to the siding 100 for temporary storage. Alternatively, the partly-depleted bobbins may be left in circulation and fed to another spinning machine processing that particular sliver.

When clearing a spinning frame that has completed its spinning quota for that type of sliver, full bobbins may still be disposed along the bobbin reservoir 39. In such an event, the robot may remove them and place them on the main conveyor 31. Alternatively, a movable plate, on which the scanner 41 is mounted, may be operated so as to move across the reservoir 39 and, in so doing, push all the bobbins sitting on the reservoir on to the return conveyor 43.

If it is desired to return any of the bobbins at the siding into circulation on the main conveyor, a robot 116 with a sensor which can be controlled to pick out bobbins in accordance with the setting of their reference indicators, or empty bobbins, is called upon to move along the holding bench 104 of the siding, pick up the bobbins to be recirculated, and place them on to a return conveyor 118 which feeds them back on to the main conveyor 31.

It will be understood that a very large number of variations can be allowed for by the system. It is possible, for example, that all the spinning machines may be spinning different types of yarn, and the packaging machines A and B will be programmed to wind the bobbins as they are required. As already described, each bobbin sensor effectively selects an appropriate bobbin which is then displaced from the conveyor and fed to its associated spinning ma-

chine, each sensor and/or bobbin displacement means being linked, directly or indirectly to detection means at its spinning machine or apparatus associated with the spinning machine such as its bobbin loading device or reservoir so as to become active only when there is a need for bobbins. Computer control allows not only for the different spinning machines spinning different yarns, but also for the different yarn counts being spun, thus resulting in the machine spinning the heavier yarns using up their bobbins of sliver more quickly than those spinning the lighter yarns. This leads to a greater demand for bobbins carrying sliver corresponding to the heavier yarns and corresponding greater production from the machines A and B.

In the description, reference is made to the conveyor being of the roller type, but it will be understood that other types of conveyors may be used including conveyors with spigots for locating and holding the bobbins. In the latter case, the bobbins may be suspended on the spigots from the underside of the conveyor, and the displacement means may be designed so that, when activated, it pushes the bobbin off the spigot, and the bobbin falls a short distance under its own weight on to a subsidiary conveyor that leads to the spinning machine. Alternatively, the displacement means does not engage the bobbin at all but, say, causes the spigot to withdraw from the bobbin, e.g. by magnetic attraction, so that the bobbin is released.

As described with reference to Figure 4, the conveyor 22 moves the bobbins in a closed loop around the spinning machines. This has the advantage that the long path of the conveyor permits plenty of storage space. This is not essential, however, and Figure 5 shows an alternative configuration of the main conveyor 31' in which it is positioned between the ends of two groups, each of four spinning machines. It is, of course, essential that the conveyor should run or move the bobbins in a closed path, but this need not be rectangular as shown in Figures 3 and 4. Irregular arrangements of spinning machines and packaging machines are possible within the scope of the invention. Whatever the path of the conveyor, it is convenient for it to run slightly above head height (e.g. about 2 metres or slightly more) so as not to obstruct the passage of operators and other personnel.

Claims

1. Textile processing apparatus including: at a first station, one or more machines having a plurality of spindles, for use in winding drawn slivers on to bobbins;
- at a second station, a plurality of spinning machines and, if desired, bobbin reservoirs therefor;
- means for indicating the present or future requirement for a type of sliver to be spun;
- an endless conveyor for the transport of the bobbins between the first station and the

second station;
 a variable reference indicator on each bobbin;
 means which sets each indicator as an identification of the type of sliver wound on that bobbin;
 detection means which can detect the transport of indicator-identified bobbins; and
 at the second station, bobbin displacement means which can act in association with the detection means so as selectively to transfer bobbins from the conveyor towards spinning machines, or reservoirs therefor, for which the types of sliver on the bobbins are required.

2. Apparatus according to claim 1, in which there is bobbin displacement means for each spinning machine.

3. Apparatus according to claim 1 or claim 2, in which there is bobbin detection means in advance of each bobbin displacement means.

4. Apparatus according to any preceding claim, including a bobbin doffing and donning device as or in addition to the bobbin displacement means, and including also means for driving the device in either direction along the creel of a spinning machine to which sliver-wound bobbins can be transferred, so as to place sliver-wound bobbins on the creel when required, and to return empty bobbins from the creel to the conveyor or to means leading to the conveyor.

5. Apparatus according to claim 4, in which the bobbin doffing and donning device includes storage means, which can move with the doffing and donning device, for holding a number of bobbins.

6. Apparatus according to claim 4 or claim 5, including signalling means at the creel, which provides a signal to the bobbin doffing and donning device and/or the bobbin displacement means, indicating when a bobbin is required at the creel or at the bobbin reservoir, or will soon be required at the creel.

7. Apparatus according to claim 4 or claim 5, in which the doffing and donning device has sensing means which detects when a full bobbin is required at the creel or at a reservoir or when a bobbin on the creel is empty or soon to become empty and which, accordingly, provides a signal to the bobbin displacement means.

8. Apparatus according to any preceding claim, including second bobbin displacement means adapted to move empty bobbins from the conveyor at the first station.

9. Apparatus according to any preceding claim, including automatic doffing and donning apparatus at the first station, for doffing sliver-wound bobbins from the machine or machines and transferring them to the conveyor or to means leading to the conveyor, and for taking empty bobbins which have been supplied by the conveyor and placing them on the spindles of the machine or machines.

10. Apparatus according to claim 9, which includes a temporary holding position to which

empty bobbins taken from the conveyor are directed before being placed on the spindles of the machine or machines.

11. Apparatus according to any preceding claim, in which the indicator-setting means is at the first station.

12. Apparatus according to claim 9 or claim 10, in which the indicator-setting means comprises a gauge positioned so as to be engaged by bobbins as they are moved by the automatic doffing and donning apparatus to/from a machine at the first station.

13. Apparatus according to any preceding claim, including third bobbin displacement means adapted to displace full or partly full bobbins from the conveyor, so as to take them out of circulation.

14. Apparatus according to claim 13, which includes a siding on to which the non-circulating bobbins are displaced, and means to return the displaced bobbins on to the main conveyor when required.

15. A method of conveying and controlling the movement of bobbins between first and second textile processing stations, which comprises operating apparatus according to any preceding claim.

Fig.1.

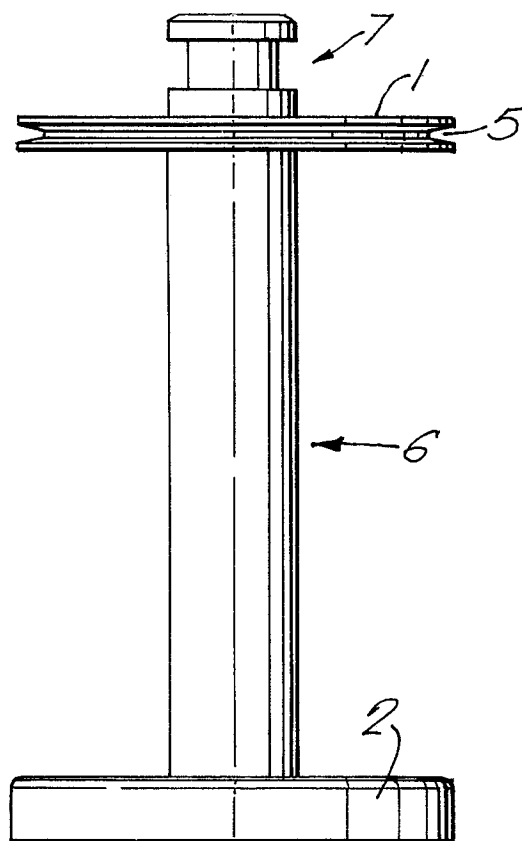


Fig.2.

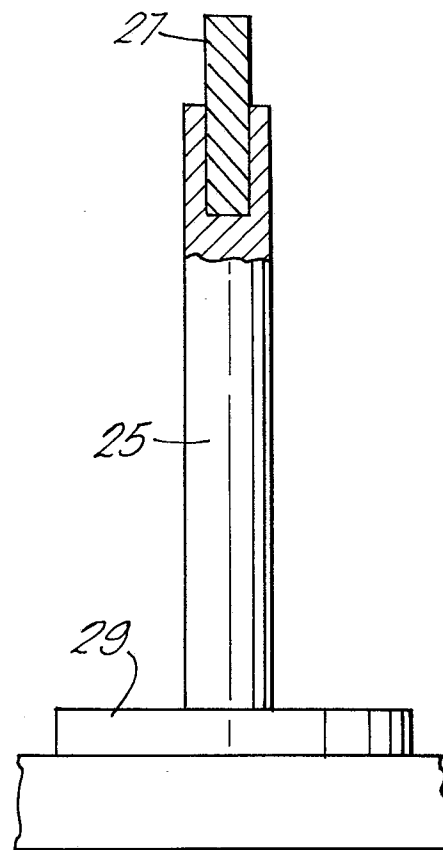
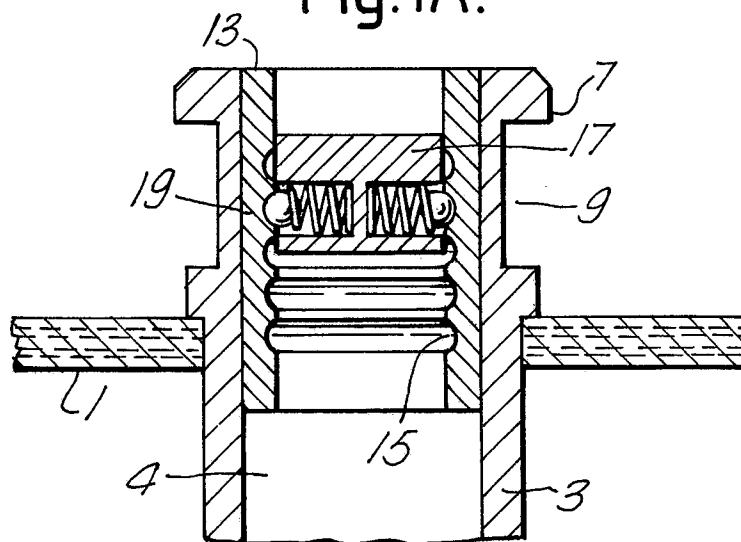


Fig.1A.



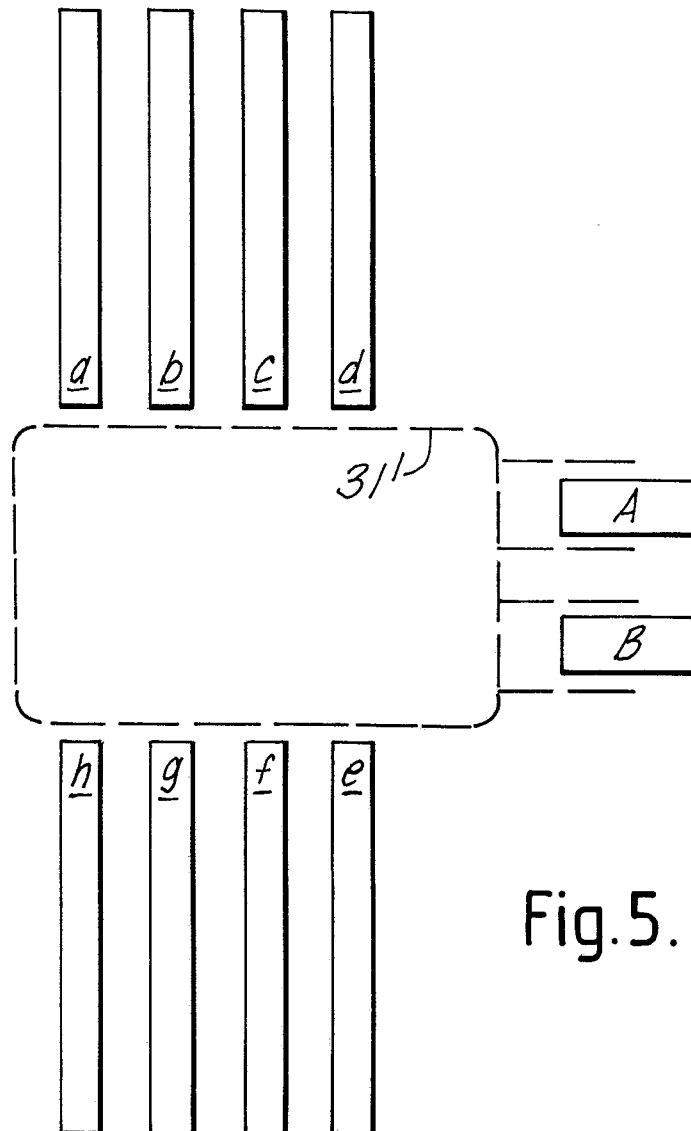
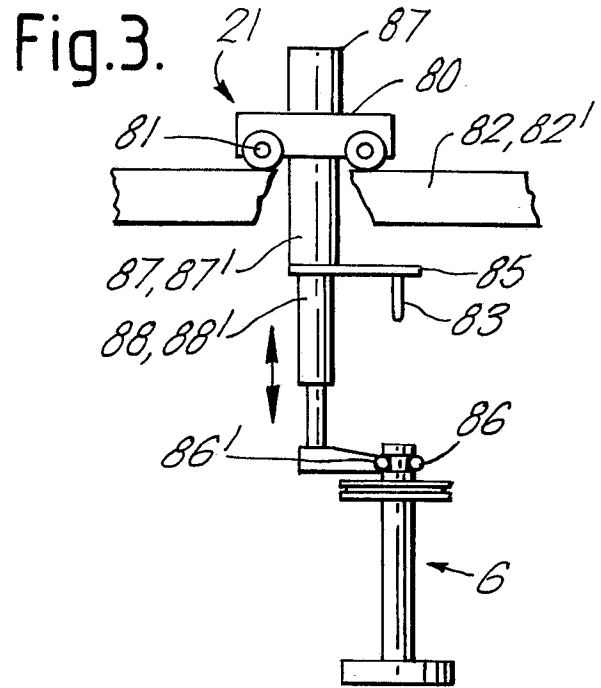


Fig.5.

Fig.4A.

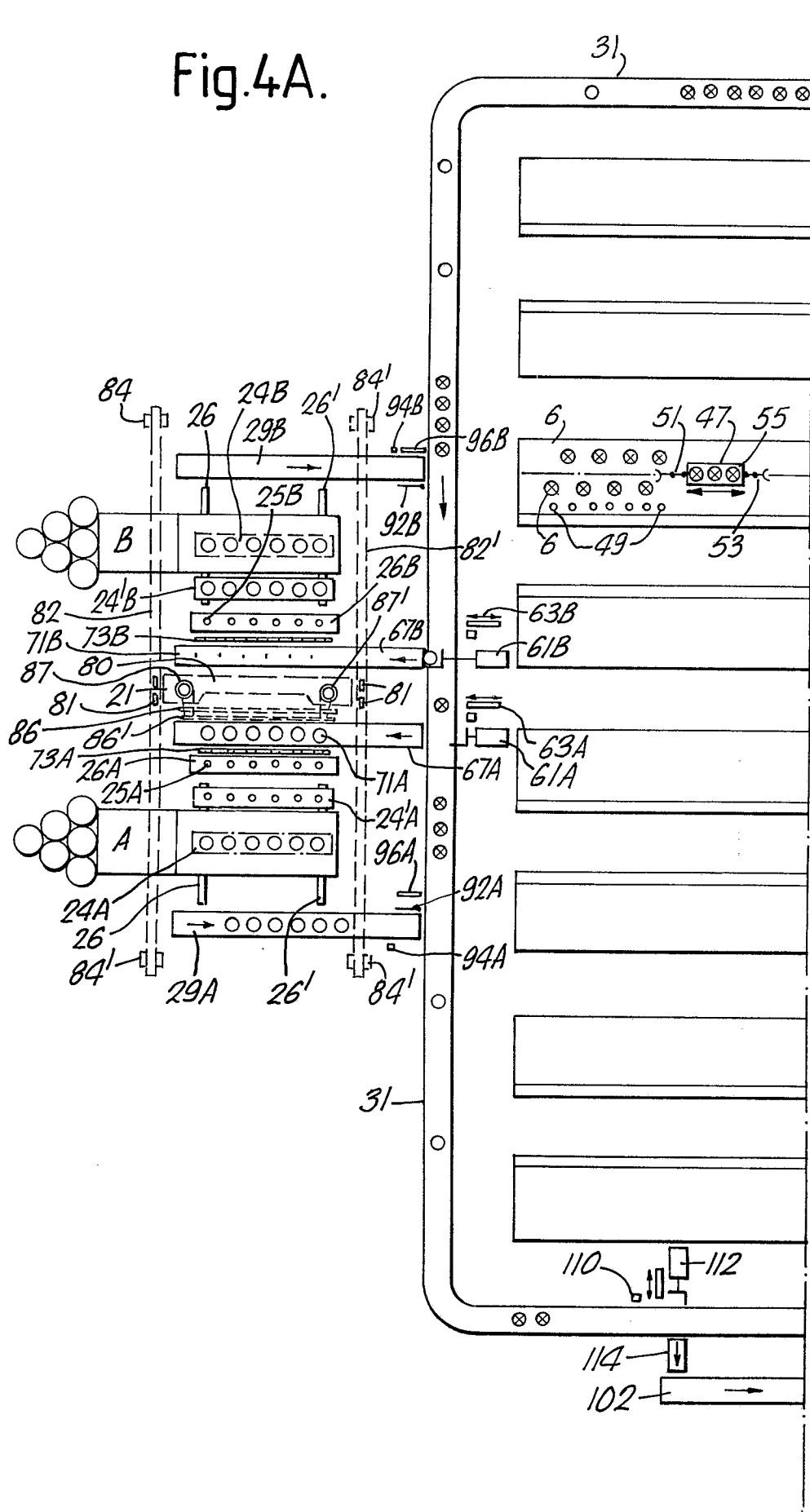
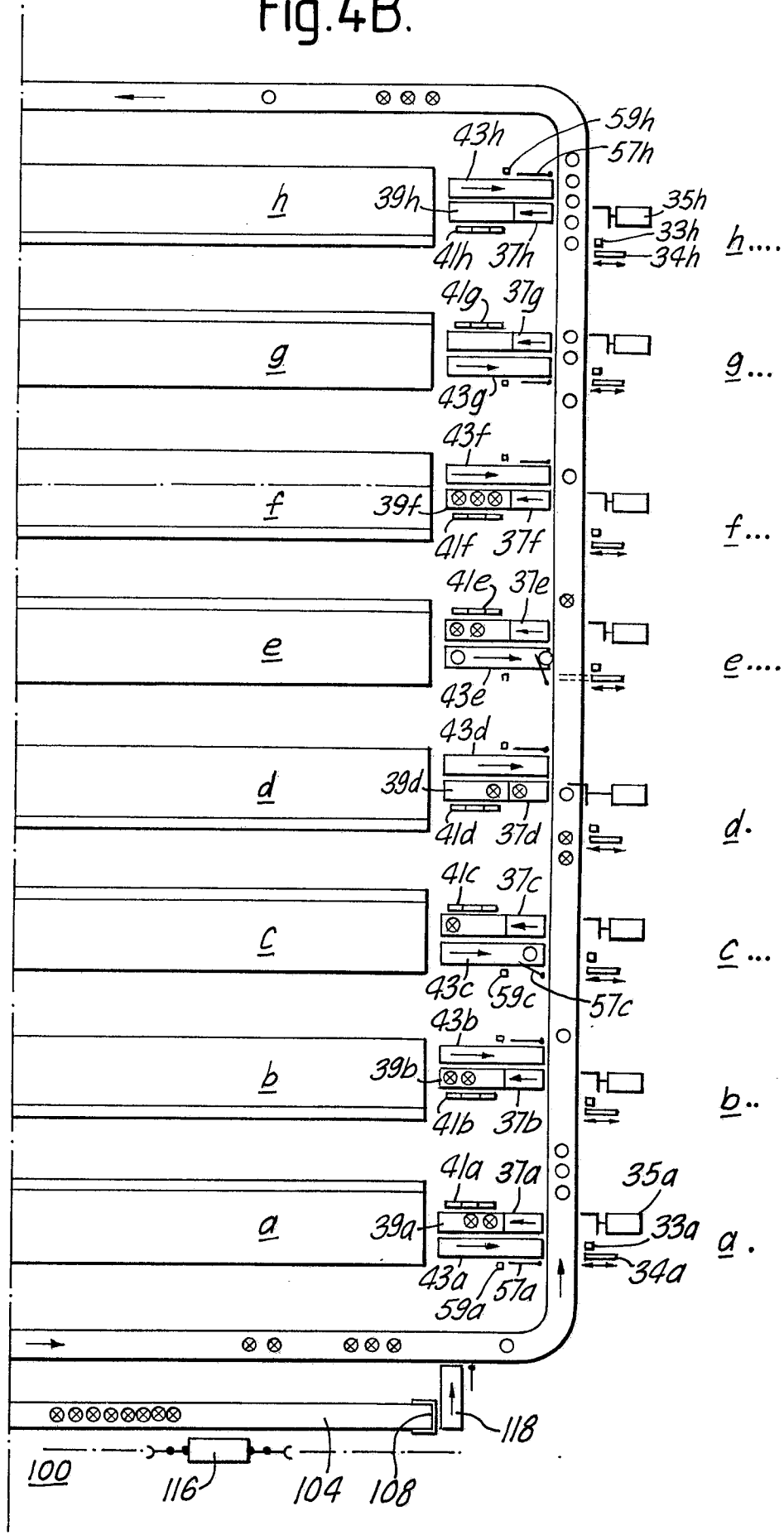


Fig.4B.





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 88 30 9311

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.4)
A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 262 (C-442) 2709 25 August 1987, & JP-A-62 62933 (HOWA MACH LTD) * see the whole document * ---	1,15	D01H9/18 B65H67/06
A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 53 (C-404) 2500 19 February 1987, & JP-A-61 215725 (TOYODA AUTOM LOOM WORKS LTD) * see the whole document * ---	1,15	
A	DE-A-3628045 (MURATA KIKAI K.K.) * claim 1 * -----	1,15	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			D01H B65H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 JANUARY 1989	Examiner HOEFER W.D.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document	