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(71) Applicant: **SAVIO S.p.A.**
Via Udine 105
I-33170 Pordenone(IT)

(72) Inventor: **Sartoni, Sandro**
Via Pendini 1/A
I-40026 Imola Bologna(IT)
Inventor: **Fontana, Mario**
Largo Mazzini 25
I-16061 Arquato Scrivia Alessandria(IT)

(74) Representative: **De Carli, Erberto et al**
ING. BARZANO' & ZANARDO MILANO S.p.A.
Via Borgonuovo, 10
I-20121 Milano(IT)

(54) Apparatus and method for conveying winding tubes to ring spinning spindles and aligning them therewith.

(57) This invention relates to an apparatus and method for conveying winding tubes (2) empty of wound yarn or pegs (16) for holding winding tubes filled with wound yarn and for aligning them in correspondence with the spinning spindles along the faces of a ring spinning machine. Said apparatus is arranged to serve and to cooperate with the automatic doffing device operating along both faces of a ring spinning machine.

More specifically, said apparatus comprises:

- a plurality of flat elements (1) connected together by an articulated swivel joint adjustable in length by means of connecting rods;
- endless mobile belts (5) which support said flat elements (1) and drive them by dragging;
- a tensioning brake which clamps the tail end of the articulated chain formed by said flat elements connected together, to halt these latter in a position such that their holding pegs are aligned in correct coincidence with the axes of the spinning spindles.

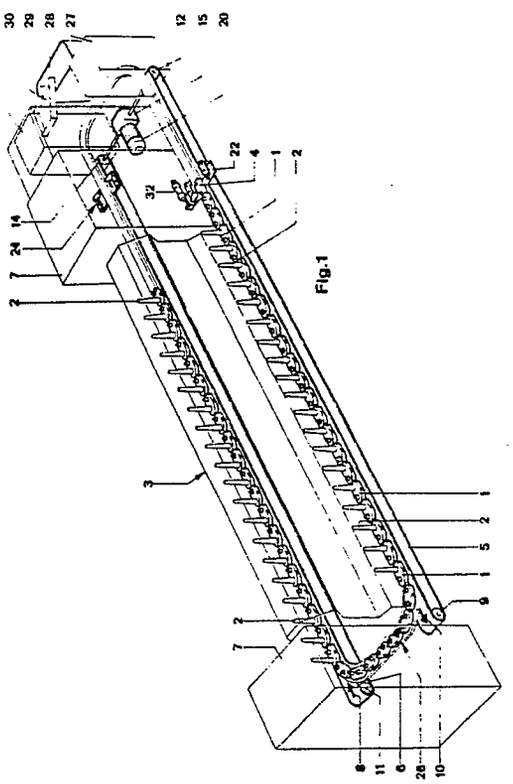

Fig.1

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APPARATUS AND METHOD FOR CONVEYING WINDING TUBES TO RING SPINNING SPINDLES AND ALIGNING THEM THEREWITH

This invention relates to an apparatus for conveying winding tubes to and aligning them with the spinning spindles along the longitudinal faces of a ring spinning machine, the winding tubes being disposed on pegs fixed to a plurality of flat elements connected together by an articulated swivel joint of adjustable length and adhering by gravity to the surface of a mobile conveyor belt. More particularly, the present invention relates to a method for positioning the pegs holding winding tubes in correct coincidence with the axes of the spinning spindles by the action of a tensioning brake which stops the movement of the flat elements by clamping the tail end of the articulated chain formed by connecting together said flat elements.

This apparatus, for conveying and positioning winding tubes and the pegs holding said winding tubes, is used in operational correlation with the automatic doffing device which automatically removes the winding tubes filled with wound yarn from the spindles and replaces them with a like number of tubes empty of wound yarn to allow further yarn collection. Said spindles are are normally the spinning spindles of a ring spinning machine.

The tubes when filled with yarn are the so-called yarn packages, which accumulate the yarn spun by the individual spindles.

In modern ring spinning machines the tendency is to completely mechanise the operations involved in conveying and withdrawing the yarn-wound tubes or the yarn-free tubes and replace manual operations by suitable automatic devices and equipment.

Ring spinning machines are already known which incorporate automatic doffing devices.

Whatever their structure and method of operation, all known devices have the common problem of feeding the winding tubes empty of wound yarn to replace the tubes filled with wound yarn, these latter being automatically withdrawn from the spinning spindles. In the present case, the preference is for a device with gripper elements projecting from a longitudinal bar which is driven with the necessary movement for simultaneously withdrawing all the tubes filled with wound yarn from the spindles and simultaneously positioning tubes empty of wound yarn on all said spinning spindles in suitable sequence. After said gripper element has handled one tube filled with wound yarn, it is made to grip a tube empty of wound yarn and mount it on the spindle. The gripper element, the levers or the other means of the automatic doffing device do not form part of the present invention and can therefore be of any constructional type suitable for their purpose. They will therefore be neither represented on the accompanying drawings nor described in the description.

The automatic doffing device in ring spinning machines is known to function in operational correlation with conveyors in the form of two endless flexible steel belts, one for each spinning face, which are driven by drive rollers along suitable guides carried by a fixed structure which extends longitudinally along the entire spindle line.

Said flexible belt conveyor comprises a plurality of pegs fixed to it at regular intervals for holding and supporting both the tubes filled with wound yarn which the gripper elements of the automatic doffing device have removed from the relative spindles, and for receiving and holding the tubes empty of wound yarn which are to replace the yarn packages extracted from the spindles.

The flexible belt conveyor, which extends along the entire length of the machine between the respective ends, can move horizontally and parallel to the machine length to bring the pegs coaxial with the axes of the various spindles.

It is thus possible to discharge the tubes filled with wound yan and withdraw the tubes empty of wound yarn by means of the gripper elements of the automatic doffing device.

When doffing is complete and the tubes empty of wound yarn have been placed on the spindles, the flexible belt is made to resume its intermittent or continuous movement along the front side of the spinning machine, and as this latter again starts to newly accumulate wound yarn it unloads the tubes filled with wound yarn from the respective support pegs by known means and also, by known means, receives the new tubes empty of wound yarn.

A conveyor apparatus of this type with flexible belts for moving the winding tubes is presented and described for example in Italian patent No. 784810.

By way of example, current ring spinning machines can comprise many hundreds of spindles along a single working face. When the tubes are full of wound yarn they are withdrawn from the relative spindles and deposited in ordered arrangement on a belt or conveyor element.

For the tube withdrawal and replacement operation to proceed without any difficulty it is necessary for all the tube holding elements fixed to the flexible belt conveyor to assume positions which exactly correspond to the positions in which the gripper elements will make their withdrawal and deposition.

The conveyor system or device of the aforesaid Italian patent and others of the known art operate on the friction drive principle. Devices of this construction are subject to more or less extensive slippage if the conveying length is long. To limit this slippage to acceptable values requires a considerable increase in the installed tension of the flexible conveyor belt in order to increase the contact pressure on the drive roller and so increase the friction force along the contact arc between said drive roller and the inner surface of the flexible belt which wraps it. This belt is susceptible to longitudinal elastic deformation, which increases as the installed tension is increased and therefore gives rise to a increasing linear non-uniformity in the distance between the pegs which hold the winding tubes. This compromises the operation of the entire conveying system during the action of the aforesaid automatic doffing device in the ring spinning machine.

In addition, said known conveyor devices with rigidly fixed pegs and friction drive suffer from further drawbacks.

In this respect, several lateral guide elements are required to prevent off-centered operation arising, this giving rise to lateral slippage of the flexible belt and, in the limit, its escape from the drive and return rollers. In this latter case, movement is blocked. The use of lateral guides complicates the construction and makes it expensive.

Furthermore, said lateral guides have to act with force against the longitudinal edges of the flexible belt to retain it within the guide, and this results in rubbing friction which because of its abrasive effect is damaging for the entire flexible belt and increases the power required to drive said belt.

The aforesaid arrangements of the known art also present some constructional complication in obtaining precise positioning of the many hundreds of holding pegs which have to be fixed rigidly in an integral manner to the flexible belt. Even if said holding pegs, which follow each other along the flexible belt, are fixed by special means to limit the true tolerance of their pitch, they can, because of the series addition of tolerances, find themselves in an unsuitable position for proper operation with the gripper elements of the automatic doffing device.

In addition, the lengthy flexible belt used for conveying can after a prolonged period of operation suffer considerable wear and deformation which together with temperature variations can result in non-uniform pitch of the pegs. These latter no longer become correctly aligned with the winding tube feed and withdrawal means, and this results in blockage of the entire handling system which extends along the face of the ring spinning machine.

The object of the present invention is to obviate the aforesaid drawbacks by providing an apparatus and method for conveying winding tubes filled with wound yarn or empty of wound yarn and for aligning them in correspondence with the spinning spindles along the faces of a ring spinning machine, which have the following advantages:

- the winding tube assembly is conveyed without the need for considerable drive force;
- the winding tubes can be moved automatically along any horizontal distance without even the minimum hindrance arising, the motion transmission being of high efficiency with perfect guiding along the entire path of movement;
- the structure is of simple construction, with very small transverse dimensions along its entire longitudinal extension, this being combined with simple operation such that the replacement of the tubes filled wound yarn by the tubes empty of wound yarn can be carried out rapidly;
- even after a prolonged period of operation under substantial temperature variations, the exact repositioning of all the pegs holding their winding tubes in a manner aligned and coaxial with the respective spinning spindles is ensured so that the gripper elements of the automatic doffing device can simultaneously and with perfect operational reliability deposit all the tubes filled with wound yarn onto said pegs and, under the same conditions of operational reliability, successively and simultaneously grip all the tubes empty of wound yarn and withdraw them from said pegs;
- installation along and about existing spinning machines is possible without considerable constructional modification being required to the spinning machine itself.

These and further advantages are attained by the apparatus of the present invention which is positioned along and about a ring spinning machine to convey winding tubes filled with wound yarn or empty of wound yarn and align them with the spinning spindles, said apparatus, which cooperates with the automatic doffing device on both the spinning faces, comprising:

- a plurality of flat elements connected together by an articulated swivel joint of adjustable length and each comprising on their upper part at least one holding peg for a winding tube; said articulated swivel joint consisting of a connecting rod which connects together two consecutive flat elements and which is connected at one end to a pin rigid with one of the two flat elements to form the articulated swivel joint and at its other end to a preferably threaded element rigid with the other flat element to effect precise and adjustable axial positioning of said flat elements;
- endless mobile belts which support and drive a plurality of flat elements having their lateral sur-

faces provided with means identifiable by position transducers;

- a tensioning brake which halts the flat elements by clamping the tail end of the articulated chain, this latter formed by said flat elements connected together, and aligning and positioning the holding pegs in coaxial coincidence with the axes of the spinning spindles, said tensioning brake being operated in such a manner as to gradually engage with the last plate of the articulated chain by a lever means which initially effects braking with adjustable friction to slow down the movement of the articulated chain, the flat elements of which are subjected to the continuous dragging movement of the underlying endless mobile elements, and which then effects positioning against a mechanical locator to lock and preserve the exact alignment of the winding tube holding pegs with the spinning spindles.

In its practical embodiment, the apparatus of the present invention implements a method both for seating the winding tube on pegs fixed to a plurality of flat elements connected together by an oscillating articulation system of adjustable length and which individually rest by gravity on the surface of a mobile drive belt, and for aligning the winding tube holding pegs in positions perfectly coaxial with the axes of the spinning spindles by the action of a tensioning brake which halts the movement of the flat elements by clamping the tail end of the articulated chain formed by said flat elements connected together.

The invention is described in detail hereinafter with reference to the embodiments which are shown diagrammatically on the figures of the accompanying drawings and for which further details and characteristics are given, it being understood that any modifications in the form and relative positions of the elements or operating means, and the consequent simplifications which may derive therefrom, are all to be considered as included within the protection of the patent as constructional variations which fall within the scope of the general idea.

On the accompanying drawings:

Figure 1 is a diagrammatic isometric perspective view of the apparatus of the present invention which with its two drive belts revolves along the two spinning fronts of the ring spinning machine, of which those parts not required for an understanding of the invention have been omitted, the figure also indicating the stage in which the assembly of tubes empty of wound yarn held on the relative pegs of the flat elements is stationary, said tubes having been positioned by the tensioning brake in positions perfectly coaxial with the axes of the spinning spindles on both faces, awaiting the commencement of automatic doffing, and further shows the clamping engagement between the tensioning brake and the last plate of the articulated chain, the flat elements of which are tensioned by the dragging movement of the two underlying endless mobile belts, one for each machine face;

Figure 2 is an isometric perspective view of a flat element of the articulated chain of Figure 1 to a slightly enlarged scale, this being connected by articulated swivel joints in the form of connecting rods to the two flat elements adjacent to it, ie the one which follows it and the one which precedes it, and also indicates diagrammatically the presence on its lateral surface of a means identifiable by a position transducer which is also shown facing it in close proximity thereto;

Figure 3 is a diagrammatic plan view of the tensioning brake supported by an underlying slide with its clamping lever mechanism in its open rest position immediately before being activated in order to engage the last flat element of the articulated chain;

Figure 4 is a diagrammatic plan view of the tensioning brake at the precise moment in which its lever mechanism, after being activated, commences its braking contact with the lateral surfaces of the last flat element, to slow down the movement of the articulated chain;

Figure 5 is a diagrammatic plan view of the tensioning brake with its lever mechanism clamped against the sides of the last flat element and its braking levers positioned against mechanical locators which provide the clamping action and preserve the exact coaxiality between the pegs holding the winding tubes and the spindle axes along the two spinning faces;

Figure 6 is a diagrammatic perspective isometric view of the apparatus of the present invention in which the articulated chain of flat elements is subjected to movement about the spinning machine by the underlying endless mobile belts in order to discharge the tubes filled with wound yarn which have been previously withdrawn from the spindles by the automatic doffing device and simultaneously mount the tubes empty of wound yarn onto the pegs in order to restore the operational situation shown in Figure 1, and also shows known blocking levers which engage between the flat elements to cause these to intermittently advance stepwise for the upward withdrawal of said tubes filled with wound yarn and the simultaneous mounting of said tubes empty of wound yarn downwards onto the pegs;

Figure 7 is a perspective isometric view of the terminal part of the articulated chain to a slightly enlarged scale when in the curve transit position guided by lateral guides which extend along the entire endless track about the spinning machine,

and also shows the connecting rod which forms the articulated swivel joint of adjustable length and the elements for connecting it to the flat elements;

Figure 8 is a diagrammatic perspective isometric view of the apparatus of the present invention extending about the entire ring spinning machine on several underlying drive belts, and shows the stage in which all the tubes empty of wound yarn are stationary as illustrated in Figure 1.

In the figures like elements have the same reference numbers. Furthermore, for the purpose of clarity of the whole,parts which are not necessary for the understanding of the invention like the driving assemblies for the various driving belts and the various supporting structures as well as the winding tube supplying and doffing means have been omitted. In said accompanying figures:

1 is the flat element comprising on its upper part two holding pegs, of which in the proposed preferred application one peg holds and supports the winding tube empty of wound yarn and the other peg holds and supports the winding tube filled with wound yarn. Said flat element rests by gravity on the surface of an underlying mobile drive belt; 2 is the tube empty of wound yarn mounted on one of the two pegs which are rigidly fixed to the flat element 1; 3 is the machinery housing of the ring spinning machine having two opposing spinning faces, each formed from some hundreds of adjacent spindles one adjacent the other; 4 is the last element of the articulated chain ready to engage with the lever mechanism of the tensioning brake; 5 and 6 are the mobile flat belts arranged along the spinning faces to support and drive the articulated chain of flat elements. Said endless mobile belts can be advantageously driven with continuous motion and thus be free of electrical or electronic locks linked to the operating cycle sequences relative to the withdrawal, insertion and positioning devices for the winding tubes; 7 are the end structures, one opposite the other, of the ring spinning machine; 8 and 10 are arrows indicating the direction of motion of the upper branches of the two endless mobile belts 6 and 5; 9 and 11 are the idle return rollers for the two endless mobile belts 6 and 5; 12 and 14 are the drive rollers for driving the endless mobile belts; 15 is the block for transmitting motion to the drive rollers 12 and 14; 16 are the pegs for holding and supporting the winding tubes. Said pegs are fixed rigidly to the flat elements by a lower shank pin 17 about which a connecting rod engages to form the swivel joint for two consecutive flat elements; 18 is the threaded element rigid with the flat element and screwed into a connecting rod to allow the precise and adjustable axial positioning of two consecutive flat elements; 19 is a position transducer which cooperates with identifiable means 21 applied to the lateral surfaces of the flat elements; 20 is the drive source for operating the drive rollers 12 and 14; 22 is the support slide for the lever mechanism of the tensioning brake. Said slide is normally stationary in position 22 and moves into position 22a when it is required to move the lever mechanism of the tensioning brake together with the articulated chain through a distance equal to the distance between the axes of the two pegs fixed on a single flat element. In the pitch of said consecutive pegs; 24 are blocking levers operated by known means for engaging between the flat elements and causing them to advance intermittently stepwise; 25 is the connecting rod which connects two consecutive flat elements and which at one end is connected to the pin shank 17 to form the swivel joint and at the other end is connected to the threaded element 18 to allow adjustable axial positioning; 26 is the articulated chain formed from the plurality of flat elements which surround the ring spinning machine; 27 is the device which contains both the accumulation of tubes empty of wound yarn and the known means for mounting said tubes in the direction of the arrow 46 onto the pegs 16 of the flat elements; 28 is the container bin for the tubes 50 filled with wound yarn which are conveyed into it by the chute 29 after being seized and withdrawn from the pegs 16 by any known withdrawal device 52, the linkages or operating means of which are located in the block 30; 32 is the actuator which moves the support slide 22 for the tensioning brake; 50 is the tube filled with wound yarn which is withdrawn from the spindle by the gripper element of the automatic doffing device and held on the peg 16 to be then moved by the articulated chain 26 to its position for withdrawal and conveying in the direction of the arrows 48 to place it in the bin 28; 33 is a section bar or structure of suitable shape which acts as a lateral guide track, and along the portions free of the mobile belt acts as the track for supporting the flat elements 1 of the articulated chain 26. Said guide and support section bar passes around the end structure 7 of the spinning machine, about the whole of which there extends an endless slide track; 34 is the rod of the actuator 32; 35 and 36 are the levers of the tensioning brake lever mechanism which engage with the frusto-conical sides of the flat element 4. Said engagement is implemented by the action of the actuator 44, which by pressing the levers 41 and 42 pivoted on the pivots 39 and 40 causes the levers 35 and 36 to gradually approach the frusto-conical sides of the flat element 4 with the aid of the elastic elements 43; 37 and 38 are two brackets fixed rigidly to the levers 41 and 42, against said brackets there being positioned the two levers 35 and 36 at the end of their engagement with the flat element 4; 6a, 6b and 6c are endless mobile

flat belts which together cover one whole spinning face, their motion being perfectly identical. Their upper branches are driven in the direction indicated by the arrow 8; 5a, 5b and 5c are endless mobile flat belts which together cover the other spinning face, their motion being perfectly identical. Their upper branches are driven in the direction indicated by the arrow 10; 55 are mobile flat belts in a transverse position, they being driven substantially with the same motion as the longitudinal belts 5 and 6.

The operation of the apparatus for conveying and positioning winding tubes in correspondence with the spinning spindles and around the spinning machine, shown on the accompanying figures, is easily deducible.

The winding tubes 2 empty of wound yarn are already, as shown in Figure 1, arranged in a position in front of the spinning spindles awaiting operational correlation with the automatic doffing device which when a winding is complete replaces the tubes filled with wound yarn and mounted on the relative spindles, with said tubes 2 empty of wound yarn and held stationary on the pegs of the articulated chain 26.

This latter is taut and aligned along the two spinning faces by the clamping action of the levers 35 and 36 of the tensioning brake which nullifies movement due to the dragging action exerted on the lower surface of the flat elements 1 by the endless mobile belts 5 and 6 extending along the two longitudinal side of the spinning machine. In Figure 1 it can be seen that the tubes 2 empty of wound yarn are present on only two partial portions of the articulated chain 26. Each portion extends frontally along the line of spinning spindles of a single face. Along the remaining length of the articulated chain 26 there are no winding tubes 2. In the practical embodiment of the present invention the winding tubes 2 are held in a line on alternate pegs at a distance apart equal to the spindle pitch, the spindle pitch being the distance between the axes of two adjacent spindles. With this construction the holding pegs 16, fixed in pairs on the flat element 1, follow each other at a distance apart equal to one half the pitch of the spinning spindles of the ring spinning machine.

In view of the aforegoing, when the automatic doffing device is activated the gripper elements firstly remove all the tubes filled with wound yarn simultaneously from both faces by withdrawing them from their spindles and immediately mounting them on the free pegs 16 which alternate with the tubes 2 empty of wound yarn.

Said free pegs 16 are stationary in positions perfectly coaxial with the axes of the various spindles, this correct precise location being determined by the clamping action of the levers 35 and 36 of the tensioning brake (see Figure 5), while the endless belts 5 and 6 exercise by their movement 8 and 10 the tensioning and aligning action on the individual flat elements 1. When unloading of the tubes 50 filled with wound yarn is complete the gripper elements are released and rise from them, after placing them on the relative pegs 16, by the distance needed not to obstruct the subsequent movement of the articulated chain 26. After disposing of one tube filled with wound yarn, the same gripper element is preferably made to grip a tube empty of wound yarn and mount it on the spindle.

The gripper elements can be of any construction suitable for the purpose. However it is preferable to use gripper elements of a new type such as those described in European patent application No. 88200602.6 of the present applicant.

The actuator 32 is then activated to move the slide 22 into the position 22a (see Figure 5, dashed-line position) . The entire lever mechanism of the tensioning brake, which continues to clamp the flat element 4, moves rigidly with said slide 22 to produce the aforesaid movement of the articulated chain 26. This latter advances through one half the spindle pitch by the dragging action of the endless mobile belts 5 and 6.

By this means all winding tubes 2 are positioned aligned and in perfectly coaxiality with the spindle axes along both spinning faces.

Consequently, said winding tubes 2 lie in perfect verticality below the gripper elements. These latter, on activation of the automatic doffing device of known type, then trip the winding tubes 2 to convey them and fix them onto the spindles. Thus by means of the apparatus of the present invention correct and precise unloading of the tubes 50 filled with wound yarn and pick-up of the tubes 2 empty of wound yarn is obtained even when simultaneously using several hundreds of gripper elements which require exact gripping positions.

The mobile belts 5 and 6 are preferably operated continuously at least during the entire doffing cycle so that by the dragging action which they exert on the flat elements 1 they produce a continuous positioning tension throughout the articulated chain 26.

Said positioning tension, which arises by the simultaneous cooperation between the clamping action of the levers 35 and 36 of the tensioning brake and the dragging movement 8 and 10 of the endless belts 5 and 6, is necessary to preserve the alignment of the flat elements 1 along the two horizontal longitudinal sections of the spinning faces of the spinning machine, and also to ensure operational coaxiality between the holding pegs 16 and the axes of the many hundreds of spindles.

When doffing is complete and the winding

tubes 2 have been placed on the spinning machine spindles, this latter again operates to produce a new batch of wound yarn and the actuator 44 is activated to pull the levers 41 and 42 pivoted on the pivots 39 and 40 and cause the levers 35 and 36 to open and release the flat element 4. The articulated chain 26 immediately advances with its ordered load of tubes 50 filled with wound yarn in the direction of movement indicated by the arrows 8 and 10 by the action of the two flat belts 5 and 6. In this respect, these latter exert contact friction on the lower surface of the flat elements 1 to cause the articulated chain 26 to move along the circuit unidirectionally and convey the first tube 50 filled with wound yarn along the side of the end structure 7 and under an automatic withdrawal device 52 which removes it vertically by withdrawing it from its peg 16 and conveys along the direction indicated by the arrows 48. Said winding tube 50 is stored in a suitable container 28 by way of a chute 29.

The expulsion of the individual winding tubes 50 from the pegs 16 of the articulated chain 26 can be continuous or intermittent in known manner.

Intermittent operation, which is preferred and is illustrated on the accompanying figures, requires the presence of blocking levers 24 operated by known means, these latter being coordinated by known position transducers 19 to correctly engage said levers between the flat elements and compel the articulated chain 26 to advance intermittently stepwise. While the manipulator 52 continues to withdraw the tubes 50 filled with wound yarn, at a certain moment the first flat element 1 from which said tube 50 was withdrawn arrives below a mechanism, not shown, which takes a tube 2 empty of wound yarn from a container 27 and mounts it on the relative peg 16 of said flat element as indicated by the arrow 46.

The insertion mechanism and pickup device can be of any known type suitable for the purpose.

After the aforesaid operation in which the levers 35 and 36 of the tensioning brake release the flat element 4 by the action of the actuator 44, the slide 22 is repositioned by the actuator 32 in its normal rest position 22a to again await the operational situation shown in Figure 3, said levers 35 and 36 remaining in the open position during this waiting period.

The withdrawal and insertion cycles for the tubes 50 filled with wound yarn and the tubes 2 empty of wound yarn proceed by assuming the intermediate configuration shown in Figure 6 and then returning to the initial configuration shown in Figure 1.

Immediately before its return to this latter initial configuration the flat element 4, as it terminates its complete revolution about the spinning machine, is pincered by the levers 35 and 36 of the tensioning brake. Said levers approach the lateral frusto-conical surfaces of the flat element 4 and gradually self-lock around it (see Figures 4 and 5) to halt and correctly position the entire articulated chain 26 along the two spinning faces of the ring spinning machine. This is attained for arranging the system of the present invention in operational correlation with the known automatic doffing device which when yarn winding onto the winding tubes is complete replaces on the spindles the tubes filled with wound yarn by tubes empty of wound yarn. While awaiting yarn winding completion on the winding tubes the endless belts 5 and 6 can be advantageously halted. They are then reactivated substantially at the start of the known doffing cycle. Said endless mobile belts 5 and 6 are driven by the same drive source 20 (see Figures 1 and 6) which by way of a reduction gear and inverter 15 causes the two drive pulleys 12 and 14 to rotate substantially synchronized but in reverse directions. These latter drive the two endless belts 5 and 6 at a substantially identical rate, their upper branches moving in opposite directions in accordance with the arrows 10 and 8.

The operational stages involving movement of the various parts of the apparatus according to the invention and the activation of the actuators or drive sources for the various aforesaid devices together with the operational correlation with the automatic doffing device are controlled overall by position transducers 19 associated with identifiable means 21, both of the known art, these latter being positioned advantageously on the lateral surfaces of the flat elements 1 (see Figure 2).

Furthermore, during its installation the articulated chain 26 is adjusted in length by making micrometric adjustments on the screw connections between the elements 18 and the connecting rods 25 of consecutive flat elements 1, this precision then not changing with time because their movement within the apparatus of the present invention does not involve any forced dragging, the sliding of the chain also being smooth about curves because of the facility for considerable swivelling between said flat elements 1 (see Figure 7).

The method shown in Figures 1 and 6 for moving the articulated chain 26 is only one example of the many possible methods, such as moving by several short-length belts disposed along the individual spinning faces. They are driven in the same direction and in substantial synchronism along their individual spinning face Figure 8 shows one of these possible methods in which the belts 5a, 5b and 5c are driven in the direction indicated by the arrow 8 whereas the belts 6a,6b and 6c of the opposite spinning face are driven in the direction indicated by the arrow 9. Said figure also

shows the presence of transverse belts which can be installed to improve the movement of the articulated chain 26. The aforesaid methods involving two or more dragging belts enable two spindle faces, one opposite the other, to be served with a single articulated chain, and a construction of this type cooperating with an automatic doffing device acting simultaneously on both faces is therefore economically interesting.

According to a modification, not shown, an installation can be desirable consisting of a double apparatus of the type according to the invention, one for each spinning face, to cooperate with an automatic doffing device which operates on only one face of the spinning machine independently of the other face, to allow spinning of different batches of yarn.

Each apparatus in this case extends horizontally about the spindle line of one spinning face in an arrangement comprising a return track for the articulated chain entering and underlying the machinery housing 3 of the spinning machine. Both apparatuses then assume an arrangement symmetrical to each other about the longitudinal axis of the spinning machine, it being apparent that such an embodiment does not lie outside the scope of protection of the present invention.

It is also within the spirit of the invention to provide holding pegs 16 fixed one following the other on the flat elements 1 at a distance apart equal to the spindle pitch of the ring spinning machine.

In this modification, the gripper elements of the automatic doffing device firstly remove the tubes filled with wound yarn from the spindles and place them temporarily on stationary pegs fixed to a rod or similar element fixed rigidly to the spinning machine frame, to then grip the tubes empty of wound yarn and fix them onto the spindle, and then again grip the tubes filled with wound yarn and transfer them from the pegs on which they are held to the pegs 16 of the flat elements 1 of the apparatus according to the invention. Such an automatic doffing cycle and device are of the known art and thus no further description is necessary. It is apparent that in this latter modification the slide 22 of the tensioning brake is never moved through the aforesaid half spinning spindle pitch.

The purpose of these various modifications is specifically to allow the apparatus of the present invention to be incorporated in the different automatic doffing cycles and devices provided in the overall automation of ring spinning machines for the production of different textile articles.

The apparatus must also be made compatible with the movement of other elements such as travelling cleaner devices, yarn rejoining trolleys etc.

A preferred embodiment with some modifications has been described, but other embodiments are possible.

For example, the number of pegs 16 fixed on each flat element 1 can vary; the shapes and dimensions of said holding pegs 16 can vary; a single transfer belt could be provided extending along the entire spinning face opposite that spinning face comprising the tensioning brake; a plurality of transfer belts could be provided driven with identical or slightly different speeds; dragging elements other than belt elements could be provided; it would also be possible to provide a different lever mechanism for the tensioning brake; and drive sources could be added or removed to advantageously coordinate the movement of the dragging belts with all the various operating stages of the devices provided in the apparatus of the present invention.

These and further modifications are possible without leaving the scope of the invention.

Claims

1. An apparatus for conveying winding tubes empty of wound yarn or pegs for holding winding tubes filled with wound yarn and for aligning them in correspondence with the spinning spindles, said apparatus being arranged to serve and to cooperate with the automatic doffing device in a ring spinning machine, characterised by comprising:
- a plurality of flat elements connected together by an articulated swivel joint of adjustable length and each comprising on their upper part at least one holding peg for a winding tube;
- endless mobile belts which support said flat elements and drive them by dragging;
- a tensioning brake which halts the flat elements by clamping the tail end of the articulated chain formed by said flat elements connected together, to align the holding pegs and position them in coaxial coincidence with the axes of the spinning spindles.

2. An apparatus as claimed in claim 1, characterised in that the articulated swivel joint of adjustable length consists of a connecting rod which connects together two consecutive flat elements, one following the other, and which at one end is connected to a pin rigid with one of the two flat elements to form the articulated swivel joint, and connected at its other end to a preferably threaded element rigid with the other flat element to allow precise and adjustable axial positioning of said flat elements.

3. An apparatus as claimed in claim 1, characterised in that the flat elements have their lateral surfaces provided with means identifiable by posi-

tion transducers

4. An apparatus as claimed in claim 1, characterised in that then tensioning brake is operated in such a manner as to gradually engage with the last plate of the articulated chain, the flat elements of which are subjected to the continuous dragging movement of the underlying endless mobile element.

5. An apparatus as claimed in claims 1 and 4, characterised in that the tensioning brake comprises a lever mechanism which effects the following operations in succession:
- adjustable friction braking to slow down the motion of the articulated chain;
- positioning against a mechanical locator which ensures locking and preservation of exact alignment between the holding pegs for the winding tubes and the spinning spindles.

6. A method for conveying tubes filled with wound yarn or empty of wound yarn and aligning them in correspondence with the spinning spindles of a ring spinning machine, characterised by:
- vertically seating said winding tubes on pegs fixed to a plurality of flat elements which are connected together by articulated swivel joints of adjustable length and individually adhere by gravity to the surface of an endless mobile dragging belt;
- aligning the axes of the winding tube holding pegs and positioning them in perfect frontal coaxiality with the axes of the spinning spindles by the action of a tensioning brake which halts the motion of the flat elements by clamping the tail end of the articulated chain formed by said flat elements connected together.

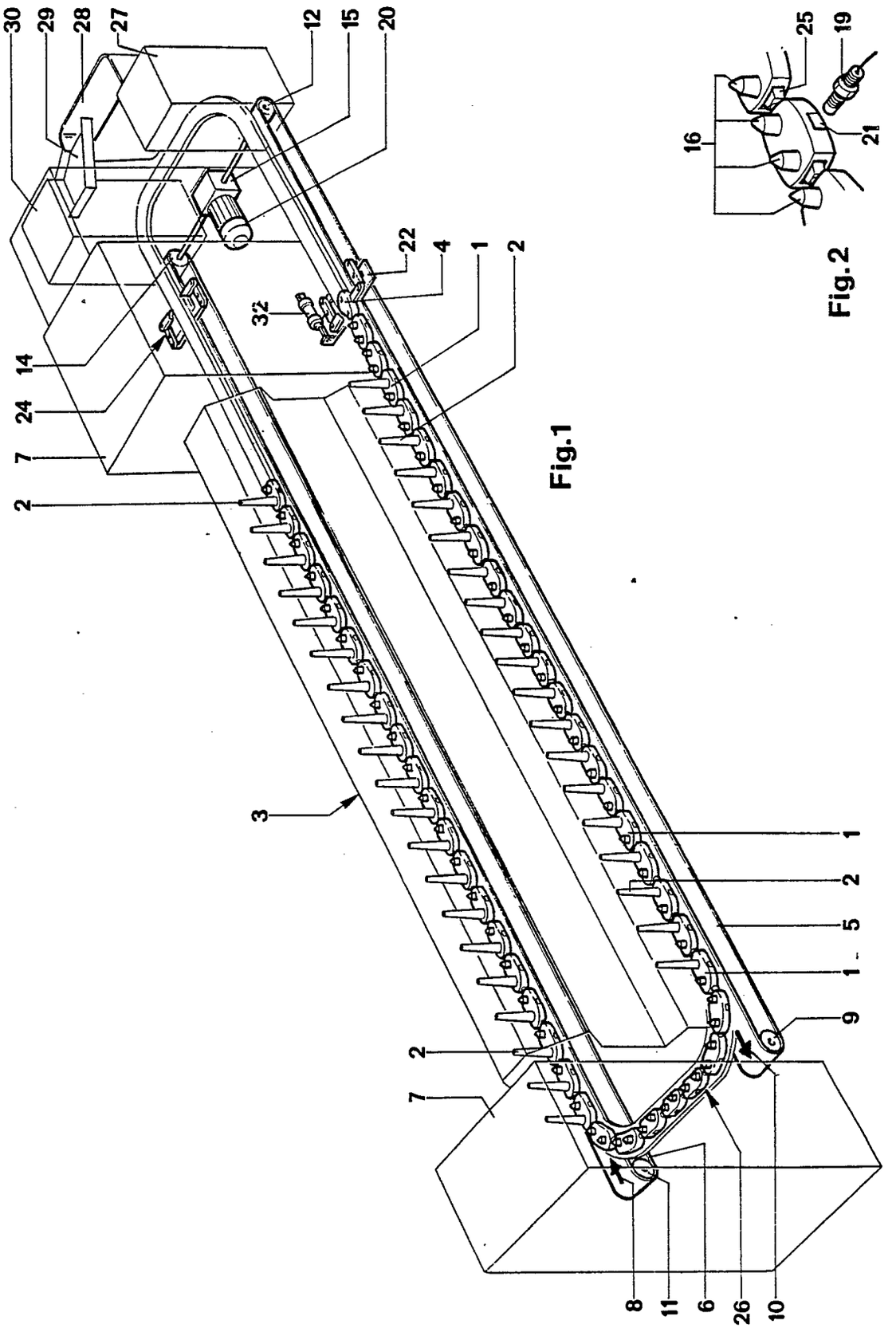
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Fig.1

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Fig.2

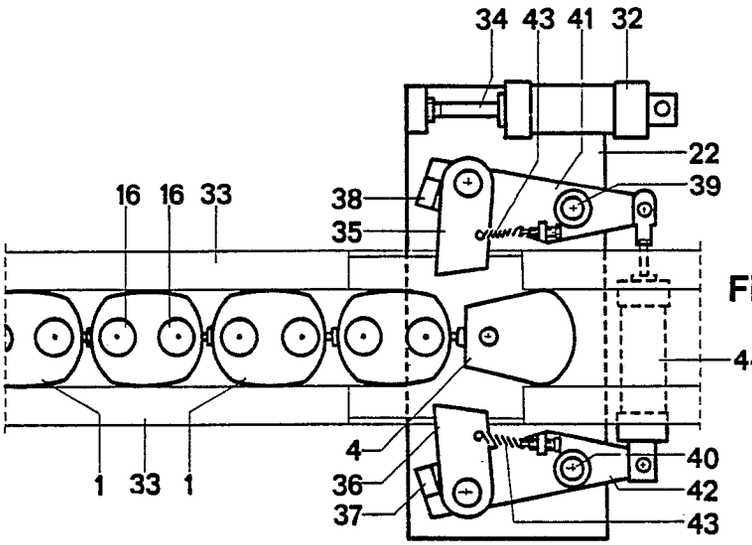

Fig.3

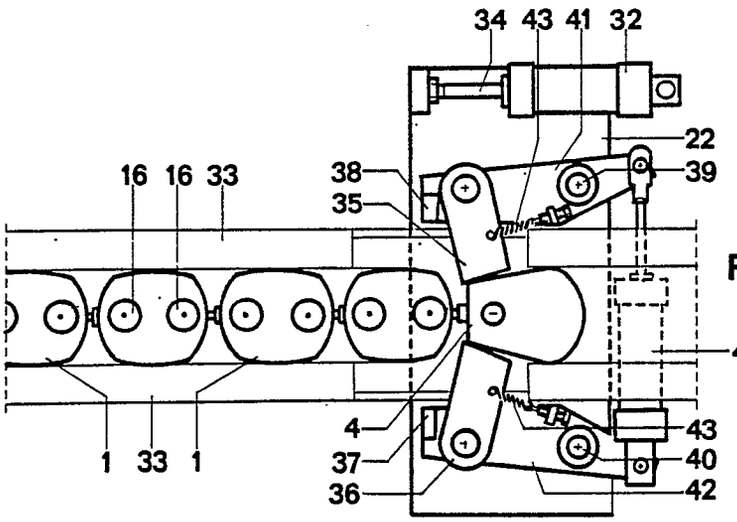

Fig.4

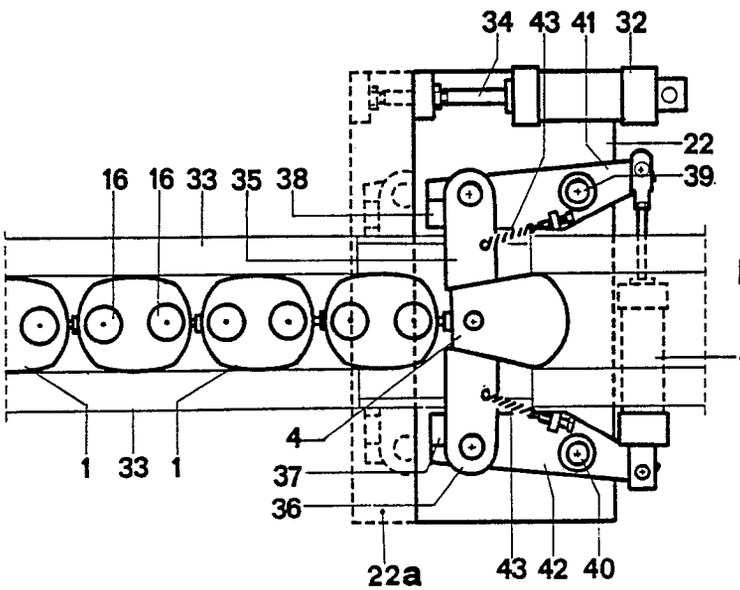

Fig.5

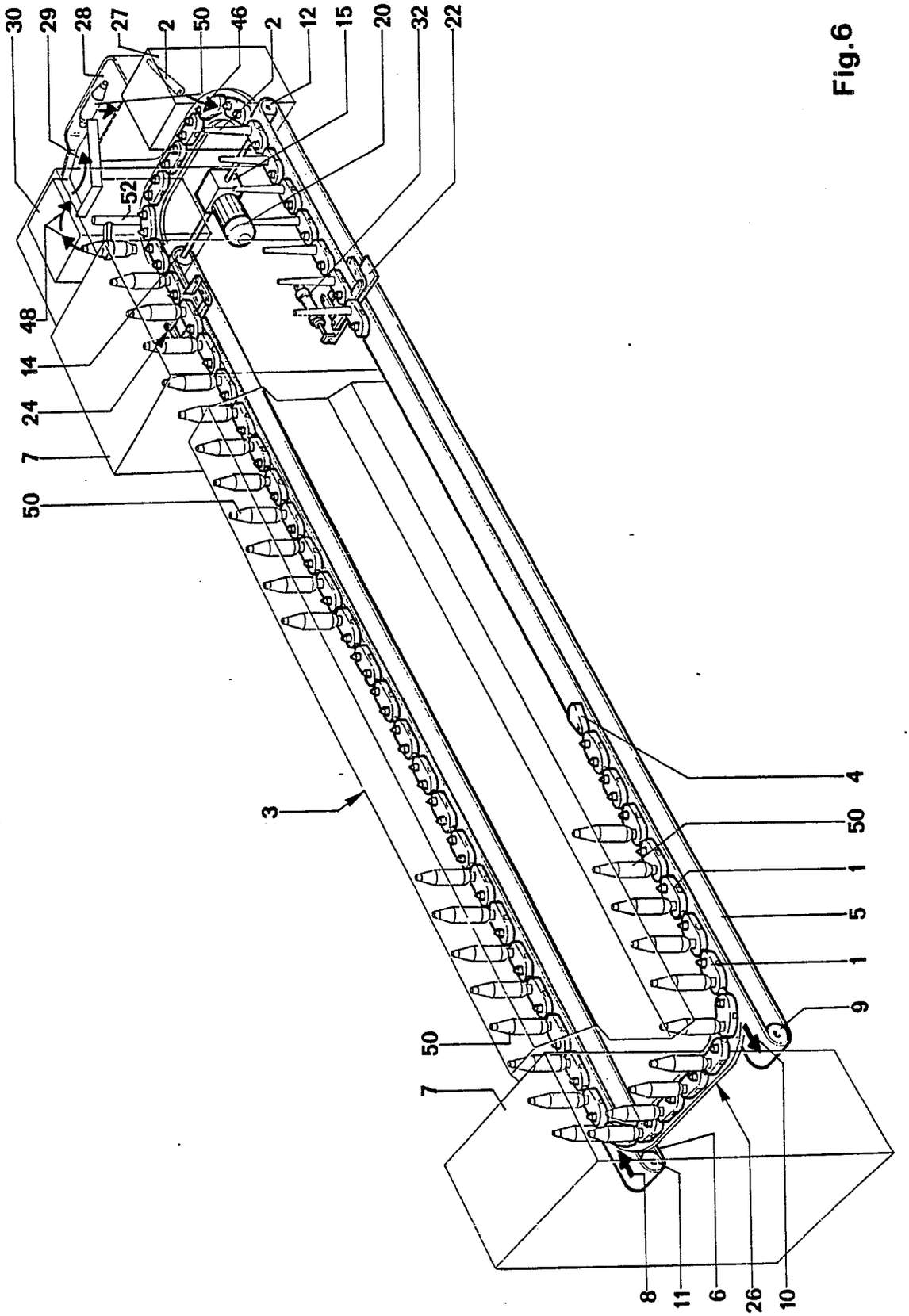
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Fig.6

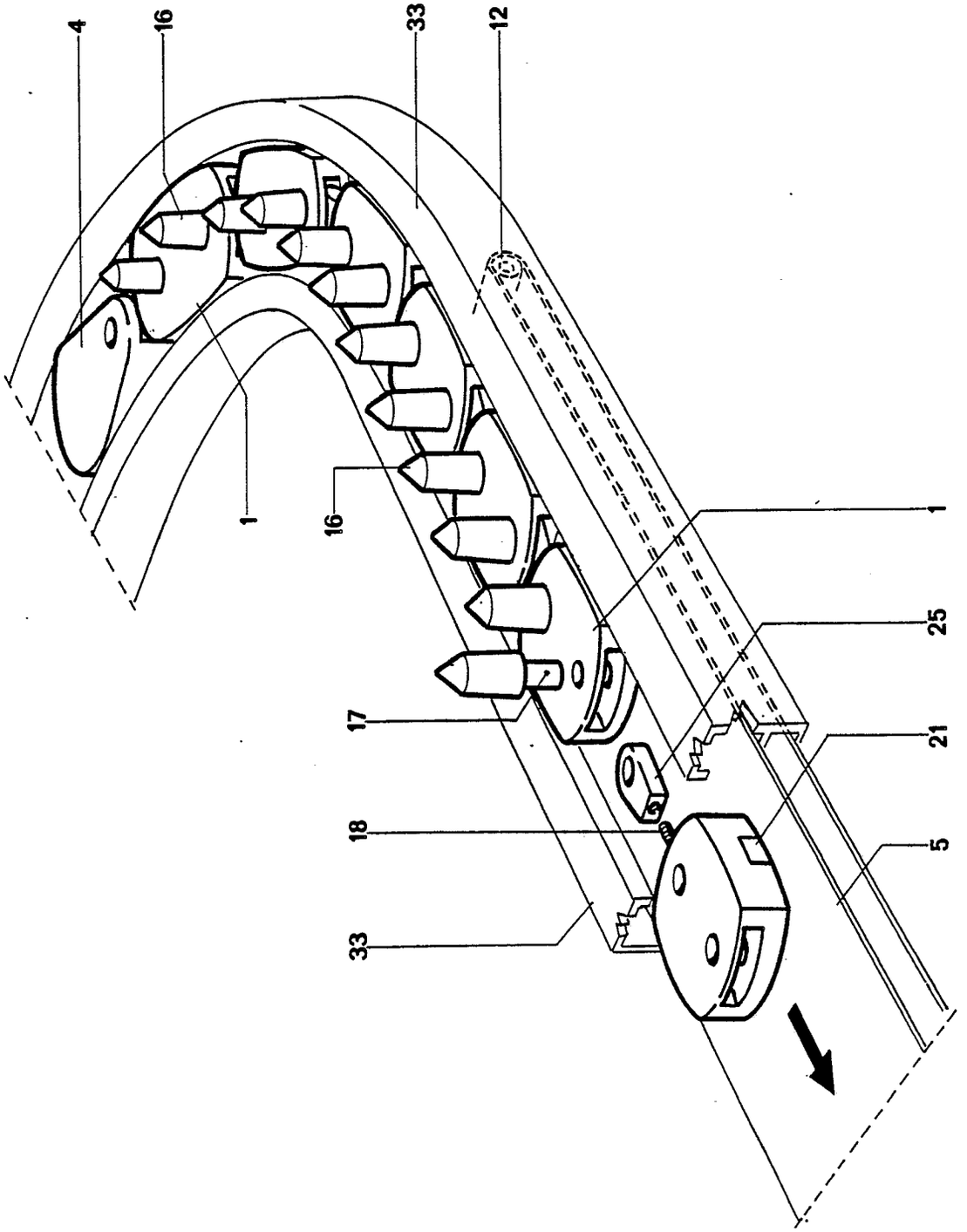

Fig.7

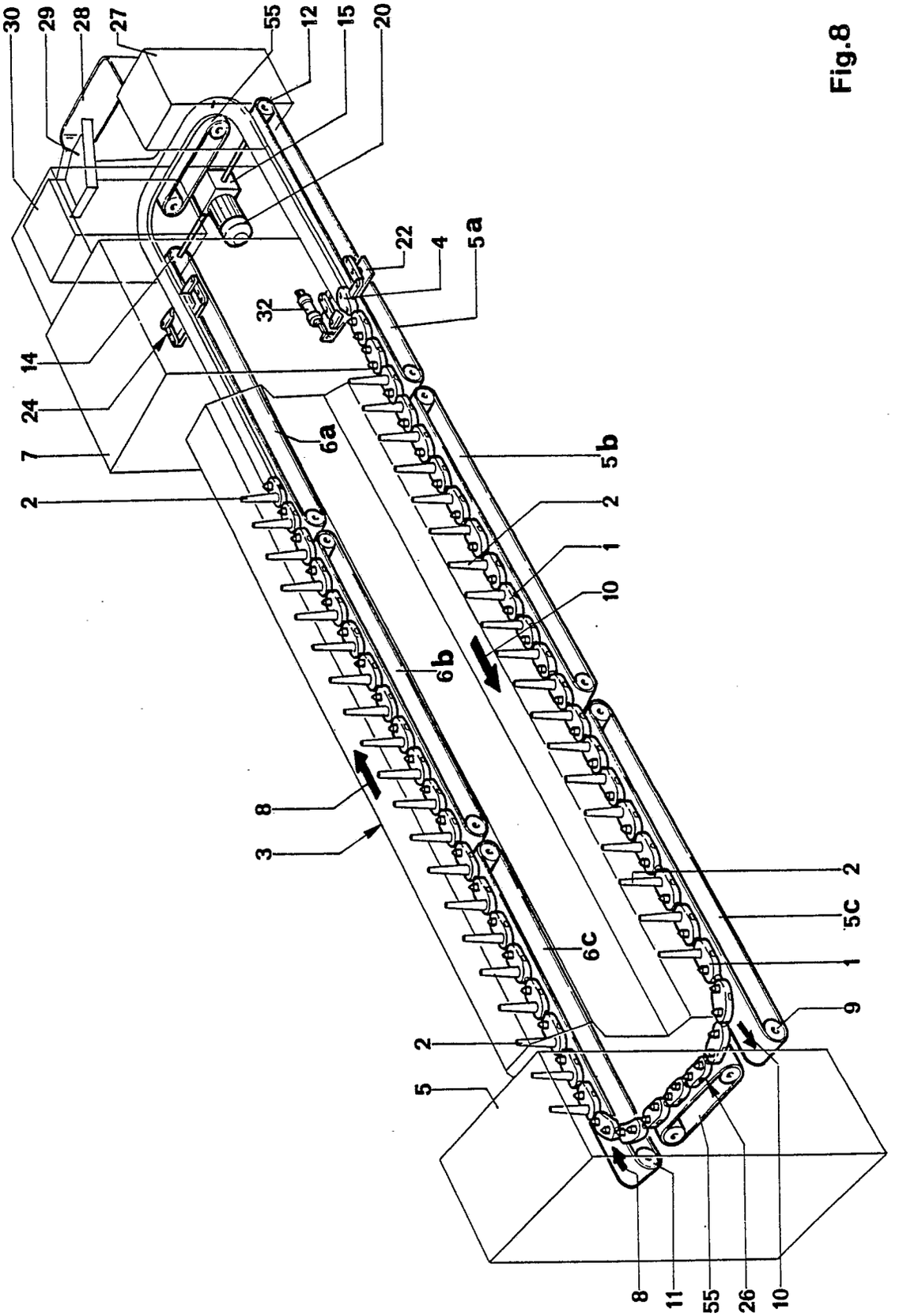
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Fig.8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP .89 20 1987

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)
A	DE-A-3731497 (MURATA KIKAI K.K.)		D01H9/18 B65H67/06
A	DE-A-3712027 (KABUSHIKI KAISHA TOYODA JIDOSHOKKI SEISAKUSHO KARIYA)		
A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 353 (C-457)(2800) 18 November 1987, & JP-A-62 125026 * the whole document *		
A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 353 (C-457)(2800) 18 November 1987, & JP-A-62 125025 (TOYODA AUTOM LOOM WORKS LTD.) * the whole document *		
A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 267 (C-443)(2714) 28 August 1987, & JP-A-62 069834 (HOWA MACH LTD.) * the whole document *		
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 301 (C-316)(2024) 28 November 1985, & JP-A-60 139836 (HOWA KOGYO K.K.) * the whole document *		TECHNICAL FIELDS SEARCHED (Int. Cl.5) D01H B65H
A	PATENT ABSTRACTS OF JAPAN vol. 7, no. 3 (C-143)(1148) 07 January 1983, & JP-A-57 161134 * the whole document *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 NOVEMBER 1989	HOEFER W.D.

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