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(54) MODULAR MACHINE FOR SPINNING AND DOUBLING WITH ELEMENTS FOR TRANSMITTING INDIVIDUALLY THE SPINDLES WITH CONICAL OR DOUBLE CONICAL CONTINUOUS AND INDIVIDUAL FOLDING SYSTEM

(57) Modular machine for spinning and doubling with individual transmission elementos for spindles with continuous, individual, conical or double conical folding system, comprising a frame formed by two metal cabinets connected to each other by means of a central body; the machine further comprises

a series of mobile elements; the spindles with their respective driving system, the ring rail on which the travellers turn around, the yarn guide, the feeding system and the control panel, said machine being capable of producing bobbins wound by the conical or double conical continuous, individual, winding system. Said machine can be used for spinning and doubling yarn, cord or similar product in a continuous endless process.

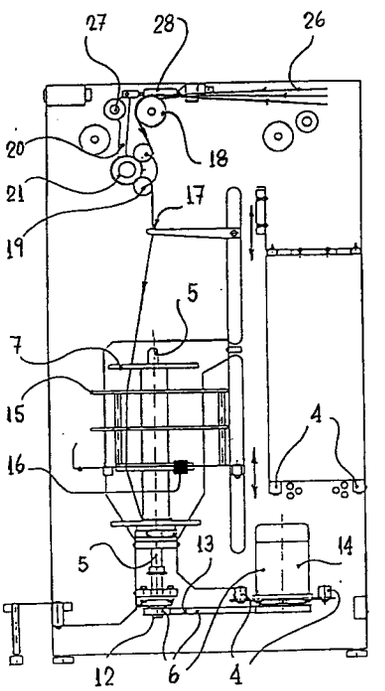

Fig. 3

EP 0 916 755 A1

Description

Object of the Invention

[0001] The object of present invention consists of a modular machine for spinning and doubling with individual transmission elements for spindles with continuous and individual conical or double conical folding system by means of conventional asynchronous alternative current motors controlled by frequency converters and programmed by a control or microprocessor unit.

Background of the Invention

[0002] The textile industry uses two types of the so called continuous spinning and doubling machines whic, among other elements, are provided basically with some elements, called spindles, in a number ranging from fiive units up to several hundreds in each machine. Said spindles are turning continuosly at the same speed, driven by only one electric motor by means of gear or pulleys assembly. Also, there is the possibility of having each spindle driven by an individual electric motor, with all motors controlled by a frequency variation unit so that all spindles turn at a same speed.

[0003] These machines, have a high efficiency, but since all spindles turn at a same speed, they all have to use the same thread type and are unable to combine different thread types in order to perform simultaneous short operations, so when it is necessary to produce different spinning and doubling operations it will be required to adapt the machine to the new process, causing an increase in production costs.

[0004] Furthermore, in spinning, doubling, textile spinning, spool roving frame, spool doubling macines, etc., the thread obtained is being stored in spinning bobbins, while the process for doubling the final product has suffered changes. The conventional process consisted of the so called "reel" doubling where the product was wound around a cylindrical reel provided in its upper and lower sides with rims to avoid the thread coming off the cylinder. This process had several inconveniences; to carry out the unfolding of the thread in the following process it was necessary to turn the reel to avoid the breakage of the thread due to the strain caused by the pulling of the bobbin. Another inconvenience is that the unfolding had always to be done perpendicularly to the turning axis to avoid thread breakage due to fouling in the bobbin upper rim.

[0005] A new reel type was later developed, which was known as "conventional conical", having reduced the upper rim to a diameter slightly larger than that of central axis so that the bobbin obtained had a mixed shape, with conical upper portion. With this new pattern some of previous inconveniences of the previous "reel" type model were eliminated. However this new process also involves some problems in order to figure the bobbin pattern it will be necessary to match the cone angle with the number of coats required to obtain the required configuration. It will be necessary to repeat such process for each reel type provided in the spinning machine in the case that thread of different types and thicknesses are used, thus affecting the machine efficiency, another inconvenient being that when finishing a manufacturing cycle the machine stops completely, and therefore all spindles stop turning even if they have not completed their process so that implies a considerable time waste and also it would not be possible to have bobbins with the same pattern when processing different products in the different spindles of the spinning machine, doubling machine, textile spinning, spool roving frame, spool doubling macines, etc.

Description of the Invention

[0006] With the purpose to prevent all serious inconveniences indicated above, when it is necessary to spin or double small amounts of product and to avoid wasting time in the machine preparation, an improved modular machine for spinning and doubling with elements for spindles individual transmission has been developed, and also a new system for doubling threads and welts has been developed as a continous and individual conical or double conical folding system with its correspondin programming and control unit, as the object of the present invention.

[0007] The modular machine for spinning and doubling with elements for spindles individual transmission with a continuous and individual conical or double conical folding system is made of a frame composed by two metal cabinets, one at the left and the other at the right hand side, with vertical cubic shape, made preferably in steel plate, each cabinet provided in its exterior side with a pivoting access door. The central portion of said frame, connecting the two cabinets fastened by bolts, is provided with cross bars made preferably of welded steel tubes whic will act as a support for the different moving elements that will be described hereinafter.

[0008] The central portion of said frame contains within the space between both cabinets and held by the crossing tubes, from one to thirty spinning or folding spindles, each having its own driving means. The spindles are turning vertical axis on which the different types of spinning or folding reels will be mounted. Said spindles are held by a twin roller system of the ball type bearing. The upper bearing unit is packed in connection with a synthetic rubber ring to absorb the radial vibrations and the lower bearing unit is mounted on a support of the swinging type which is allowed to be displaced radially.

[0009] The spindle bottom part has fastened a pulley arranged to receive a transmission flat belt, for connection to the output of an induction electrical motor mounted on a pair of crossing tubes placed in the back side of frame.

[0010] A ring rail, having a vertical up and down dis-

placement, on which a sliding piece rotates to create the twisting of the thread, is mounted coaxially on the spindle head. Above this ring rail there is a thread guide having a similar movement but with a different speed, said thread guide having the purpose of guiding the different threads towards the sliding piece coming from the hake box or feeding assembly.

[0011] The feeding assembly for each spindle comprises a pair of feeding rollers, an inlet thread roller and a pressure cylinder. The feeding rollers, made preferably of chromed carbon steel, are driven by means of two horizontal shafts, which are also driven, through a flat belt transmission system by an alternate current motor controlled by a conventional frequency variator controlled by a potentiometer, the whole assembly being located in the right hand side cabinet. Said shafts are made of carbon steel and go through from one cabinet to the other supported by said cabinets, and a shaft is located vertically above the other, connected to each other by means of a chain that makes them turn in the same direction. The pressure roller is located between the two feeding rollers and exerts a pressure on the thread in order to obtain a better draw, said pressure roller being held by means of ball bearings, the pressure arm is also fastened by means of bearings to another vertical shaft placed on top of those supported by the feeding rollers. Said pressure arm is allowed to move radially when actuated by a neumatic piston as to exert more or less pressure on threads moving through the pressure roller and feeding rollers. The neumatic pistons acting on the pressure rollers of the feeding system in each spindle are driven by the pressured air flow coming from the air pressure piping system, with pressure regulated by a pressure control valve located in the left hand side cabinet.

[0012] In the modular machine for spinning and doubling with elements for spindle individual transmission with conical or double conical continuous and individual folding system, spindles are the main elements that are in continuous movement, and are able to turn at different speeds; the ring rail has a vertical up and down movement, with the sliding pieces and thread guides turning around and having, as in the case of the ring rail, a vertical up and down movement, the feeding rollers, the pressure rollers and the inlet thread rollers.

[0013] Each spindle turns around its own shaft driven by an alternate current induction motor by means of a belt preferably of the flat type with interior teeth.. Each motor is individually controlled by a frequency variator, preferably of the conventional, vectorial or other type, which is programmed independently for each spindle by means of a potentiometer located in each spindel control panel, so that each spindle can turn at a different speed and have a opposite turning direction.

[0014] The ring rail can move vertically along two vertical guides, one in each side cabinet. Said guides are of cylindrical shape and are made of carbon steel and fastened in the bottom to each cabinet forming the machine frame. Said ring rail moves vertically up and down with a stroke equivalent to the spindle reel height, being possible to regulate the length of said stroke. The thread guides move above the ring rail, following a similar motion pattern, along said guides.

[0015] The ring rail as well as the thread guides are driven by an alternate current electric motor provided with a speed variator of the manual regulation disc type. Said variator transmits the turning movement to a speed reduction unit by means of said flat teethed belt, the output of said reduction unit being an horizontal shaft driving two drums with a different diameter on which steel cables are wound which hold the thread guides and the ring rail. The vertical up and down displacement is created as a consequence of the reverse in the motor turning direction by means of the control provided by limit switches mounted on said drums. The thread guides and the ring rail are driven by same means and the same motor with reduction unit, so all have the same frequency of movement.

[0016] The feeding rollers are mounted on two horizontal cross shafts vertically one on top of the other and are driven through a flat belt transmission system by an alternate current motor controlled by a conventional frequency variator controlled by a potentiometer. The turning movement is transmitted, between both of them, by means of a driving chain so that both shafts turn in the same direction.

[0017] The driving motor as well as the frequency variator and the control potentiometer are located in the right band side cabinet. Finally, the swing arm of each pressure roller is actuated by means of a neumatic cylinder.

[0018] For a better understanding of the new continuous, individual conical or double conical folding system, first we will explain the process to obtain a conventional simple conical folding as it is used now. A conventional reel, comprising a cylindrical central body with its bottom provided with disc having a diameter from two to five times de central body diameter to support the processed thread, will be inserted in spindles of spinning and doubling machine, said reel havingin its upper part another disc with a diameter slightly larger than that of central body. The processed thread is inserted in the central body bottom part of said reel, driving the spinning and doubling machine so the reel turns driven by the spindle. By means of the up and down displacement of the sliding piece, driven by the ring rail, in which the processed thread is inserted, said thread will be wound or folded around the reel in upwards direction so that once the reel central body is covered with a first coat, a second coat is folded in downwards direction, this process being repeated sucessively to get a diameter slightly smaller than that of reel bottom disc, in a manner such that each coat presents a height slightly smaller to previous coat as to obtain a mixed pattern bobbin, with approximately two thirds of it with cylindrical shape and truncoconical shpa in its upper portion in

order to obtain an improved stability od folded material.

[0019] With the new continuous, individual, conical or double conical folding system, the process to obtain a bobbin is totally different from the conventional process. In the conventional process the thread or welt is folded in accordance with a bobbin simple pattern with most of its lenght being of cylindrical shape and truncoconical upper portion, while with the new continuous, individual, conical or truncoconical folding system the folding pattern corresponds to a bobbin made up of multiple concentric cylinders and truncocones, forming assemblies called "subcycles", each of said subcycles comprising a smaller given number of thread or welt coats, with respect to the conventional system, and each subcycle having a height slightly lower than that of previous subcycle. The assembly comprising a given number of subcycles is called "repeated great cycle".

[0020] With this improvement, the modular machine for spinning and doubling with individual transmission elements for spindles is provided with a control unit comprising a microprocessor which enables said machine to program, on a display, the length required to be stored in each reel, the reel length, the height (h) of the cone or truncocone, and by means of a display restricted to the user, the number of subcycles (m) and number of thread or welt coats in each subcycle (n) in accordance with the features of the processed products.

[0021] The difference in height between a coat and next coat (Ca) and the difference in height between a subcycle and nex (Cb), computed by means of the microprocessor algorithm, establishes the corresponding parameters.

[0022] Also, said microprocessor provides said machine with capability to program different bobbin shapes: single cone, double cone or cylinder, all these patterns obtained under same process of subcycles and coats as previously described.

[0023] With the improvement introduced with the new control unit, the spinning machine, doubling machine, textile spinning, spool roving frame, spool doubling macines, etc., having the capacity to apply the above described programs, individually to each spindle of the machine.

Detailed Description of Drawings

[0024] For a better understanding of the object of present invention, a practical preferential embodiment of the improved modular spinning and doubling machine with individual transmission elements for spindles, object of present invention, and based on enclosed figures:

Fig. 1 Front view of the modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system.

Fig. 2 Plan view of the modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system.

Fig. 3 Sectional view of assembly.

Fig. 4 Section view of detail of spindles bearing system.

Fig. 5 Front and plan views of right hand side cabinet.

Fig. 6 Front and plan views of left hand side cabinet.

Fig. 7 Fron view of a completely cylibdrical reel with two ientical discs.

Fig. 8 Front view of a reel folded in accordance with conventional process.

Fig. 9 Front schematic view of continuous conical foldinf process.

Fig. 10 Front view of bobbin once it has been configurated in accordance with the continuous conical folding process.

Preferential Embodiment of the Invention

[0025] The modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system is made of a frame composed by two metal cabinets, one at the left (2) and the other at the right (1) hand side, with vertical cubic shape, made preferably in steel plate, each cabinet provided in its exterior side with a pivoting access door. The central portion of said frame, connecting the two cabinets fastened by bolts, is provided with cross bars made preferably of welded steel tubes whic will act as a support for the different moving elements that will be described hereinafter.

[0026] The central portion of said frame contains within the space between both cabinets (1, 2)and held by the cross tubes (4) from one to thirty spinning or folding spindles (5), each having its own driving means. The spindles (5) are turning vertical axis on which the different types of spinning or folding reels will be mounted. Said spindles (5) are held by a twin roller system of the ball type bearing. The upper bearing unit (8) is packed in connection with a synthetic rubber ring (9) to absorb the radial vibrations and the lower bearing unit (10) is mounted on a support (11) of the swinging type which is allowed to be displaced radially.

[0027] The spindle bottom part is fastened to a pulley (12) arranged to receive a transmission flat belt(13), for connection to the output of an induction electrical motor (14) mounted on a pair of crossing tubes placed in the back side of frame.

[0028] A ring rail (15), having a vertical up and down displacement, on which a sliding piece (16) rotates to create the twisting of the thread, is mounted coaxially on the spindle (5) head. Above this ring rail (15) there is a threads guide (17) having a similar movement but with a different speed, said thread guide having the purpose of guiding the different threads towards the sliding piece

(15) coming from the hake box or feeding assembly.

[0029] The feeding assembly for each spindle comprises a pair of feeding rollers (19), an inlet thread roller (18) and a pressure cylinder (21). The feeding rollers (19), are made preferably of chromed carbon steel, are driven by means of two horizontal shafts (22), which are also driven, through a flat belt (23) transmission system by an alternate current motor (24) controlled by a conventional frequency variator controlled by the control unit or microprocessor (29). Said shafts are made of carbon steel and go through from one cabinet to the other supported by said cabinets, and a shaft is located vertically above the other, connected to each other by means of a chain (25) that makes them turn in the same direction. The pressure roller (21) is located between the two feeding rollers (19) and exerts a pressure on the threads (26) in order to obtain a better draw, said pressure roller being held by means of ball bearings, the pressure arm (20) is also fastened by means of bearings to another horizontal shaft (27) placed on top of those supported by the feeding rollers (19). Said pressure arm (20) is allowed to move radially when actuated by a neumatic piston (28) as to exert more or less pressure on threads moving through the pressure roller (21) and feeding rollers (19). The neumatic pistons (26) acting on the pressure rollers (21) of the feeding system in each spindle are driven by the pressured air flow coming from the air pressure piping system, with pressure regulated by a pressure control valve located in the left hand side cabinet.

[0030] In the modular machine for spinning and doubling with elements for spindle individual transmission with conical or double conical continuous and individual folding system, spindles (5) are the main elements that are in continuous movement, and are able to turn at different speeds; the ring rail has a vertical up and down movement, with the sliding pieces (16) and thread guides (17) turning around and having, as in the case of the ring rail (15), a vertical up and down movement, the feeding rollers (19), the pressure rollers (21) and the inlet thread rollers (18).

[0031] Each spindle (5) turns around its own shaft driven by an alternate current induction motor (14) by means of a belt (13, preferably of the flat type with interior teeth.. Each motor (14) is individually controlled by a frequency variator, preferably of the conventional, vectorial or other type, which is programmed independently for each spindle (5) by means of the control unit or microprocessor (29) located in each spindel control panel, so that each spindle can turn at a different speed and have a opposite turning direction.

[0032] The ring rail (15) can displace vertically along two vertical guides (30), one in each side cabinet. Said guides (30) are of cylindrical shape and are made of carbon steel and fastened in the bottom to each cabinet (1, 2) forming the machine frame. Said ring rail (15) moves vertically up and down with a stroke equivalent to the spindle reel height, being possible to regulate the length of said stroke. The thread guides (17) move above the ring rail, following a similar motion pattern, along said guides.

[0033] The ring rail (15) as well as the thread guides (17) are driven by an alternate current electric motor (31) provided with a speed variator (32) of the manual regulation disc type. Said variator (32) transmits the turning movement to a speed reduction unit (34) by means of said flat teethed belt (35), the output of said reduction unit being an horizontal shaft (36) driving two drums (37) with different diameter on which steel cables (38) are wound which hold the thread guides (17) and the ring rail (15). The vertical up and down displacement is created as a consequence of the reverse in the motor (31) turning direction by means of the control provided by limit switches mounted on said drums. The thread guides (17) and the ring rail (15) are driven by same means and the same motor with reduction unit, so all have the same frequency of movement.

[0034] The feeding rollers (19) are mounted on two horizontal cross shafts (27) vertically one on top of the other and are driven through a flat belt transmission system by an alternate current motor (24) controlled by a conventional frequency variator controlled by a control unit or a microprocessor (29). The turning movement is transmitted, between both of them, by means of a driving chain (25) so that both shafts turn in the same direction.

[0035] For a better understanding of the new continuous, individual conical or double conical folding system, first we will explain the process to obtain a conventional simple conical folding as it is used now. A conventional reel (7), comprising a cylindrical central body (53) with its bottom provided with disc having a diameter from two to five times de central body diameter to support the processed thread, will be inserted in spindles (5) of spinning and doubling machine, said reel havingin its upper part another disc with a diameter slightly larger than that of central body (53). The processed thread is inserted in the central body (53) bottom part of said reel (7), driving the spinning and doubling machine so the reel (7) turns driven by the spindle. By means of the up and down displacement of the sliding piece (16), driven by the ring rail (15), in which the processed thread is inserted, said thread will be wound or folded around the reel (7) in upwards direction so that once the reel central body is covered with a first coat, a second coat is folded in downwards direction, this process being repeated sucessively to get a diameter slightly smaller than that of reel bottom disc, in a manner such that each coat presents a height slightly smaller to previous coat as to obtain a mixed pattern bobbin, with approximately two thirds of it with cylindrical shape and truncoconical shpa in its upper portion in order to obtain an improved stability od folded material.

[0036] With the new continuous, individual, conical or double conical folding system, the process to obtain a bobbin, Fig. 9, is totally different from the conventional

process. In the conventional process, Fig. 8, the thread or welt is folded in accordance with a bobbin simple pattern with most of its lenght being of cylindrival shape and a trunco-conical upper portion, while with the new continuous, individual, conival or trunco-conical folding system the folding pattern corresponds to a bobbin made up of multiple concentric cylinders and trunco-cones, forming assemblies called "subcycles" (45), each of said subcycles (45) comprising a smaller given number of thread or welt coats (44), with respect to the conventional system, and each subcycle (45) having a height slightly lower than that of previous subcycle. The assembly comprising a given number of subcycles is called "repeated great cycle" (46).

[0037] With this improvement, the modular machine for spinning and doubling with individual transmission elements for spindles is provided with a control unit (29) comprising a microprocessor which enables said machine to program, on a display, the length required to be stored on each reel (7), the reel length, the height (h) (49) of the cone or trunco-cone, and by means of a display restricted to the user, the number of subcycles (m) and the number of thread or welt coats in each subcycle (n) in accordance with the features of the processed products.

The difference in height between a coat and next coat (Ca) (48) and the difference in height between a subcycle and nex (Cb) (47), computed by means of the microprocessor algorithm, establishes the corresponding parameters.

[0038] Also, said microprocessor (29)provides said machine with capability to program different bobbin shapes: single cone, double cone or cylinder, all these patterns obtained under same process of subcycles and coats as previously described.

[0039] With the improvement introduced with the new control unit (29), the spinning machine, doubling machine, textile spinning, spool roving frame, spool doubling macines, etc., having the capacity to apply the above described programs, individually to each spindle of the machine.

[0040] In order to start the process a operation cycle is programmed for each spindle by means of the display (29) of the control unit or microprocessor by introducin the following data: twist degree, bobbin shape (simple cone, double cone or straight), length to be processed in each spindle, conical (49) and the reel height (50).

[0041] Following that process the different threads (26) are inserted to form the final thread or welt through the inlet rollers (18), then through the feeding rollers (19) and pressure roller (21), through the thread guides (17) and sliding piece (16) and wound on the reels (7).

[0042] With the pressure arms up (20) and the spndles (5) stopped, the feeding rollers (18), the ring rail (15) and the thread guide (17) are started by means of the feeding system start switch (51). Further to that the motors driving the spindles are started in sequence by means of individual switches.

[0043] The twist index is given by the control unit or microprocessor (29) to the frequency variator in each motor based on turning speed of each spindle provided by the encoder or motor pulse generator and by the turning speed of the feeding rollers, also provided by the pulse generator or encoder of the frequency variator of feeding rollers driving motor.

[0044] Simultaneously, the operation cycle is started winding or folding the thread or welt on the reel central body (53) with upwards movement and when reaching the maximum reel height by the action of the ring rail sliding piece, the thread or well starts folding next coat in downwards direction, in this case of smaller height since it is conditioned by the programmed dimension of high cone (48), and so on to configurate a complete subcycle (45) with n coats (44) which will start the configuration of a new subcycle, with the same number of coats than the previous one, which in accordance with the low cone (47) dimension, it will be of smaller height than previous one, and so on, to the point in which, as a consequence of the programmed length to be folded on each reel, said reel will stop whereas the remaining spindles will continue the process without being required to stop. Once the filled reel is replaced with an empty reel, the individual starting switch (52) is turned on to initiate the reel operation, then starting a new folding process.

[0045] Once the nature of the present invention, as well as an embodiment of same have been described suficiently, we only have to add that it will be possible to introduce changes in shape, arrangement and constitution in the assembly and its components as long as those alterations do not affect substantially to the characteristics of the invention as claimed below.

Claims

1. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system is made of a frame composed by two metal cabinets, one at the left (2) and the other at the right (1) hand side, with vertical cubic shape, made preferably in steel plate; by a central body connecting said cabinets by means of cross bolted bars (4) made preferably of welded steel tube; by a series of moving elements: the spindles (5) with associated driving system (6), the ring rail (15) on which the sliding pieces (16), the thread guide (17), the inlet rollers (18), the feeding rollers (19) and the pressure rollers (21) characterized in that it has the capacity to provide a different twist degree, for each spindle (5) in the machine is driven by an individual power system (6) comprinsing a pulley (12), a transmission belt (13) of the flat type connected to an alternate current induction electric motor (14), fed through a frequency variator which is programmed by a control unit or a microprocessor (29)

providing said spinning and doubling machine, trough its display, with capacity to configurate tue different parameters affecting to the twist degree and to the computaion algorthim of the continuous, individual, conical or double conical folding system; spindles (5) supported by a twin bearing system, Fig. 4.

2. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that the asynchronous motors (14) meeting standards IEC, CENELEC, VDE and DIN having an output from 0.75 to 3.0 Kw, for driving the spindles (5), are provided with a frequency variator, preferably of the conventional, vectorial or similar type, programmed individually through the control unit or microprocessor (29), which allows said motor to reverse the turning direction and the turning speed in a range 0 - 150 Hz corresponding to a speed range 0 - 3,500 r.p.m.

3. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that it comprises a control unit or microprocessor (29) which allows the spinning and doubling machine, through its display, to configurate the different parameters considered with respect to the twist degree of each product processed and to the computation algorithm for the folding system.

4. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, in accordance with claim 1, characterized in that the spindles (5) are supported by a twun bearing system of the ball type; the upper bearing (8) is packed together with a synthetic rubber ring (9) capable of absorbing the radial vibrations produced, and tue lower bearing (10) is mounted on a support (11) of the swinging type capable of radial displacement, the distance between bearings being from 150 and 350 mms.

5. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that in the winding and folding process, the following parameters are considered: the final shape of the bobbin, Fig. 10, (the rrel with the processed product) as a simple, double or straight cone; the thread length required on each reel, the number of coats in each subcycle (44) = **n**, number of subcycles (45) = **m** required for each repetitive cycle (46), **n** and **m** being a number between 1 and 40 units; the low cone (47) = **Cb**, the high cone (48) = **Ca**, the height of the trunco-cone or "conical" (49) = **h**, between 1 and 1,500 mm., and the reel length (59) all related in accordance with following formulae:

$$Ca = h/m, \text{ and } Cb = h/(m \cdot n).$$

6. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that the winding or folding operations a process is followed to insert the thread into the different spindles (5) of said machine through the control unit or microprocessor display unit (29) by introducing data such as bobbin shape (simgle cone, double cone or straight), the length of thrad to be processed, the conical (49) and the reel height (50); it is started by means of a start main switch (51) and the operation cycle initiates the winding and folding the thread or welt around the reel central body (53) in upwards direction, once the reel maximum height is reached by means of the ring rail sliding piece, the thread or welt initiates in downwards direction the folding of next coat with smaller height since it is conditioned by the programmmed dimension of the high cone (48), and so to configurate a complete subcycle (45) with n coats (44) which will initiate the configuration of a new subcycle, having the same number of coats that previous one, so that in accordance with the dimension of the low cone (47) it will have samaller height than the first one and so on, up to the point that as a consequence of the programmed length to be folded on each reel, said reel will stop whereas the remaining spindles will continue the process; once the filled reel is replaced with an empty reel, the individual starting switch (52) is turned on to initiate the reel operation, then starting a new folding process.

7. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that said folding system gives the spinning and doubling machine the capacity for folding in a continuous process, without having to stop said machine when atarting or completing a cycle.

8. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claims 1 and 7, characterized in that said system provides the spinning and dou-

bling machine with the capacity to continue folding in all existing reels except with the stopped reel, for said reel has completed the programmed length and requires to be replaced with an empty reel., always obtaining the same exterior shape even when processing different threads.

9. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that it is provided with a control unit or microprocessor (29) which gives the spinning and doubling machine the capacity to configurate, by means of the display unit, the different parameters considered in the computation logarithm of said system.

10. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that for **m** = 1 and **n** is from 2 to 50 units, and in that said machine will be able to produce a bobbin with a single subcycle and n coats, obtaineng a conventional bobbin.

11. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that when **n** = 1 and **m** is from 2 to 50 units, said machine will be able to produce a bobbin, Fig. 10, with **m** subcycles (45) of a single coat, obtaineng a conventional bobbin.

12. A modular spinning and doubling machine with individual transmission elements for spindles with continuous, individual, conical or double conical folding system, according to claim 1, characterized in that the program allows for changes in the sequence of the operation process, obtaining the same final result, or, in other words, within a great operatiion cycle it will be possible to change the sequence of the folding subcycles and, within said subcycles, the sequence of the coats, and obtaining the same final result.

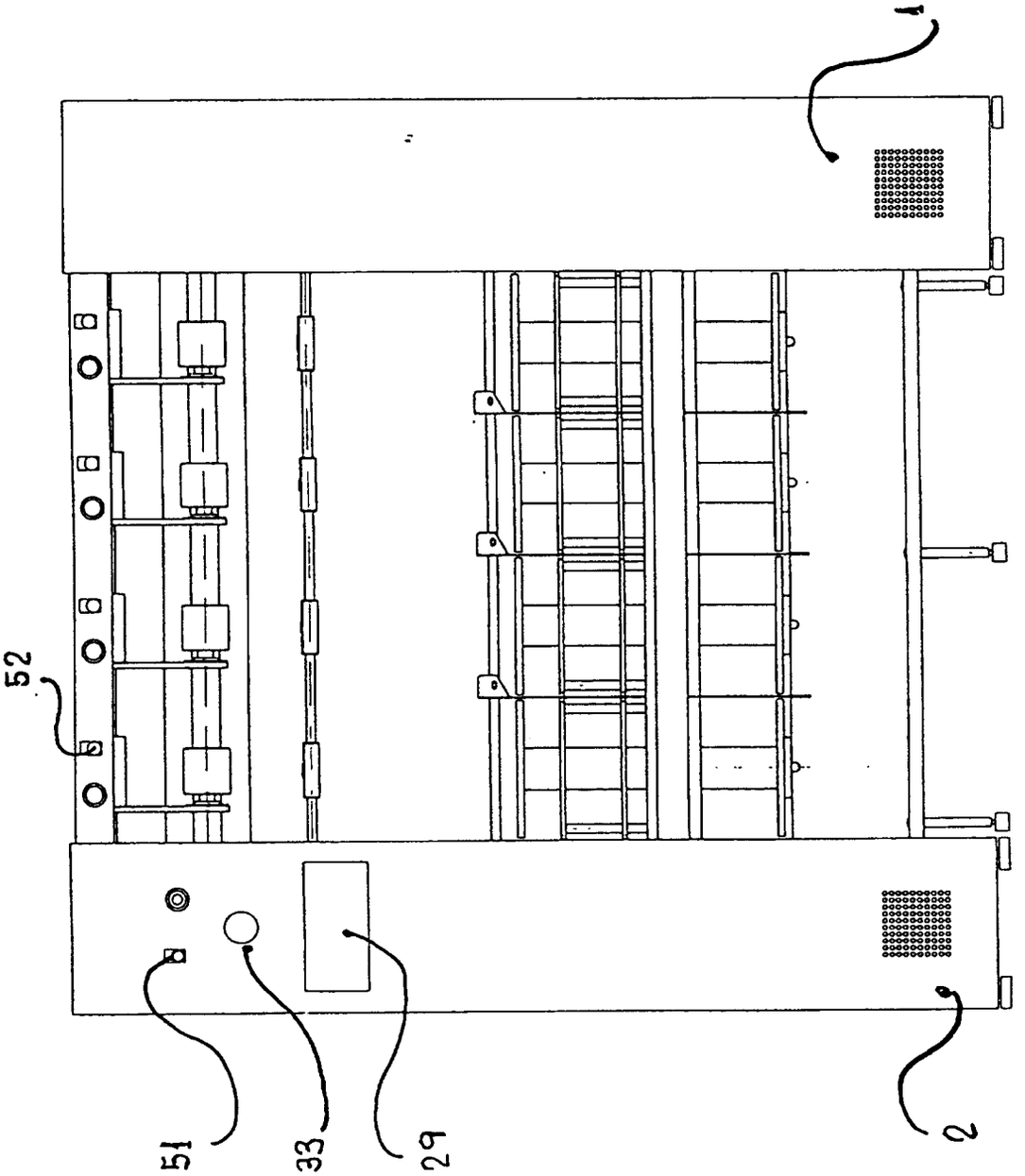

FIG. 1

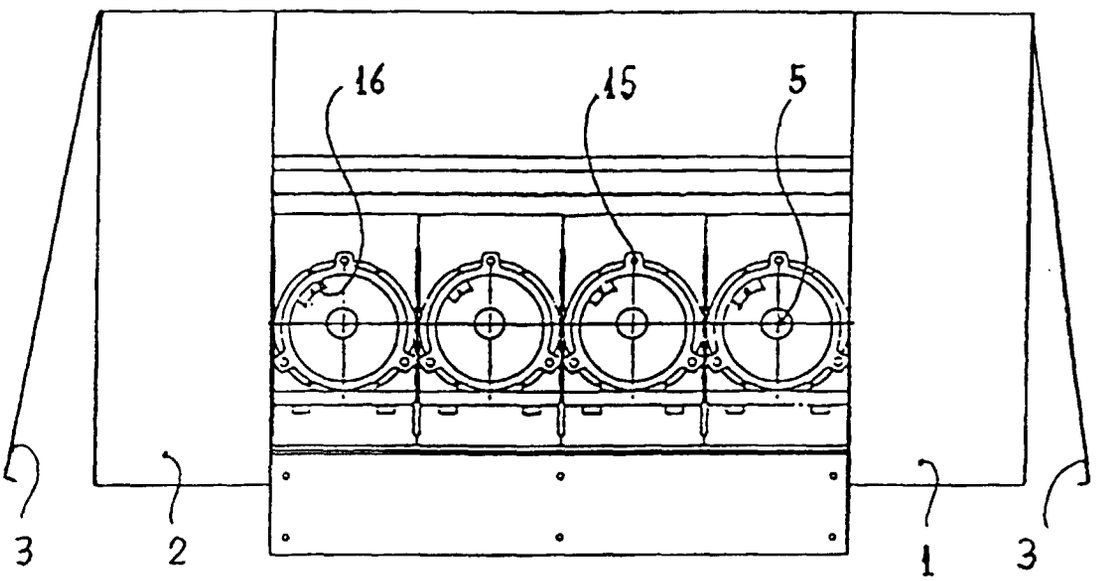

Fig. 2

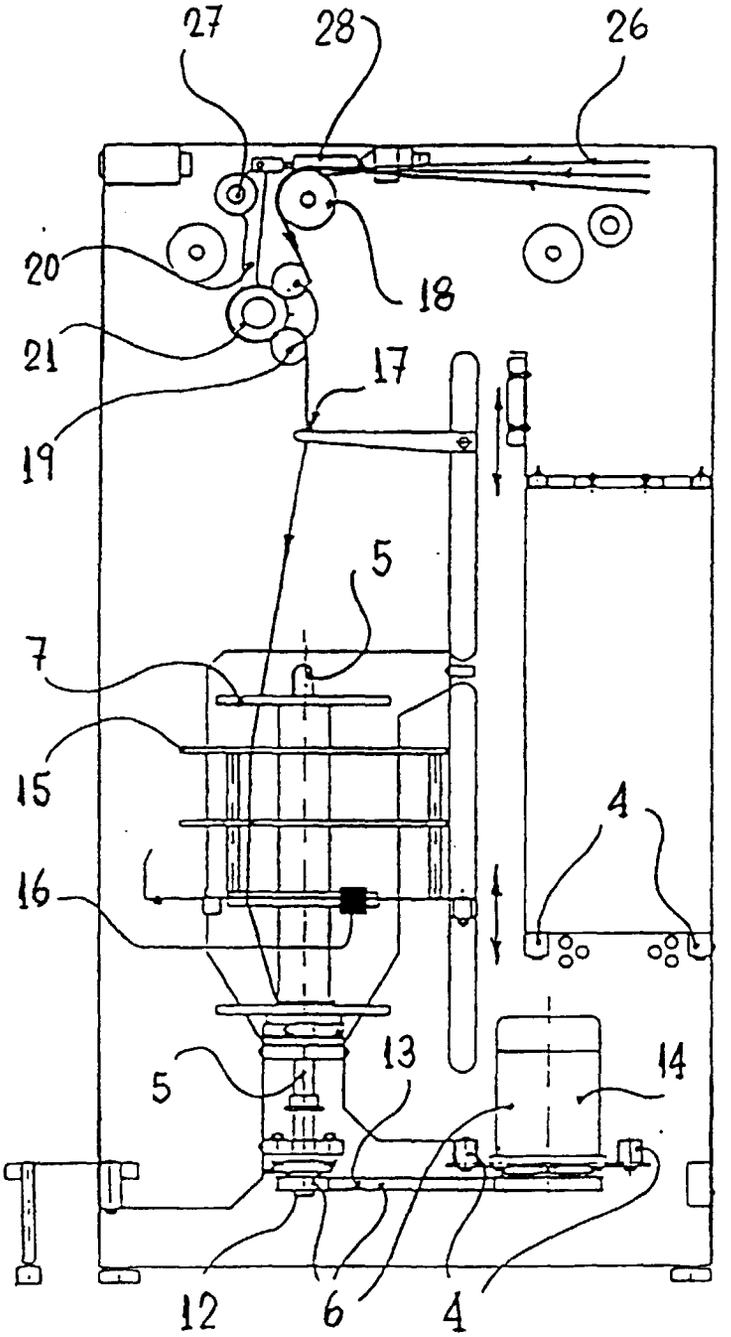

Fig. 3

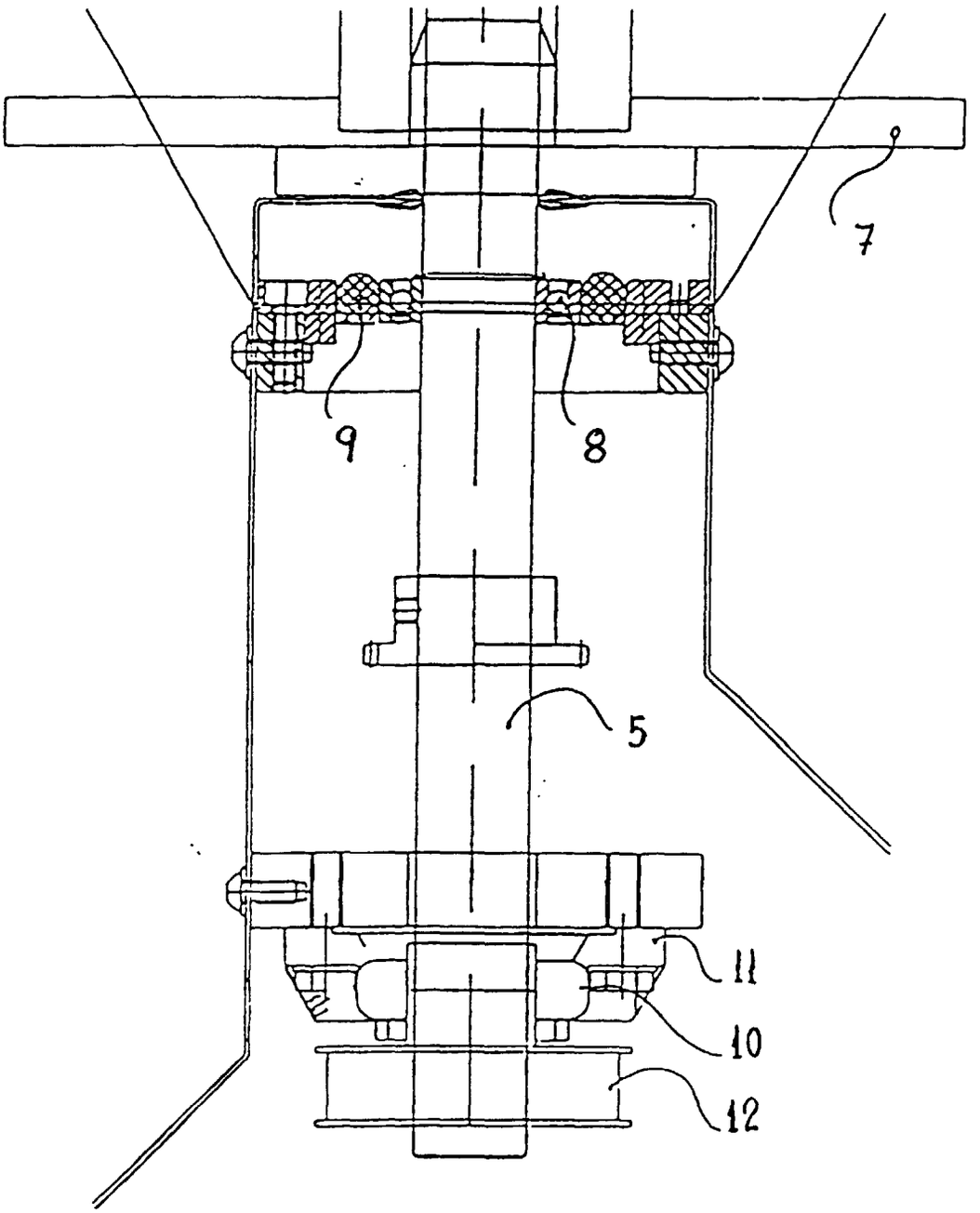

Fig. 4

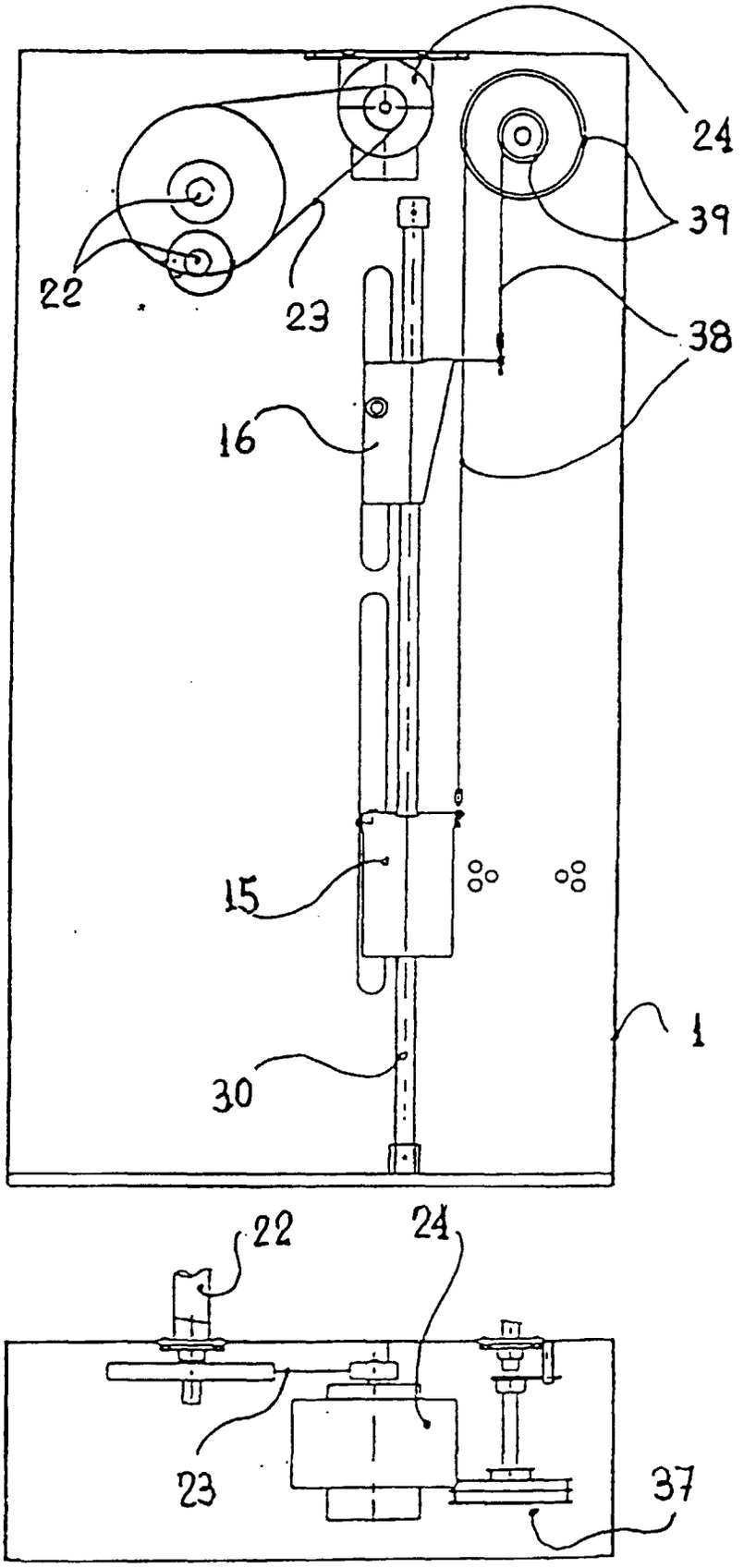

Fig. 5

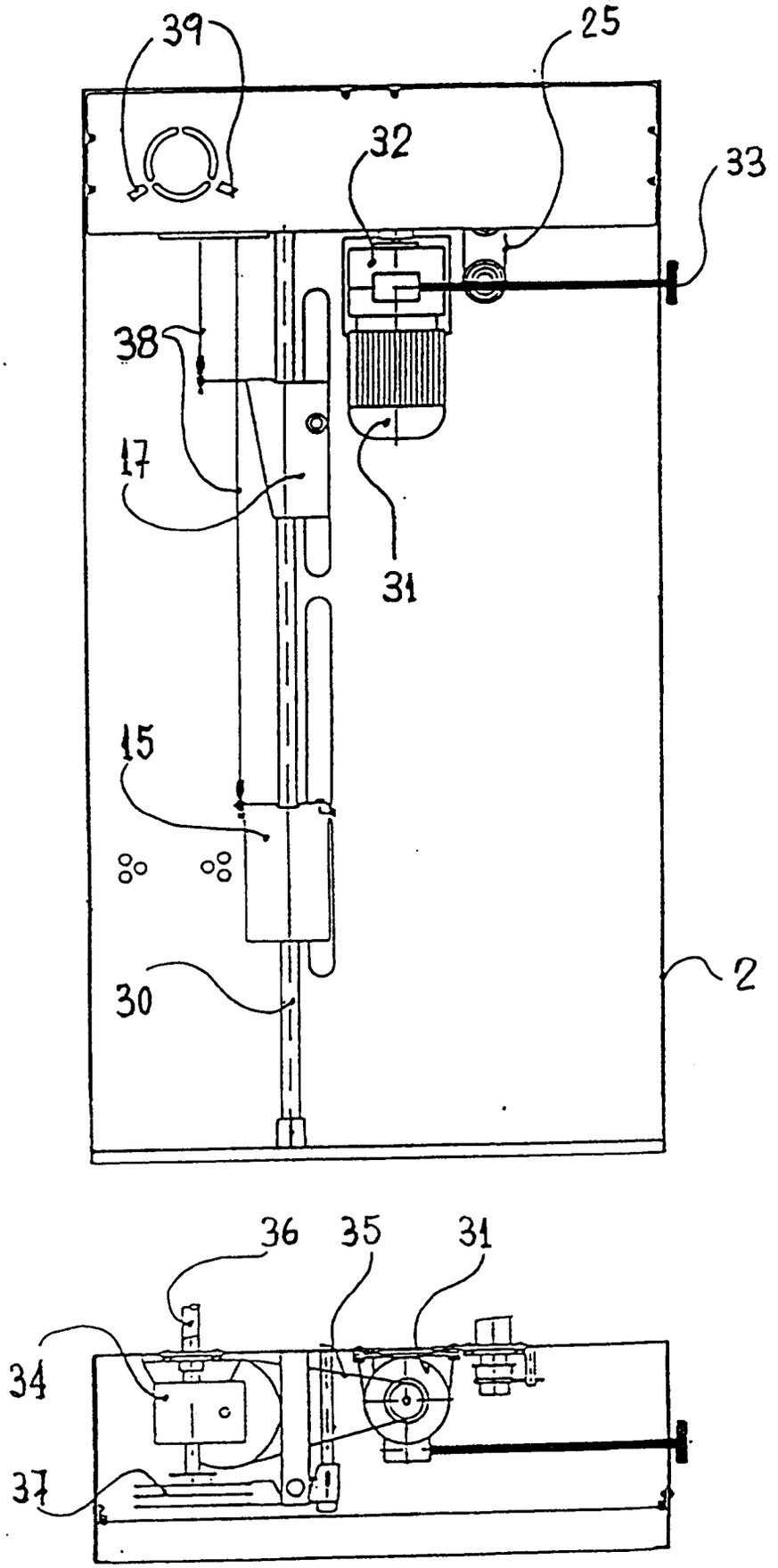

Fig. 6

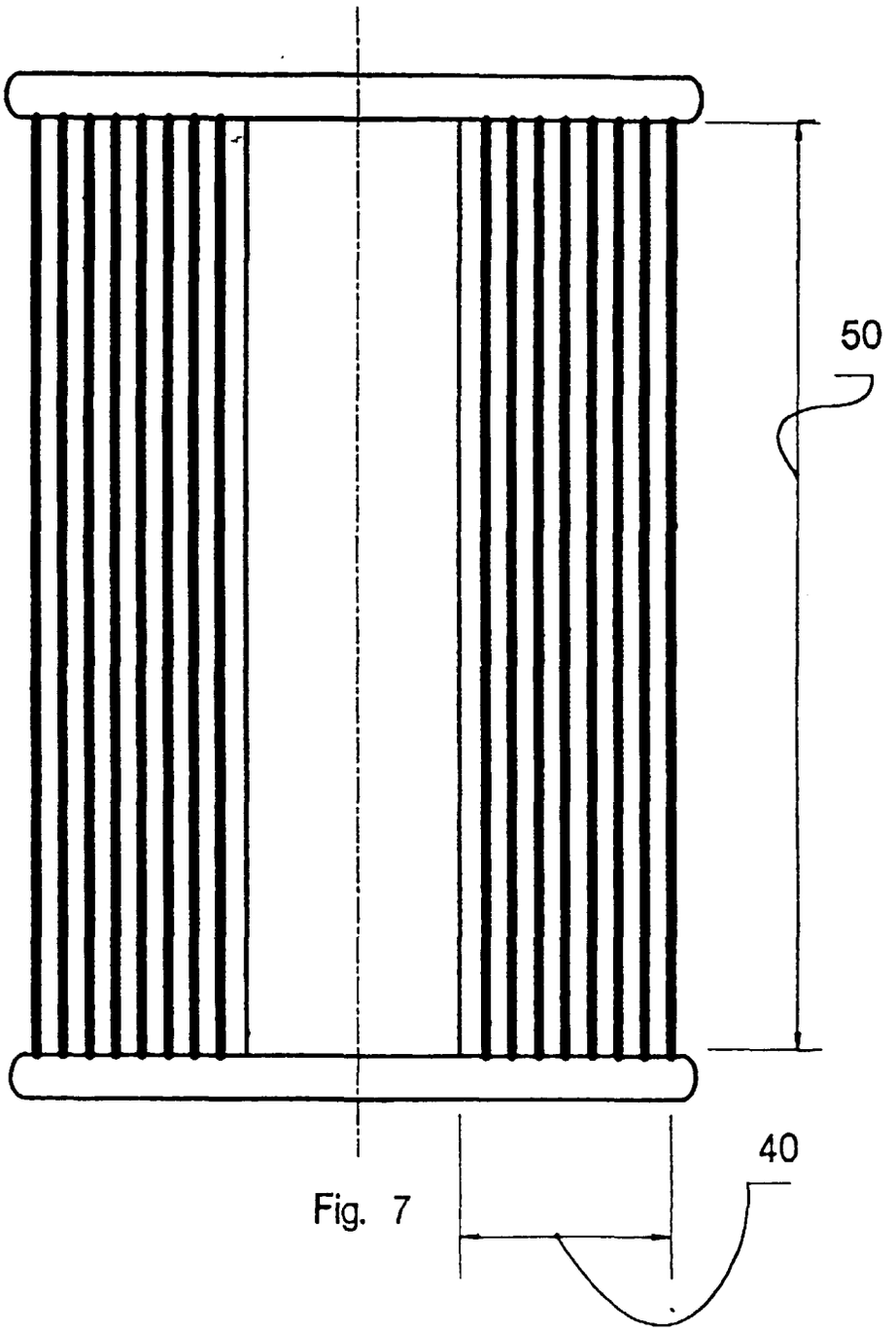

Fig. 7

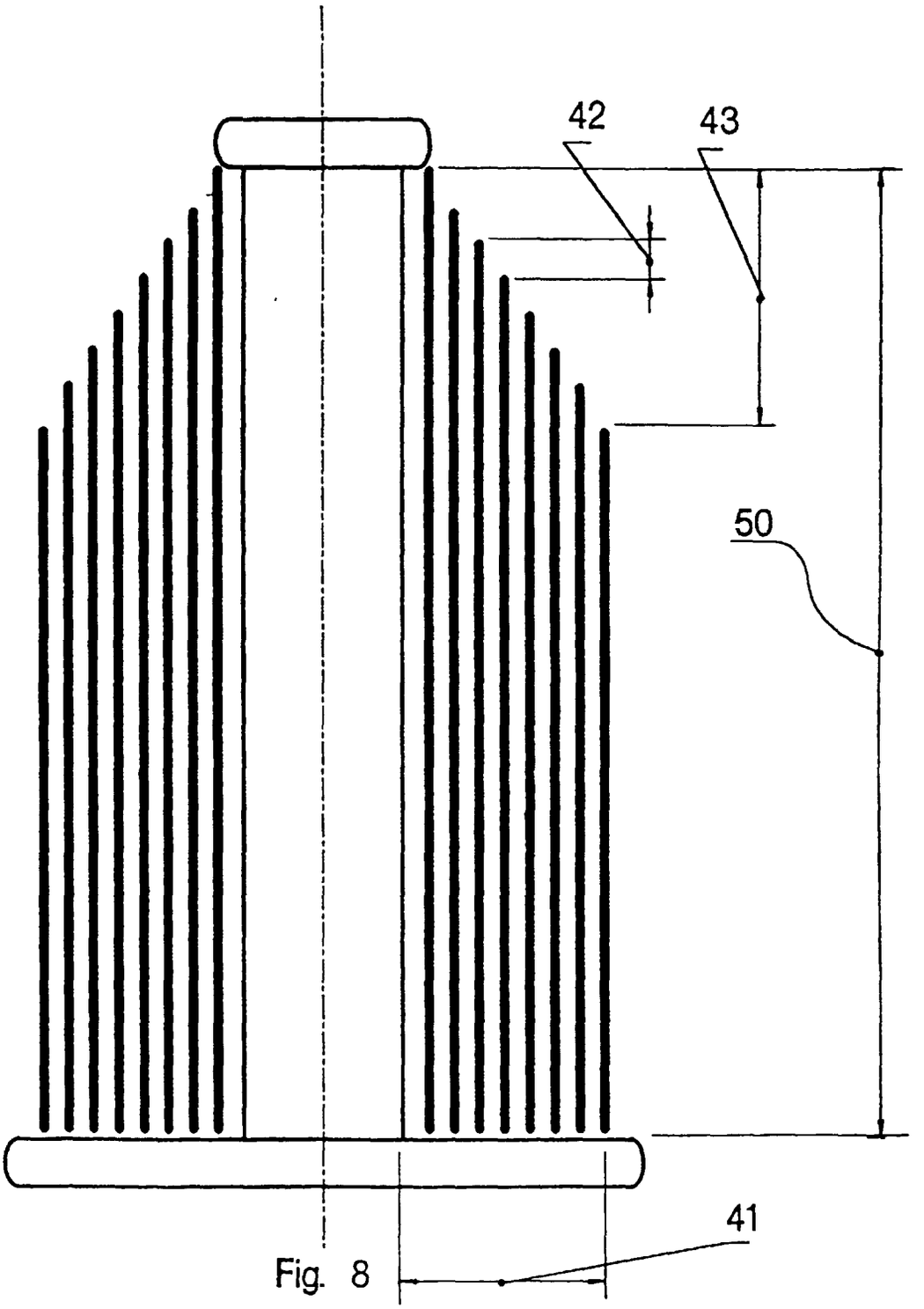

Fig. 8

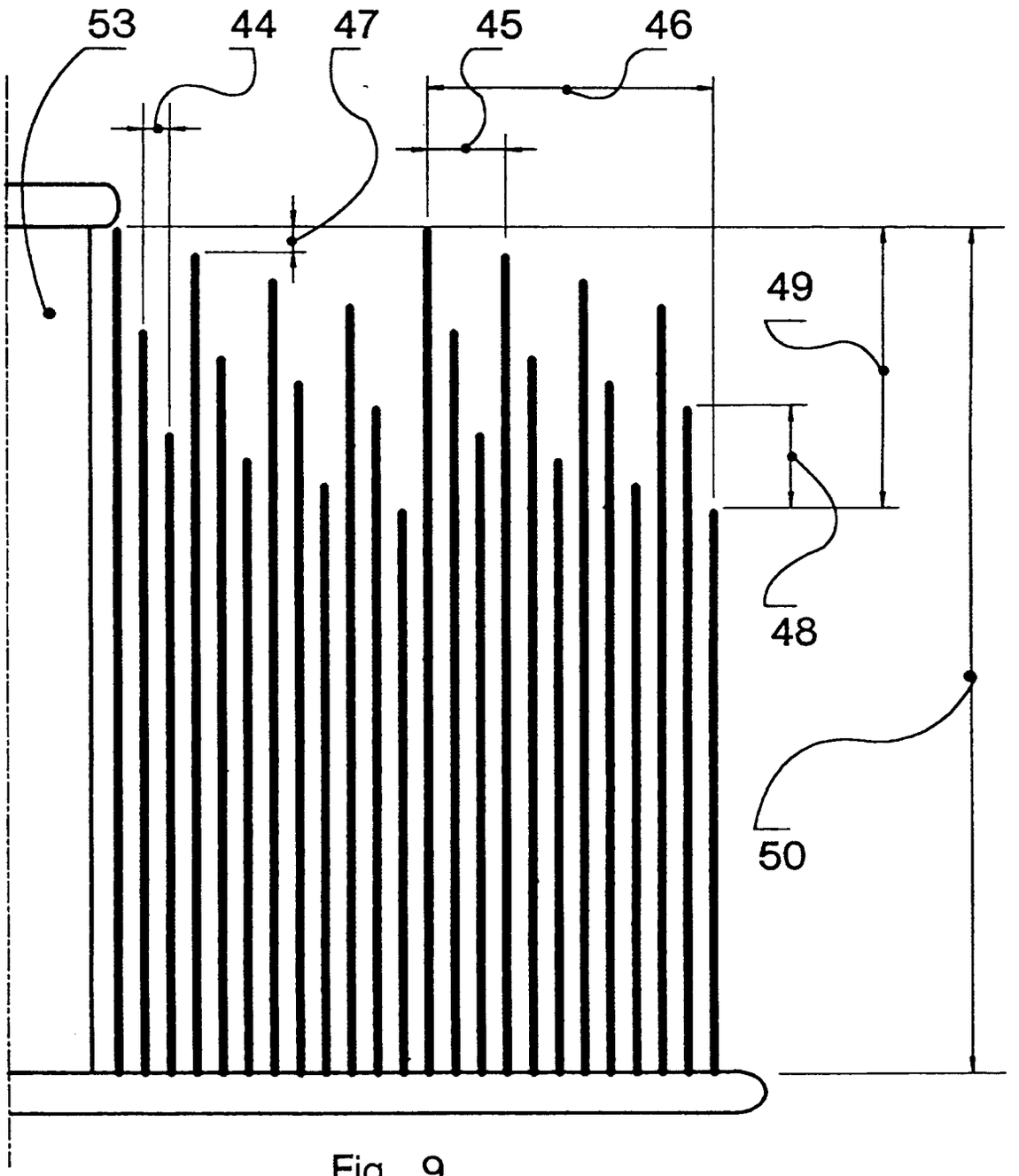

Fig. 9

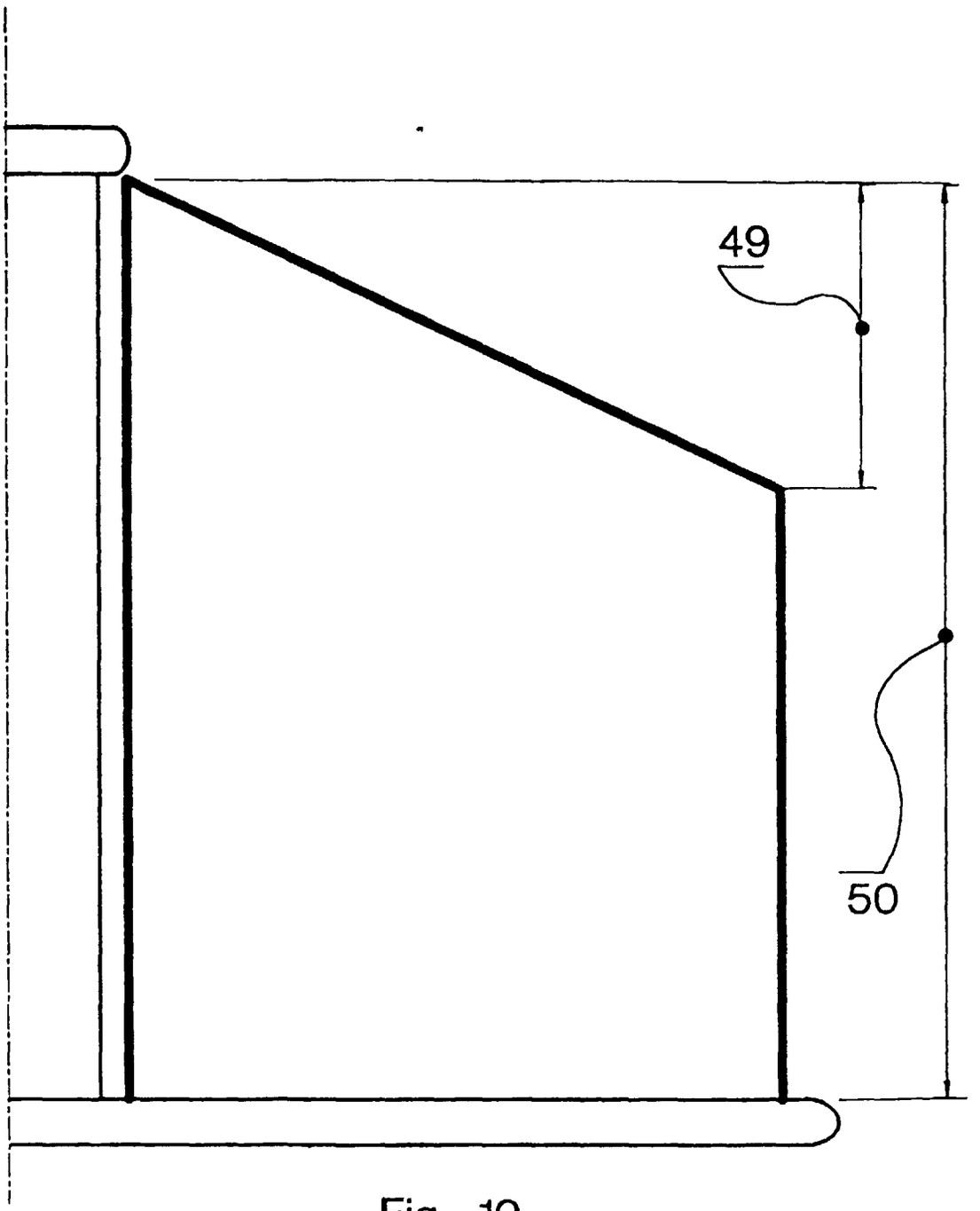

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES 98/00054

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D01H 1/244, 1/02, 1/36, B65H55/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D01H, B65H

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

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

CIPEBAT, EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACT OF JAPAN, PAJ CD-ROM N° 36, D01-07 21 1976-1993 & JP-61201028-A (TOYOTA AUTOM) 05 September 1986 (05.09.86)	1,2
Y	US-4562388-A (WOLF) 31 December 1985 (31.12.85) see the whole document	1,2
A	EP-0140801-A (ASA) 08 May 1985 (08.05.85) Pages 4, 5; figures 2, 3	1-3,9,12
A	PATENT ABSTRACTS OF JAPAN, PAJ CD-ROM 9508 1995-11 [011] [07-194201 / 07-231700]& JP-07216664-A (TOYOTA AUTOM) 15 August 1995 (15.08.95)	1,3,9,12
A	US-4204653-A (NOSE et al.) 27 May 1980 (27.05.80) see the whole document	5,6
A	US-2296420-A (CAMPBELL) 22 September 1942 (22.09.42) see the whole document	5,6

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
15 June 1998 (15.06.98)	18 June 1998 (18.06.98)
Name and mailing address of the ISA/ S.P.T.O	Authorized officer
Facsimile No.	Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES 98/00054

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB-2029459-A (SOC.NAZ.IND.APLICAZ.VISCOSA) 19 March 1980 (19.03.80), Page 4, line 56- page 5, line 113	5,6

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES98/00054

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 7,8,10 and 11
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claims 7 and 8 disclose advantages provided by the invention, but not technical caracteristics.
Claims 10 and 11 represent particular events of the type of winding when certain parameters have certain values , without any claimable qualitative difference.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Individual drive system for each spindle, according to claims : part of claim 1 in all of claim 2.
2. Control unit for the various parts of the spinning machine in order to determine the twisting degree in the calculation algorithm of the folding system according to claims: part of claim 1 in all of claim 3,9 and 12.
3. System for supporting the spindles according to claims: part of claim 1 in all of claim 4.
4. Type of folding in bobin obtained according to the design specified in claims 5 and 6.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)