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(54) **Multi-container dyeing machine with individual container temperature control and quantitative chemical-feeding control**

(57) A multi-container dyeing machine includes a machine frame base, a heating and cooling module having multiple temperature-controlled heating and cooling devices each consisting of a housing, a container, a heating unit, a temperature sensor, a transmission wheel and an electric fan and a mounting plate mounted in the machine frame base to carry the temperature-controlled

heating and cooling devices, an automatic quantitative feeder for selectively feeding an auxiliary agent to the containers of the temperature-controlled heating and cooling devices selectively without interrupting the machine and a swinging mechanism controllable to tilt the mounting plate of heating and cooling module and the temperature-controlled heating and cooling devices.

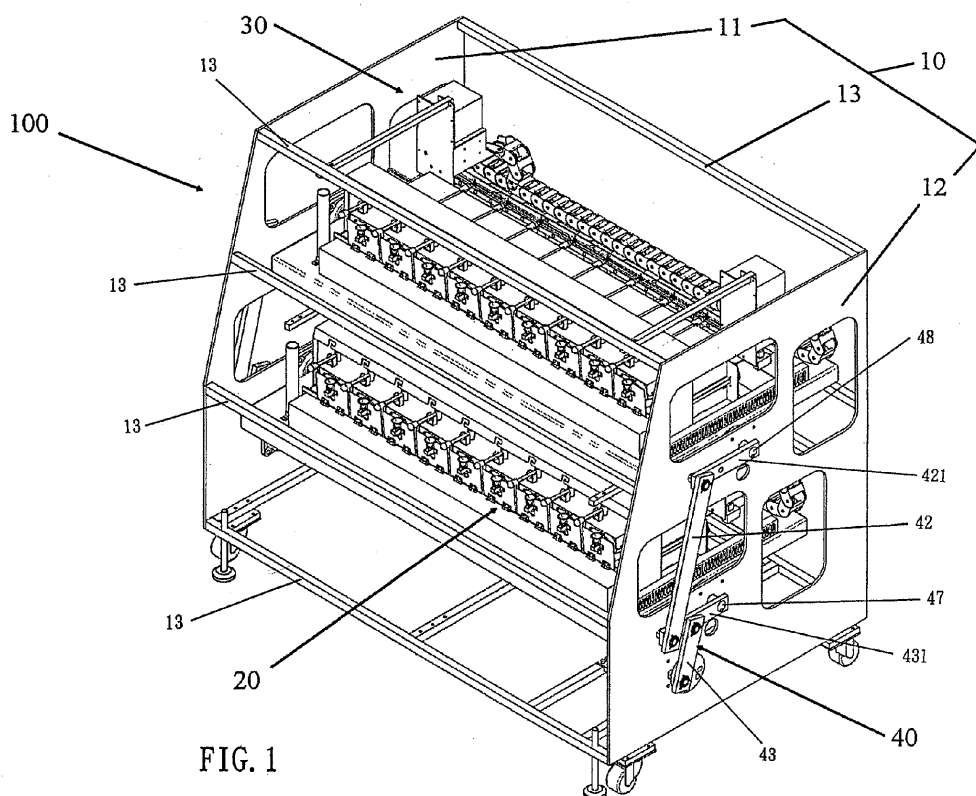


FIG. 1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention:

[0001] The present invention relates to dyeing technology and more particularly, to a multi-container dyeing machine, which enables the dyeing containers to be rotated and shaken and can separately control the dyeing temperature in every individual dyeing container and quantitative feeding of chemicals to every individual dyeing container.

2. Description of the Related Art:

[0002] Regular textile dyeing machines are generally of a multi-container design. These multi-container design textile dyeing machines are suitable for dyeing multiple pieces of fabric at a time. When performing a dyeing process, it must be laid out subject to the physical properties of the fabric and dyeing agent to perform temperature-rising, temperature-maintaining, temperature-lowering and agent-feeding steps properly, thereby achieving a uniform dyeing effect. However, regular dyeing machines commonly adopt a single temperature control, i.e., sensing one single spot in the machine base, and use only one single heater to heat the whole machine base. In consequence, the operating speed is low (refer to US Pat. No.6302168 B1).

[0003] Although conventional dyeing machines are of a multi-container design, they simply provide one reference temperature. These dyeing machines can simply dye fabrics in the multiple containers with one same dyeing agent, or dyeing agents having similar characteristics so that the temperature of the multiple containers can be simultaneously raised or lowered. Therefore, conventional dyeing machines are not practical for dyeing different fabrics with different dyeing agents in the multiple containers at a time.

[0004] Except the aforesaid temperature control problem, it is necessary to consider the adhesion of the dyeing agent to the fabric. Simply by controlling the dyeing temperature cannot cause the applied dyeing agent to be fully adhered to the fabric. It is necessary to rotate or bias the containers during the dyeing process, thereby enhancing the dyeing agent adhesion effect. However, conventional dyeing machines can simply turn the containers back and forth within 90-degrees or 45-degrees. When dyeing a soft fabric, this motion may wrinkle the fabric, resulting in uneven dyeing.

[0005] Further, during the dyeing process, it may need to feed an auxiliary agent to accelerate the chemical reaction of the applied dyeing agent. However, according to conventional dyeing machines, the feeding of an auxiliary agent is to be performed manually. Before feeding an auxiliary agent, the operator must interrupt the dyeing process (i.e., shut down the dyeing machine) and then

resume the dyeing process after feeding of the auxiliary agent. Manually feeding an auxiliary agent cannot accurately control the quality and requires much labor. If the auxiliary agent is not properly applied, the dyeing result may be not acceptable. In this case, the fabric may have to be abandoned, and the dyeing process may have to be performed again.

SUMMARY OF THE INVENTION

[0006] The present invention has been accomplished under the circumstances in view. It is one object of the present invention to provide a multi-container dyeing machine, which enables the temperature of each of multiple containers thereof to be individually and accurately controlled to perform a respective dyeing process.

[0007] It is another object of the present invention to provide a multi-container dyeing machine, which enables the temperature of each of multiple containers thereof to be individually and accurately controlled so that different fabrics or different dyeing agents can be respectively applied to the containers to perform different dyeing processes.

[0008] It is still another object of the present invention to provide a multi-container dyeing machine, which enables the containers of the heating and cooling modules thereof to be rotated on their own axis to make a first motion along a first motion path, and tilted forwards and backwards to make a second motion along a second motion path, enhancing mixing of the fabric with the applied dyeing agent in each container to obtain a better dyeing quality and to avoid wrinkles of the dyeing fabric.

[0009] It is still another object of the present invention to provide a multi-container dyeing machine, which can automatically feed an auxiliary agent, enhancing the dyeing performance.

[0010] To achieve these and other objects of the present invention, a multi-container dyeing machine comprises a machine frame base having opposing first sidewall and second sidewall, and at least one heating and cooling module mounted in the machine frame base. Each heating and cooling module comprises a mounting plate coupled between the opposing first sidewall and second sidewall of the machine frame base and a plurality of temperature-controlled heating and cooling devices mounted on the mounting plate. Each temperature-controlled heating and cooling device comprises a housing, a container, a heating unit, a temperature sensor, a transmission wheel and an electric fan. The heating unit, the temperature sensor and the electric fan are electrically connected together. The housing is mounted on the mounting plate. The container is set in the housing, comprising a chamber, a feeding port in communication between the chamber and the outside space and a recessed portion in communication between the chamber and the outside space. The heating unit is mounted in the bottom side inside the housing, and adapted for heating the container. The temperature sensor is inserted through the

recessed portion into the chamber, and adapted for sensing the temperature in the chamber. The transmission wheel is connected with the container and coupled to an external drive means through a belt for rotating the container upon operation of the external drive means. The electric fan is mounted on the mounting plate and controllable to cool down the container.

[0011] The multi-container dyeing machine further comprises at least one automatic quantitative feeder respectively and movably mounted on the mounting plate of the at least one heating and cooling module for selectively feeding an auxiliary agent to the containers of the temperature-controlled heating and cooling device. Each automatic quantitative feeder comprises a pumping device, a link belt and a dispensing nozzle. The pumping device is mounted on the mounting plate of one heating and cooling module and adapted for pumping an auxiliary agent to the dispensing nozzle for output. The link belt is mounted on the mounting plate of the respective heating and cooling module for moving the pumping device into alignment with one temperature-controlled heating and cooling device of the respective heating and cooling module selectively for enabling the pumping device to pump the auxiliary agent through the feeding port into the container of the selected temperature-controlled heating and cooling device by means of the dispensing nozzle.

[0012] The multi-container dyeing machine further comprises a swinging mechanism mounted on the machine frame base and coupled with the mounting plate of each heating and cooling module and controllable to tilt the respective heating and cooling modules.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is an elevational view of a multi-container dyeing machine in accordance with a first embodiment of the present invention.

FIG. 2 is an exploded view of the multi-container dyeing machine in accordance with the first embodiment of the present invention.

FIG. 3 is an enlarged view in section of a part of one heating and cooling module of the multi-container dyeing machine shown in FIG. 1.

FIG. 4 is an enlarged view in section of the automatic quantitative feeder of the multi-container dyeing machine shown in FIG. 1.

FIG. 5 is a side view, in an enlarged scale, of the multi-container dyeing machine shown in FIG. 1.

FIGS. 6~8 are schematic drawings, illustrating the operation of the swinging mechanism of the multi-container dyeing machine in accordance with the first embodiment of the present invention.

FIGS. 9A, 9B, 10A, 10B, 11A and 11B are schematic drawings, illustrating the operation of a swinging mechanism of a multi-container dyeing machine in

accordance with a second embodiment of the present invention.

FIG. 12 is a perspective view of a part of the swinging mechanism of the multi-container dyeing machine in accordance with the second embodiment of the present invention.

FIG. 13 is a schematic side view of FIG. 12.

FIG. 14 is an elevational view of a part of the multi-container dyeing machine in accordance with the second embodiment of the present invention, illustrating the heating and cooling modules mounted in the swinging mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Referring to FIGS. 1~8, a multi-container dyeing machine **100** in accordance with the present invention is shown comprising a machine frame base **10**, and at least one heating and cooling module **20**.

[0015] As shown in FIGS. 1 and 2, the machine frame base **10** can be firmly positioned on the floor (or a flat surface), comprising opposing first upright sidewall **11** and second upright sidewall **12** and a plurality of connection bars **13** connected between the first upright sidewall **11** and the second upright sidewall **12**. The first upright sidewall **11** and the second upright sidewall **12** each have a plurality of through holes **14** arranged in a symmetric manner.

[0016] Referring to FIGS. 1~3 again, two heating and cooling modules **20** are provided in machine frame base **10** according to the present preferred embodiment. These two heating and cooling modules **20** are identical and respectively pivotally connected between the first upright sidewall **11** and the second upright sidewall **12**. Each heating and cooling module **20** comprises a mounting plate **21** and a plurality of temperature-controlled heating and cooling devices **22**. The mounting plate **21** has its two opposite ends respectively pivotally coupled to one respective through hole **14** on the first upright sidewall **11** and the second upright sidewall **12**. The temperature-controlled heating and cooling devices **22** are arranged on the mounting plate **21** in a row. Each temperature-controlled heating and cooling device **22** comprises a housing **221**, a container **222**, a heating unit **223**, a temperature sensor **224**, a transmission wheel **229** and an electric fan **225**. The heating unit **223**, the temperature sensor **224** and the electric fan **225** are electrically connected together. The housing **221** is mounted on the mounting plate **21**, having a cover **2211** on its one side. The container **222** is set in the housing **221** after opening of the cover **2211** from the housing **221**. The container **222** has its two opposite ends pivotally coupled to the inside wall of the housing **221**, and rotatable by a motor (not shown) directly or by means of a transmission gear set or like means.

[0017] The container **222** comprises a chamber **226**, a feeding port **227** disposed at one side of the chamber

226 and connecting the chamber **226** to the outside space and a recessed portion **228** disposed at an opposite side of the chamber **226** and connecting the chamber **226** to the outside. The recessed portion **228** curves inwards toward the inside of the container **222**, keeping the respective side of the container **222** in an enclosed status. The heating unit **223** is mounted in the housing **221** at a bottom side, and adapted for heating the container **222**. The heating unit **223** can be selected from the group of heating lamp tubes, heating lamp bulbs and infrared heating elements. According to this embodiment, the heating unit **223** is a heating lamp tube. The temperature sensor **224** is inserted through one side of the housing **221** and the recessed portion **228** of the container **222** into the chamber **226** for sensing the temperature in the chamber **226** without interfering with rotation of the container **222**. Further, the temperature sensor **224** is electrically connected with the heating unit **223** and the electric fan **225** to an external computer (not shown). The transmission wheel **229** is coupled with the container **222** and rotatable by an external drive means, for example, motor (not shown) through a transmission belt (not shown) to rotate the container **222** on its own axis in the housing **221**. The electric fan **225** is mounted on the mounting plate **21** and controllable to induce currents of air toward the container **222**, thereby lowering the temperature of the container **222**.

[0018] The aforesaid container **222** is provided with a hollow wheel cover **2221**. The hollow wheel cover **2221** is joined to one end of the container **222**. The aforesaid feeding port **227** has its one end inserted through the center of the wheel cover **2221** so that the container **222** can be rotated with the hollow wheel cover **2221** without hindering the feeding port **227**. The aforesaid transmission wheel **229** comprises a shaft **2291** and a wheel **2292**. The shaft **2291** is fixedly connected to the center of one side of the wheel **2292**. By means of setting the wheel **2292** in the housing **221** in mesh with the wheel cover **2221** and connecting the shaft **2291** to the wheel **2292**, starting the external drive means to rotate the transmission wheel **229**, the shaft **2291** and the wheel **2292** are driven to rotate the hollow wheel cover **2221** and the container **222** synchronously, thereby mixing the loaded dyeing agent and fabric and performing the dyeing process.

[0019] As stated above, every container **222** is provided with one respective temperature sensor **224**. Therefore, every container **222** can perform a dyeing process independently, i.e., the temperature sensor **224** in each individual container **222** independently senses the internal temperature of the associating container **222** for enabling the external computer to read in the sensing temperature data from temperature sensor **224** and to set or control the operation of every temperature-controlled heating and cooling device **22** of each heating and cooling module **20**. Thus, the external computer can provide a respective command to the heating unit **223** or electric fan **225** of each temperature-controlled heating and cool-

ing device **22** to heat or cool the associating container **222**, enabling the temperature of every container **222** of every temperature-controlled heating and cooling device **22** of each heating and cooling module **20** to be individually controlled to perform a respective different fabric dyeing process or to dye a respective piece of fabric with a respective different dyeing agent. Further, a handle **2212** is coupled to the housing **221** of each temperature-controlled heating and cooling device **22** and operable to open the associating cover **2211** so that the associating container **222** can be put into or taken out of the housing **221**.

[0020] Further, because the temperature of every container **222** can be respectively raised, maintained or lowered, the temperature of every container **222** can be accurately controlled, maintaining the dyeing quality.

[0021] According to this embodiment, the container **222** is horizontally rotatable, and therefore the container **222** and the internal fabric are kept in horizontal for dyeing uniformly, avoiding wrinkles.

[0022] Further, as shown in FIGS. 1, 2 and 4, the multi-container dyeing machine **100** further comprises at least one automatic quantitative feeder **30**. The automatic quantitative feeder **30** comprises a pumping device **31**, a link belt **32** and a dispensing nozzle **33**. The pumping device **31** is mounted on the mounting plate **21** of one heating and cooling module **20** and adapted for pumping an auxiliary agent to the dispensing nozzle **33** for output. The link belt **32** is mounted on the mounting plate **21** of the respective heating and cooling module **20** for moving the pumping device **31** into alignment with one of the temperature-controlled heating and cooling devices **22** of the respective heating and cooling module **20** so that the pumping device **31** can be controlled to pump the auxiliary agent (that can be water) through the feeding port **227** of the container **222** of the selected temperature-controlled heating and cooling device **22** into the chamber **226** of the container **222** via the dispensing nozzle **33**.

[0023] Thus, the auxiliary agent or water can be automatically fed to the container **222** of every temperature-controlled heating and cooling device **22** automatically without shutting down the machine, enhancing the productivity.

[0024] Referring to FIGS. 1 and 2 and FIGS. 5-8 again, the multi-container dyeing machine **100** further comprises a swinging mechanism **40**. The swinging mechanism **40** is mounted on the machine frame base **10** and connected with the mounting plate **21** of each heating and cooling module **20**. The mounting plate **21** of each heating and cooling module **20** further comprises a locating groove **211** located on the bottom side thereof. According to this embodiment, the swinging mechanism **40** comprises a set of eccentric wheels **41**, a set of second links **43**, a set of third links **431**, a transmission shaft **44**, a gear wheel **45**, a motor **46** and a lower locating rod **47**. Each second link **43** has its one end hinged to one respective eccentric wheel **41**, and its opposite end hinged one respective third link **431**. Each third link **431** has its

one end connected to the lower locating rod **47**. The lower locating rod **47** is inserted through one through hole **14** of the machine frame base **10** and coupled to the locating groove **211** of the mounting plate **21** of one heating and cooling module **20**. The transmission shaft **44** is connected with the eccentric wheels **41**. The gear wheel **45** is mounted on the transmission shaft **44**, and rotatable by the motor **45**. Therefore, rotating the gear wheel **45** by the motor **45** will cause rotation of the eccentric wheels **41** with the transmission shaft **44**. During rotation of the eccentric wheels **41**, the second links **43** are forced to move the third links **431** and the lower locating rod **47** in carrying the heating and cooling modules **20** to a forwardly tilted position (see FIG. 6), horizontal position (see FIG. 7) or backwardly tilted position (see FIG. 8). Thus, the containers **222** of the heating and cooling modules **20** can be rotated on their own axis by the respective external motor and belt to make a first motion along a first motion path, and tilted forwards and backwards to make a second motion along a second motion path, enhancing mixing of the fabric with the dyeing agent in each container **222** to obtain a better dyeing quality.

[0025] The aforesaid swinging mechanism **40** further comprises a set of first links **42**, a set of fourth links **421** and an upper locating rod **48**. Each first link **42** has its one end hinged to one respective third link **431** and its other end hinged to one respective fourth link **421**. Thus, the first links **42** are coupled with the second links **43** and the eccentric wheels **41**. The fourth links **421** are coupled with the upper locating rod **48**. The upper locating rod **48** is inserted through one through hole **14** of the machine frame base **10** and coupled to the locating groove **211** of the mounting plate **21** of the other heating and cooling module **20**. Therefore, the swinging mechanism **40** is coupled with the mounting plates **21** of the two heating and cooling modules **20**, and movable to tilt the mounting plates **21** forwards and backwards. The invention uses the swinging mechanism **40** to couple the hinged multiple first links **42** and second links **43** with other locating rods and the multiple mounting plates **21** so that the single motor **46** and eccentric wheel **41** can be operated to move the mounting plates **21** the containers **222** of the respective temperature-controlled heating and cooling devices **22**.

[0026] FIGS. 9~14 illustrate a second embodiment of the present invention. According to this embodiment, an alternate form of swinging mechanism **50** is used to substitute for the aforesaid swinging mechanism **40**. According to this embodiment, the swinging mechanism **50** comprises a motor **51**, a transmission member **52**, an eccentric member **53**, a set of swinging plates **54**, at least one rod member **55** and a rack **56**. The rod member **55** is transversely connected with its two distal ends to the top-most edge of each of the two opposite upright lateral sides of the rack **56**. The swinging plates **54** have the respectively top ends thereof respectively pivotally connected to the two distal ends of the rod member **55** with a respective pivot **541** so that the swinging plates **54** can

be swung in the rack **56**. By means of starting up the motor **51** to rotate the transmission member **52**, the eccentric member **53** is forced to swing the swinging plates **54**. The swinging plates **54** are joined with the mounting plates **21** of the two heating and cooling modules **20**. Actually, the mounting plates **21** of the two heating and cooling modules **20** are made in integrity. Therefore, the integrated mounting plate **21** of heating and cooling modules **20** and the respective temperature-controlled heating and cooling devices **22** can be tilted forwards/backwards with the swinging plates **54** to a forwardly tilted position (see FIGS. 9A and 9B), horizontal position (see FIGS. 10A and 10B) or backwardly tilted position (see FIGS. 11A and 11B).

[0027] Thus, the containers **222** of the heating and cooling modules **20** can be rotated on their own axis by the respective external motor and belt to make a first motion along a first motion path, and tilted forwards and backwards to make a second motion along a second motion path, enhancing mixing of the fabric with the dyeing agent in each container **222** to obtain a better dyeing quality. By means of mounting the swinging mechanism **50** inside the machine frame base **10** and coupling the swinging mechanism **50** with the heating and cooling modules **20** and the automatic quantitative feeders **30** symmetrically, this second embodiment is assembled. This second embodiment achieves the same effects as the aforesaid first embodiment.

[0028] Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

Claims

1. A multi-container dyeing machine, comprising:

a machine frame base having opposing first sidewall and second sidewall; and
at least one heating and cooling module mounted in said machine frame base, each said heating and cooling module comprising a mounting plate coupled between the opposing first sidewall and second sidewall of said machine frame base and a plurality of temperature-controlled heating and cooling devices mounted on said mounting plate, each said temperature-controlled heating and cooling device comprising a housing, a container, a heating unit, a temperature sensor, a transmission wheel and an electric fan, said heating unit, said temperature sensor and said electric fan being electrically connected together, said housing being mounted on said mounting plate, said container being set in said housing, said container comprising a

- chamber, a feeding port in communication between said chamber and the space outside said container and a recessed portion in communication between said chamber and the space outside said container, said heating unit being mounted in a bottom side inside said housing and adapted for heating said container, said temperature sensor being inserted through said recessed portion into said chamber and adapted for sensing the temperature in said chamber, said transmission wheel being connected with said container and coupled to an external drive means through a belt for rotating said container upon operation of said external drive means, said electric fan being mounted on said mounting plate and controllable to cool down said container.
2. The multi-container dyeing machine as claimed in claim 1, wherein said container is provided with a hollow wheel cover, said hollow wheel cover being joined to one end of said container; said feeding port has one end thereof inserted through the center of said wheel cover so that said container is rotatable with said hollow wheel cover relative to said feeding port; said transmission wheel comprises a shaft and a wheel said shaft being fixedly connected to the center of one side of said wheel, said wheel being disposed inside said housing in mesh with said wheel cover such that said shaft and said wheel are driven to rotate said hollow wheel cover and said container synchronously when said external drive means is started up to rotate said transmission wheel.
 3. The multi-container dyeing machine as claimed in claim 1, wherein said housing has one side thereof covered with an openable cover.
 4. The multi-container dyeing machine as claimed in claim 1, wherein said housing is provided with a handle operable to open said openable cover.
 5. The multi-container dyeing machine as claimed in claim 1, further comprising at least one automatic quantitative feeder respectively and movably mounted on the mounting plate of said at least one heating and cooling module for selectively feeding an auxiliary agent to the containers of said temperature-controlled heating and cooling devices.
 6. The multi-container dyeing machine as claimed in claim 5, wherein said automatic quantitative feeder comprises a pumping device, a link belt and a dispensing nozzle, said pumping device being mounted on the mounting plate of one said heating and cooling module and adapted for pumping an auxiliary agent to said dispensing nozzle for output, said link belt being mounted on the mounting plate of the respective heating and cooling module for moving said pumping device into alignment with one said temperature-controlled heating and cooling device of the respective heating and cooling module selectively for enabling said pumping device to pump the auxiliary agent through the feeding port into the container of the selected temperature-controlled heating and cooling device via said dispensing nozzle.
 7. The multi-container dyeing machine as claimed in claim 1, further comprising a swinging mechanism mounted on said machine frame base and coupled with the mounting plate of each said heating and cooling module and controllable to tilt the respective heating and cooling modules.
 8. The multi-container dyeing machine as claimed in claim 7, wherein said machine frame base comprises a plurality of through holes symmetrically located on said first sidewall and said second sidewall; the mounting plate of each said heating and cooling module comprises a locating groove located on a bottom side thereof; said swinging mechanism comprises a set of eccentric wheels, a set of second links, a set of third links, a transmission shaft, a gear wheel, a motor and a lower locating rod, each said second link having one end thereof hinged to one said eccentric wheel and an opposite end thereof hinged one said third link, each said third link having one end thereof connected to said lower locating rod, said lower locating rod being inserted through one respective through hole on each of the opposite first sidewall and second sidewall of said machine frame base and coupled to the locating groove of the mounting plate of one said heating and cooling module, said transmission shaft being connected with said eccentric wheels, said gear wheel being mounted on said transmission shaft and rotatable by the motor said swinging mechanism such that rotating said gear wheel by the motor of said swinging mechanism causes rotation of said eccentric wheels with said transmission shaft for causing said second links to move said third links and said lower locating rod in carrying said heating and cooling modules to one of a forwardly tilted position, a horizontal position and a backwardly tilted position.
 9. The multi-container dyeing machine as claimed in claim 8, further comprising at least one automatic quantitative feeder respectively and movably mounted on the mounting plate of said at least one heating and cooling module for selectively feeding an auxiliary agent to the chamber of the container of one said temperature-controlled heating and cooling device.
 10. The multi-container dyeing machine as claimed in claim 7, wherein said swinging mechanism compris-

es a motor, a transmission member, an eccentric member, a set of swinging plates, at least one rod member and a rack, said rod member being transversely connected between the topmost edge of each of two opposite upright lateral sides of said rack, said swinging plates being respectively pivotally connected to two distal ends of said rod member, said transmission member being rotatable by the motor of said swinging mechanism to rotate said eccentric member, said eccentric member being adapted for causing said swinging plates to swing upon rotation of said transmission member, said swinging plates being joined with the mounting plate of each said heating and cooling modules for moving said temperature-controlled heating and cooling devices to one of a forwardly tilted position, a horizontal position and a backwardly tilted position.

11. The multi-container dyeing machine as claimed in claim 10, further comprising a plurality of automatic quantitative feeders for selectively feeding an auxiliary agent to the containers of said temperature-controlled heating and cooling devices, wherein said swinging mechanism is mounted inside said machine frame base and coupled with said heating and cooling modules and said automatic quantitative feeders symmetrically.

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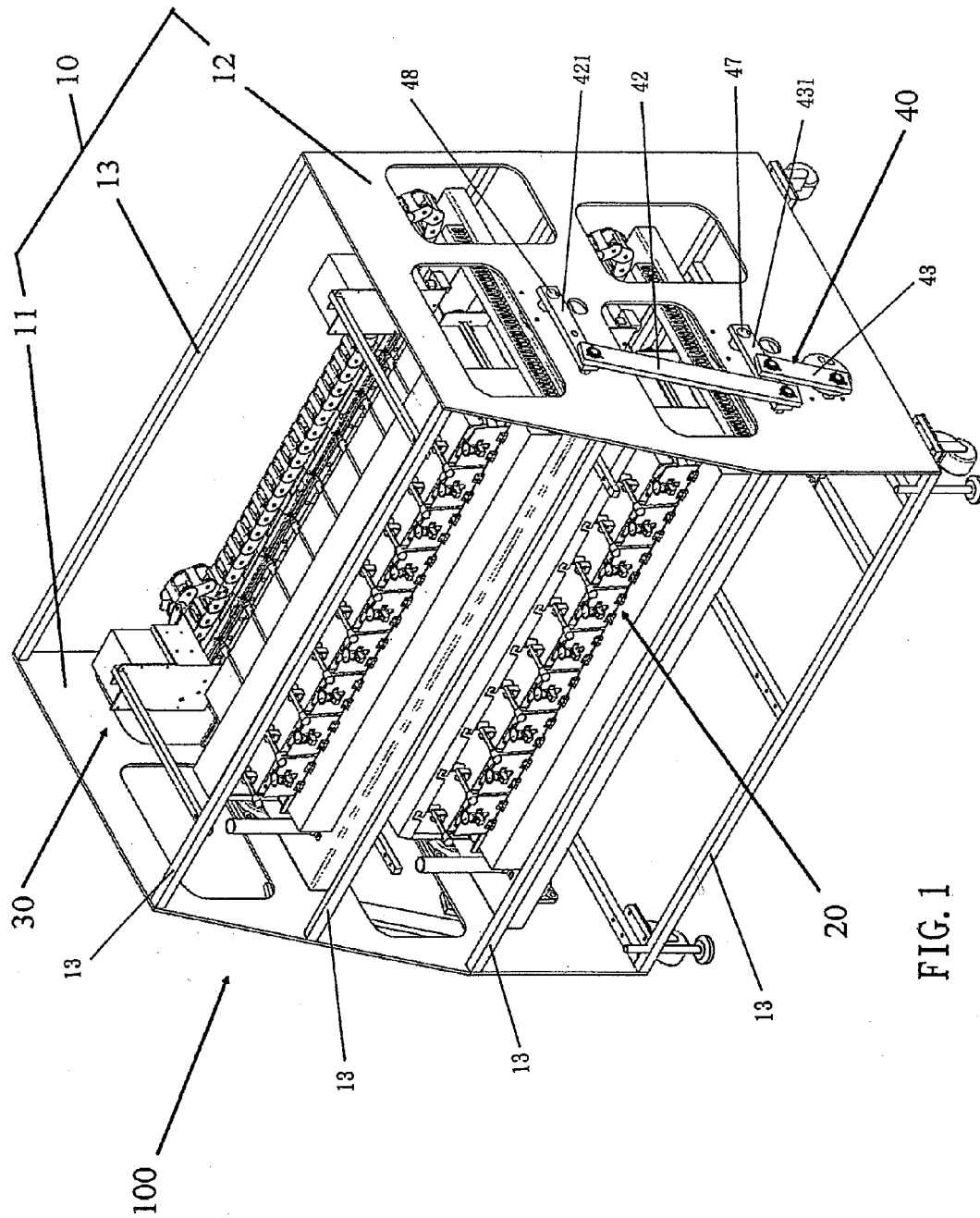


FIG. 1

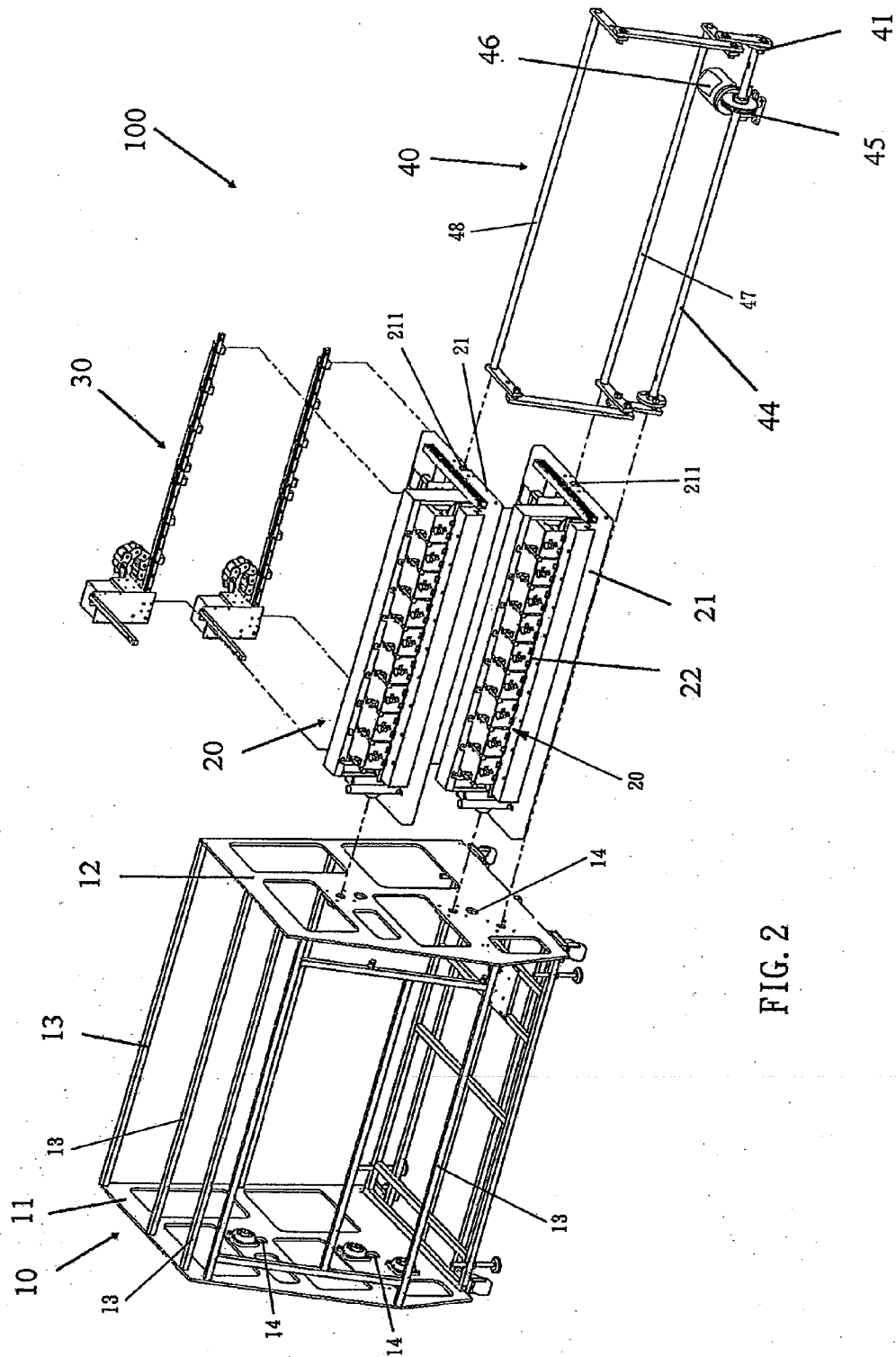


FIG. 2

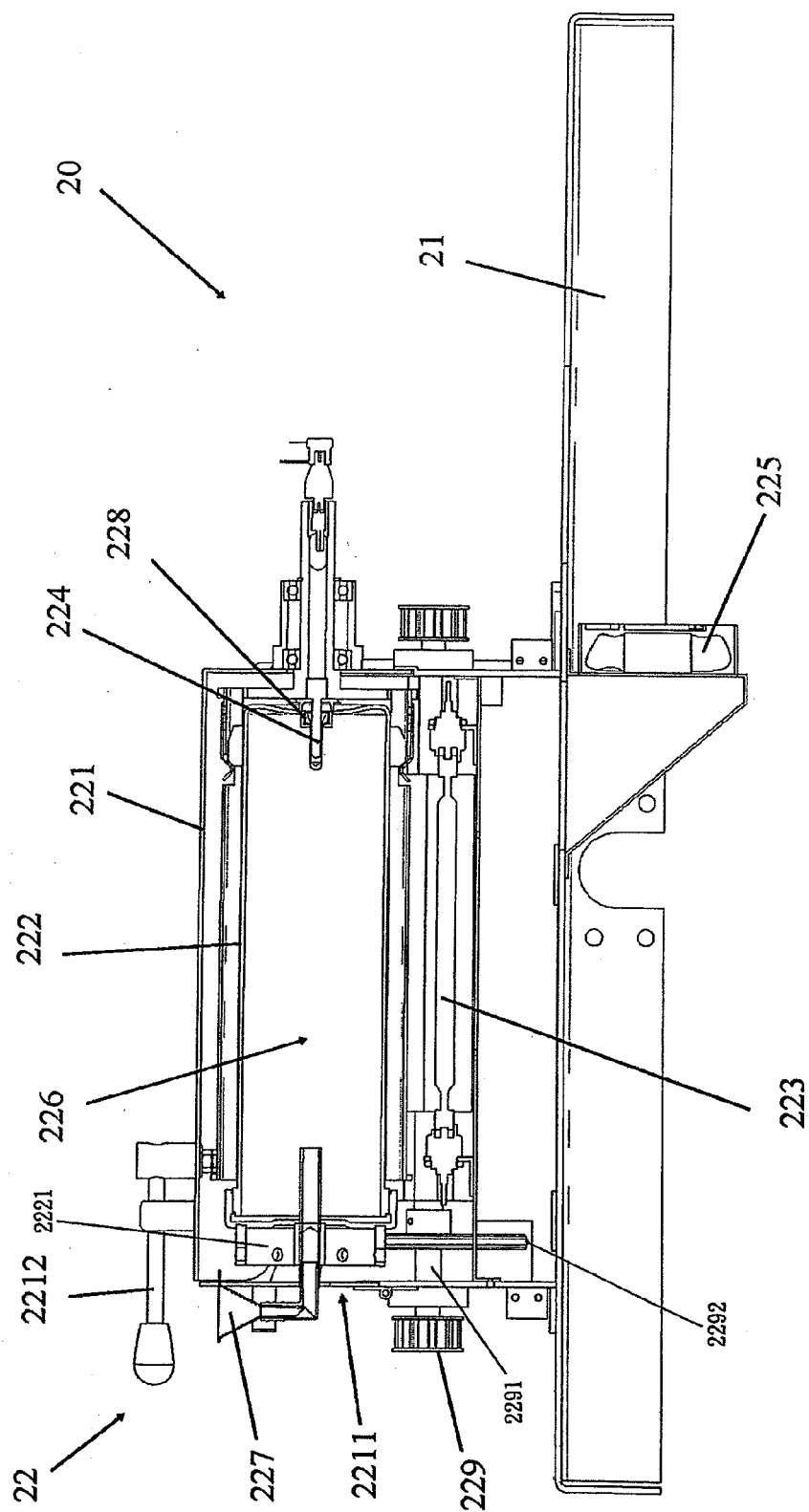


FIG. 3

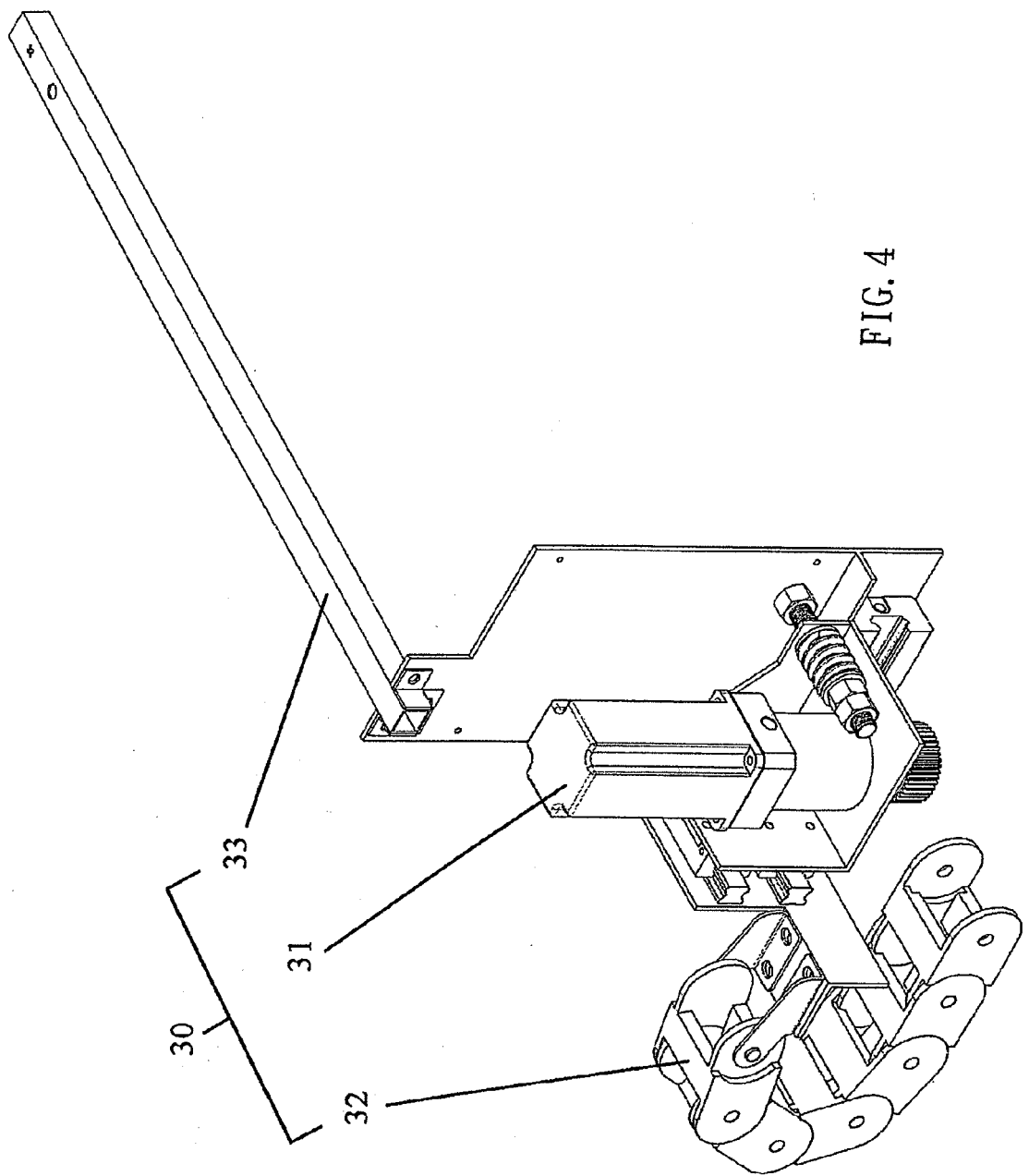


FIG. 4

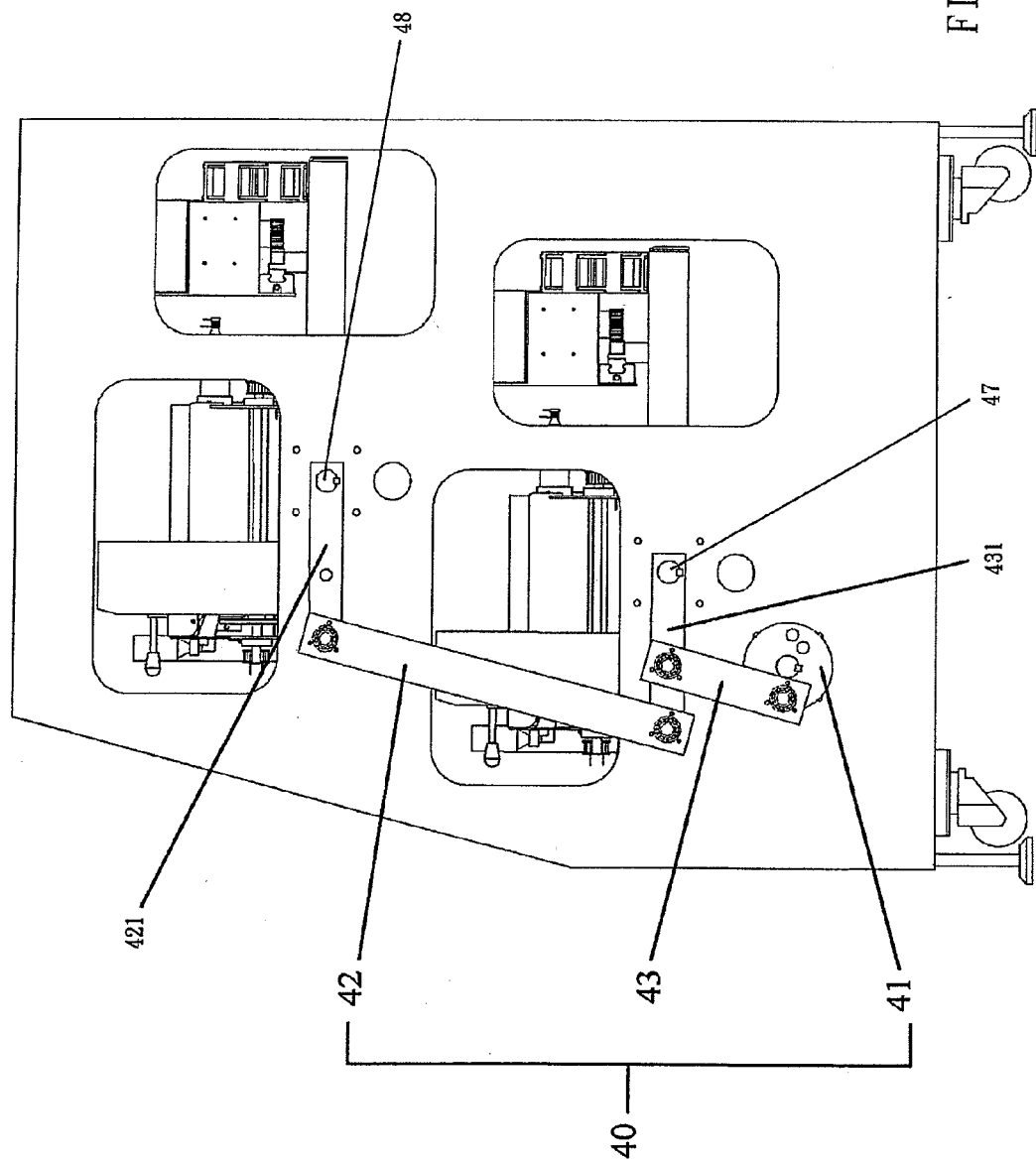


FIG. 5

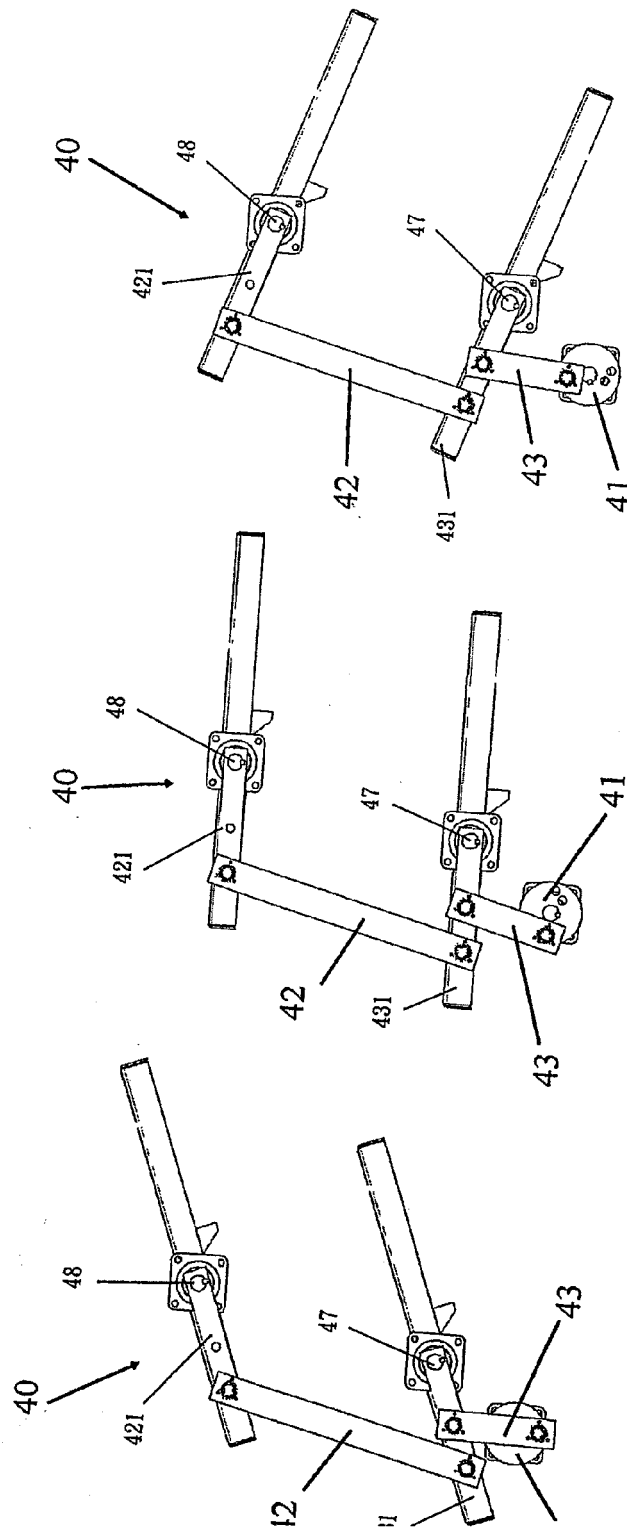


FIG. 6

FIG. 7

FIG. 8

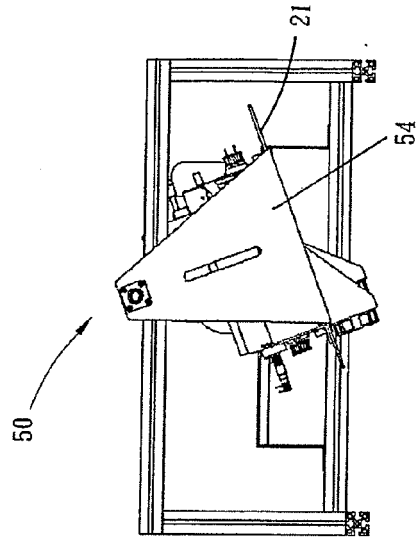


FIG. 11A

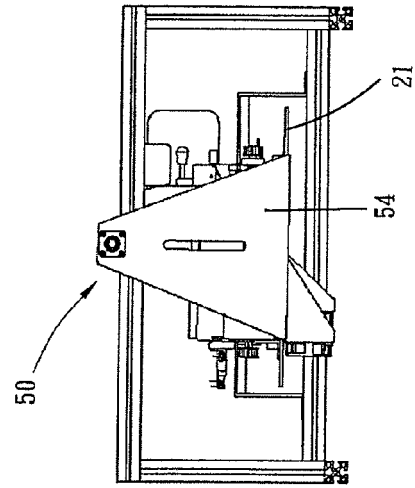


FIG. 10A

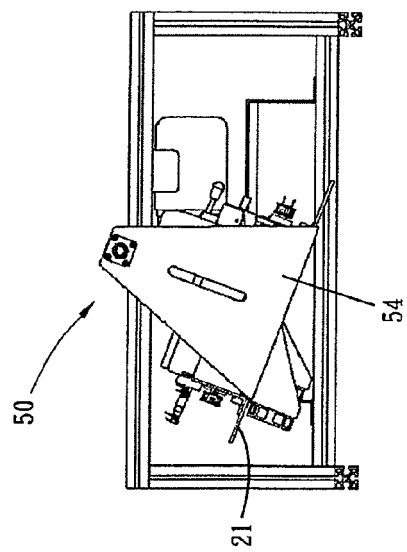


FIG. 9A

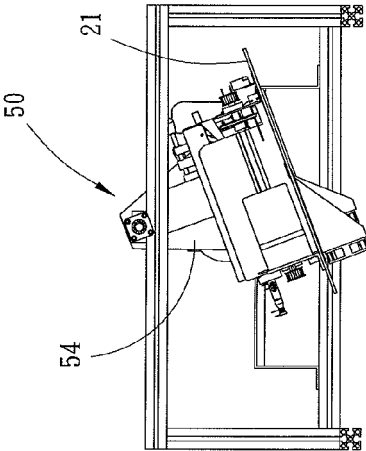


FIG. 9B

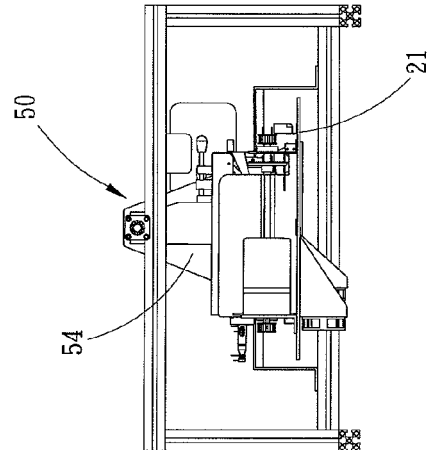


FIG. 10B

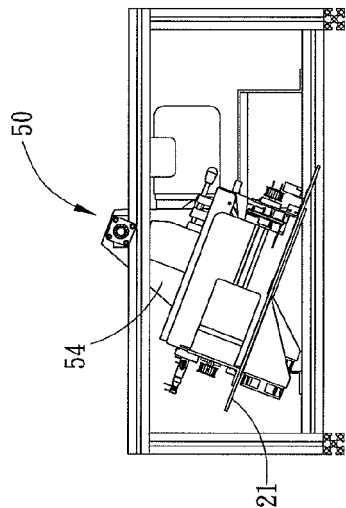


FIG. 11B

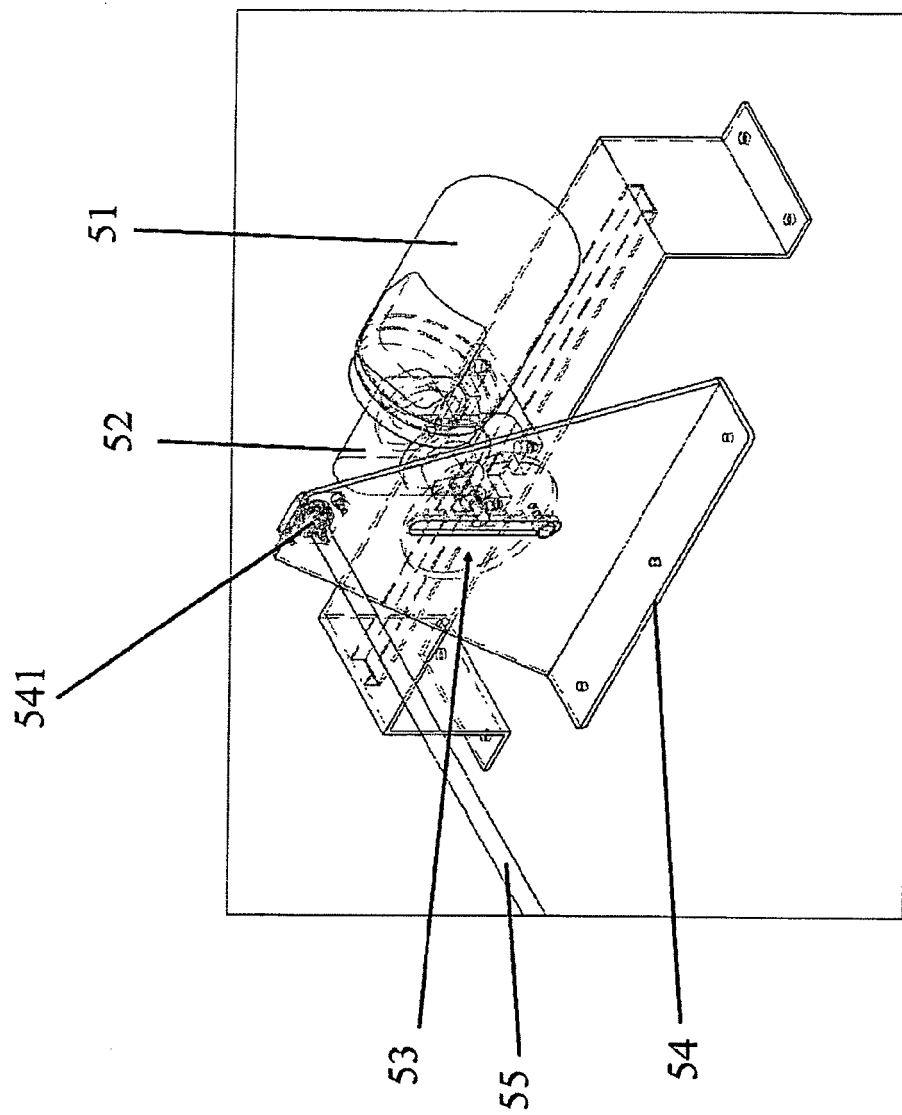


FIG. 12

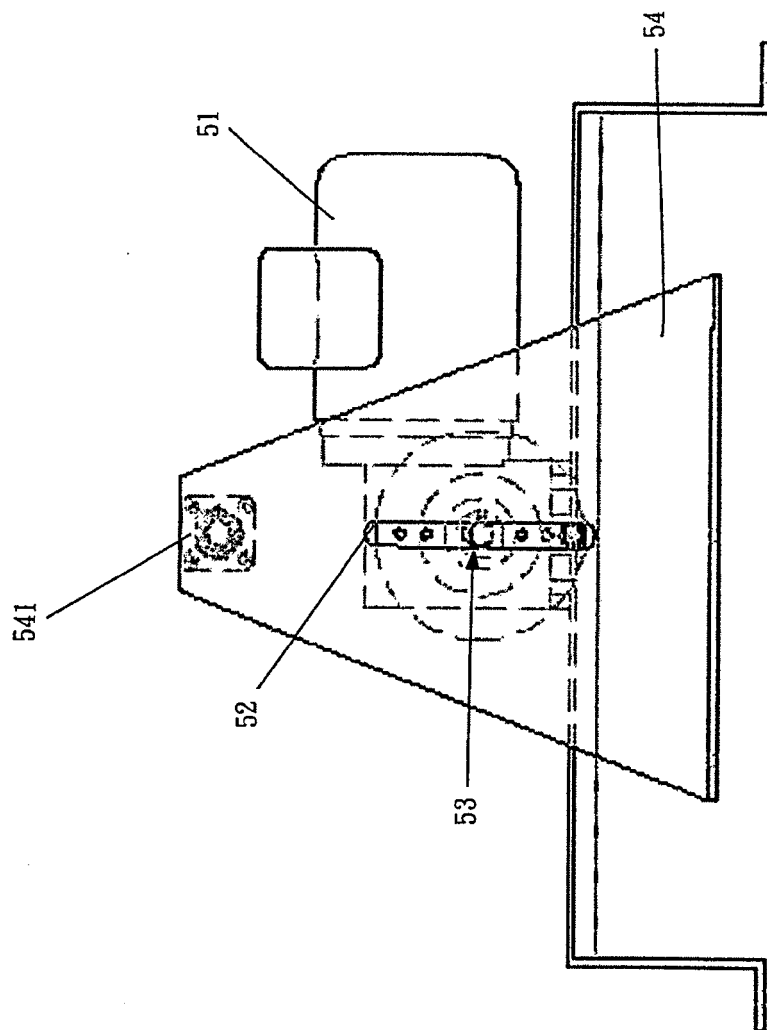


FIG. 13

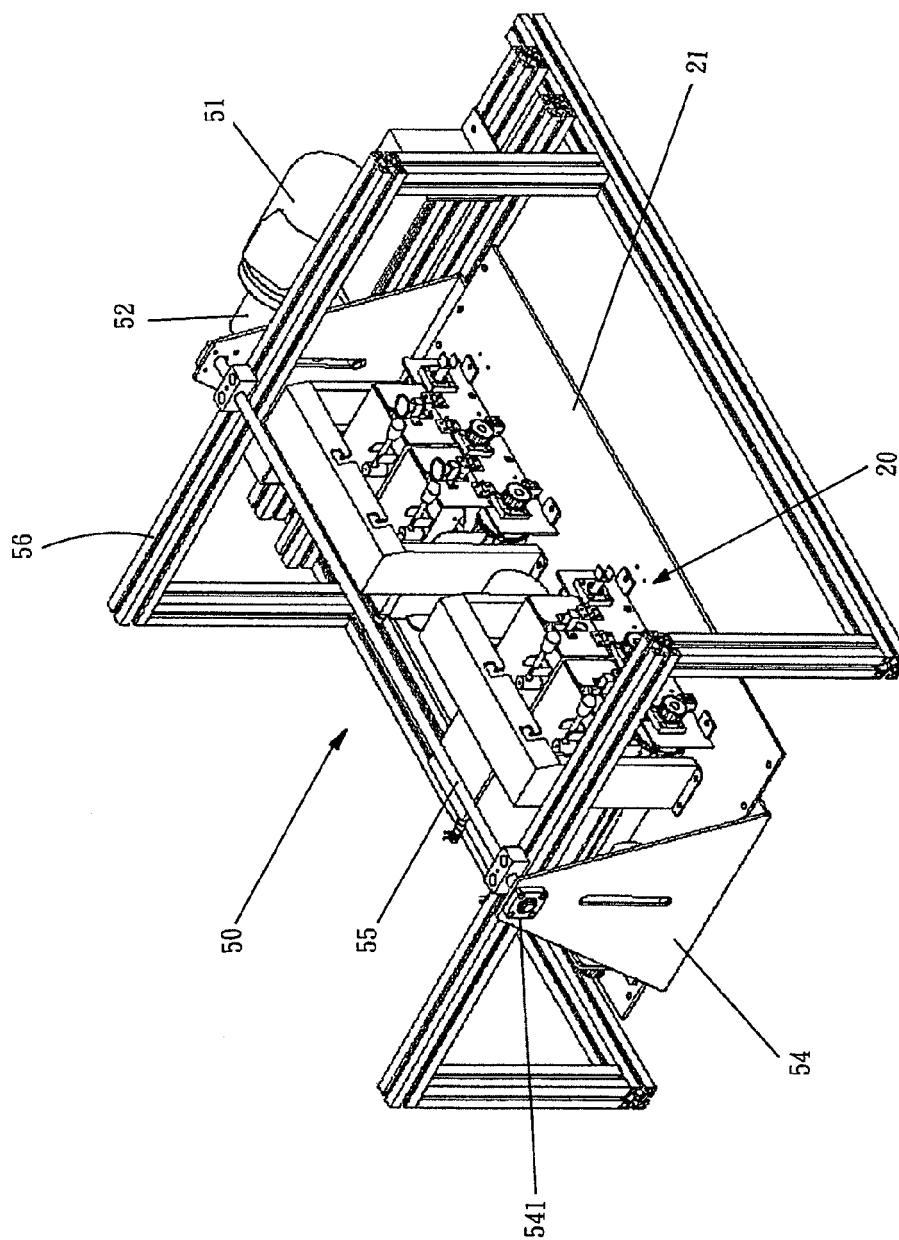


FIG. 14



EUROPEAN SEARCH REPORT

Application Number
EP 11 15 6413

DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 May 2011	Examiner Bichi, Marco
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 L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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