



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.01.2012 Bulletin 2012/01

(51) Int Cl.:
D06F 71/10 (2006.01)

(21) Application number: **11172013.2**

(22) Date of filing: **29.06.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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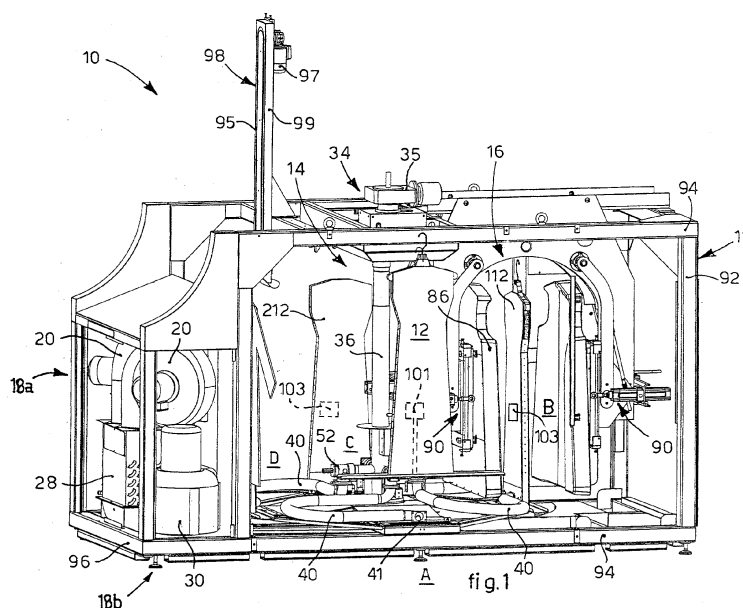
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(30) Priority: **30.06.2010 IT MI20101203**

(54) **Machine for the industrial ironing and drying of clothing, and relative ironing and drying method**

(57) A machine (10) for the industrial ironing and drying of clothing, in particular, but not only, overalls, jackets and the like, comprises at least three operating stations (A,B,C,D), of which at least a loading station (A), at least a hot pressing station (B) and at least a discharge station (D) disposed in succession along a closed path, each of said operating stations (A, B, C, D) being provided with a relative mannequin (12,112,212,312) on which a damp garment to be ironed and dried is positioned, a rotation unit (14) able to determine a rotation movement of said mannequins (12,112,212,312) from one to the other of said operating stations (A,B,C,D) according to a prede-

termined and univocal work direction along said closed path, at least generation means (20, 28) to generate a stream of superheated air, the machine further comprises a first circuit (15) to blow superheated air inside the mannequins (12,112,212,312), which is formed by a first part (26,44) connected to said generation means (20,28) and by a second part (42) connected to said mannequins (12,112,212,312), which second part (42) is movable solidly with said mannequins (12,112,212,312) from one to the other of said operating stations (A,B,C,D) and is able to be put in fluid communication with the inside of a determinate zone of the mannequins (12,112,212,312) in order to blow in the superheated air.



Description

FIELD OF THE INVENTION

[0001] The present invention concerns a machine for the industrial ironing and drying of clothing, in particular but not only overalls and jackets for use in hospitals, laboratories or other, and the relative ironing and drying method.

BACKGROUND OF THE INVENTION

[0002] It is known to wash with water, to partly dry and to iron articles of clothing for work, both long garments such as overalls and also short garments such as shirts, jackets and the like, for example for use in hospitals, laboratories or other, typically made of cotton, cotton mix or synthetics, in specialized industrial plants in which all the above operations are carried out, and which supplies the final product - the washed, dried and packaged garment - in the quantities and modes desired as per the orders of the Client, for example a hospital.

[0003] Normally, once washed, the garments are left with a residual humidity of about 20%-40%, which reduces the cost of drying and facilitates the subsequent ironing step.

[0004] Different machines are known for the industrial ironing and drying of garments of this type, which provide an ironing unit formed by two heated pressure plates located opposite each other and which act on two opposite sides of the garments to be ironed.

[0005] Known machines are provided with mannequins on which the garments to be pressed in the ironing unit are positioned. The mannequins generally work with suction, so as to facilitate the disposition of the garments to be ironed on the mannequin, and use heating on the inside, by means of steam or electricity, to prevent condensation and dripping due to residual humidity. Along the sides, known mannequins have selectively inflatable members to adapt to the sizes and conformation of the garments that are ironed on each occasion, so as to take the garment into contact with the plates, whereas at the center they have a rigid box-like central part. One problem with using these inflatable members is that they are suitable to adapt to long garments but when they are used with short garments they run the risk of tearing the garment along the seams. Generally, this risk is reduced by providing holding or containing elements which in any case complicate the mannequin.

[0006] Furthermore, known mannequins can be selectively lifted so as to facilitate the correct positioning of long garments, such as overalls.

[0007] Generally, the pressing plates allow to iron the central part of the garments, and also to dry them, but do not iron the sleeves and collar, which are generally ironed by other machines in another working step.

[0008] A first known machine comprises two mannequins to support the garments, of which a first mannequin

operates initially in a loading/discharge station and a second mannequin operates initially in an ironing station provided with an ironing unit, disposed at the side of the loading/discharge station, which provides to iron the garment and dry it thanks to the heating action of the ironing unit itself. The first known machine provides movement means to move the two mannequins respectively from the loading/discharge station to the ironing station and vice versa. One disadvantage of this first machine is its reduced productivity, which is limited by the time needed for ironing and drying performed in the ironing station, and also the previous or subsequent steps of ironing the sleeves and collars performed on different machines.

[0009] A second known ironing machine is formed by a turntable or carousel, with three mannequins, which irons and dries the garments, including the sleeves but not the collar, and automatically discharges the ironed and dried garment.

[0010] In particular, in the second known machine the mannequins are associated respectively with a loading station, an ironing and mannequin holding station where a blast of superheated air is statically produced in order to finish the sleeves, and with an automatic discharge station, where only the operation of removing the ironed and dried garment is performed. Movement means are provided to rotate the mannequins between the various stations.

[0011] In this second known machine, instead of ironing the sleeves with different machines, it is possible to treat the sleeves of the garments to be ironed with a blast of superheated air from inside the mannequin and which flows forcefully through the sleeves, enough to provide a partial effect of smoothing and finishing, so that once the sleeves have been refolded over the central body of the garment and the whole thing has been folded, the sleeves are acceptable for the client and, in this way, at least for the sleeves, the further stage of subsequent ironing is avoided and a further contribution is given to the drying of the garment.

[0012] The second known machine, by ironing the sleeves and discharging the garment automatically, reduces operating times but it cannot give satisfactory and competitive results in terms of productivity because the second station, where the pressing is done and where the superheated air is blown statically, conditions the overall cycle times, with 40-45 seconds dedicated only to the operations performed in it. In fact, normally, a complete drying requires the garment to remain in the hot pressing station for about 40-45 seconds.

[0013] Another known ironing machine is described in US-A-3,174,662 and comprises a turntable to move four mannequins between corresponding operating stations along a circular path.

[0014] Purpose of the present invention is to achieve a machine for the industrial ironing and drying of garments and a relative ironing and drying method which has an improved productivity compared with known ironing machines.

[0015] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0016] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0017] In accordance with the above purpose, a machine for the industrial ironing and drying of garments, in particular but not only overalls and jackets, for example for use in hospitals and laboratories or other, comprises at least three operating stations, of which at least a loading station, at least a hot pressing station and at least an discharge station disposed in succession along a closed path.

[0018] Each of the operating stations is provided with a relative mannequin on which a damp garment to be ironed and dried is positioned.

[0019] The machine according to the present invention comprises a rotation unit able to determine a movement of rotation of said mannequins from one of said operating stations to the other, in a predetermined and univocal working direction along the closed path, in particular from the loading station to the pressing station to the discharge station, and then to return to the loading station.

[0020] The machine according to the present invention comprises at least means to generate a stream of superheated air.

[0021] The machine according to the present invention also comprises a first circuit for blowing superheated air inside the mannequins, which is formed by a first part connected to the means to generate a stream of superheated air, and by a second part, connected to said mannequins, which is mobile solid with the mannequins and is able to be put into fluidic communication with the inside of a determinate zone of the mannequins in order to blow in the superheated air, so as to allow the selective execution of a blast of superheated air through the garment positioned on the mannequin, both at least in static conditions of the mannequin and also in dynamic conditions of the mannequin at least as it passes from one to another of the loading, hot pressing and discharge stations. In this way the superheated air is always available on the mannequins, whether they are in static correspondence with the stations, or are transiting dynamically from one station to the other.

[0022] According to one form of embodiment of the present invention, the operating stations comprise, between the hot pressing station and the discharge station, another operating station, also provided with a relative mannequin on which the garment to be treated is positioned. The mannequin of this further operating station is also in communication at least with the mobile part of the first blowing circuit, to blow in superheated air. In this

way, the superheated air can be blown in the further operating station too, as well as in the transit steps toward and from the further operating station and in the other operating stations.

[0023] According to another feature of the present invention, the ironing and drying machine also comprises a second air suction circuit through the mannequins, which is formed by a first part connected to suction means and a second part connected to the mannequins, which is mobile solidly with the mannequins and is able to be put in communication with the inside of a determinate zone of the mannequins so as to allow suction through them. In this way the suction, which can facilitate the positioning of the garments on the mannequins, is always available on the mannequins, whether they are in correspondence with the above stations or are transiting from one station to another.

[0024] Furthermore, in variant forms of embodiment, the mannequin in the last blowing station is also in communication with the mobile part of the second suction circuit. In this way, the suction of air is also available in the last blowing station as well as in the transit steps toward and from the blowing station and in the other operating stations cited.

[0025] The present invention allows to obtain a much higher productivity than known machines, since it has both the streams of superheated air and advantageously also the suction air available, in all the operating stations and during transit from one to another; furthermore, the time each mannequin stays in the hot pressing station is much reduced, about half the time normally needed to iron and dry since the drying effect of the superheated air in the other operating stations completes the operation. Therefore it is no longer necessary, as in known machines, to have an extended period of time in the hot pressing station in order to complete the drying.

[0026] Furthermore, the possibility of blowing superheated air also in correspondence with the sleeves of the garment allows a finishing and smoothing of the sleeves that can positively replace the ironing step normally made separately.

[0027] In particular, the form of embodiment with four operating stations optimizes the productivity of the ironing and drying machine, since the drying operation is distributed along the whole processing cycle of the garment and not only in the hot pressing station: this therefore no longer conditions the overall duration of the cycle with its own work times. In fact, in the time in which, in the state of the art, the garment stayed in the hot pressing station, with the present invention it is possible to process two or more garments in sequence, with an obvious increase in productive efficiency.

[0028] In some forms of embodiment, each mannequin in the operating stations is associated with valve selection means, which are located downstream of valve means to control the suction and valve means to control the blowing of superheated air: the valve selection means are configured to assume at least a first condition in which

they allow the superheated air to pass, and a second condition in which they prevent the passage of the superheated air toward the inside of the mannequin. In the first condition of the valve selection means, the valve means to control the suction are configured to prevent the passage of the suction air.

[0029] In other forms of embodiment, the rotation unit comprises a rotary turntable made to rotate by means of a rotating shaft, which can be commanded by an inter-mittor. The turntable comprises a number of rotating sectors coordinated with the number of the operating stations. The rotating sectors branch off from the center of the ironing and drying machine, in substantial correspondence with the rotating shaft, toward the periphery, and each of the rotating sectors supports on its periphery a relative mannequin. Inside each of the rotating sectors a blowing chamber is made, which develops toward the mannequins and defines the second mobile part of the first blowing circuit.

[0030] In variant forms of embodiment, the first part of the first circuit comprises a main blowing pipe which develops from the means to generate the superheated air toward a central blowing connector, which is rotatably coupled with the rotary turntable, putting the blowing chambers into fluidic communication with the main blowing pipe.

[0031] In some forms of embodiment of the present invention, each mannequin on the machine according to the present invention is associated with inflatable elements in order to selectively adapt to the sizes and conformation of the garment positioned on it. In these forms of embodiment, a compressed air circuit is provided, connected to the inflatable elements of each mannequin. The inflatable elements are selectively activated, in particular in cooperation and coordination with the ironing unit, and de-activated, in particular when the ironing unit is de-activated.

[0032] In some forms of embodiment of the present invention, the first circuit for blowing superheated air is also configured to function as heating for the mannequin, so as to prevent the formation and dripping of condensation in the mannequin.

[0033] It also comes within the spirit of the present invention to provide a method for the industrial ironing and drying of damp garments, in particular but not only overalls, jackets and the like, for example for use in hospitals, laboratories or other.

[0034] The method according to the present invention comprises a loading step, in which a garment is positioned on a relative mannequin of a loading station, a step of moving the garment positioned on the mannequin from the loading station to a hot pressing station in which a pressing step is performed, in which the garment positioned on the mannequin is hot pressed, and at least an discharge step in which the ironed and dried garment is removed in an discharge station.

[0035] The method according to the present invention provides at least to selectively blow superheated air

through the garment positioned on the mannequin, both at least in static conditions of the mannequin in the loading step, in the pressing step and in the discharge step, and also in dynamic conditions of the mannequin at least in its passage from one to the other of the loading, pressing and discharge stations.

[0036] In some forms of embodiment of the invention, the pressing operation and the blowing of superheated air is first carried out in the pressing station at least through the sleeves of the garment and, after pressing, the superheated air is also blown through the remaining part of the garment.

[0037] In other forms of embodiment, at least in the loading step and possibly also in the hot pressing step and in the subsequent steps, air is sucked in through the mannequins, which can facilitate the positioning and drying of the garments on the mannequins.

[0038] In some forms of embodiment of the method according to the present invention, at least the selective suction of air through the garment positioned on the mannequin is provided, both at least in static conditions of the mannequin in the loading step, in the pressing step and in the discharge step, and also in dynamic conditions of the mannequin at least as it passes from one to another of the loading, pressing and discharge stations.

[0039] In some forms of embodiment according to the present invention, the method also comprises, before the discharge step, at least a further step of moving the mannequin to at least another subsequent operating station, after the hot pressing station and before the discharge station, in which more superheated air is blown through the garment positioned on the mannequin, so as to complete the treatment and drying thereof.

[0040] In some forms of embodiment of the present invention, at least during its movement from the hot pressing station to the at least one further operating station, superheated air is blown through the garment positioned on the mannequin.

[0041] In other forms of embodiment, after the pressing step in the hot pressing station, the mannequin supporting the garment is moved to another operating station where at least superheated air is blown through the garment positioned on the mannequin, and subsequently is moved to an discharge station where the garment is at least removed.

[0042] In some variant forms of embodiment, during its movement from the further blowing station to the discharge station, superheated air is blown through the garment positioned on the mannequin.

[0043] In some forms of embodiment of the present invention, the method comprises a step of activating inflatable elements associated with each mannequin, provided to adapt to the sizes and conformation of the garment positioned on the mannequin. The method according to the present invention provides, in some forms of embodiment, to activate the inflatable elements with compressed air in the hot pressing station, concurrently with the start of pressing. Once the pressing step is com-

plete, the inflatable elements are selectively de-activated, in which their internal pressure is progressively reduced, thus facilitating the passage of the superheated air.

[0044] According to some forms of embodiment of the present invention, the mannequin is heated by blowing superheated air so as to prevent the formation and dripping of condensation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a perspective view of a machine according to the present invention;
- fig. 2 is a front view of part of the machine in fig. 1;
- fig. 3 is the enlarged detail P of fig. 2;
- fig. 4 is a side view of the machine in fig. 1;
- fig. 5 is a plane view from above of part of the machine in fig. 1;
- fig. 6 is a view of an ironing unit of the machine in fig. 1;
- fig. 7 is a schematic front view of part of the machine in fig. 1;
- fig. 8 is a side view of a part of fig. 7.

[0046] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one form of embodiment can conveniently be incorporated into other forms of embodiment without further clarifications.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF

EMBODIMENT

[0047] With reference to fig. 1, a machine 10 according to the present invention is used in a plant for the industrial ironing and drying of clothing or garments, for example overalls or other long garment, or jackets, or other short garment. The garment is typically damp with a residual humidity comprised between about 20% and 40% in order to reduce the cost of drying and to facilitate the subsequent ironing step.

[0048] In some forms of embodiment, the machine 10 comprises four operating stations A, B, C and D, including a first loading station A, a second pressing or ironing station B, with the blowing of superheated air, a third station C for blowing superheated air, and a fourth station D for blowing superheated air and for discharging, all disposed in succession along a closed path, typically in a ring.

[0049] Each operating station A, B, C and D is associated with a relative mannequin 12, 112, 212, 312 on which the garment to be ironed is positioned.

[0050] With reference to the mannequin 12, it is formed by a rigid metal box 71 (figs. 7 and 8) suitably shaped and holed to allow the passage of air, covered by a transpirant material, in this case an open cell silicon sponge which also functions as an abutment cushion during ironing. Here and hereafter, the description of mannequin 12 is applied equally to mannequins 112, 212, 312.

[0051] The machine 10 comprises a rotation unit or turntable 14, on which the four mannequins 12, 112, 212, 312 are mounted, in this case staggered by 90° with respect to each other. In fig. 1 the mannequin 12 of the first station A is shown in its raised position

[0052] The rotation unit 14 is configured to allow the rotation of the four mannequins 12 around a common center of rotation and in sequence through the four operating stations A, B, C and D, in a direction of rotation, predetermined and univocal for the working cycle, along the closed path (arrows L in fig. 5), in particular passing from the first station A, to the second station B, to the third station C to the fourth station D, to then return to the first station A, where a new working cycle is started.

[0053] The machine 10 comprises a blowing unit 18a, comprising two fans 20, in this case of the centrifugal type, by means of which superheated air is blown into the mannequins 12, 112, 212, 312 through a first circuit 15 of superheated air (figs. 2 and 5).

[0054] The machine 10 also comprises a suction unit 18b which comprises an aspirator 30 by means of which a stream of air is generated through a second suction circuit 17 (figs. 2 and 5), taken in through the mannequins 12, 112, 212, 312 so as to keep the garments to be ironed adherent to the external surface of the mannequins 12, 112, 212, 312 and thus to facilitate their positioning during the loading by the operator.

[0055] The machine 10 also comprises a main frame 11, formed by uprights 92 and cross-pieces 94, to support the rotation unit 14 and the ironing unit 16, and a secondary frame 96 to support the units 18a and 18b. All in all, the main frame 11 can be associated with a covering guard, or fairing, not shown in the drawings. Normally a control unit or panel for the machine 10 is installed on the fairing, and is provided with a user interface, such as a touchscreen, not shown in the drawings either, accessible directly by the operator to condition the functioning of the machine and to select the appropriate ironing program. The fairing normally provides apertures for access to the inside of the machine 10, the apertures being associated with safety doors, advantageously automatic.

[0056] The first circuit 15 comprises a first part, in this case fixed with respect to the frame 11, connected to the fans 20 and comprising a main blowing pipe 26 which conveys the superheated air toward the center of the machine 10 into a first central blowing collector 44, and a second movable part, connected to the mannequins 12 and solid with them in rotation, comprising blowing

chambers 42 which distribute the superheated air from the center to the periphery toward the respective mannequins 12, 112, 212, 312, as shown in detail hereafter in the description.

[0057] The second circuit 17 comprises a first part, in this case fixed with respect to the frame 11, connected to the aspirator 30 and formed by a main suction pipe 46

[0058] (fig. 5) and by a second central suction collector 47 (fig. 2), and a second movable part connected to the mannequins 12, 112, 212, 312 and solid with them in rotation, formed by suction pipes 40 that branch off peripherally toward the mannequins 12, 112, 212, 312.

[0059] With reference to the rotation unit or turntable 14, it comprises a rotating shaft 36, in a substantially central position, and a rotating table 38, connected to the rotating shaft 36 (fig. 2). At the top, a control unit 34 is provided, associated with an actuator 35 to make the rotating shaft 36 rotate and connected to the control unit. The control unit 34 is also used for electric and pneumatic commands of the rotation unit 14.

[0060] The rotating table 38 is formed by four rotating sectors 39, which are disposed radially, substantially cross-wise, and branch off from the center in correspondence with the rotating shaft 36.

[0061] On each of the rotary sectors 39, in a distal position with respect to the rotating shaft 36, a relative mannequin 12, 112, 212, 312 is disposed.

[0062] The rotating table 38 is hollow inside, so as to define, inside each rotating sector 39, a relative one of said blowing chambers 42 of superheated air arriving from the fans 20. The first circuit 15, as we said, provides the first central blowing collector 44, located at the center and in a fixed position under the rotating table 38, which receives superheated air from the main blowing pipe 26 from the fans 20. The blowing chambers 42 diverge from the first central collector 44 and extend radially toward the periphery where for each rotating sector 39 an inlet aperture 53 is provided, to allow the passage of the superheated air blown inside the mannequins 12, 112, 212, 312 disposed there.

[0063] An annular packing 45, advantageously made of silicon material, is positioned between the upper edge of the first central collector 44 and an edge or lip of the central aperture of the rotating table 38, to which the first central collector 44 is coupled.

[0064] The annular packing 45 determines the aeraulic seal between the first central collector 44, which is fixed, and the rotating table 38, which is mobile above it. The aeraulic seal is guaranteed in particular by the prevalence supplied by the fans 20, so that the super-pressure of the superheated air blown determines an upward thrust on the annular packing 45 that adheres to the rotating table 38, even when the latter is in rotation.

[0065] With reference to fig. 6, on the right side we see part of the pressing unit 16 while on the left side we see a partial section thereof.

[0066] The pressing or ironing unit 16 shown in fig. 6 comprises a fork-like frame 84, on which two pressing

arms 85 are hinged in an opposite and facing position (in fig. 6 only the right arm is visible, but it is clear that an identical arm is also provided on the left side in a symmetrical position).

[0067] Each of the two pressing arms 85 is hinged, on the side opposite that where they are hinged to the fork-like frame 84, to a relative heated ironing plate 86 which, in normal use, goes to press one side of the mannequin 12, 112, 212, 312 on which the garment to be ironed is positioned. Each ironing plate 86 is heated to a temperature suitable for the ironing operation to be performed. The temperature is normally obtained using superheated steam that passes inside the ironing plate 86, in particular in suitable coil-like channels integrated or incorporated in the ironing plate 86.

[0068] Each pressing arm 85 is moved by means of first linear actuators 90, in this case two pistons disposed at the sides of each ironing plate 86, which move the two pressing arms 85 one toward the other, alternately, along a two-way path, so that the ironing plates 86 act on the mannequin 12, 112, 212, 312.

[0069] The necessary ironing pressure, on the contrary, is exerted by means of second linear actuators 88, in this case pneumatic pistons, of the bellows type, associated at the rear part with each of the two ironing plates 86, which are responsible for most of the pressure that is exerted centrally and in opposite directions on the mannequin 12, 112, 212, 312. It is clear, however, that the first linear actuators 90 also contribute to the ironing pressure that is exerted, although to a limited and lesser degree.

[0070] With reference to the blowing unit 18a shown in detail in fig. 4, the two fans 20, provided with relative motors 21, are disposed at the sides of a common suction chamber 22, which on one side is closed by a filter 24 and on the other side faces and is connected to a heat exchanger 28 to heat the ventilated air. The main blowing pipe 26 extends from the heat exchanger 28 and conveys the heated air from the heat exchanger 28 toward the first central collector 44 from where it is then directed, by means of the blowing chambers 42, toward the mannequins 12, 112, 212, 312. In some forms of embodiment, the prevalence of the fans 20 is generally about 150-220 mbar, with an air delivery rate of about 3000 m³/hour.

[0071] The first circuit 15 for blowing superheated air, and in particular the performances of the fans 20 and the heat exchanger 28, are configured to function also as heating for the mannequins 12, 112, 212, 312, so as to prevent condensation and dripping due to the residual humidity, without needing to have recourse to auxiliary heating of the mannequin, steam or electric, simplifying everything and reducing costs.

[0072] The aspirator 30 of the suction unit 18b, in this case of the 5 stage type, is connected on one side to the main suction pipe 46 connected to the mannequins 12, 112, 212, 312, and on the other side has a discharge pipe 32, the end of which terminates directly in the suction chamber 22 between the two fans 20. This position of

the discharge pipe 32 is advantageous because, since the suction chamber 22 acts as a silencer, it reduces the noisiness and also determines a super-pressure in the suction chamber 22, allowing a superfeed of the fans 20 and hence a better ventilation performance; finally, it allows to recover the enthalpy, or heat, of the air that is heated in the thermo-dynamic suction cycle that is performed in the aspirator 30, hence increasing the performance of the heat exchanger 28.

[0073] The second circuit 17 provides that the main suction pipe 46 extends from the aspirator 30 and connects to a suction intake 48, in a substantially central position, in this case located under the rotation unit 14.

[0074] The second central suction collector 47 extends from the suction intake 48 upward, from where the four suction pipes 40 branch off, from the center toward the periphery of the machine 10, each of which being connected to a peripheral suction intake 41 associated with a relative mannequin 12, 112, 212, 312.

[0075] Downstream of the central collector 47, for each suction pipe 40, relative valves to control the suction 52 are provided, which, according to determinate controls, allow or prevent the passage of air through the suction pipes 40.

[0076] Fig. 3 shows in detail the zone where for each mannequin 12, 112, 212, 312 the superheated air blown by the fans 20 enters, and where the air taken in by the aspirator 30 passes.

[0077] In particular, each rotating sector 39 is provided with a shutter valve 50 which is mobile between a condition in which it allows the superheated air to pass toward the aperture 53, in this case in a horizontal position to occlude a fissure to partialize the flow rate, and a condition in which it prevents the passage of the superheated air blown, in this case in a vertical position so as to obstruct the gap of the blowing chamber 42 upstream of the aperture 53.

[0078] The lower end of the mannequin 12, 112, 212, 312 is directly located in correspondence with the aperture 53, and has one or more passages for the air toward the inside.

[0079] Downstream of the aperture 53, each mannequin 12, 112, 212, 312 has at the lower part a connection element 55 which conveys the suction air or the superheated air from and to the inside of the mannequin.

[0080] The connection element 55 is disposed transversely both with respect to the relative suction pipe 40, and also with respect to the associated suction chamber of the relative rotating sector 39 from which the superheated air is blown.

[0081] Inside the connection element 55 a selection valve 54 is disposed, which is mobile between a closed condition (indicated by the continuous line associated with the reference number 54 in fig. 3) of the passage of superheated air, in which it is disposed to transversely close the connector element 55, preventing the passage of superheated air in the mannequins 12, 112, 212, 312, and an open condition (indicated by the line of dashes

associated with the reference number 54 in fig. 3), in which it is disposed substantially adjacent and parallel to an external wall of the connection element 55, allowing the superheated air to pass.

[0082] The selection valve 54 is also operatively disposed in correspondence with the peripheral suction intake 41, as can easily be seen in fig. 3, so that when the selection valve 54 is in the condition that prevents the passage of superheated air, at the same time it allows the passage of suction air through the peripheral suction intake 41.

[0083] On the contrary, when the selection valve 54 is in the condition where it allows the passage of superheated air, it would also allow the passage of suction air.

[0084] However, this condition is avoided since according to the present invention there is no simultaneous suction and blowing of superheated air through the mannequins 12, 112, 212, 312.

[0085] To this purpose, when the selection valve 54 is in the condition where it allows the passage of superheated air, automatically the suction control valve 52 is closed, so that in practice there is no suction through the suction pipes 40 and therefore the mannequin is not actively in suction. In particular, in some forms of embodiment, each of the mannequins is configured and connected to suction and blowing of superheated air so that, when there is superheated air blowing in the central part of the mannequin, there is no suction, and vice versa.

[0086] The electronic control unit associated with the user interface, for example the cited touchscreen, controls the suction and superheated air blowing cycles correlated to the type of ironing program, which in turn varies according to the type of garment to be ironed (length, type of fiber).

[0087] With reference to the mannequin 12, it is formed as we said (and this description also applies to the mannequins 112, 212, 312) by an external rigid metal box 71, which substantially reproduces the shape of the upper part of a person's body and inside it the superheated air is blown or suction is generated on the garments. The metal box 71 that defines the mannequin 12 is holed, that is, it has through holes 77 made with a constant diameter and pitch, according to a desired repetitive pattern, for the passage of the superheated air or for suction (figs. 7 and 8). The external metal box 71 is delimited peripherally by external or peripheral walls 73, which have upper apertures 78 (figs. 2, 7 and 8) made laterally in a position coordinated with the position of the sleeves of the garments to be ironed, wherein during normal use the superheated air blown in is made to emerge, with an effect on the sleeves that is similar to ironing.

[0088] Furthermore, central walls 75 are provided in the mannequin 12, which divide the inside of the mannequin 12 into peripheral or lateral chambers 70, comprised between the external walls 73 and the central walls 75, and a central chamber 72, comprised between the central walls 75.

[0089] The lateral chambers 70 open at the upper part

toward the outside through the upper apertures 78, and at the lower part are able to be put into direct communication, through the connection element 55, with the blowing chamber 42 associated with the mannequin 12, so that when the ventilation of superheated air is active according to the steps of the process, the passage of superheated air is always allowed in them.

[0090] The central chamber 72 is also able to be connected through the connection element 55 to the blowing chamber 42, and also to the suction intake 41 of the suction pipe 40. However, the intake of superheated air or suction into the central chamber 72 is determined by the condition of the cited selection valve 54, which therefore makes possible to have a condition of superheated air in the central chamber 72, or a condition of suction, but not the two conditions simultaneously. It is understood that, during normal functioning of the machine 10, it is also possible to have a condition in which, in the central chamber 72, there is neither blowing nor suction.

[0091] In the lateral chambers 70 of each mannequin third linear actuators 74 are provided, able to extend and contract in a vertical direction to lift/lower the mannequin 12, to selectively allow the movement of the mannequin between a position substantially flush with the rotating table 38, and a position where it is raised by a determinate amount (in fig. 1 the mannequin can be seen in the first station A which is raised, while the other mannequins are lowered).

[0092] The lifting/lowering movement is guided by rods of linear guides 76, located vertically in a position adjacent to the third linear actuators 74, in each of the lateral chambers 70.

[0093] The lifting/lowering of the mannequin 12 is selectively activated manually by the operator, or automatically by the machine 10, to promote the action of fitting the garment on the mannequin 12 by the operator.

[0094] In particular, in the case of a long garment, an upper part of the garment is fitted when the mannequin 12 is lowered, and subsequently the mannequin is lifted to a more comfortable position for the operator, to allow him to fit and arrange the lower part as well.

[0095] Typically, each mannequin 12, 112, 212, 312 is provided with inflatable members 65 disposed laterally to the metal box 71.

[0096] The inflatable members 65 are activated to adapt to the sizes and conformation of the garments which are ironed on each occasion, so as to bring the garment into contact with the ironing plates 86 of the ironing unit 16.

[0097] The inflatable members 65 are generally made of flexible material, which prevents the transpiration of the air, and are shaped to define at least an internal chamber that is inflated.

[0098] Generally, the extension in height of the inflatable members 65 is commensurate with the length of the garments to be ironed.

[0099] The fluid that inflates the inflatable members 65 is generally compressed air which is taken from an ac-

cumulation tank 56 connected to the distribution network of compressed air that is normally provided in an industrial plant of the type in question.

[0100] The inflation pressure is normally comprised between about 1 atm and about 1.5 atm, depending on operating needs.

[0101] The accumulation tank 56 also supplies the compressed air to actuate the second linear actuators 88.

[0102] The machine 10 provides a compressed air circuit 57 (fig. 7) to feed the inflatable members 65, which is mounted on board the rotating table 38 together with the accumulation tank 56, and is mobile with the mannequins 12, 112, 212, 312, so that the compressed air for inflation is always available both in the static phases when the mannequins 12, 112, 212, 312 are in the operating stations A, B, C, D, and also in the dynamic phases when they are in transit between one operating station and another.

[0103] In some forms of embodiment of the present invention, it is possible to provide that each inflatable member 65 associated with each mannequin 12, 112, 212, 312 is formed by two inflation chambers 66, 68, separate and distinct, of which a first lower chamber 66 and a second upper chamber 68, as described in the co-pending Italian patent application in the name of the Applicant and filed on the same day, entitled "PERFECTED MANNEQUIN FOR INDUSTRIAL IRONING, INDUSTRIAL IRONING MACHINE COMPRISING SAID PERFECTED MANNEQUIN, AND IRONING METHOD".

[0104] This form of embodiment allows to partialize the inflation, so as to adapt to the length of the garment to be ironed, whether it is a long or short garment, preventing or at least reducing the risk of tearing the seams in short garments which, with the traditional inflation technique, are subjected to stress due to the inflation in the parts where the seams are, often causing breakages.

[0105] In particular, in this form of embodiment, the compressed air circuit 57 comprises two valves 58, 60, in this case of the proportional type, connected to the accumulation tank 56. In particular, a first valve 58 is used to control the sending of compressed air to the lower chambers 66 of all the mannequins 12, while a second valve 60 is used to control the sending of compressed air to the upper chambers 68.

[0106] Downstream of the valves 58, 60 a first aeraulic connection element 63 and a second aeraulic connection element 69 are respectively provided, each of which is connected to a plurality of distribution valves, respectively 62 and 64, which are equal in number to the number of mannequins 12 in the machine 10. The distribution valves 62, 64 are connected upstream to a respective compressed air line 59, 61 which feeds the compressed air to the lower chamber 66 (line of dashes in fig. 7) or to the upper chamber 68 (continuous line in fig. 7). The distribution valves 62, 64 are activated independently of each other so as to determine a desired inflation pressure, variable from one operating station to another according to needs. Consequently, the first valve 58 and

the distribution valves 62 are used to inflate all the lower chambers 66 of the mannequins 12, while the second valve 60 and the distribution valves 64 are dedicated to inflating the upper chambers 68. With this system, apart from inflating and deflating the lower chamber 66 with respect to the upper chamber 68 independently for each mannequin, it is also possible to differentiate the inflation pressure, both upper and lower, between one mannequin 12 and the other, according to needs. For example, in the ironing step in the second station B, the maximum inflation pressure is normally required so as to have a good contact with the ironing plates 86, whereas in the other stations the pressure can be reduced or released, also to prevent the inflatable members 65 from breaking.

[0107] In the solution shown here, the separation interface between the lower chamber 66 and the upper chamber 68 is made along an oblique edge 67, in this case inclined downward. This has the technical effect of distributing the inflation pressure gradually from the top downward, allowing to exercise a pressure on the garments more bearable for the seams, thus reducing the risk of tearing.

[0108] In some forms of embodiment of the present invention, an optical sensor is provided, like a photocell 101, mounted in correspondence with the first station A, in this case between the rotating shaft 36 and the mannequin 12. The photocell 101 reads the presence or absence of an optical element 103, such as a reflector, disposed on the mannequin 12 at a height correlated to the typical length of the long garment and to the position of the optical sensor 101, and is able to provide a signal to the control unit of the machine 10 which is interpreted as presence or absence of a long garment or a short garment. According to this interpretation, the control unit activates or not the third linear actuators 74 as described above. Furthermore, according to the signal received, the control unit activates only the upper chambers 68 or also the lower chambers 66 of the inflatable members 65, depending on whether a long garment or a short garment is positioned. In fact, the long garment covers the optical element 103 and the optical sensor 101 reads this, while the short garment leaves the optical element 103 uncovered, and this situation is also detected by the optical sensor 101.

[0109] In a conventional manner, each mannequin 12, 112, 212, 312 is associated with its own clothes hanger 80, which is mounted in the upper part and is provided with a hook 82. The clothes hanger 80 can be removed from the mannequin 12, allowing to remove the garment once it has been ironed and dried, in particular in correspondence with the fourth discharge station D.

[0110] A removal device 98, located in correspondence with the fourth station D, provides to remove the clothes hanger 80, acting on the hook 82, taking the ironed garment with it, which is sent to the warehouse. The removal device 98 comprises a vertical bar 99 of the oblong type, along the vertical extension of which a guide groove 95 is made in a closed ring, in which a slider, not

visible in the drawings, is able to slide, driven by a motor 97, following a two way travel from the bottom to the top and vice versa. When the slider is at the lower end of the vertical bar 99, it cooperates in its movement along the lower curve of the guide channel 95 with the hook 82, picking up the clothes hanger 80 and the garment supported thereon, which is then transferred upward where, in correspondence with the upper curve of the guide channel 95, it is deposited with the hook 82 on an inclined wire, not visible in the drawings, which automatically makes the ironed garment slide downward with its clothes hanger toward the warehouse.

[0111] The machine 10 functions as follows. An operator starts the cycle he has selected on the interface of the control unit, for example by pressing once a start pedal on a command footboard, not shown in the drawings. The command can close the safety doors, if provided.

[0112] The operator positions a garment to be ironed on the mannequin 12 of the first loading station A. In order to fit the garment to be ironed, suction is normally activated in the first station A through the mannequin 12, which allows the garment to adhere better to the external surface.

[0113] If the garment is short, the optical sensor 101 detects the presence of the optical element 103 on the mannequin 12 and therefore the machine recognizes that it is a short garment.

[0114] Consequently, if necessary, the upper chambers 68 will be activated and not the lower chambers of the inflatable members 65, in particular in the second ironing station B.

[0115] In the case of a short garment, once it has been positioned correctly on the mannequin 12, the operator presses the command pedal a second time, and the second pressure is interpreted by the machine, according to information deriving from the optical sensor 101, as a signal to start the pressing cycle and the movement into the second station B.

[0116] On the contrary, if the garment is long, this is recognized by the optical sensor 101 of the machine 10, as described above, but the second pressure is interpreted as a command to lift the mannequin 12 in the first station A to facilitate the placement of the garment by the operator and not as a command to move it to the second station B.

[0117] Finally, a third pressure on the command pedal by the operator is interpreted as the go-ahead to start the pressing and to move to the second station B.

[0118] Normally, the time required for loading a long garment is about 20-22 seconds and about 11-12 seconds for a short garment.

[0119] Depending on the operator's commands, the rotating table 38 of the rotation unit 14 makes the mannequin 12 rotate, which passes from the first station A to the second station B, where the garment is pressed by the ironing unit 16 and where blowing with superheated air is selectively activated. Here, first the heated ironing

plates 82 are brought closer for the pressing operation, and the inflatable members 65 are activated, possibly according to the recognition effected in the first station A. During pressing, the blowing of superheated air is also activated through the sleeves of the garment. After pressing has been carried out, and after the plates 86 of the ironing unit 16 have been moved away, the blowing of superheated air is activated through the central part of the garment too. As can easily be seen in fig. 2, at this point the superheated air permeates mainly through the front and rear surface of the mannequin 12 (arrows F) and also through the upper apertures 78 (arrows G) in correspondence with the sleeves of the garment to be ironed. The garment remains in the second station B for about 20 seconds, enough to complete the ironing operation with the ironing plates 86 of the ironing unit 16 and to provide about half the time that is normally necessary for the treatment with superheated air.

[0120] Afterward the rotating table 38 displaces the mannequin 12 from the second station B to the third station C where it remains for another determinate period of time, for example about 20 seconds more, in which the ventilation of superheated air is active, finalizing the treatment of the sleeves and the overall drying. The blowing of superheated air is also available in the passage from the second station B to the third station C.

[0121] The ventilation of superheated air also allows to effect the complete ironing of the edges of the sides of the garment that protrude laterally, generally by about 1 cm, and which do not come into contact with the ironing plates 86.

[0122] Afterward, the rotating table 38 moves the mannequin 12 to the fourth discharge station D, where further forced ventilation with superheated air may be provided. Finally the removal device 98 picks up and transports the clothes hanger 80 with the ironed and dried garment to the warehouse. Subsequently the mannequin 12 is again taken to the first station A, ready for another cycle. It is clear that in the meantime the other three mannequins 112, 212, 312 of the machine 10 have followed similar steps and staggered with respect to that of the mannequin 12 as above, obtaining a great exploitation of the cycle time of the machine 10 and hence a considerable increase in productivity, even up to 70%-100% more.

[0123] The transfer steps from one operating station to another have a duration of about 3-4 seconds, in the course of which forced ventilation with superheated air and/or suction is always available, if necessary.

[0124] In the same way, in the time the mannequin 12 remains in the various operating stations of the machine 10, it is always possible to blow in superheated air, and also to take in air through the mannequin 12.

[0125] Furthermore, in the various operating stations A, B, C and D compressed air supplied by the compressed air circuit 57 is always available, to inflate the inflatable members 65, typically in the second station B, possibly varying the inflation pressure from one station to another so as to adapt to the expected operating con-

ditions.

[0126] With the present invention there will be an overall cycle time that can vary from 50 to 70 seconds, depending on whether the garment is long or short, or has double seams, or according to the type of fiber or other. However, the time in which each operating station A, B, C, D is occupied is less than in the state of the art, in particular for the second station B, and it is thus possible to free and make available each station quickly for treating the next garment to be ironed.

[0127] Furthermore, the overall time in which the superheated air is potentially available in the four operating stations A, B, C and D, and in the transfer from one to the other, is much greater, up to about 50—60 seconds, compared with in known machines, with an even more effective possibility of treatment. The presence of the superheated air in all the stations, moreover, allows to substitute and eliminate the heating systems using steam or electric resistances for the mannequins used in the state of the art to eliminate condensation and dripping due to the residual humidity. Moreover, the availability of superheated air along the whole cycle of the machine 10 also reduces the pressing times required, since the drying is completed exploiting all four operating stations A, B, C and D.

Claims

1. Machine for the industrial ironing and drying of clothing, in particular, but not only, overalls, jackets and the like, comprising:

- at least three operating stations (A, B, C, D), of which at least a loading station (A), at least a hot pressing station (B) and at least an discharge station (D) disposed in succession along a closed path, each of said operating stations (A, B, C, D) being provided with a relative mannequin (12, 112, 212, 312) on which a damp garment to be ironed and dried is positioned;
- a rotation unit (14) able to determine a rotation movement of said mannequins (12, 112, 212, 312) from one to the other of said operating stations (A, B, C, D) according to a predetermined and univocal work direction along said closed path;
- at least generation means (20, 28) to generate a stream of superheated air; **characterized in that** it comprises a first circuit (15) to blow the superheated air inside the mannequins (12, 112, 212, 312), which is formed by a first part (26, 44) connected to said generation means (20, 28) and by a second part (42) connected to said mannequins (12, 112, 212, 312), which second part (42) is movable solidly with said mannequins (12, 112, 212, 312) from one to the other of said operating stations (A, B, C, D) and is able

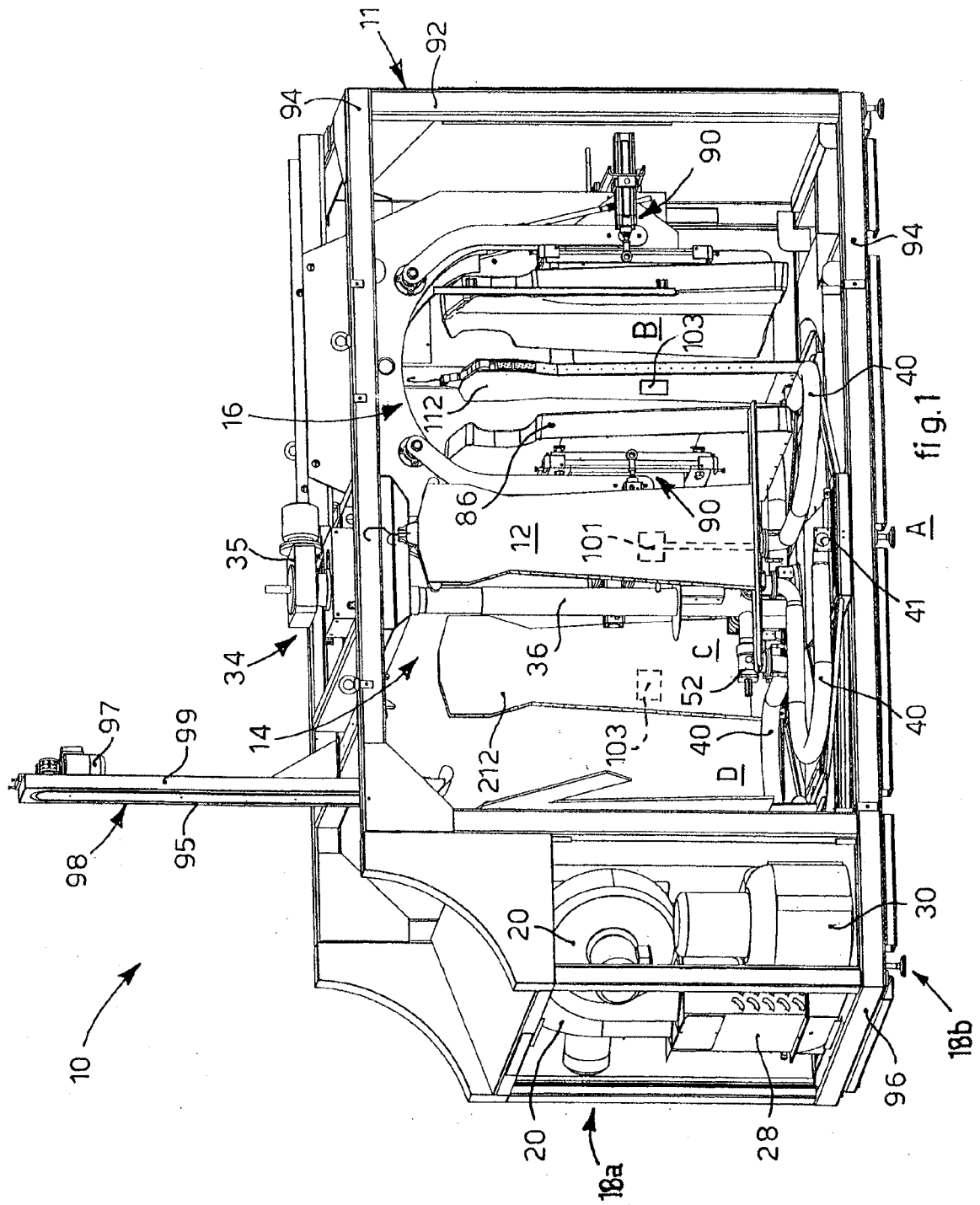
- to be put in fluidic communication with the inside of a determinate zone of the mannequins (12, 112, 212, 312) in order to blow in the superheated air, so as to allow the selective blowing of superheated air through the garment positioned on the mannequin (12, 112, 212, 312), both at least in static conditions of the mannequin (12, 112, 212, 312) and also in dynamic conditions of the mannequin (12, 112, 212, 312) at least in the passage from one to the other of the loading station (A), pressing station (B) and discharge station (D).
2. Machine as in claim 1, **characterized in that** it comprises a second circuit (17) to suck in air through the mannequins (12, 112, 212, 312), which is formed by a first part (46, 47) connected to suction means (30) and by a second part (40) connected to said mannequins (12, 112, 212, 312), which second part (40) is movable solidly with said mannequins (12, 112, 212, 312) and is able to be put in communication with the inside of a determinate zone of each of the mannequins (12, 112, 212, 312) in order to allow suction through the same.
 3. Machine as in claim 1 or 2, **characterized in that** said operating stations (A, B, C, D) comprise, between the hot pressing station (B) and the discharge station (D), a further operating station (C) for blowing in superheated air, said station (C) also provided with a relative one (212) of said mannequins (12, 112, 212, 312) on which the garment to be treated is positioned, said mannequin (212) of said further operating station (C) being in communication at least with the second movable part (42) of the first blowing circuit (15).
 4. Machine as in claims 2 and 3, **characterized in that** the mannequin (212) of the further operating station (C) is also in communication with the second movable part (40) of the second suction circuit (17).
 5. Machine as in any claim hereinbefore, **characterized in that** each mannequin (12, 112, 212, 312) of said operating stations (A, B, C, D) is associated with valve selection means (54), which are located downstream of valve means (52) to control the suction and valve means (50) to control the blowing of superheated air, which valve selection means (54) are configured to assume at least a first condition in which they allow the passage of superheated air and a second condition in which they prevent the passage of superheated air toward the inside of said mannequin (12, 112, 212, 312), said valve suction control means (52) being configured to prevent, in said first condition of said valve selection means (54), the passage of suction air through the mannequin (12, 112, 212, 312).
 6. Machine as in any claim hereinbefore, **characterized in that** the rotation unit (14) comprises a rotating table (48) made to rotate by means of a rotating shaft (36) and having rotating sectors (39) in a number coordinated to the number of said operating stations (A, B, C, D), which rotating sectors (39) branch off from the center, in substantial correspondence with the rotating shaft (36), toward the periphery, each of which rotating sectors (39) peripherally supports a relative mannequin (12, 112, 212, 312), inside each of said rotating sectors (39) a blowing chamber (42) being made which develops toward the mannequins (12, 112, 212, 312), defining said second movable part of said first blowing circuit (15).
 7. Machine as in claim 6, **characterized in that** the first part of the first circuit (15) comprises a main blowing pipe (26) which develops from the superheated air generation means (20, 28) toward a first central blowing collector (44), which is rotatably coupled to the rotating table (38), putting the blowing chambers (42) in fluidic communication with said main blowing pipe (26).
 8. Machine as in any claim hereinbefore, **characterized in that** the first superheated air blowing circuit (15) is also configured to heat the mannequin (12, 112, 212, 312) so as to prevent the formation and dripping of condensation.
 9. Method for the industrial ironing and drying of damp clothing, in particular, but not only, overalls, jackets and the like, comprising a loading step in which a garment is positioned on a relative mannequin (12, 112, 212, 312) of a loading station (A), a step of moving the garment positioned on the mannequin (12, 112, 212, 312) from the loading station (A) to a hot pressing station (B) in which a pressing step is carried out, in which the garment positioned on the mannequin (12, 112, 212, 312) is hot pressed and at least a discharge step in which the ironed and dried garment is taken to an discharge station (D), **characterized in that** it provides at least the selective blowing of superheated air through the garment positioned on the mannequin (12, 112, 212, 312), both at least in static conditions of the mannequin (12, 112, 212, 312) at least in the loading step, in the pressing step and in the discharge step, and also in dynamic conditions of the mannequin (12, 112, 212, 312) at least in the passage from one to the other of the loading station (A), pressing station (B) and discharge station (D).
 10. Method as in claim 9, **characterized in that** at least in the loading step, and possibly also in the hot pressing step and in the subsequent steps, air is sucked in through the mannequins (12, 112, 212, 312).

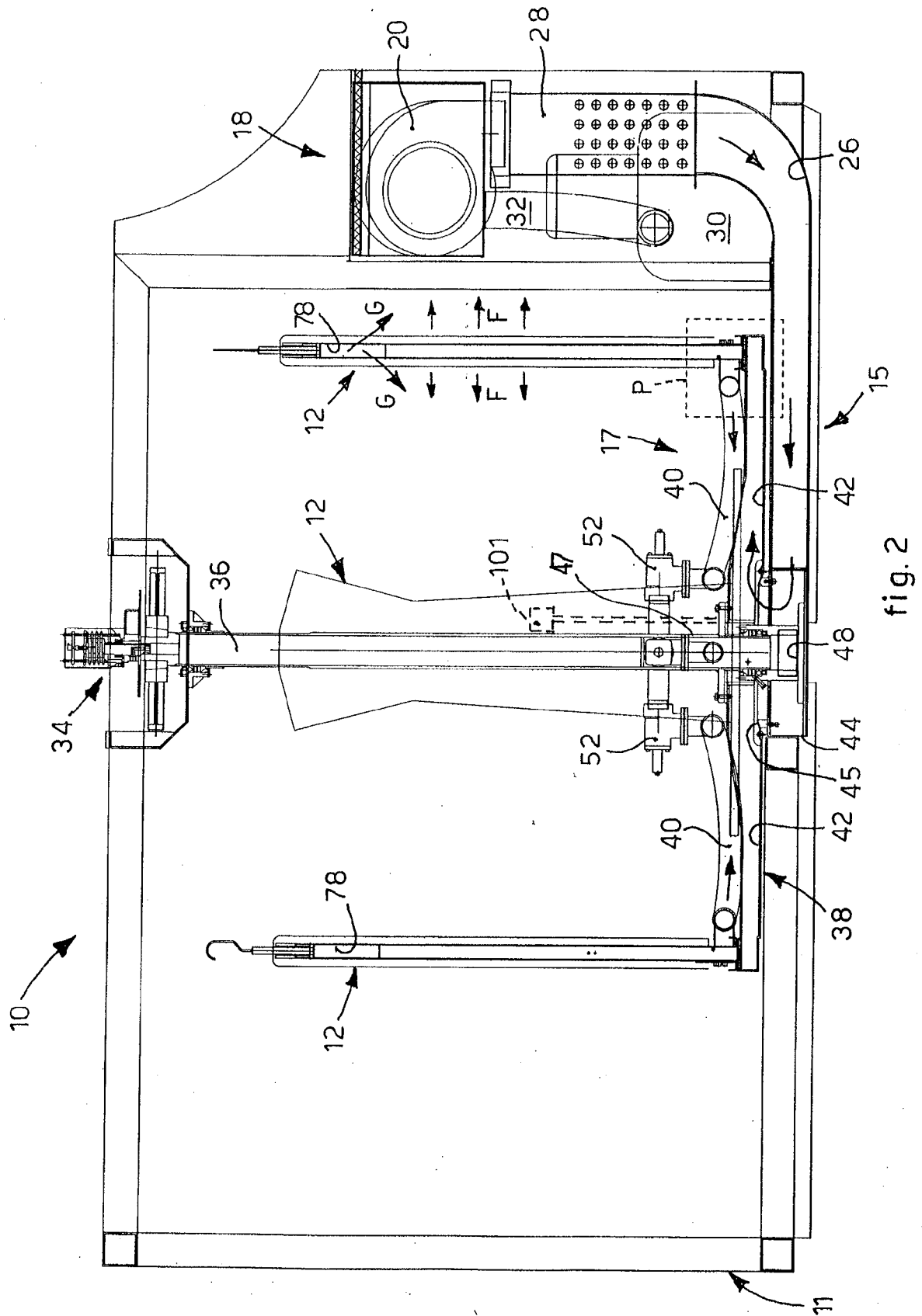
11. Method as in claim 10, **characterized in that** it provides to selectively suck in air through the garment positioned on the mannequin (12, 112, 212, 312), both at least in static conditions of the mannequin (12, 112, 212, 312) at least in the loading step and in the pressing step, and also in dynamic conditions of the mannequin (12, 112, 212, 312) at least in the passage from one to the other of the loading station (A), pressing station (B) and discharge station (D). 5
12. Method as in claim 9, 10 or 11, **characterized in that** it also comprises, before the discharge step, at least a further step of moving the mannequin (12, 112, 212, 312) to at least a further operating station (C) after the hot pressing station (B) and before the discharge station (D), in which more superheated air is blown through the garment positioned on the mannequin (12, 112, 212, 312), and subsequently the mannequin (12, 112, 212, 312) is moved to an discharge station (D) where the garment is at least removed. 10 15 20
13. Method as in claim 12, **characterized in that** at least in the movement from the hot pressing station (B) to at least a subsequent operating station (C) superheated air is blown through the garment positioned on the mannequin (12, 112, 212, 312). 25
14. Method as in claim 13, **characterized in that** during the movement from the further subsequent operating station (C) to the discharge station (D) superheated air is blown through the garment positioned on the mannequin (12, 112, 212, 312). 30
15. Method as in any claim from 9 to 14, **characterized in that** it provides to heat the mannequin (12, 112, 212, 312) by blowing in superheated air in order to prevent the formation and the dripping of condensation. 35 40

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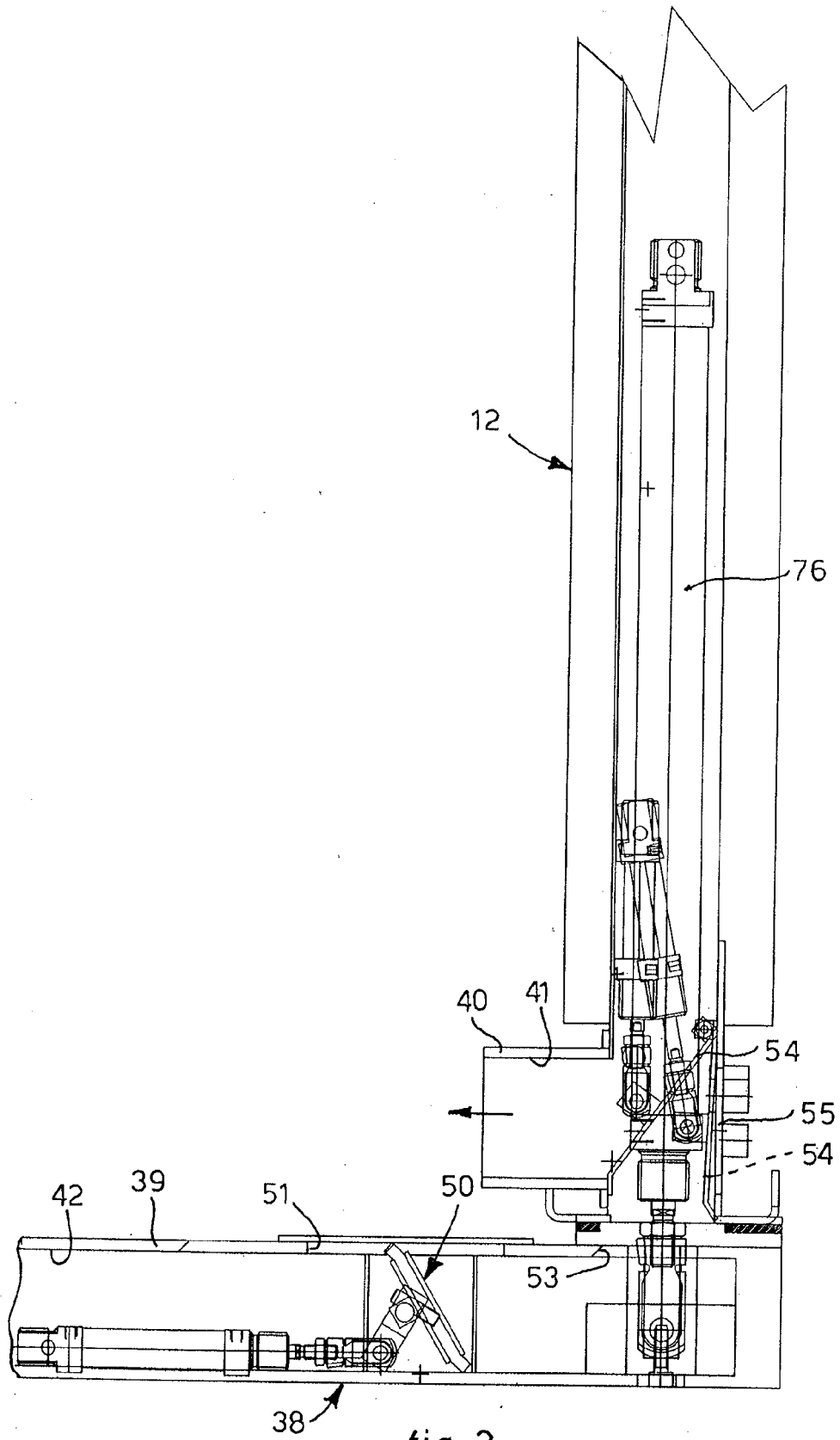


fig. 3

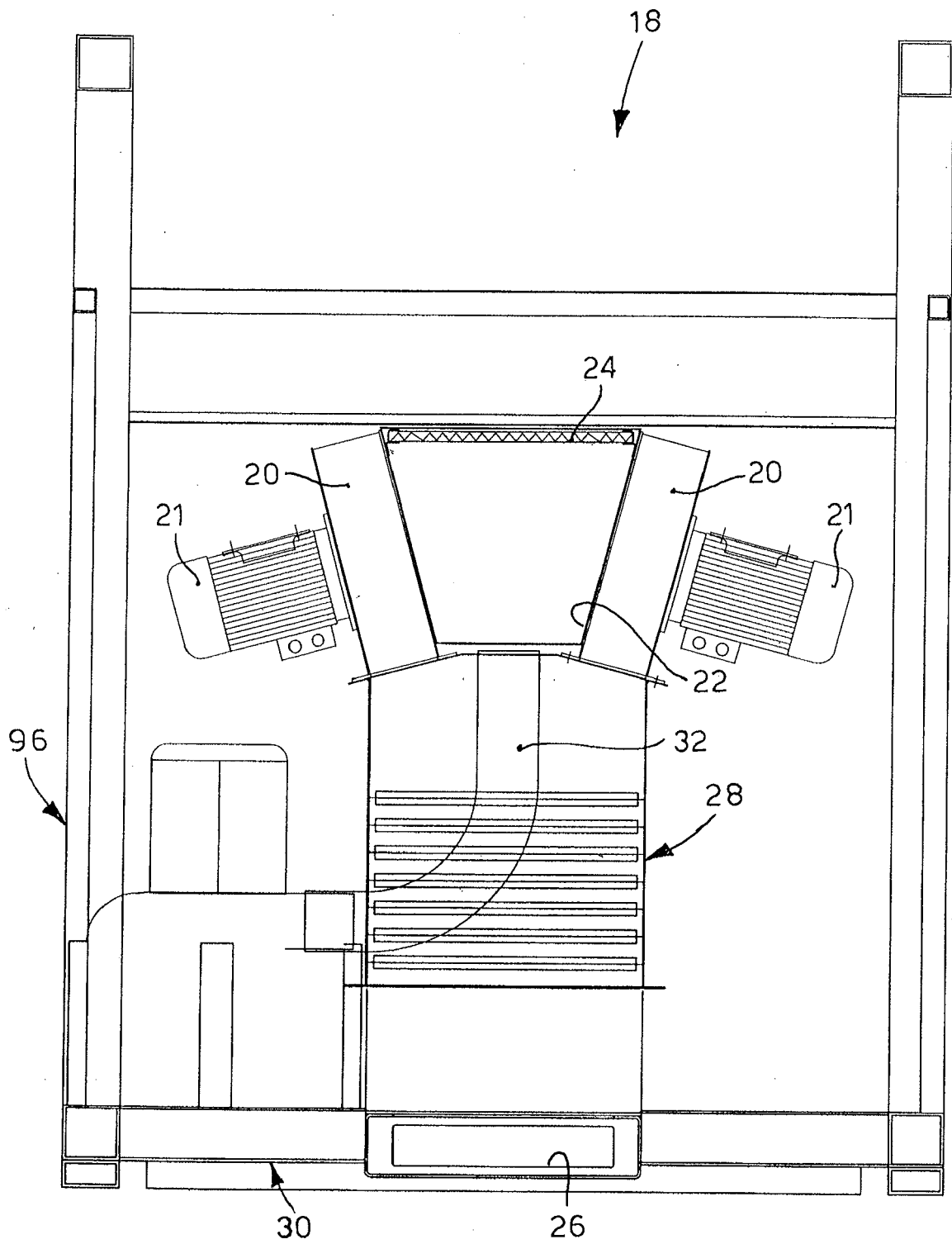


fig. 4

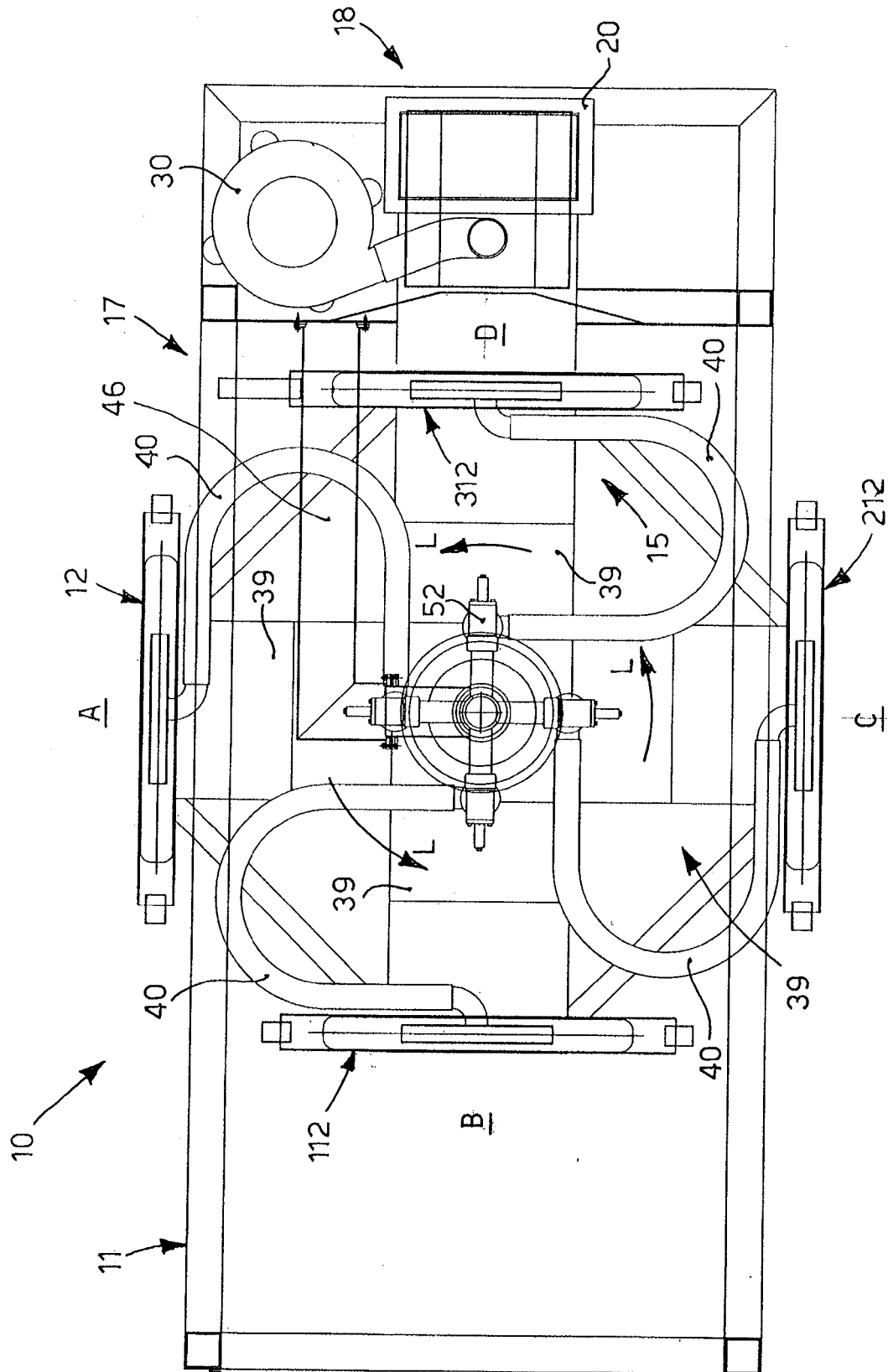


fig. 5

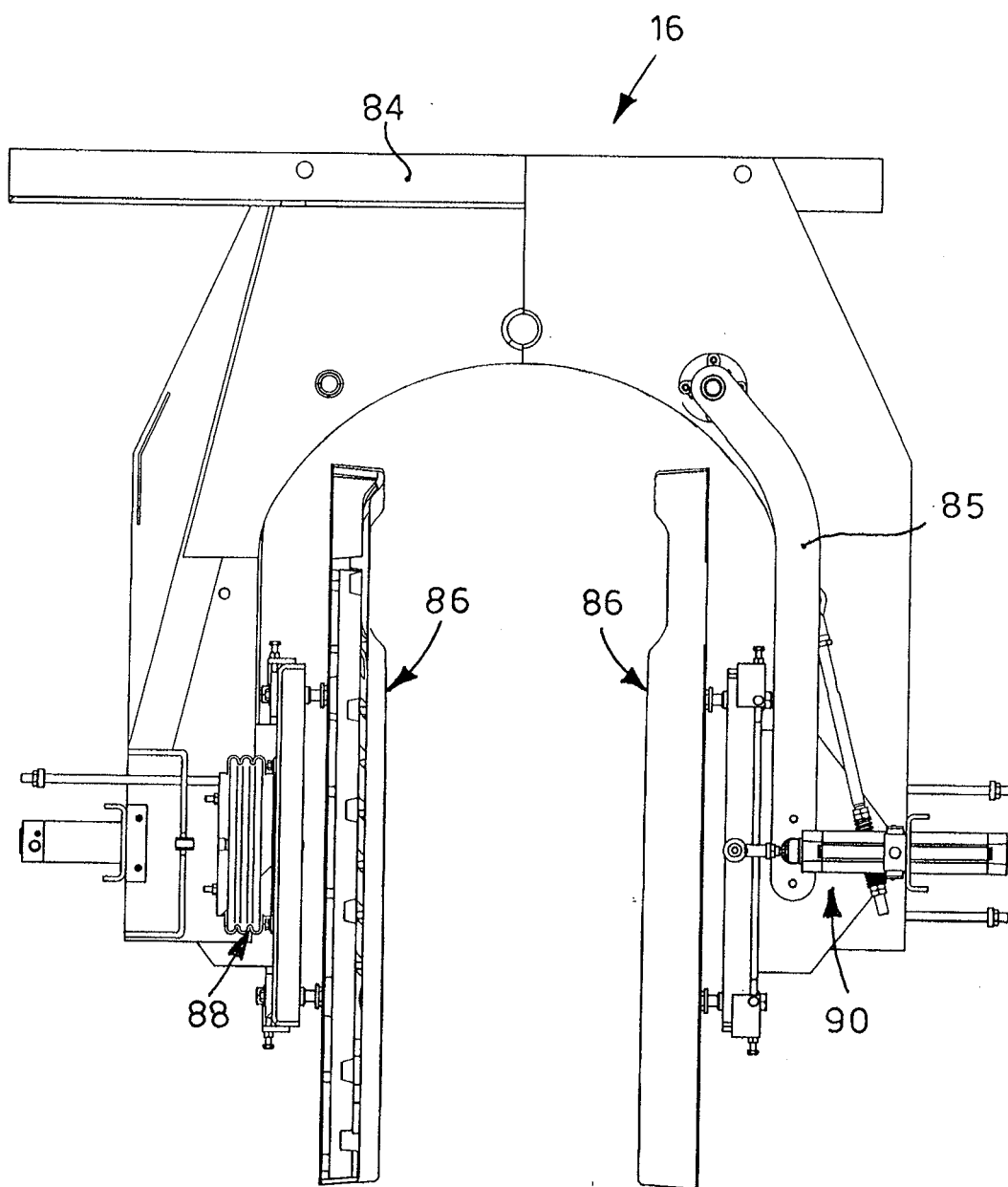
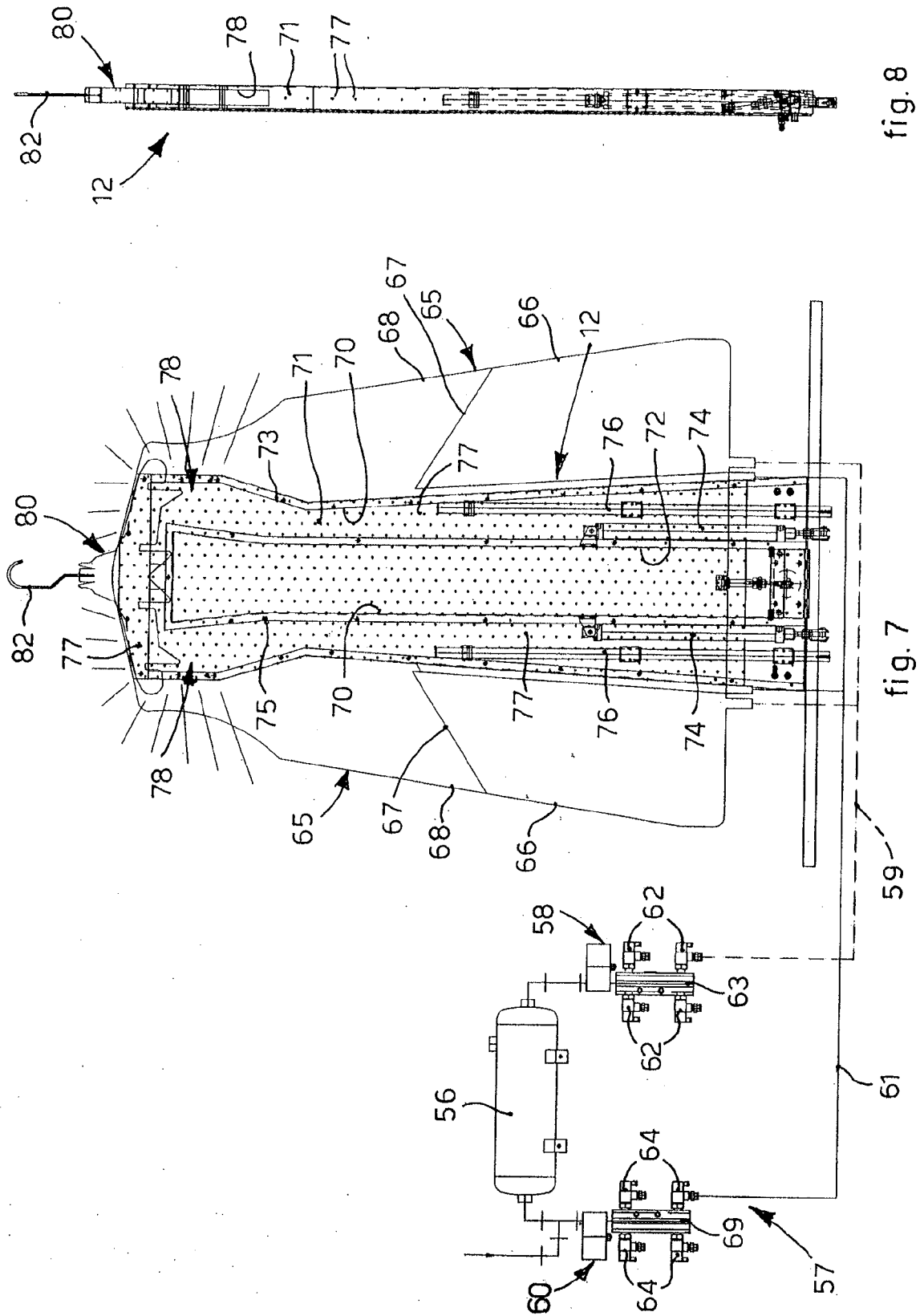


fig. 6





EUROPEAN SEARCH REPORT

Application Number
EP 11 17 2013

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 174 662 A (HERBERT KANNEGIESSER ET AL) 23 March 1965 (1965-03-23) * column 3, line 5 - column 4, line 73; claims; figures *	1-15	INV. D06F71/10
A	GB 618 853 A (FORREST JOHN COUCH) 28 February 1949 (1949-02-28) * page 1, lines 10-45; page 2, lines 20-27, 44-49, 73-77; page 3, line 112 - page 4, line 8; page 5, line 124 - page 6, line 26; page 6, lines 102-113; page 7, lines 5-98; page 8, lines 51-61; page 10, line 103 - page 12, line 6; claims 1, 7; figures *	1-15	
A	US 5 970 637 A (MOHAN MANOHAR [US] ET AL) 26 October 1999 (1999-10-26) * column 3, line 46 - column 4, line 1; column 5, line 34 - column 6, line 51; figures *	1-15	
A	US 5 692 326 A (MOHAN MANOHAR [US] ET AL) 2 December 1997 (1997-12-02) * column 3, line 19 - column 4, line 22; figures *	1-15	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) D06F
Place of search Munich		Date of completion of the search 24 October 2011	Examiner Clivio, Eugenio
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 17 2013

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24-10-2011

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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GB 618853	A	28-02-1949	NONE	
US 5970637	A	26-10-1999	NONE	
US 5692326	A	02-12-1997	NONE	

REFERENCES CITED IN THE DESCRIPTION

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