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(72) Inventors:
• **Hoornaert, Sigvard
8930 Menen (BE)**
• **Odersky, Michai
74221 Koprivnice (CZ)**

(71) Applicant: **Primus N.V.
8560 Gullegem (BE)**

(74) Representative: **Bird, William Edward et al
Bird Goen & Co.,
Klein Dalenstraat 42A
3020 Winksele (BE)**

(54) **Folding device for ironing machine and method of operating the same**

(57) The present invention provides an ironing machine (100) having an ironing means (3) for ironing a workpiece (6), a support structure for supporting the ironed workpiece downstream of the ironing means and a folding means for folding a workpiece (6), wherein the folding means comprises electrically operated means

for oscillatory motion of the support structure. A zig-zag folding of the workpiece (6) is therefore obtained. The ironing machine (100) may furthermore comprise a device for doubling up or back-to-back folding of the ironed workpiece (6), which device is mounted upstream of the support structure.

Corresponding methods are also provided.

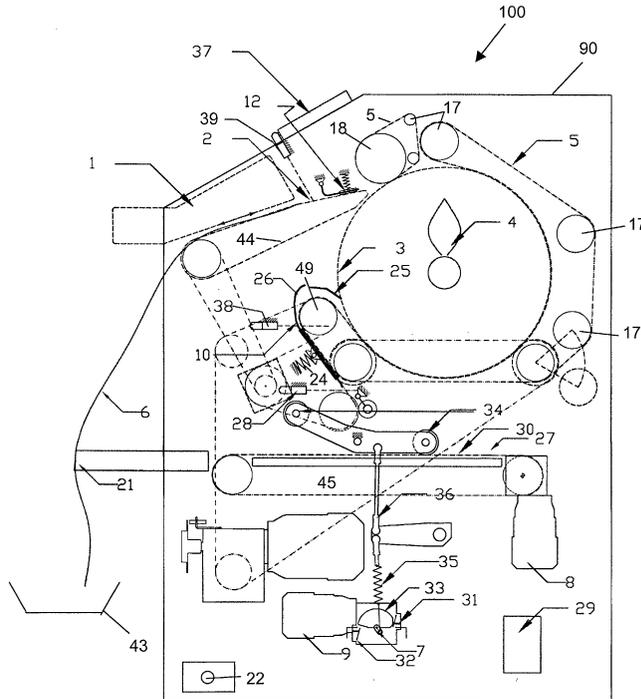


Fig. 1

Description

Technical field of the invention

[0001] The present invention relates to ironing machines and in particular, but not exclusively, to an improved folding mechanism for belt ironers as well as methods of operating the same.

Background of the invention

[0002] It is known to provide laundry apparatus adapted to iron fabric workpieces on an industrial scale, such fabrics often comprising linen, sheets, pillowcases, tablecloths and similar laundry items and sometimes being referred to for convenience as flatwork. Some such prior art apparatus comprise in general terms a heated main cylinder, having several small cylinders and textile belts that convey fabric workpieces across and in contact with the heated main cylinder. A heating system for heating of the main cylinder may be provided by a variety of means, such as electrical elements, gas, steam or heated fluid oil. The heating system keeps the cylinder at an optimal temperature set by the operator according to the type of workpiece. The heated main cylinder has as a function to remove moisture from the flatwork adapted to be ironed by the smooth outer periphery of the cylinder. A preferred situation is to keep the main cylinder and the ironing process at a stable temperature. The efficiency of ironing depends on a combination of cylinder temperature, ironing pressure and the transportation speed of the fabric across the surface of the heated main cylinder.

[0003] The fabric workpiece is inserted in the ironer by an introduction system that generally consists of two clamps in which the operator clamps the workpiece. By pressing a button, the workpiece is stretched by means of a pneumatic cylinder which moves a cable on which the clamps are permanently fixed. Entangled linen is disentangled by means of brushes, for example as described in US-3736678, which push each end of the workpiece to an appropriate side of the ironer.

[0004] During the ironing process the workpiece can become electrically charged. This electrical charge is generally taken away by an anti-static tube that ionises the air around the workpiece so that it arrives electrically uncharged in the folding equipment. Failing to do this often causes the workpiece to get obstructed in the folding device. Even in cases where there is provided an anti-static bar there may still be problems of obstruction in case the workpiece is too dry. For this reason, in general, ironing machines are provided with systems to measure the residual humidity. Another reason to measure the residual humidity is to assure that only linen is folded when the humidity level is below 8 % so that no mould can grow.

[0005] Combined ironer-folding apparatus have long been known in the art, e.g. from US-4479640, US-

4061326 and US-5079867. In general, a folding unit receives a flat workpiece from an ironer unit, and through manipulation by mechanical or pneumatic means, folds that workpiece into several successive smaller sizes to form a neat and easily handlable bundle. Zig-zag folded sheets are preferred e.g. in hotels because of the ease of unfolding of the linen and by this saving a lot of labour. However, no automatic folding devices for zig-zag folding are known.

Summary of the invention

[0006] It is an object of the present invention to provide a folding mechanism in an ironing machine, which can handle accordion type and/or zig-zag type of folding and back to back folding or the manual type of folding.

[0007] It is furthermore an object of the present invention to implement the zig-zag folding so that no compressed air is needed. This zig-zag movement could be executed by means of a pneumatic piston. However, the use of compressed air is more expensive and leads to a less reliable installation.

[0008] It is also an object of the present invention to provide a cheaper and more reliable installation for zig-zag folding.

[0009] The above objective is accomplished by the devices and methods according to the present invention.

[0010] The present invention provides an ironing machine having an ironing means for ironing a workpiece, a support structure, such as a belt for example, for supporting the ironed workpiece downstream of the ironing means and a folding means for folding the ironed workpiece, wherein the folding means comprises electrically operated means for oscillatory motion of the support structure. The electrically operated means for oscillatory motion of the support structure may comprise a first electrical gearbox. Due to the oscillatory movement of the support structure, the folding means is a zig-zag folding means.

[0011] The ironing machine may be provided with a controller for adapting the moving speed of the support structure in function of the ironing speed and/or the desired width of folding.

[0012] The ironing machine may furthermore comprise pressure means for exerting pressure on the folded workpiece, such as for example pressure rollers. The pressure means may be driven by a second gearbox for being in engaging contact with the workpiece or the support structure or not.

[0013] The ironing machine may furthermore comprise a device for doubling up, or back-to-back folding of, the ironed workpiece, which device is mounted upstream of the support structure. The device for doubling up the ironed workpiece may comprise a supporting guiding device, for example a plate, for guiding the workpiece towards the support structure, and a directing device for directing the workpiece towards the supporting

guiding device. The supporting guiding device and the directing device are movable with respect to each other, e.g. by means of a suitably driven eccentric. If they are both in a first position, a first part of the ironed workpiece is delivered to a first location. When they are thereafter switched or moved to a second position, a second part of the ironed workpiece together with the first part of the ironed workpiece are delivered to a second location, for example to the zig-zag folding means of the present invention.

[0014] The ironing machine according to the present invention may furthermore comprise a conductive grounded discharge device located at an exit of the ironing means, for discharging the ironed workpiece from static electrical charges. This conductive grounded discharge device may be formed by the supporting guiding device.

[0015] The present invention also provides a method of zig-zag folding a workpiece in a folding means. The method includes depositing the workpiece on a support structure, while imparting an electrically operated oscillatory movement to that support structure. The method may furthermore comprise controlling the oscillatory movement of the support structure in function of the ironing speed and/or the desired width of folding. The method may also comprise exerting pressure on the folded workpiece.

[0016] The method according to the present invention may furthermore comprise back-to-back folding or doubling up of the workpiece before the zig-zag folding.

[0017] The back-to-back folding may comprise:

in a first movement, guiding a first part of the workpiece towards a first location,
and

in a second movement, guiding the first part and a second part of the workpiece towards a second location, such as the support structure for example.

[0018] The method may furthermore comprise discharging the workpiece by means of a conductive grounded discharge device such as a grounded metal plate for example.

[0019] Although there has been constant improvement, change and evolution of laundry apparatus in this field, the present concepts are believed to represent substantial new and novel improvements, including departures from prior practices, resulting in the provision of devices that improve the quality of ironing.

[0020] These and other characteristics, features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. This description is given for the sake of example only, without limiting the scope of the invention. The reference figures quoted below refer to the attached drawings.

Brief description of the drawings

[0021]

5 Fig. 1 is a schematic cross-sectional side view of an ironing machine with a folding system for both zig-zag folding and back to back folding according to an embodiment of the present invention.

10 Figs. 2.1. to 2.4 are side views illustrating the sequence of operations of the bottom folding mechanism for obtaining a zig-zag folding according to an embodiment of the present present invention.

15 Figs. 3.1 and 3.2 are side views illustrating the sequence of operations of the plates to obtain a folding result as it would be when folded manually.

20 Figs. 4.1 and 4.2 are a side view and a front view respectively of a capacitive humidity sensor mounted on a conductive plate at the exit of the ironing means.

[0022] In the different drawings, the same reference figures refer to the same or analogous elements.

Description of illustrative embodiments

25 **[0023]** The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes.

30 **[0024]** Referring to the drawings and in particular to Fig. 1, an ironing machine 100 is represented, which comprises an outer casing 90 that houses an ironing means, the ironing means being expressed in the embodiment given in the form of an ironing cylinder 3 provided with a heating system 4 to keep the ironing cylinder 3 at a specific and preferably predetermined temperature. The heating system 4 may take a variety of forms, e.g. electrical, gas, steam or heated fluid heating. It is not anticipated that the present invention is limited by the heating system. The cylinder 3 is adapted for rotation, and may be driven for rotation by a suitable motor such as a variable speed motor and transmission (not represented in the drawings). The active heating surface of the cylinder 3 that heats the fabric workpiece 6 is preferably about 3/4 of the total surface of the heating cylinder 3.

35 **[0025]** An inlet means is provided which may comprise an entry table 2. The inlet means presents a fabric workpiece 6 to a feed means of the ironing cylinder 3. A rounded table 21 may be provided to assure that the fabric 6 is nicely stretched without the need of brushes.

40 **[0026]** The feed means may be provided in the form of a pressure cylinder 18, which rests substantially parallel to and on or in the neighbourhood of the ironing cylinder 3, a plurality of belt cylinders 17 and one or more

endless textile belts 5. Such a feed means may be arranged in use to feed the fabric workpiece 6 into the ironing machine 100 and to drive it through the machine 100 from the inlet to an outlet and to keep it in contact with the ironing cylinder 3. The pressure cylinder 18 may cooperate with the plurality of continuous/endless textile belts 5 which are trained around the pressure cylinder 18 and around a series of belt cylinders 17. In at least one point of their path, the belts 5 are trapped between cylinders 3, 17 and 18 in such a way that movement is imparted to the belts 5 and they feed a fabric workpiece 6 into the machine 100 and drive it through, keeping the fabric 6 in contact with the heating cylinder 3. At the end of the ironing process, the feed means is adapted to return the fabric workpiece 6, via an outlet comprising an exit table roller 49, to an exit table (not represented) where an operator can fetch it in an ironed condition. Alternatively, the ironed workpiece 6 can be presented to a folding mechanism where it is folded, as explained below.

[0027] A control unit may be provided (not shown in the drawings) for controlling the operation of the complete machine or the control unit may be split up into one or more controllers, each controller carrying out specific control functions, e.g. temperature, movement control. The control unit may make use of any suitable control method, e.g. mechanical, electronic, hydraulic, pneumatic although an electronic control system using microcontrollers or similar is preferred.

[0028] The operation of the ironing is essentially as follows: once an ironing temperature has been achieved at the surface of the heated ironing cylinder 3 that is suitable for the type of fabric 6 (e.g. cotton, linen, synthetics) to be ironed, the fabrics work piece 6 is put on the top fabrics holder 43. The top fabrics holder 43 acts as an input of the machine 100 and is used for receipt of fabric workpieces 6 upstream of the ironing cylinder 3. An operator then shifts the fabrics 6 over to the transportation belts 44 and initiates a machine ironing cycle, e.g. by means of a user device such as a pedal or button 22. Initiating an ironing cycle starts the turning of the belts 5 and cylinders 17 and 18. By friction, the fabrics 6 are transported automatically by the belts 5 into the machine 100 between the pressure cylinder 18 and the heated ironing cylinder 3. Body part protection, such as finger protection (not represented in the drawings) may be provided to protect an operator from injury, and is then adapted to put the drive motor of the cylinder 3 in reverse if something goes wrong at the entry table 2, e.g. if an operator body part passes beyond a finger protection trip switch. Body part protection therefore comprises a sensor suitable for sensing a body part passing beyond a finger protection trip switch, which sensor sends a corresponding signal to the control unit. The control unit then sends, in response to the signal received from the sensor, an appropriate signal to the drive motor of the ironing cylinder 3 for driving the ironing cylinder 3 in reverse.

[0029] In a case where the ironing machine 100 is provided with a folding mechanism, the fabrics 6 will be folded automatically downstream of the ironing means 3, i.e. after having left the ironing means 3.

[0030] The workpiece 6 is transported by means of the cylinder 3 and the endless ironing belts 5 up to the point where an de-sticking or removing means 25 (Fig. 1, Figs. 3.1 and 3.2, Fig. 4.1) peels off the workpiece 6 from the hot cylinder 3. According to the present invention, the workpiece 6 will be ironed, and folded in a suitable way, e.g. folded in an accordion or zig-zag way, or folded as it would be done in a manually way.

ZIG-ZAG FOLDING

[0031] A first plate 26 and a second plate 10 are in a position as shown in Fig. 1, i.e. both plates 26, 10 are close to each other with substantially no gap in between, so that together these plates 26, 10 lead the workpiece 6 from the ironing means 3 down to folding table 27. The workpiece 6 is transported towards a folding table 27 by means of the endless belts 5 and the first and second plates 26, 10, the second plate 10 being a conductive plate, for example a stainless steel plate, mounted on springs 24 connected to earth.

[0032] It will be appreciated by those skilled in the art that the second conductive plate 10 connected to earth gives the following advantage: due to the grounded second plate 10, electrical charge which is present on the workpiece 6 due to the ironing process is eliminated so that there is no need for an anti-static tube. Such anti-static tube works on the principle that due to a high voltage (5000 V) the air around it is ionised and neutralises the electrical charge on the workpiece 6. Such anti-static tube is expensive due to the presence of a high voltage transformer, it is dangerous and demands a lot of maintenance due to the dust that is attracted. Also the distance between the workpiece 6 and the anti-static tube needs to be very accurate. So it will be appreciated by those skilled in the art that the need for an anti-static tube is eliminated by the placement of a conductive plate 10 connected to earth. The use of an anti-static tube is only effective when the air contains sufficient humidity. In other words when the humidity of the workpiece 6 is still above a certain minimum level. In the present case there is mounted over the complete width of the ironing means 3 at the exit side a grounded metal plate 10, as shown in Fig. 4.2. All static electricity present on the ironed workpiece 6 will be discharged to the ground independent of the residual humidity.

[0033] Based on Figs. 2.1 to 2.4, it will be explained how the bottom folding table 27 operates. It is an object of the present invention to present a folding mechanism which eliminates the need of any pneumatically parts, resulting in a cheaper, more reliable folding machine and a lower installation and operating cost. A logical assumption would be to install an electrical jack, but electrical jacks are too slow and not designed for a large

amount of cycles. Using an electrical coil could also be a solution, but considering the big mass to be moved, the electrical coil would have to be dimensioned very large in size and would be source of a lot of noise due to the very quick response that is required. Also to avoid overheating of the coil due to the high frequency of operation it would have to be over-dimensioned. The above object may be achieved by a totally electrical operated folding mechanism according to the present invention.

[0034] The bottom folding table 27 comprises a movable support structure, such as e.g. folding belts 30. When the leading edge of workpiece 6 passes a proximity detector such as an optical detector 28, generates a signal which is sent to the control unit, which then starts a first gearbox 8 driven by a driver such as a frequency converter 29. The first gearbox drives folding belts 30 in a direction depending on which one of switches 31, 32 is closed by cam 33 on a second gearbox 9. The cam 33 has a shape such that it closes one of the two switches 31, 32 during less than half of a rotation cycle of the cam 33. The duration of the closure of the switches 31, 32 depends on the speed of rotation of the exit axe of the second gearbox 9. When the leading edge of workpiece 6 passes the optical sensor 28, the second gearbox 9 starts turning until one of switches 31, 32 switches on, e.g. switch 31 as represented in Fig. 2.1.

[0035] On the exit axis 45 there is also mounted an eccentric 7 which pushes one of the pressure rolls 34 through a mechanism of a spring 35 and some connection handles 36 onto the movable support structure 30 of the folding table 27. If folded workpiece 6 is present on the support structure 30, pushing down one of the pressure rolls 34 onto it provides a pleat. The spring tension of the spring 35 is adjustable so that also the pressure for making a pleat in the workpiece 6 is adaptable. A control means may be provided for controlling the spring tension of spring 35, for example on the basis of a value for the spring tension set by an operator via an input device such as for example a keyboard or a touch screen.

[0036] The first gearbox 8 drives the folding belt 30 so as to move workpiece 6 landing on it to the left (as switch 31 is closed - see Fig. 2.1). The speed of the folding belt 30 is adapted to the speed of the ironing cylinder 3 so that the moving of the workpiece 6 on the folding belt 3 happens at the same speed as the delivery of workpiece 6 from the ironing cylinder 3. This adaptation may be carried out by a suitable control device.

[0037] The speed of the second gearbox 9 is also adapted to the circumference speed of the cylinder 3. This adaptation may be carried out by a suitable control device such as the control unit. The control unit may for example receive signals from speed sensors near, adjacent or abutting the surface of the cylinder 3, and send appropriate drive signals to the second gearbox 9. Alternatively the control unit may receive information on the circumference speed of the cylinder 3 from the drive

settings thereof, e.g. via a look-up table, and send corresponding drive signals to the second gearbox 9.

[0038] The length of the workpiece 6 that passes the optical detector 28 is measured by a length measuring device, comprising for example an incremental encoder 41 mounted on or associated with folding belts 30. The incremental encoder 41 may be any encoder sending out a signal, e.g. a number of pulses, relating to the length of workpiece 6 that has passed. It may for example be a rotational encoder with a resolution of a predefined number of pulses per rotation, the incremental encoder 41 rotating then with movement of the folding belt 30 in either direction. The output from the incremental encoder 41 is read by a counter input of the control unit, e.g. a PLC, where the signal is filtered and interpreted before being passed as an actual distance.

[0039] When a predefined folding length, or thus a predetermined length of workpiece 6 is reached, e.g. 1/4 of the length of the workpiece 6, or a length corresponding to the desired length of a folded packet to be formed, the second gearbox 9 starts turning, driven by a suitable signal from a control device in response to the length signal received from the incremental encoder 41, until the other switch 31, 32, in the case represented in Fig. 2.2 switch 32, switches on. The closure of the second switch 32 makes a second pressure roll 34b touch the folding belt 30, so as to make a pleat in the folded workpiece 6 underneath it, if present. The first gearbox 8 starts turning in the opposite direction, driven by a suitable signal from the control unit, until the encoder 41 has measured again the desired, predefined folding length. In the case represented in Fig. 2.2, the folding belt 30 with a predetermined length of the workpiece 6 deposited onto it moves to the right, and a second layer of workpiece 6 is deposited on top of the first layer.

[0040] When the predefined folding length is again reached the second gearbox 9 starts turning, driven by a suitable signal from the control unit in response to the length signal received from the incremental encoder 41, until the other switch 31, 32, in the case represented in Fig. 2.3 switch 31, switches on again, which makes the first pressure roll 34a touch the folding belt 30, or the part of the workpiece 6 deposited onto it, so as to make a pleat in the folded workpiece 6 underneath it. The first gearbox 8 starts turning in the opposite direction, driven by a suitable signal from the control unit, until the encoder 41 has sent out a signal relating to the length of workpiece 6 that has passed, which signal is interpreted by the control unit as the desired, predefined folding length. In the case represented in Fig. 2.3, the folding belt 30 with already two predetermined lengths of the workpiece 6 deposited onto it in two layers, moves to the left again, a pleat is made by the first pressure roll 34a being brought down, and a third layer of workpiece 6 is deposited on top of the second layer.

[0041] These steps are repeated till the optical detector 28 transmits a signal representative of the detection of the absence of workpiece 6. The driving by means of

the first gearbox 8 brings the folded workpiece 6 to the front or the rear of the machine 100, where it can e.g. be fetched by an operator. The second gearbox 9 starts turning, driven by a suitable signal from the control unit, until both switches 31, 32 are switched off. This is to assure that both pressure rolls 34a, 34b do not touch the folding belts 30 to avoid wearing of those latter, as shown in Fig. 2.4.

[0042] In this way a zig-zag way of folding is achieved, which is also referred to as an accordion way of folding.

MANUAL TYPE OF FOLDING

[0043] It is another object of the present invention to offer next to the accordion way of folding also the possibility to carry out two subsequent double up operations or back-to-back folding on the workpiece 6, which is also referred as the manual quality of folding.

[0044] This may be done by arranging the above described conductive or metal second plate 10 so that it can be positioned in two positions so as to obtain in one position the manual way of folding and in a second position the zig-zag folding. The latter is preferred in hotels because of the ease of unfolding of the linen and thus saving a lot of labour.

[0045] Referring to Figs. 3.1 and 3.2, when an operator has set the ironing machine 100 in the manual quality fold mode, e.g. by entering suitable commands into the control unit, the plates 10 and 26 will be withdrawn e.g. by means of an eccentric 46, 48 driven by suitable driving mechanisms such as a motor, in a position A as shown in fig 3.1. The workpiece 6 passes through the gap 47 between first plate 26 and second plate 10, preferably under gravity forces. A length measuring device, such as for example an optical detector 38 is provided (see Fig. 1) which sends to the control unit a signal relating to the length of the workpiece 6 that passes the length measuring device 38. In the control unit, this signal is interpreted as an actual length. The total length of the workpiece 6 is either measured by a length measuring device such as for example an optical detector 39 represented in Fig. 1, which also sends to the control unit a signal relating to the length of the workpiece 6 that passes the optical detector 39, or it can be previously programmed by the operator in an electronic controller 37 of the machine 100. Referring back to Fig. 3.2, the moment that half of the length of the workpiece 6, which value can be calculated by a calculation unit based on length signals received from the control unit or from the electronic controller 37, has passed the optical detector 38, the first and second plates 26, 10 are pushed into position B, i.e. second plate 10 is pushed upwards towards first plate 26, and first plate 26 is moved closer to the belt 5, so as to close the gap 47 between first and second plates 26, 10. The first plate 26 guides the ironed workpiece 6 between the upper surface of second plate 10 and a continuous belt 5. Both the newly delivered workpiece 6 coming from the ironing means 3 and pre-

viously delivered workpiece 6 are moved down along the upper surface of second plate 10, the movement being imposed by the movement of the continuous belt 5. The workpiece 6 is therefore transported double folded towards the folding table 27. As was described hereinabove, the workpiece may then be zig-zag folded by using the folding belt 30 and the pressure rollers 34. If the zig-zag folding consists of only two steps, wherein the folding belt 30 once moves to the right and once to the left, the workpiece 6 is twice doubled up. If the zig-zag folding consists of three steps, wherein the folding belt 30 e.g. moves to the left, to the right and back to the left again, as for the embodiment represented in Figs. 2.1 to 2.4, the double up operation is followed by a real zig-zag folding. By inserting the workpiece 6 already doubled up, the operator can obtain a folded workpiece 6 in a quality as would it be manual folded in a width of e.g. 1/4 or 1/6 of the length of the workpiece 6.

[0046] The speed of the ironing cylinder 3 and the power of the heating means 4 may be adapted by suitable drive signals according to the amount of water present in the workpiece 6 that enters the ironing machine 100. This adaption may be made under the control of the control unit. At the entry of the ironing machine 100 there is mounted a first humidity sensor 12 and optionally other sensors, for example a capacitive sensor device, which measures the thickness and the amount of water in the workpiece 6 that enters the ironer. The control unit may send suitable drive signals to the drive mechanism of the ironing cylinder 3 and/or to the heating means 4, in response to the signals received from the first humidity sensor 12 and optionally of other sensors. Keeping the speed and temperature of ironing constant may be achieved by adapting the heating power 4 according the humidity. This results in higher productivity.

[0047] According to a preferred embodiment, in the second conductive plate 10 a second capacitive humidity sensor 11 is mounted, as shown in Fig. 4.2, which controls the residual humidity in the workpiece 6 after ironing. Without this metal plate 10, capacitive measurement wouldn't be possible because the static electricity of the workpiece 6 would disturb the measurement. This second humidity sensor 11 gives a feedback to the control unit for correction of values set in accordance with the output of a first humidity sensor 12, e.g. by correcting the speed and power of heating as determined from the output values of the first humidity sensor 12. Thereby it is assured that the workpiece 6 has the correct humidity level. A correct humidity level is below an upper limit so that productivity and hygienic standards (growth of mould being prevented) are respected. Workpiece 6 that is too wet will be not folded in order to avoid mycosis. At the same time a correct humidity level is above a bottom limit otherwise workpiece 6 may be wrinkled by the handling or next folding operations. This way the ironing machine 100 is equipped with an improved ironing control system.

[0048] It is to be understood that although preferred embodiments, specific constructions and configurations, have been discussed herein for devices according to the present invention, various changes or modifications in form and detail may be made without departing from the scope and spirit of this invention.

Claims

1. An ironing machine (100) having an ironing means (3) for ironing a workpiece (6), a support structure for supporting the ironed workpiece downstream of the ironing means and a folding means for folding a workpiece (6), wherein the folding means comprises electrically operated means for oscillatory motion of the support structure.
2. An ironing machine (100) according to claim 1, wherein the electrically operated support structure is a belt (30).
3. An ironing machine (100) according to any of the previous claims, furthermore comprising a first electrical gearbox (8) for electrically driving the support structure.
4. An ironing machine (100) according to any of the previous claims, furthermore comprising a controller for adapting the moving speed of the support structure in function of the ironing speed and/or the desired width of folding.
5. An ironing machine (100) according to any of the previous claims, furthermore comprising pressure means (34a, 34b) for exerting pressure on the folded workpiece (6).
6. An ironing machine (100) according to claim 5, wherein the pressure means (34a, 34b) are pressure rollers.
7. An ironing machine (100) according to any of claims 5 or 6, wherein the pressure means are driven by a second gearbox (9) for being in engaging contact with the workpiece (6) or not.
8. An ironing machine (100) according to any of the previous claims, furthermore comprising a device for doubling up the ironed workpiece (6), which is mounted upstream of the support structure.
9. An ironing machine (100) according to claim 8, wherein the device for doubling up the ironed workpiece (6) comprises a supporting guiding device (10) for guiding the workpiece towards the support structure, and a directing device (12) for directing the workpiece towards the supporting guiding device (10), the supporting guiding device (10) and the directing device (12) being movable with respect to each other.
10. An ironing machine (100) according to claim 9, wherein the supporting guiding device (10) and the directing device (12) are movable with respect to each other by means of an eccentric (46).
11. An ironing machine (100) according to any of the previous claims, the ironing means (3) having an exit, furthermore comprising a conductive grounded discharge device (10) located at the exit of the ironing means (3) for discharging the workpiece (6) from static electrical charges.
12. An ironing machine (100) according to any of claims 9 or 10 and 11, wherein the supporting guiding device is the grounded discharge device.
13. A method of zig-zag folding a workpiece (6) in a folding means, the method including depositing the workpiece (6) on a support structure (30), while imparting an electrically operated oscillatory movement to the support structure (30).
14. A method according to claim 13, furthermore comprising controlling the oscillatory movement of the support structure (30) in function of the ironing speed and/or the desired width of folding.
15. A method according to any of claims 13 or 14, furthermore comprising exerting pressure on the folded workpiece (6).
16. A method according to any of claims 13 to 15, furthermore comprising back-to-back folding of the workpiece (6) before zig-zag folding.
17. A method according to claim 16, wherein the back-to-back folding comprises:
 - in a first movement, guiding a first part of the workpiece (6) towards a first location, and
 - in a second movement, guiding the first part and a second part of the workpiece (6) towards a second location.
18. A method according to any of claims 13 to 17, furthermore comprising discharging the workpiece (6) by means of a conductive grounded discharge device (10).

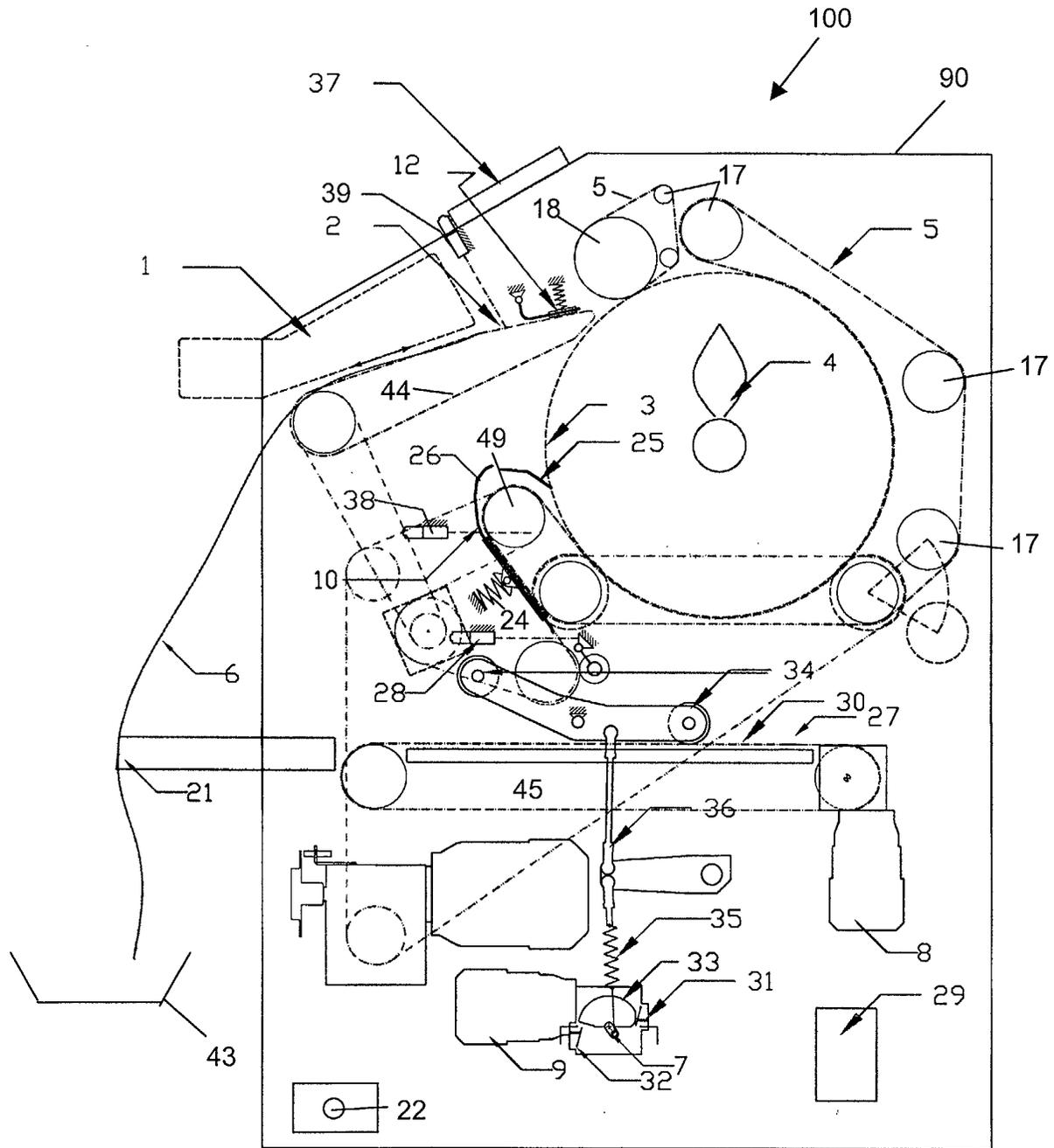


Fig. 1

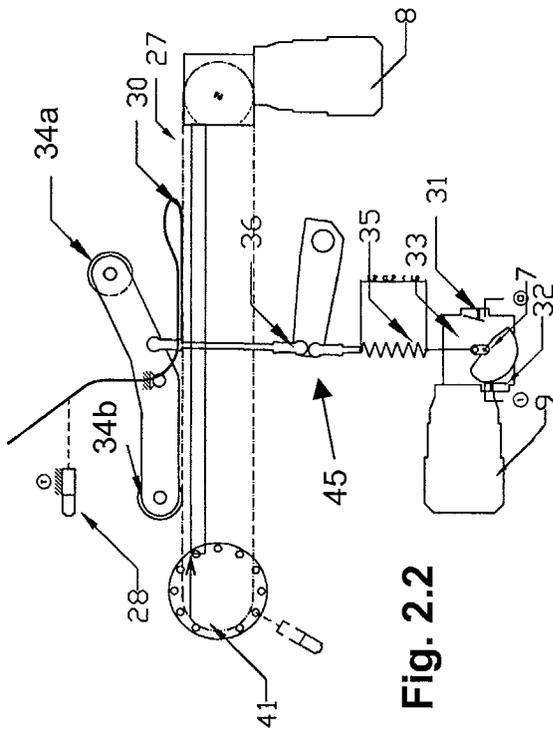


Fig. 2.1

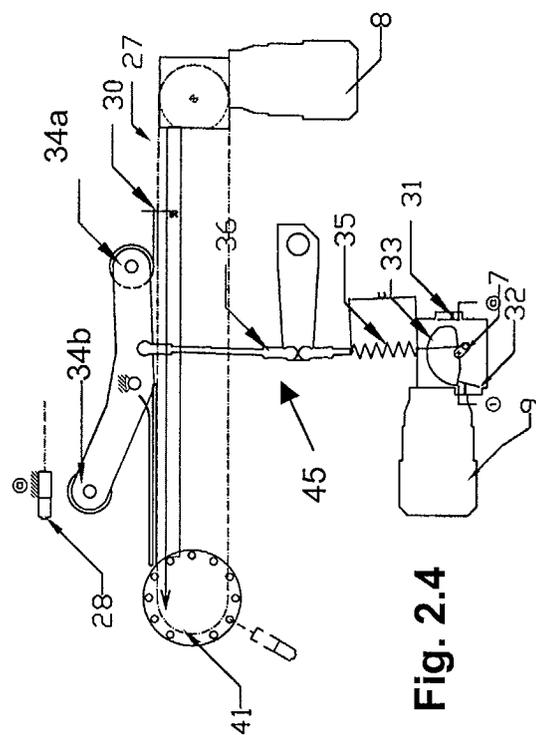


Fig. 2.2

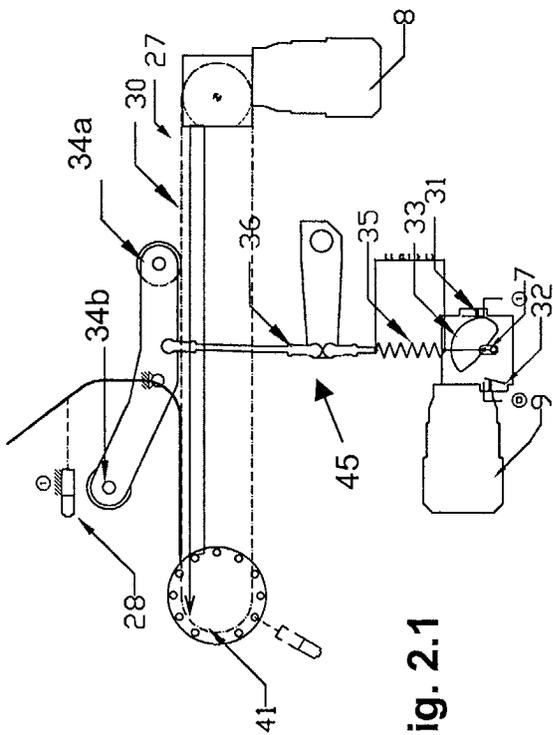
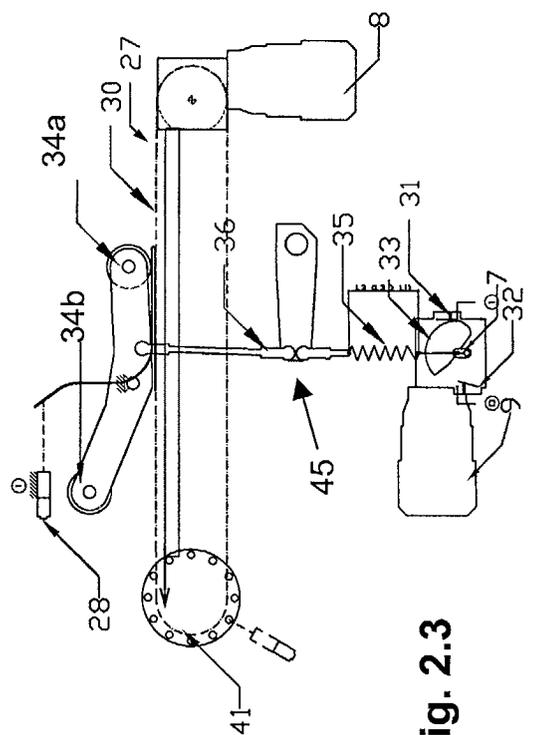
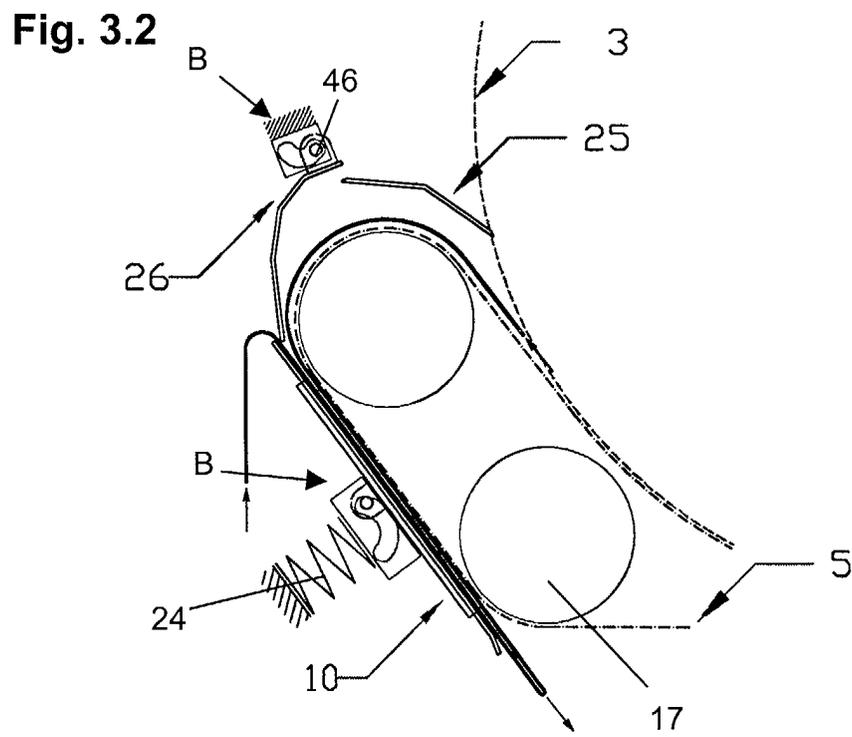
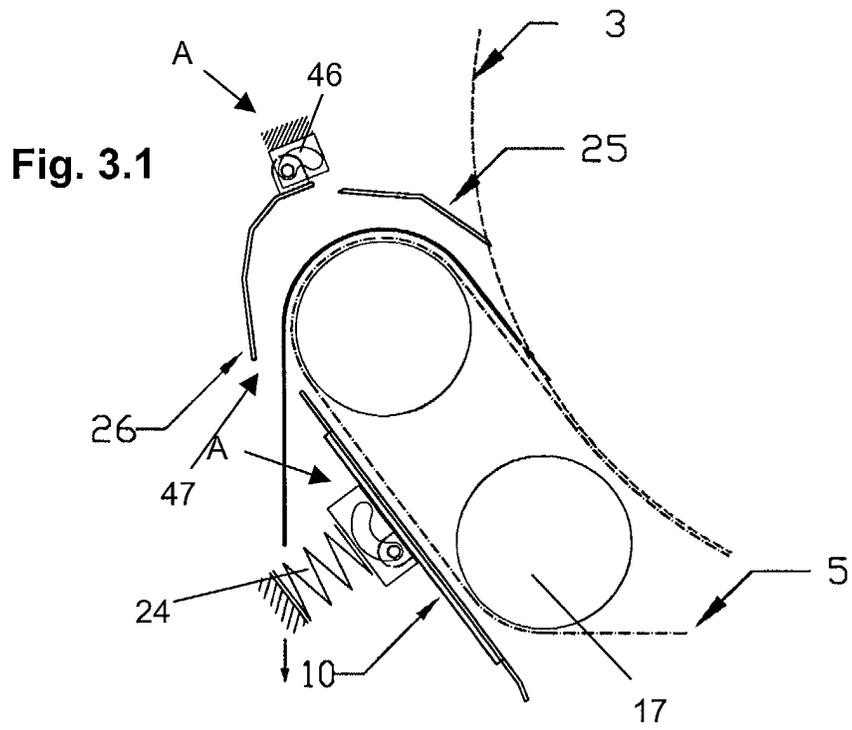


Fig. 2.3





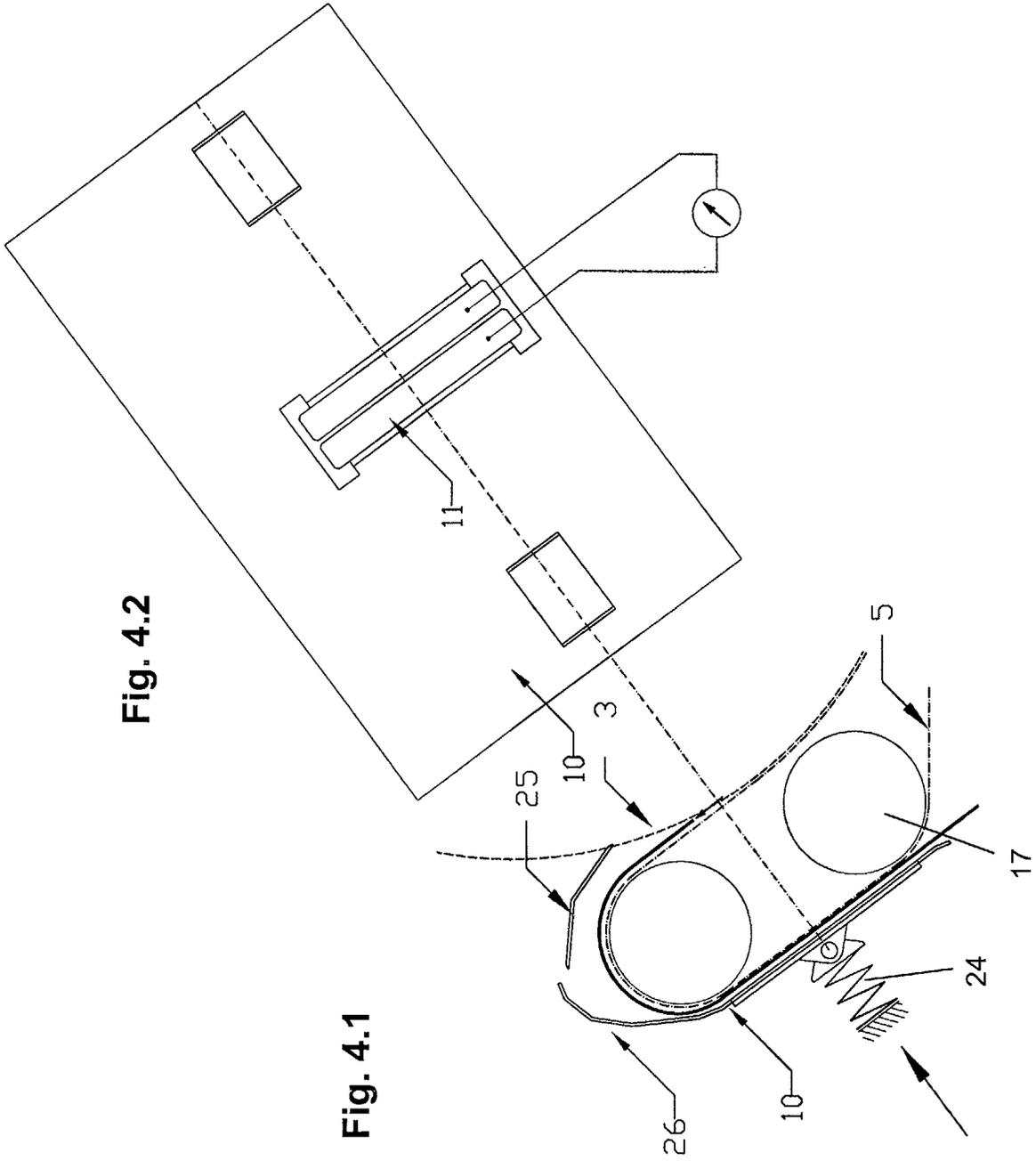


Fig. 4.2

Fig. 4.1



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 9373

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