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(54) **Device for producing corrugated board and condensate recovery method**

Vorrichtung zur Herstellung von Wellpappe und Kondensatrückgewinnungsverfahren

Dispositif de production de carton ondulé et procédé de récupération de condensats

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Description

Technical field

[0001] The present invention relates to improvements to systems, machinery and devices for producing corrugated board. More in particular, the present invention relates to improvements to the devices, usually called "double facers", for coupling smooth and corrugated paper sheets to form a corrugated board.

Background of the invention

[0002] The corrugated board is usually formed by a plurality of paper sheets glued together, of which at least two are smooth and at least one is corrugated. The corrugated paper sheet is arranged between two smooth paper sheets, and the sheets are bonded by gluing. The simplest structure of the corrugated board can provide for three sheets as described above, but it can be also produced with more corrugated sheets, i.e. constituted by a greater number of corrugated paper sheets coupled with smooth paper sheets. In general, the corrugated board comprises two outer smooth paper sheets, usually called liners, between which one or more corrugated paper sheets are arranged with the interposition of one smooth paper sheet between two consecutive corrugated paper sheets.

[0003] Cardboard is produced as follows. Two smooth paper sheets are fed in a so-called corrugating machine. One of these sheets is corrugated forming waves by passing through a corrugating nip formed between two corrugating rollers. A glue is applied on the crests formed by the corrugating rollers and a smooth paper sheet is bonded to the corrugated paper sheet thus obtained, by pressing and heating. In this way, a semi-finished product is obtained at the exit of the corrugator, constituted by two paper sheets, one smooth and one corrugated, glued together. A corrugator of this type is described for example in EP-A-1362691.

[0004] One or more composite sheets, constituted by one smooth paper sheet and one corrugated paper sheet bonded together in a corrugator, are fed into a so-called double-facer together with a further smooth paper sheet, and the double-facer glues together the semi-finished products.

[0005] US 2004/0261950 describes an example of a double-facer. These devices substantially comprise a corrugated cardboard feed path extending along a series of sequentially arranged heated plates defining a sliding surface for the corrugated cardboard. Pressing means are arranged above the heated plates to press the paper sheets forming the corrugated cardboard against the sliding surface defined by the heated plates. A flexible drawing member can be interposed between the pressing means and the paper sheets. In some known devices it is vice versa provided for directly pressing with the pressing members on the corrugated cardboard without inter-

posing a flexible member.

[0006] The device comprises a relatively high number of sequentially arranged plates along the machine direction, i.e. along the feed direction of the sheets forming the corrugated cardboard. Upstream of the heated plates gluing units are arranged, applying glue on the crests of the corrugated paper sheets fed into the bonding device.

[0007] Gluing occurs through the combined effect of heating the paper sheets stacked together and pressing them against the heated plates below by means of the pressing members. As some paper sheets fed into the device are corrugated, the pressure exerted by the pressing members cannot be hard, as in this case the corrugated paper sheet flutes would be squashed with irreparable damage to the finished product. For gluing it is therefore necessary to apply a limited pressure, maintaining it for a relatively long time. A high number of plates, arranged one after the other along the feed path of the paper sheets forming the corrugated cardboard, is thus required so that pressure and temperature are maintained for a sufficient time to set and dry the glue. Pressure and temperature are applied for a time depending upon the length of the sliding surface defined by the heated plates divided by the feed speed of the paper sheet.

[0008] The plates are usually heated by means of pressurized and preferably overheated steam coming from a steam generator, a boiler for instance. The steam heats the plates and they transfer heat to the paper sheets advancing along the sliding surface defined by the heated plates, between said surface and the pressing members. Following the heat transferred to the paper sheets, the steam condensates and the resulting water must be extracted from the heated plates and fed back into the steam generator in a closed circuit.

[0009] The heated plates are usually divided into several different groups; the steam is fed into each group at a pressure different from one group to the other, so as to obtain different temperatures in the different groups of heated plate. This allows to modulate the temperature profile along the corrugated cardboard feed path. The temperature profile can change according to the type of material to be produced; in particular it can change for example according to the number of bonded paper sheets, to the paper sheet grammage, the applied glue quantity, and/or other parameters.

[0010] The glue is usually water-based. The glue must penetrate inside the cellulose fibers, of which the paper sheets to be glued are made, when it has still enough water content. Once the glue has been penetrated into the cellulose fibers, it is necessary to remove the water so that the glue dries. If the glue is heated too quickly, i.e. if the temperature in the heated plates further upstream along the cardboard feed path is too high, then the water evaporates before the glue is sufficiently penetrated inside the cellulose fibers.

[0011] For this reason, water is usually heated at lower temperatures in the first portion of the feed path along the surface formed by the heated plates, so as to condi-

tion the paper, i.e. to heat the cellulose fibers before achieving a sufficient temperature for drying the glue. In the subsequent path portions the temperature increases to completely dry the glue, which has had enough time to penetrate inside the cellulose fibers.

[0012] The lower the quantity of applied glue and the weight per surface unit of the sheets to be glued, the lower the gluing temperature. To adapt the device operating conditions to the different requirements according to the type of material to be produced, it is generally well known to feed steam under different pressures into different subsequent groups of heated plates. Usually, the higher the temperature required in a given path section, the greater the steam pressure. The steam pressure generated by the steam generator is usually in the order of 15-20 bar. Starting from this maximum pressure value, steam flows at lower pressures are generated by means of adequate regulating valves and are fed into the different groups of heated plates.

[0013] WO-A-98/47699 discloses a method and apparatus for processing paperboard, including a double-facer and a system for generating a steam film between an advancing cardboard or paperboard web and the sliding surface formed by the heating plates.

[0014] EP-A-0949065 discloses a further double-facer for manufacturing a web of corrugated cardboard.

[0015] For a better understanding of the state of the art and the merits of the invention, enclosed Figure 1 schematically shows a so-called double-facer according to the prior art. The device is generically indicated with number 1. Number 3 indicates the single heated plates defining a sliding surface for the corrugated cardboard being formed, obtained by gluing webs of semi-finished material. In the illustrated example three webs of semi-finished material, indicated with N1, N2, and N3, are fed into the device 1. The web material N3 can be formed for instance by one smooth paper sheet, while the webs N1 and N2 are formed by a smooth paper sheet and a corrugated paper sheet bonded together in respective corrugating machines, so-called single facers, arranged upstream of the device 1 and not shown.

[0016] Along the path defined by the heated plates 3 pressing members 5 are arranged, pressing the webs N1, N2, and N3 against one another and against the sliding surface formed by the heated plates 3. In the illustrated embodiment, a flexible drawing member 7 extends between the pressing members 5 and the webs N1, N2, and N3; this member draws the corrugated cardboard being formed to make it slide against the sliding surface formed by the heated plates 3. In other embodiments the continuous flexible member 7 can be omitted, and the webs N1, N2 and N3 are drawn by means of roller transferring means or other systems.

[0017] The heated plates 3 are divided into several groups in a known manner. Figure 1 shows only a portion of the device 1, which can comprise an even very high number of heated plates 3 arranged one following the other along the cardboard feed direction F. In the portion

of the device 1 illustrated in figure 1 two groups of heated plates are shown, indicated with 9A and 9B. In the illustrated example the first group 9A comprises four heated plates 3, while the second group 9B comprises six heated plates 3. It should be understood that the number of groups and the number of heated plates 3 in each group can change according to the configuration of the device 1.

[0018] In the known plants the steam coming from a boiler or other generator, not shown in figure 1, is traditionally fed along a steam supply line 11. Through respective pressure regulating valves the steam is fed from the steam supply line 11 into the single groups 9A, 9B ... of heated plates 3. Figure 1 shows two pressure regulating valves 13A and 13B, feeding the steam coming from the steam supply line 11 into the groups 9A and 9B of heated plates 3. 15A and 15B indicate two conveying ducts that transfer the steam from the regulating valves 13A and 13B to respective steam collectors 17A and 17B associated with the groups 9A and 9B of heated plates 3.

[0019] The pressure of the steam fed into the two collectors 17A and 17B can be set by means of the pressure regulating valves 13A and 13B, so as to have, if necessary, different steam pressures in the two groups 9A and 9B of heated plates 3. The steam is fed from the collectors 17A and 17B into the single heated plates 3 of the groups 9A and 9B through ducts 19A, 19B.

[0020] Each plate is connected through ducts 22A, 22B with a condensate collector, indicated with 21A for the group 9A and with 21B for the group 9B. According to the prior art, each condensate collector 21A, 21B of each group 9A, 9B ..., into which the heated plates 3 are subdivided, is connected with a respective condensate storage tank, indicated with 23A for the group 9A and with 23B for the group 9B. An intercepting condensate relief valve, indicated with 25A for the group 9A and with 25 B for the group 9B, is arranged along the duct connecting each condensate collector 21A, 21B with the respective condensate storage tank 23A, 23B. The condensate storage tanks 23A, 23B are connected with a condensate recovery line 29 through respective ducts 27A, 27B. From this condensate recovery line 29 the condensate is fed back into the steam generator.

[0021] An intercepting valve, indicated with 31 A for the group 9A and with 31 B for the group 9B of heated plates 3, is arranged on each duct 27A, 27B. Each condensate storage tank 23A, 23B is connected to the steam supply line 11 through a steam feed line, indicated with 33A for the group 9A and 33B for the group 9B. On this line an intercepting valve is arranged, indicated with 35A for the group 9A and with 35B for the group 9B of heated plates 3.

[0022] The condensate forming in each plate group 9A, 9B ... is collected in the respective condensate collector 21A, 21B and discharged into the respective condensate storage tank 23A, 23B passing through the generally open valve 25A, 25B. The valve 31A, 31B of each condensate storage tank 23A, 23B is usually closed. Also the valve 35A, 35B, connecting each condensate storage

tank 23A, 23B with the steam supply line 11, is closed. When inside a condensate storage tank 23A, 23B a condensate maximum level is achieved (detected for instance by a float, a pair of level sensors or in other adequate) the respective condensate relief valve 25A or 25B is closed, the valve 31A or 31B is opened and also the valve 35A or 35B is opened to feed pressurized steam coming from the steam supply line 11 inside the condensate storage tank 23A, 23B. This steam pushes the condensate along the duct 27A into the recovery line 29. In this way for each group 9A, 9B ... of heated plates 3 an autonomous pumping system is obtained, allowing recovering the collected condensate as it forms.

[0023] The condensate heating and recovery system described above, characterizing the known plants and devices, is particularly complex.

Summary of the Invention

[0024] According to one aspect, the object of the invention is to provide a device of the above described type allowing to obtain an efficient condensate collection by means of a simpler and more economical system.

[0025] This is obtained with a device according to claim 1.

[0026] In one embodiment the invention advantageously provides for a device (so-called double facer) for producing corrugated cardboard, comprising: a feed path for the corrugated cardboard; along the feed path, a series of sequentially arranged heated plates defining a sliding surface for said corrugated cardboard, said series of heated plates being subdivided into a plurality of groups of heated plates; pressing members to press said corrugated cardboard against the sliding surface; a heating steam circuit for heating the heated plates. The circuit characteristically comprises: a pressurized steam supply line from a steam generator. Furthermore, for each group of heated plates, a pressure regulating valve is provided between said steam supply line and the heated plates of the respective group of heated plates, to supply said heated plates with steam under regulated pressure. For each group of heated plates a condensate relief valve is provided, connecting the heated plates of the respective group with a common condensate collecting line. The condensate coming from the groups of heated plates accumulates in a condensate storage tank. The storage tank is in turn advantageously connected with a condensate recovery line toward the steam generator. The condensate storage tank can be formed by the same common condensate collecting line. This common condensate collecting line can be formed for instance by a tube with a sufficient diameter to form a condensate storage inner space. The tube can be advantageously inclined so that the condensate accumulates at one end of the tube; otherwise it can be formed by more portions inclined towards condensate converging and storage areas. In some embodiments the storage tank can be simply produced with a tube portion descending from the tube form-

ing the common condensate collecting line, for instance a tube segment perpendicularly connected with the main body of a common tube collecting the condensate from the various groups of heated plates. In other embodiments the storage tank can be constituted by a component separate from the common condensate collecting line and in fluid connection with it.

[0027] According to some embodiments, a device for producing corrugated cardboard is provided, comprising: a feed path for corrugated cardboard; along said feed path, a series of sequentially arranged heated plates defining a sliding surface for said corrugated cardboard, said series of heated plates being subdivided into a plurality of groups of heated plates; pressing members to press said corrugated cardboard against said sliding surface; a heating steam circuit for heating said heated plates; wherein said circuit comprises:

- a pressurized steam supply line;
- for each group of heated plates, a pressure regulating valve between said pressurized steam supply line and the heated plates of the respective group of heated plates, to supply said heated plates with steam under regulated pressure;
- for each group of heated plates a condensate relief valve connecting the heated plates of the respective group with a common condensate collecting line.

[0028] Thanks to a device according to the invention it is possible to eliminate most of tubes, valves and control systems usually required in this type of plants, thus reducing dimensions, production and operation costs as well as maintenance.

[0029] In fact, a single condensate storage tank is enough for the entire device, instead of one tank for each group of heated plates. Just this entails high savings and simplification, as these pressurized tanks are subjected to specific safety requirements and need periodical inspections. The use of only one tank thus reduces costs and simplifies the periodical inspections. As indicated above, in some embodiments the condensate storage tank can be constituted only by a simple tube with adequate diameter, for which the law does not require periodical inspections. This would entail further simplifications and reduction in device production and operation costs.

[0030] Further advantageous features and embodiments of the device according to the present invention will be described in the attached claims, which form an integral part of the present description.

[0031] The maximum advantage exits by using only a single condensate storage tank for all the heated plates. It should be however understood that the invention can be embodied also using more condensate storage tanks, at least one of which is connected with at least two groups of heated plates. In this case a lower simplification is achieved, but an advantage is however obtained over the known plants and devices.

[0032] In some embodiments, for each group of heated plates a steam collector is provided connected between the respective pressure regulating valve and the heated plates of the respective group. A condensate collector is furthermore provided, connected between the heated plates of the respective group and the condensate relief valve.

[0033] In an improved embodiment of the invention, for at least one group of heated plates and preferably for each group of heated plates a common steam and condensate collector is vice versa provided, connected between the steam supply line and the heated plates of the respective group of heated plates and between the heated plates and the common condensate collecting line, the respective condensate relief valve being arranged between each steam and condensate collector and said common condensate collecting line. This allows to obtain a further simplification and reduction in the device costs.

[0034] A common steam and condensate collector can be used also in a traditional device, where each group of heated plates has one condensate storage tank. In this case the advantages of using a common condensate collecting line and a single condensate storage tank get lost, but the advantage is maintained of simplifying the steam supply and condensate recovery system of a single group of heated plates.

[0035] Therefore, according to one aspect the invention also relates to a device for producing corrugated cardboard, comprising: a feed path for the corrugated cardboard; along the feed path, a series of sequentially arranged heated plates defining a sliding surface for said corrugated cardboard; pressing members to press said corrugated board against said sliding surface; a heating steam circuit for heating said heated plates; wherein said circuit comprises: a pressurized steam supply line; for at least one group of heated plates, a steam and condensate collector, connected between the steam supply line and the heated plates of the respective group of heated plates and between the heated plates and a condensate collecting and relief system. In some embodiments, the device comprises more groups of heated plates and more collectors, one for each group of plates. A relief valve for each collector discharges the condensate toward a collecting system.

[0036] In some embodiments the steam and condensate collector comprises a tubular volume connected with each heated plate of the respective group of heated plates through a respective steam discharge connection and a respective condensate collecting connection. Each of the condensate collecting connections can advantageously form a siphon between the respective heated plate and the respective steam and condensate collector.

[0037] The device comprises a control system for opening and closing the condensate relief valves, controlling the selective opening and closing of said condensate relief valves to discharge the condensate selectively from each of said groups of heated plates towards said common condensate collecting line. Advantageously,

according to some embodiments the control system is designed to open the condensate relief valves sequentially. Advantageously, according to some embodiments the condensate relief valves are opened sequentially starting from the condensate relief valve of the group of heated plates under minimum pressure until the condensate relief valve of the group of heated plates under maximum pressure. This is the preferred sequence, because, passing from the condensate relief of a group of heated plates to the condensate relief of the subsequent group, it is not necessary to discharge the steam pressure accumulated in the common condensate collecting line and in the condensate storage tank. In fact, each group of plates of the adopted sequence has a steam pressure greater than that of the group that has discharged in the previous phase. The pressure from the condensate storage tank and the common condensate collecting line must be discharged in this way only at the end of a complete condensate relief cycle from all the groups of heated plates.

[0038] In other less advantageous embodiments different sequences can be used, for example random sequences, or according to the succession with which the plate groups are physically arranged along the cardboard feed path, for example starting from the utmost downstream group until the upward group. In this case the pressure can increase from the first group (i.e. the most downstream group) to the last group (the most upstream group) of the sequence. However this does not necessarily occur and depends upon the chosen pressure (and therefore temperature) profile.

[0039] In other embodiments the sequence can be not fixed but depending on the condensate quantity accumulated in each collector.

[0040] In general, when the condensate relief sequence does not follow the pressure profile in the various groups of heated plates it is possible to provide for discharging the pressure from the common condensate collecting line and from the condensate storage tank when the pressure is greater than that existing in the subsequent group of heated plates from which the condensate must be discharged. Condensate relief can occur for instance through an atmospheric discharge duct. In other embodiments relief can occur towards a group of heated plates by opening the respective condensate relief valve, for example towards the group of heated plates with the minimum pressure.

[0041] According to some embodiments of the invention, for discharging condensate from the storage tank and send it towards the steam generator, the condensate storage tank is connected with the pressurized steam supply line through an insertion valve for inserting pressurized steam into said condensate storage tank and thus eject condensate from said condensate storage tank.

[0042] According to some embodiments, a backflow valve is arranged between the condensate storage tank and the condensate recovery line from the condensate

storage tank towards the steam generator.

[0043] In some embodiments, with the condensate storage tank a level detector is associated, connected with a control system for controlling the condensate discharge from said storage tank. In some embodiments the control system advantageously detects the condensate quantity discharged from each group of heated plates and modifies the opening times of the condensate relief valves of the various groups of heated plates according to the condensate quantity accumulated in the time unit.

[0044] The condensate can be discharged from the storage tank by injecting steam into the tank directly from the steam supply line. In other embodiments the condensate can be discharged from the storage tank towards the steam generator by using the steam at reduced pressure in one of the groups of heated plates. To this end in some embodiments a pressure transducer can be provided on the condensate recovery line. A control system controls the opening of one of the condensate relief valves of a group of heated plates inside which the pressure is higher than the pressure in the condensate recovery line, to discharge condensate from said condensate storage tank towards said recovery line. It is possible for instance to provide for the condensate to be discharged from the storage tank by opening the condensate relief valve from the group of plates where there is the lowest steam pressure. In this case the following occurs: after having discharged the condensate from the collectors of the groups of plates at pressure increasing from the minimum to the maximum, the condensate relief valve from the collector associated with the group of plates with highest pressure is maintained open until the condensate has been completely discharged and it is maintained open so that the pressurized steam flows from the heated plates into the common condensate collecting line and from this into the storage tank. This steam coming from the heated plates pushes the condensate from the storage tank towards the recovery line to the steam generator. In this way neither a separate line to feed pressurized steam into the condensate storage tank is necessary nor a specific intercepting valve on this line.

[0045] According to a different aspect the invention relates to a method for recovering condensate in a device for producing corrugated cardboard comprising: a feed path for the corrugated cardboard; along said feed path, a series of sequentially arranged heated plates defining a sliding surface for said corrugated cardboard, said series of heated plates being subdivided into a plurality of groups of heated plates; pressing members to press said corrugated cardboard against said sliding surface; a heating steam circuit for heating said heated plates. The method of the invention is defined in claim 18. According to said method, the condensate of each group of heated plates is selectively discharged through a common condensate collecting line into a condensate storage tank, and is then ejected from said condensate storage tank towards a condensate recovery line by insertion in said

condensate storage tank at a higher pressure than the pressure in said condensate recovery line.

[0046] In some embodiments, the method according to the invention comprises the steps of

- selectively discharging the condensate accumulated in respective collectors associated with said groups of heated plates and collecting said condensate in said condensate storage tank;
- detecting the condensate level in said condensate storage tank;
- depending on the detected level, ejecting condensate from said condensate storage tank towards said condensate recovery line.

[0047] The method can advantageously comprise the steps of sequentially discharging condensate from at least some of said groups of heated plates starting from the group of heated plates inside which there is steam under the lowest pressure until the group of heated plates inside which there is steam under the highest pressure.

[0048] Further advantageous characteristics and embodiments of the method according to the invention will be described in the attached claims, which form an integral part of the present description.

Brief description of the drawings

[0049] The present invention will be better understood by means of the description and the attached drawing, which shows non-limiting embodiments of the invention. More in particular, in the drawing:

- figure 1, already described, shows a device or system according to the prior art;
- figure 2 shows a device according to the invention in a possible embodiment;
- figure 3 shows a simplified circuit diagram of a device according to the present invention;
- figure 4 shows an improved configuration of the steam distribution and condensate recovery system in a group of heated plates; and
- figure 5 shows a section according to V-V of figure 4.

Detailed description of embodiments of the invention

[0050] Figure 2 schematically shows a portion of a device 101 according to the invention. The device 101 receives a plurality of webs of semi-finished material, indicated again with N1, N2, and N3, that can be constituted by smooth paper and corrugated paper sheets as described with reference to figure 1.

[0051] The device 101 comprises a plurality of sequentially arranged heated plates 103 along the feed direction of the corrugated cardboard formed by the webs N1, N2 and N3 according to the arrow F.

[0052] In the illustrated example, in a known manner and as already described with reference to figure 1, along

the sliding surface formed by the heated plates 103 pressing members 105 are arranged, that press the paper webs N1, N2, and N3 against one another and against the sliding surface defined by the heated plates 103. In the illustrated example, between the pressing members 103 and the paper webs N1, N2, and N3 a continuous flexible member 107 is arranged, drawing the cardboard being formed.

[0053] Figure 2 shows only a portion of the device, being understood that it can extend also beyond the portion shown in this figure, presenting an even very high number of heated plates 103 arranged sequentially along the cardboard feed direction F. More in particular, in the portion of device 101 shown in figure 2 only two groups of heated plates 103 are visible, indicated respectively with 109A and 109B. In this embodiment, the first group 109A comprises four heated plates 103, whilst the second group 109B contains six heated plates 103. It should be understood that the number of groups and the number of plates for each group can vary without however affecting the description of the present invention.

[0054] Number 111 indicates the steam supply line coming from a boiler not shown in this figure. The device comprises a plurality of pressure regulating valves equal in number to the groups 109A, 109B ... into which the heated plates 103 are subdivided. In the portion of the device 101 visible in figure 2 two pressure regulating valves are present, indicated with 113A for the group 109A of heated plates 103 and with 113B for the group 109B of heated plates 103. The pressure regulating valves 113A and 113B are joined by means of a duct 115A and 115B respectively to a first steam collector 117A and to a second steam collector 117B for the first group 109A of heated plates 103 and for the second group 109B of heated plates 103, respectively.

[0055] From the respective steam collectors 117A and 117B discharge connections 119A, 119B extend to feed steam into the heated plates 103 of each group 109A, 109B. Advantageously, each steam collector 117A, 117B is separately connected with each heated plate 103 of the respective group 109A, 109B. In this way the steam is distributed, at the pressure set through the pressure regulating valve 113A or 113B, into all the heated plates 103 of one or of the other of the groups 109A and 109B.

[0056] Each group 109A, 109B of heated plates 103 furthermore comprises a condensate collector 121A, 121B. All the heated plates 103A of the group 109A are connected with the condensate collector 121A through respective ducts 122A, while all the heated plates 103 of the group 109B are connected with the condensate collector 121B through ducts 122B. In this way the condensate forming in the plates 103 of the group 109A is collected in the condensate collector 121A, while the condensate forming in the heated plates 103 of the group 109B is collected in the condensate collector 121 B.

[0057] Each condensate collector 121A, 121B of the various groups 109A, 109B ... is connected with a common condensate collecting line indicated with 130. In the

illustrated example the condensate collectors 121 A and 121B are connected with the common condensate collecting line 130 through respective ducts 132A, 132B. A respective intercepting valve, indicated with 134A for the condensate collector 121A and with 134B for the condensate collector 121B, is arranged on each duct 132A, 132B . These intercepting valves will be indicated below as condensate relief valves, being understood that they can be designed as simple intercepting valves.

[0058] Through a control of the condensate relief valves 134A, 134B ..., which will be described below, the condensate forming in the plates of each group 109A, 109B ... can be collected in the common condensate collecting line 130 thus discharging the condensate of all groups 109A, 109B ... of heated plates 103 into a condensate storage tank 136. The condensate storage tank 136 can be provided with a level detector, for example a float, a pair of level sensors or any other device suitable for detecting the quantity of condensate collected in the condensate storage tank 136. The condensate level detecting device is schematically indicated with 138. The condensate storage tank 136 furthermore comprises an exit 137 connected with a condensate recovery line 140 that brings the condensate back to the steam generator (not shown in figure 2). An intercepting valve 142 is arranged between the exit 137 of the condensate storage tank 136 and the condensate recovery line 140.

[0059] The condensate storage tank 136 is furthermore connected with the steam supply line 111 through a duct 144. Advantageously, on the duct 144 an intercepting valve 146 can be arranged for selectively opening and closing the duct 144.

[0060] The device described above operates traditionally as regards gluing of the webs N1, N2, and N3 and as regards the steam feed into the single groups 109A, 109B of heated plates 103. As already described with reference to figure 1, the pressure regulating valves 113A, 113B associated with the various groups 109A, 109B ... of heated plates 103 allow to maintain the steam pressure inside these plates at the value corresponding to the temperature which is required in the various sections of the cardboard feed path.

[0061] What substantially distinguishes the device of figure 2 from the prior art devices, illustrated for example in figure 1 and described above, are the condensate management and recovery from the various heated plates 103.

[0062] In fact, contrarily to what occurs in the known systems, the device 101 does not provide for individual condensate storage tanks for each group of heated plates; a pressurized steam pumping system in the single storage tanks is thus not provided. Vice versa, only one storage tank 136 is provided, receiving the condensate from the various groups 109A, 109B ... of heated plates 103. The condensate is therefore fed at variable pressure according to the steam pressure inside the various groups 109A, 109B ...

[0063] To collect correctly the condensate from the var-

ious groups 109A, 109B ... of heated plates 103 operating under different pressures, the condensate relief valves 134A, 134B ..., connecting each group 109A, 109B of heated plates 103 with the common condensate collecting line 130, are opened selectively.

[0064] According to one embodiment, an adequate control system, with a control unit schematically indicated with 150, manages the opening and closing of the single condensate relief valves 134A, 134B ... as follows.

[0065] The condensate relief valve corresponding to the group 109A, 109B ... of heated plates 103 where there is the lowest pressure, is opened firstly. Supposing for instance that the steam pressure in the heated plates 103 of the group 109A is equal to 4 Bar and the steam pressure in the heated plates 103 of the group 109B is equal to 8 Bar, in a first phase the control unit 150 will maintain the condensate relief valve 134B closed and will open the condensate relief valve 134A. In this way, supposing that in this phase the pressure inside the condensate storage tank 136 is equal to or lower than 4 Bar, i.e. the pressure inside the heated plates 103 of the group 109A, the condensate collected by the collector 121A is discharged, through the duct 132A and the condensate relief valve 134A, into the common condensate collecting line 130 and from here into the condensate storage tank 136. When the condensate has been wholly or partially discharged from the collector 121A, the control unit 150 closes the condensate relief valve 134A and opens the condensate relief valve 134B to discharge the collected condensate from the heated plates 103 of the group 109B. When the condensate has been wholly or partially discharged from the collector 121B, the control unit closes the condensate relief valve 134B and, if necessary, opens the condensate relief valve of the subsequent group 109 of heated plates 103 that is under the immediately higher pressure. The process is repeated for a number of times equal to the number of groups 109A, 109B ... into which the heated plates 103 of the device 101 are subdivided.

[0066] Preferably, during each selective opening step of the pressure relief valves 134A, 134B ... the condensate collected in the respective collector 121A, 121B is completely discharged. This is however not necessary. It is also possible for the condensate to be discharged only partially.

[0067] The condensate discharge can occur by timing the opening steps of the condensate relief valves 134A, 134B.

[0068] In other embodiments it is possible to control the change in the condensate level in the condensate storage tank 136. In this case the control unit 150 can be connected with the device 138 for detecting the condensate level in the condensate storage tank 136 and operate as follows. Once one of the condensate relief valves 134A, 134B has been opened, the condensate, discharged into the common condensate collecting line 130, discharging into the condensate storage tank 136 will cause a gradual increase in the level detected by the

detecting device 138. Once the condensate has been completely discharged from the respective group 109A, 109B ..., the condensate level in the condensate storage tank 136 remains constant, or it changes in an imperceptible manner, due to the fact that anyway the condensate formation is a continuous phenomenon and thus the steam condensation occurs also during the discharge step. However, the condensate formation speed is negligible if compared to the condensate discharge speed from the condensate collector.

[0069] The control unit 150 interprets the substantially constant condensate level in the condensate storage tank 136 as a signal of complete condensate discharge from the group 109A, 109B ... that in this phase is with the discharge valve 134A, 134B ... opened. The relief valve in question will be therefore closed and the control unit will open the subsequent relief valve.

[0070] Once the level inside the condensate storage tank 136 has achieved a maximum allowable value, which can be again detected for instance through the level detecting device 138, the control unit 150 can start a cycle of pumping the condensate from the condensate storage tank 136 toward the condensate recovery line 140. This occurs as follows.

[0071] Whilst, during the phase of discharging condensate from the various collectors 121A, 121B ... to the common condensate collecting line 130, the intercepting valve 142 on the exit 137 of the condensate storage tank 136 is closed, to pump the condensate from the condensate storage tank 136 to the condensate recovery line 140 said intercepting valve 142 is opened and the condensate relief valves 134A, 134B ... are closed. Also the valve 146 on the steam line 144 is opened. This means that the steam under the pressure from the steam supply line 111, for example 15 Bar, is fed into the condensate storage tank 136, thus pumping the condensate through the exit 137 toward the recovery line 140. Once the minimum condensate level in the condensate storage tank 136 has been achieved, the steam valve 146 is closed and, immediately after that, also the intercepting valve 142 is closed.

[0072] At this point in the condensate storage tank 136 the pressure is equal to the steam pressure of the steam supply line 111. This pressure can be discharged through a discharge duct 152 or by opening the condensate relief valve 134A, 134B ... of the group 109A, 109B ... of heated plates 103 where there is the highest pressure. In the first case a small steam quantity will be dispersed toward the environment. In the second case the steam pressure will slightly increase temporarily inside the group of heated plates 103 where the steam discharge occurs.

[0073] Once this operation of discharging pressure from the condensate storage tank 136 has been completed, the device can perform a new condensate recovering cycle from the various collectors 121A, 121B ... with the process of selective opening the condensate relief valves 134A, 134B ... described above.

[0074] The cycle of selective opening the condensate

relief valves 134A, 134B can be repeated automatically and sequentially at adequate time intervals. In other embodiments it is possible to detect the condensate level accumulated in the various condensate collectors 121A, 121B ... and therefore open selectively the condensate relief valves 134A, 134B ... according to the accumulated condensate level.

[0075] It should be understood that while in the simplest embodiment the condensate discharge occurs sequentially, starting from the group 109A, 109B ... with the lowest pressure until the group 109A, 109B ... with the highest pressure, by sequentially discharging all the condensate collectors 121A, 121B ... (if necessary controlling the opening time of the condensate relief valves 134A, 134B ... through detection of changes in the level of the condensate storage tank 136), in other embodiments, more efficient but more complex to be managed, only the condensate relief valves 134A, 134B ..., where there is an excessive condensate accumulation in the respective condensate collector 121A, 121B ..., can be opened according to an adequate sequence based on the existing pressure in each group of heated plates 3.

[0076] Independently of the adopted criterion and the control method managed through the control unit 150, the condensate coming from groups 109A, 109B ... of heated plates 103, wherein are different steam pressures are provided, will be anyway discharged in the common condensate collecting line 130, the discharge being controlled so as to selectively and sequentially open the pressure relief valves 134A, 134B, through which the discharge is required, passing from groups of heated plates 103 with a lower pressure to groups of heated plates 103 with a higher pressure.

[0077] Figure 3 schematically shows the essential elements of the steam circuit and condensate circuit of a device 101 according to the invention, where four groups of heated plates are illustrated. The same numbers indicate identical or equivalent parts to those illustrated in figure 2.

[0078] The diagram in figure 3 schematically shows also the steam generator 160 connected with the steam supply line 111 and with the condensate recovery line 140. Four groups 109A, 109B, 109C and 109D of heated plates 103 are indicated in the diagram of figure 3. The various groups of heated plates 103 are represented separate from one another only for the sake of clarity, but it should be understood that actually the plates 103 of the various groups 109A, 109B, 109C, and 109D form a continuous sliding surface, as shown in figure 2. In the schematic example of figure 3, the group 109A comprises three heated plates 103, while each of the groups 109B, 109C and 109D comprises four heated plates 103.

[0079] An incondensable gases relief duct can be associated with the condensate storage tank 136. This relief duct can match with the steam relief duct 152 for discharging steam once the condensate has been pumped from the condensate storage tank 136 toward the recovery line 140. In the illustrated example on the line 152

two valves 162 and 164 are provided for discharging the incondensable gases and steam once the condensate has been completely discharged from the condensate storage tank 136 to the condensate recovery line 140.

[0080] In the embodiment of figure 2 and in the diagram of figure Fig.3 a steam collector, for distributing the steam coming from the line 111 to the various plates 103, and a condensate collector, for collecting the condensate from the various plates 103, are associated with each group 109A, 109B, 109C, 109D ... of heated plates 103. According to an improved embodiment of the invention, the device can be further simplified by providing a single collector for each plate group 109A, 109B, 109C, 109D, ... for both the steam distribution and the condensate collection. The schema of this steam and condensate collector is represented in figures 4 and 5 only as regards a group of four heated plates. The same numbers indicate equal or corresponding parts to those described with reference to figure 2. In particular, 115 indicates the steam supply line, 103 the heated plates, and 103A the hollow spaces thereof inside which the steam flows and the condensate forms. 130 indicates the common condensate collecting line, 132 indicates the duct along which is arranged the condensate relief valve 134 for discharging condensate from the group of heated plates 103.

[0081] In the embodiment illustrated in figures 4 and 5 a single collector is provided, indicated as a whole with number 201 and advantageously formed as a tubular body, formed for example by one or more sections or portions connected with one another, for example through flanged connections. In the illustrated example the tubular body of the collector 201 is formed by five sections connected through respective flanges. It should be however understood that the tubular body of the collector 201 can also be formed in a different manner, with a different number of sections or even with a single section.

[0082] The steam supply duct 115 is connected with the collector 201 for example at the flange 115F. The collector 201 is furthermore provided with a plurality of ducts 122, which are connected with the highest part of the collector 201 and through which the pressurized steam coming from the duct 115 is injected in the single plates 103. In the illustrated example four plates 103 and four ducts 122 are provided, one for each plate.

[0083] Each duct 112 advantageously ends with a portion 119X projecting inside a space 103A of the respective heated plate 103, so as to prevent condensate from flowing through the duct 119 towards the inside of the collector 201.

[0084] In the lower part of the collector 201 ducts 122 open, through which the condensate forming in the spaces 103A of each heated plate 103 flows by gravity inside the collector 201. This latter, as schematically indicated in figure 4, is arranged at a level lower than the bottom of the heated plates 103.

[0085] In this way with a single collector 201 it is pos-

sible both to distribute steam collected in the upper part of the tubular body of the collector 201, and to collect the condensate from the various plates 103 in the lower part of the collector.

[0086] To prevent steam from flowing through the ducts 122 towards the inside of the plates 103, each duct 122 forms preferably a sort of siphon, with a curve 122X (figure 5) where the condensate accumulates, closing the duct 122 to the steam flow also in the case the collector 201 has been drained by opening the condensate relief valve 134.

[0087] Producing the various groups 109A, 109B, 109C e 109D ... of heated plates 103 as illustrated in figures 4 and 5, the device can be further simplified, reducing the number of collectors and ducts and therefore decreasing the production, maintenance and repair costs as well as the overall dimensions of the components of the device 101.

[0088] It is understood that the drawing only shows an example provided by way of a practical arrangement of the invention, which can vary in forms and arrangements without however departing from the scope of the concept underlying the invention. Any reference numbers in the appended claims are provided for the sole purpose of facilitating reading of the claims in the light of the description and the drawing, and do not in any manner limit the scope of protection represented by the claims.

Claims

1. A device for producing corrugated cardboard, comprising: a feed path for corrugated cardboard (N1, N2, N3); along said feed path, a series of sequentially arranged heated plates (103) defining a sliding surface for said corrugated cardboard, said series of heated plates being subdivided into a plurality of groups (109A, 109B, 109C, 109D) of heated plates (103); pressing members (105) to press said corrugated cardboard (N1, N2, N3) against said sliding surface; a heating steam circuit for heating said heated plates (103); wherein said heating steam circuit comprises:

- a pressurized steam supply line (111);
- for each group (109A, 109B, 109C, 109D) of heated plates (103), a pressure regulating valve (113A, 113B) between said pressurized steam supply line (111) and the heated plates (103) of the respective group (109A-109D) of heated plates, to supply said heated plates with steam under regulated pressure; wherein

for each group of heated plates (103) a condensate relief valve (134A, 134B, 134C, 134D) is provided, connecting the heated plates (103) of the respective group (109A, 109B, 109C, 109D) with a common condensate collecting line (130, 136), such that said

plurality of groups (109A, 109B, 109C, 109D) of heated plates (103) are connected to said common condensate collecting line (130, 136); and **characterized in that** a control system (150) is provided, for opening and closing the condensate relief valves (134A-134D), said control system (150) controlling the selective opening and closing of said condensate relief valves (134A-134D), to discharge the condensate selectively from each of said groups (109A, 109B, 109C, 109D) of heated plates (103) towards said common condensate collecting line (130) .

2. A device as claimed in claim 1, comprising a condensate recovery line (140) from which the condensate, collected through said common condensate collecting line (130, 136), is recovered towards a steam generator (160).
3. A device as claimed in claim 1 or 2, wherein said common condensate collecting line (130, 136) comprises a storage tank (136) for the condensate coming from said plurality of groups of heated plates.
4. A device as claimed in claim 1 or 2 or 3, comprising, for each group (109A, 109B, 109C, 109D) of heated plates (103) a steam collector (117A, 117B, 117C, 117D) connected between the respective pressure regulating valve (113A, 113B, 113, C, 113D) and the heated plates (103) of the respective group (109A, 109B, 109C, 109D) of heated plates.
5. A device as claimed in one or more of the previous claims, comprising, for each group (109A, 109B, 109C, 109D) of heated plates (103) a condensate collector (121A, 121B, 121C, 121D) connected between the heated plates (103) of the respective group and the condensate relief valve (134A, 134B, 134C, 134D).
6. A device as claimed in claim 1 or 2 or 3, comprising, for each group (109A, 109B, 109C, 109D) of heated plates (103), a steam and condensate collector (201), connected between the steam supply line (111) and the heated plates (103) of the respective group (109A, 109B, 109C, 109D) of heated plates and between said heated plates and said common condensate collecting line (130), the respective condensate relief valve (134A, 134B, 134C, 134D) being arranged between each steam and condensate collector (201) and said common condensate collecting line (130).
7. A device as claimed in claim 6, wherein said steam and condensate collector (201) comprises a tubular volume connected to each heated plate (103) of the respective group (109A, 109B, 109C, 109D) of heated plates through at least one respective steam discharge connection (119) and through at least one

respective condensate collecting connection (122).

8. A device as claimed in claim 7, wherein each of said condensate collecting connections (122) forms a siphon (122X) between the respective heated plate (103) and the respective steam and condensate collector (201).
9. A device as claimed in any one of the previous claims, wherein said control system (150) is arranged to open said condensate relief valves (134A-134D) sequentially.
10. A device as claimed in claim 9, wherein said control system (150) is arranged to open said condensate relief valves (134A-134D) sequentially starting from the condensate relief valve (134A-134D) of the group (109A, 109B, 109C, 109D) of heated plates (103) under minimum pressure until the condensate relief valve of the group of heated plates under maximum pressure.
11. A device as claimed in at least claim 2, wherein said common condensate collecting line (130) is connected with the pressurized steam supply line (111) through a pressurized steam insertion valve (146) to eject the condensate towards said condensate recovery line (140).
12. A device as claimed at least in claim 2, wherein a backflow valve (142) is arranged between said common condensate collecting line and said condensate recovery line (140).
13. A device as claimed in one or more of the previous claims, wherein with said condensate storage tank (136) a level detector (138) is associated, connected with a control system (150) for controlling the condensate discharge from said storage tank (136).
14. A device as claimed in claim 14, wherein said control system (150) is arranged to detect the quantity of condensate discharged from each group (109A, 109B, 109C, 109D) of heated plates (103) and modifies the opening times of the condensate relief valves (134A-134D) of the various groups (109A, 109B, 109C, 109D) of heated plates (103) according to the condensate quantity accumulated per time unit.
15. A device as claimed at least in claim 2, comprising a pressure transducer on the condensate recovery line (140), and wherein a control system (150) controls the opening of one of the condensate relief valves (134A-134D) of a group of heated plates (103), inside which there is a pressure greater than the pressure in said condensate recovery line (140) to discharge condensate from said condensate stor-

age tank (136) towards said recovery line (140).

16. A device as claimed at least in claim 5, wherein to each condensate collector (121A-121D) a condensate level detector is associated, and wherein the respective condensate relief valve (134A-134D) is opened according to the condensate level detected by the corresponding condensate level detector.
17. A device as claimed at least in claim 6, wherein a condensate level detector is associated with each steam and condensate collector (201), and wherein the respective condensate relief valve (134) is opened according to the condensate level detected by the corresponding condensate level detector.
18. A condensate recovery method in a device for producing corrugated cardboard comprising: a feed path for corrugated cardboard (N1, N2, N3); along said feed path, a series of sequentially arranged heated plates (103) defining a sliding surface for said corrugated cardboard, said series of heated plates (103) being subdivided into a plurality of groups (109A, 109B, 109C, 109D) of heated plates (103); pressing members (105) to press said corrugated cardboard against said sliding surface; a heating steam circuit for heating said heated plates (103); **characterized in that**
 - the condensate of each of said groups (109A, 109B, 109C, 109D) of heated plates is selectively discharged into a common condensate collecting line (130);
 - and **in that** the condensate discharged into said common condensate collecting line (130) is supplied towards a condensate recovery line (140).
19. A method as claimed in claim 18, comprising the steps of:
 - selectively discharging the condensate accumulated in respective collectors (121A-121D; 201) associated with said groups (109A-109D) of heated plates and conveying said condensate into a condensate storage tank (136) through said common condensate collecting line (130);
 - detecting the condensate level in said condensate storage tank (136);
 - according to the detected level, ejecting condensate from said condensate storage tank (136) towards said condensate recovery line (140).
20. A method as claimed in claim 18 or 19, comprising the steps of sequentially discharging condensate from at least some of said groups (109A, 109B, 109C, 109D) of heated plates starting from the group

of heated plates inside which there is steam under the lowest pressure, until the group of heated plates inside which there is steam under the highest pressure.

21. A method as claimed in claim 21, wherein the steps of sequential condensate discharging occur at time intervals set by a control system.
22. A method as claimed in claim 20 or 21, comprising the steps of performing cycles of condensate sequential discharge from said groups of heated plates, in each cycle the condensate being discharged from each of said groups of heated plates (109A, 109B, 109C, 109D).
23. A method as claimed in claim 18 or 19, comprising the steps of: detecting the condensate level in a collector (121; 201) associated with each group of heated plates (109A, 109B, 109C, 109D); actuating the condensate discharge from said groups of heated plates according to the condensate level detected in said condensate collectors.
24. A method as claimed in one or more of claims 18 to 23, wherein said condensate is supplied towards said recovery line (140) through insertion of steam at a pressure greater than the pressure inside said common condensate collecting line (130).

Patentansprüche

1. Vorrichtung zur Herstellung von Wellpappe, umfassend:

einen Zuführweg für Wellpappe (N1, N2, N3); entlang des Zuführweges eine Reihe von hintereinander angeordneten beheizten Platten (103), die eine Gleitfläche für die Wellpappe bilden, wobei die Reihe von beheizten Platten in eine Mehrzahl von Gruppen (109A, 109B, 109C, 109D) von beheizten Platten (103) unterteilt ist, Presselemente (105), um die Wellpappe (N1, N2, N3) gegen die Gleitfläche zu drücken, einen Heizdampfkreislauf zum Beheizen der beheizten Platten (103), wobei der Heizdampfkreislauf umfasst:

- eine Zuführleitung (111) für unter Druck stehenden Dampf;
- für jede Gruppe (109A, 109B, 109C, 109D) von beheizten Platten (103) ein Druckregulierungsventil (113A, 113B) zwischen der Zuführleitung (111) für unter Druck stehenden Dampf und den beheizten Platten (103) der jeweiligen Gruppe (109A - 109D) von beheizten Platten, um den beheizten Plat-

ten Dampf unter reguliertem Druck zuzuführen, wobei

für jede Gruppe von beheizten Platten (103) ein Kondensat-Entlastungsventil (134A, 134B, 134C, 134D) vorgesehen ist, das die beheizten Platten (103) der jeweiligen Gruppe (109A, 109B, 109C, 109D) mit einer gemeinsamen Kondensatsammelleitung (130, 136) verbindet, so dass die mehreren Gruppen (109A, 109B, 109C, 109D) von beheizten Platten (103) an die gemeinsame Kondensatsammelleitung (130, 136) angeschlossen sind, und

dadurch gekennzeichnet, dass

ein Steuersystem (150) zum Öffnen und Schließen der Kondensat-Entlastungsventile (134A - 134D) vorgesehen ist, wobei das Steuersystem (150) das selektive Öffnen und Schließen der Kondensat-Entlastungsventile (134A - 134D) steuert, um Kondensat selektiv von jeder der Gruppen (109A, 109B, 109C, 109D) von beheizten Platten (103) zu der gemeinsamen Kondensatsammelleitung (130) abzuführen.

2. Vorrichtung nach Anspruch 1, wobei diese eine Kondensat-Rückgewinnungsleitung (140) umfasst, aus der das über die gemeinsame Kondensatsammelleitung (130, 136) gesammelte Kondensat für einen Dampfgenerator (160) zurückgewonnen wird.
3. Vorrichtung nach Anspruch 1 oder 2, wobei die gemeinsame Kondensatsammelleitung (130, 136) einen Speicherbehälter (136) für das von den mehreren Gruppen von beheizten Platten kommende Kondensat umfasst.
4. Vorrichtung nach Anspruch 1 oder 2 oder 3, wobei diese für jede Gruppe (109A, 109B, 109C, 109D) von beheizten Platten (103) einen Dampfkollektor (117A, 117B, 117C, 117D) umfasst, der zwischen dem jeweiligen Druckregulierungsventil (113A, 113B, 113C, 113D) und den beheizten Platten (103) der jeweiligen Gruppe (109A, 109B, 109C, 109D) von beheizten Platten angeschlossen ist.
5. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei diese für jede Gruppe (109A, 109B, 109C, 109D) von beheizten Platten (103) einen Kondensatkollektor (121A, 121B, 121C, 121D) umfasst, der zwischen den beheizten Platten (103) der jeweiligen Gruppe und dem Kondensat-Entlastungsventil (134A, 134B, 134C, 134D) angeschlossen ist.
6. Vorrichtung nach Anspruch 1 oder 2 oder 3, wobei diese für jede Gruppe (109A, 109B, 109C, 109D) von beheizten Platten (103) einen Dampf- und Kon-

- densatkollektor (201) umfasst, der zwischen der Dampfzufuhrleitung (111) und den beheizten Platten (103) der jeweiligen Gruppe (109A, 109B, 109C, 109D) von beheizten Platten und zwischen den beheizten Platten und der gemeinsamen Kondensatsammelleitung (130) angeschlossen ist, wobei das jeweilige Kondensat-Entlastungsventil (134A, 134B, 134C, 134D) zwischen jedem Dampf- und Kondensatkollektor (201) und der gemeinsamen Kondensatsammelleitung (130) angeordnet ist.
7. Vorrichtung nach Anspruch 6, wobei der Dampf- und Kondensatkollektor (201) ein rohrförmiges Volumen umfasst, das mit jeder beheizten Platte (103) der jeweiligen Gruppe (109A, 109B, 109C, 109D) von beheizten Platten verbunden ist, und zwar über mindestens einen jeweiligen Dampfabführanschluss (119) und über mindestens einen jeweiligen Kondensatkollektorananschluss (122).
8. Vorrichtung nach Anspruch 7, wobei jeder der Kondensatkollektorananschlüsse (122) einen Siphon (122X) zwischen der jeweiligen beheizten Platte (103) und dem jeweiligen Dampf- und Kondensatkollektor (201) bildet.
9. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das Steuersystem (150) zum nacheinander erfolgenden Öffnen der Kondensat-Entlastungsventile (134A - 134D) ausgelegt ist.
10. Vorrichtung nach Anspruch 9, wobei das Steuersystem (150) zum nacheinander erfolgenden Öffnen der Kondensat-Entlastungsventile (134A - 134D) ausgelegt ist, beginnend mit dem Kondensat-Entlastungsventil (134A - 134D) der unter minimalem Druck stehenden Gruppe (109A, 109B, 109C, 109D) von beheizten Platten (103) bis zu dem Kondensat-Entlastungsventil der unter maximalem Druck stehenden Gruppe von beheizten Platten.
11. Vorrichtung nach zumindest Anspruch 2, wobei die gemeinsame Kondensatsammelleitung (130) mit der Zufuhrleitung (111) für unter Druck stehenden Dampf über ein Einlassventil (146) für unter Druck stehenden Dampf verbunden ist, um das Kondensat zu der Kondensat-Rückgewinnungsleitung (140) hin auszustößen.
12. Vorrichtung nach zumindest Anspruch 2, wobei zwischen der gemeinsamen Kondensatsammelleitung und der Kondensat-Rückgewinnungsleitung (140) ein Rückflussventil (142) angeordnet ist.
13. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei dem Kondensat-Speicherbehälter (136) ein Füllstandsdetektor (138) zugeordnet ist, der mit einem Steuersystem (150) zum Steuern der Kondensatabführung aus dem Speicherbehälter (136) verbunden ist.
14. Vorrichtung nach Anspruch 14, wobei das Steuersystem (150) dafür ausgelegt ist, die Menge an Kondensat, das von jeder Gruppe (109A, 109B, 109C, 109D) von beheizten Platten (103) abgeführt wird, zu erfassen und die Öffnungszeiten für die Kondensat-Entlastungsventile (134A - 134D) der verschiedenen Gruppen (109A, 109B, 109C, 109D) von beheizten Platten (103) gemäß der pro Zeiteinheit angesammelten Kondensatmenge zu modifizieren.
15. Vorrichtung nach zumindest Anspruch 2, wobei diese einen Druckmessaufnehmer an der Kondensat-Rückgewinnungsleitung (140) umfasst, und wobei ein Steuersystem (150) das Öffnen eines der Kondensat-Entlastungsventile (134A - 134B) einer Gruppe von beheizten Platten (103) steuert, in deren Innerem ein größerer Druck herrscht als der Druck in der Kondensat-Rückgewinnungsleitung (140), um Kondensat aus dem Kondensat-Speicherbehälter (136) in Richtung der Rückgewinnungsleitung (140) abzuführen.
16. Vorrichtung nach zumindest Anspruch 5, wobei jedem Kondensatkollektor (121A - 121D) ein Kondensat-Füllstandsdetektor zugeordnet ist, und wobei das jeweilige Kondensat-Entlastungsventil (134A - 134D) entsprechend dem von dem jeweiligen Kondensat-Füllstandsdetektor erfassten Kondensatfüllstand geöffnet wird.
17. Vorrichtung nach zumindest Anspruch 6, wobei jedem Dampf- und Kondensatkollektor (201) ein Kondensat-Füllstandsdetektor zugeordnet ist, und wobei das jeweilige Kondensat-Entlastungsventil (134) entsprechend dem von dem entsprechenden Kondensat-Füllstandsdetektor erfassten Kondensatfüllstand geöffnet wird.
18. Kondensatrückgewinnungsverfahren in einer Vorrichtung zur Herstellung von Wellpappe, welche umfasst: einen Zuführweg für Wellpappe (N1, N2, N3); entlang des Zuführweges eine Reihe von hintereinander angeordneten beheizten Platten (103), die eine Gleitfläche für die Wellpappe bilden, wobei die Reihe von beheizten Platten in eine Mehrzahl von Gruppen (109A, 109B, 109C, 109D) von beheizten Platten (103) unterteilt ist, Presselemente (105), um die Wellpappe (N1, N2, N3) gegen die Gleitfläche zu drücken, einen Heizdampfkreislauf zum Beheizen der beheizten Platten (103),
dadurch gekennzeichnet, dass
 - das Kondensat von jeder der Gruppen (109A, 109B, 109C, 109D) von beheizten Platten selektiv in eine gemeinsame Kondensatsammel-

leitung (130) abgeführt wird;
 - und dass das in die gemeinsame Kondensatsammelleitung (130) abgeführte Kondensat einer Kondensat-Rückgewinnungsleitung (140) zugeführt wird.

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19. Verfahren nach Anspruch 18, welches folgende Schritte umfasst:

- selektives Abführen des Kondensats, das in entsprechenden Kollektoren (121A - 121D; 201) gesammelt wurde, die den Gruppen (109A - 109D) von beheizten Platten zugeordnet sind, und Befördern des Kondensats in einen Kondensat-Speicherbehälter (136) über die gemeinsame Kondensatsammelleitung (130);
 - Erfassen des Kondensatfüllstandes in dem Kondensat-Speicherbehälter (136);
 - entsprechend dem erfassten Füllstand, Ausstoßen von Kondensat aus dem Kondensat-Speicherbehälter (136) zu der Kondensat-Rückgewinnungsleitung (140).

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20. Verfahren nach Anspruch 18 oder 19, welches die Schritte des nacheinander erfolgenden Abführens von Kondensat von mindestens einigen der Gruppen (109A, 109B, 109C, 109D) von beheizten Platten umfasst, beginnend mit derjenigen Gruppe von beheizten Platten, in deren Innerem Dampf unter niedrigstem Druck steht, bis zu derjenigen Gruppe von beheizten Platten, in deren Innerem Dampf unter höchstem Druck steht.

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21. Verfahren nach Anspruch 20, wobei die Schritte des nacheinander erfolgenden Abführens von Kondensat in Zeitabständen erfolgen, die von einem Steuersystem festgelegt werden.

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22. Verfahren nach Anspruch 20 oder 21, welches die Schritte der Ausführung von Zyklen eines nacheinander erfolgenden Abführens von Kondensat von den Gruppen von beheizten Platten umfasst, wobei in jedem Zyklus das Kondensat von jeder der Gruppen von beheizten Platten (109A, 109B, 109C, 109D) abgeführt wird.

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23. Verfahren nach Anspruch 18 oder 19, welches folgende Schritte umfasst: Erfassen des Kondensatfüllstandes in einem Kollektor (121; 201), der jeder Gruppe von beheizten Platten (109A, 109B, 109C, 109D) zugeordnet ist; Auslösen der Kondensatabführung von den Gruppen von beheizten Platten entsprechend dem in den Kondensatkollektoren erfassten Kondensatfüllstand.

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24. Verfahren nach einem oder mehreren der Ansprüche 18 bis 23, wobei das Kondensat durch Einleiten von Dampf mit einem Druck, der größer ist als der

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Druck im Inneren der gemeinsamen Kondensatsammelleitung (130), der Rückgewinnungsleitung (140) zugeführt wird.

Revendications

1. Dispositif de production de carton ondulé, comprenant : un chemin d'alimentation en carton ondulé (N1, N2, N3) ; le long dudit chemin d'alimentation, une série de plaques chauffées agencées de façon séquentielle (103) définissant une surface coulissante pour ledit carton ondulé, ladite série de plaques chauffées étant subdivisée en une pluralité de groupes (109A, 109B, 109C, 109D) de plaques chauffées (103) ; des organes de pressage (105) pour presser ledit carton ondulé (N1, N2, N3) contre ladite surface coulissante ; un circuit de vapeur de chauffage pour chauffer lesdites plaques chauffées (103) ; dans lequel ledit circuit de vapeur de chauffage comprend :

- une conduite d'amenée de vapeur sous pression (111) ;

- pour chaque groupe (109A, 109B, 109C, 109D) de plaques chauffées (103), une vanne de régulation de pression (113A, 113B) entre ladite conduite d'amenée de vapeur sous pression (111) et les plaques chauffées (103) du groupe respectif (109A à 109D) de plaques chauffées, pour alimenter lesdites plaques chauffées en vapeur sous pression régulée ; dans lequel

pour chaque groupe de plaques chauffées (103), une vanne de décharge de condensat (134A, 134B, 134C, 134D) est prévue, raccordant les plaques chauffées (103) du groupe respectif (109A, 109B, 109C, 109D) avec une conduite commune de collecte de condensat (130, 136), de sorte que ladite pluralité de groupes (109A, 109B, 109C, 109D) de plaques chauffées (103) soient raccordés à ladite conduite commune de collecte de condensat (130, 136) ; et **caractérisé en ce qu'un** système de commande (150) est prévu, pour l'ouverture et la fermeture des vannes de décharge de condensat (134A à 134D), ledit système de commande (150) commandant l'ouverture et la fermeture sélectives desdites vannes de décharge de condensat (134A à 134D), pour évacuer le condensat de façon sélective depuis chacun desdits groupes (109A, 109B, 109C, 109D) de plaques chauffées (103) vers ladite conduite commune de collecte de condensat (130).

2. Dispositif selon la revendication 1, comprenant une ligne de récupération de condensat (140) à partir de laquelle le condensat, collecté à travers ladite conduite commune de collecte de condensat (130, 136), est récupéré vers un générateur de vapeur (160).

3. Dispositif selon la revendication 1 ou 2, dans lequel ladite conduite commune de collecte de condensat (130, 136) comprend une cuve de stockage (136) pour le condensat provenant de ladite pluralité de groupes de plaques chauffées. 5
4. Dispositif selon la revendication 1, 2 ou 3, comprenant, pour chaque groupe (109A, 109B, 109C, 109D) de plaques chauffées (103), un collecteur de vapeur (117A, 117B, 117C, 117D) raccordé entre la vanne de régulation de pression respective (113A, 113B, 113C, 113D) et les plaques chauffées (103) du groupe respectif (109A, 109B, 109C, 109D) de plaques chauffées. 10
5. Dispositif selon l'une ou plusieurs des revendications précédentes, comprenant, pour chaque groupe (109A, 109B, 109C, 109D) de plaques chauffées (103), un collecteur de condensat (121A, 121B, 121C, 121D) raccordé entre les plaques chauffées (103) du groupe respectif et la vanne de décharge de condensat (134A, 134B, 134C, 134D). 15
6. Dispositif selon la revendication 1, 2 ou 3, comprenant, pour chaque groupe (109A, 109B, 109C, 109D) de plaques chauffées (103), un collecteur de vapeur et de condensat (201), raccordé entre la conduite d'amenée de vapeur (111) et les plaques chauffées (103) du groupe respectif (109A, 109B, 109C, 109D) de plaques chauffées et entre lesdites plaques chauffées et ladite conduite commune de collecte de condensat (130), la vanne de décharge de condensat respective (134A, 134B, 134C, 134D) étant agencée entre chaque collecteur de vapeur et de condensat (201) et ladite conduite commune de collecte de condensat (130). 20
7. Dispositif selon la revendication 6, dans lequel ledit collecteur de vapeur et de condensat (201) comprend un volume tubulaire raccordé à chaque plaque chauffée (103) du groupe respectif (109A, 109B, 109C, 109D) de plaques chauffées à travers au moins un raccord d'évacuation de vapeur respectif (119) et à travers au moins un raccord de collecte de condensat respectif (122). 25
8. Dispositif selon la revendication 7, dans lequel chacun desdits raccords de collecte de condensat (122) forme un siphon (122X) entre la plaque chauffée respective (103) et le collecteur de vapeur et de condensat respectif (201). 30
9. Dispositif selon l'une quelconque des revendications précédentes, dans lequel ledit système de commande (150) est agencé pour ouvrir lesdites vannes de décharge de condensat (134A à 134D) de façon séquentielle. 35
10. Dispositif selon la revendication 9, dans lequel ledit système de commande (150) est agencé pour ouvrir lesdites vannes de décharge de condensat (134A à 134D) de façon séquentielle en commençant par la vanne de décharge de condensat (134A à 134D) du groupe (109A, 109B, 109C, 109D) de plaques chauffées (103) sous pression minimale jusqu'à la vanne de décharge de condensat du groupe de plaques chauffées sous pression maximale. 40
11. Dispositif selon au moins la revendication 2, dans lequel ladite conduite commune de collecte de condensat (130) est raccordée à la conduite d'amenée de vapeur sous pression (111) à travers une vanne d'insertion de vapeur sous pression (146) pour éjecter le condensat vers ladite conduite de récupération de condensat (140). 45
12. Dispositif selon au moins la revendication 2, dans lequel une vanne de retour (142) est agencée entre ladite conduite commune de collecte de condensat et ladite conduite de récupération de condensat (140). 50
13. Dispositif selon l'une ou plusieurs des revendications précédentes, dans lequel un détecteur de niveau (138) est associé à ladite cuve de stockage de condensat (136), raccordé avec un système de commande (150) pour commander l'évacuation de condensat depuis ladite cuve de stockage (136). 55
14. Dispositif selon la revendication 14, dans lequel ledit système de commande (150) est agencé pour détecter la quantité de condensat évacuée depuis chaque groupe (109A, 109B, 109C, 109D) de plaques chauffées (103) et modifie les temps d'ouverture des vannes de décharge de condensat (134A à 134D) des divers groupes (109A, 109B, 109C, 109D) de plaques chauffées (103) selon la quantité de condensat accumulée par unité de temps.
15. Dispositif selon au moins la revendication 2, comprenant un transducteur de pression sur la conduite de récupération de condensat (140), et dans lequel un système de commande (150) commande l'ouverture de l'une des vannes de décharge de condensat (134A à 134D) d'un groupe de plaques chauffées (103), à l'intérieur duquel se trouve une pression supérieure à la pression dans ladite conduite de récupération de condensat (140) pour évacuer le condensat depuis ladite cuve de stockage de condensat (136) vers ladite conduite de récupération (140).
16. Dispositif selon au moins la revendication 5, dans lequel un détecteur de niveau de condensat est associé à chaque collecteur de condensat (121A à 121D), et dans lequel la vanne de décharge de condensat respective (134A à 134D) est ouverte selon

le niveau de condensat détecté par le détecteur de niveau de condensat correspondant.

17. Dispositif selon au moins la revendication 6, dans lequel un détecteur de niveau de condensat est associé à chaque collecteur de vapeur et de condensat (201), et dans lequel la vanne de décharge de condensat respective (134) est ouverte selon le niveau de condensat détecté par le détecteur de niveau de condensat correspondant. 5
18. Procédé de récupération de condensat dans un dispositif de production de carton ondulé, comprenant : un chemin d'alimentation en carton ondulé (N1, N2, N3) ; le long dudit chemin d'alimentation, une série de plaques chauffées agencées de façon séquentielle (103) définissant une surface coulissante pour ledit carton ondulé, ladite série de plaques chauffées (103) étant subdivisée en une pluralité de groupes (109A, 109B, 109C, 109D) de plaques chauffées (103) ; des organes de pressage (105) pour presser ledit carton ondulé contre ladite surface coulissante ; un circuit de vapeur de chauffage pour chauffer lesdites plaques chauffées (103) ; **caractérisé en ce que** 10
- le condensat de chacun desdits groupes (109A, 109B, 109C, 109D) de plaques chauffées est évacué de façon sélective dans une conduite commune de collecte de condensat (130) ; 15
 - et **en ce que** le condensat évacué dans ladite conduite commune de collecte de condensat (130) est distribué vers une conduite de récupération de condensat (140). 20
19. Procédé selon la revendication 18, comprenant les étapes : 25
- d'évacuation sélective du condensat accumulé dans des collecteurs respectifs (121A à 121D ; 201) associés auxdits groupes (109A à 109D) de plaques chauffées et d'acheminement dudit condensat dans une cuve de stockage de condensat (136) à travers ladite conduite commune de collecte de condensat (130) ; 30
 - de détection du niveau de condensat dans ladite cuve de stockage de condensat (136) ; 35
 - selon le niveau détecté, d'éjection de condensat depuis ladite cuve de stockage de condensat (136) vers ladite conduite de récupération de condensat (140). 40
20. Procédé selon la revendication 18 ou 19, comprenant les étapes d'évacuation séquentielle de condensat depuis au moins certains desdits groupes (109A, 109B, 109C, 109D) de plaques chauffées en commençant par le groupe de plaques chauffées à 45

l'intérieur duquel se trouve de la vapeur sous la plus faible pression, jusqu'au groupe de plaques chauffées à l'intérieur duquel se trouve de la vapeur sous la pression la plus élevée.

21. Procédé selon la revendication 21, dans lequel les étapes d'évacuation séquentielle de condensat se produisent à des intervalles de temps établis par un système de commande.
22. Procédé selon la revendication 20 ou 21, comprenant les étapes de réalisation de cycles d'évacuation séquentielle de condensat depuis lesdits groupes de plaques chauffées, le condensat étant évacué dans chaque cycle depuis chacun desdits groupes de plaques chauffées (109A, 109B, 109C, 109D).
23. Procédé selon la revendication 18 ou 19, comprenant les étapes : 50
- de détection du niveau de condensat dans un collecteur (121 ; 201) associé à chaque groupe de plaques chauffées (109A, 109B, 109C, 109D) ; d'actionnement de l'évacuation de condensat depuis lesdits groupes de plaques chauffées selon le niveau de condensat détecté dans lesdits collecteurs de condensat. 55
24. Procédé selon l'une ou plusieurs des revendications 18 à 23, dans lequel ledit condensat est délivré vers ladite conduite de récupération (140) à travers l'insertion de vapeur à une pression supérieure à la pression à l'intérieur de ladite conduite commune de collecte de condensat (130).

Fig.1

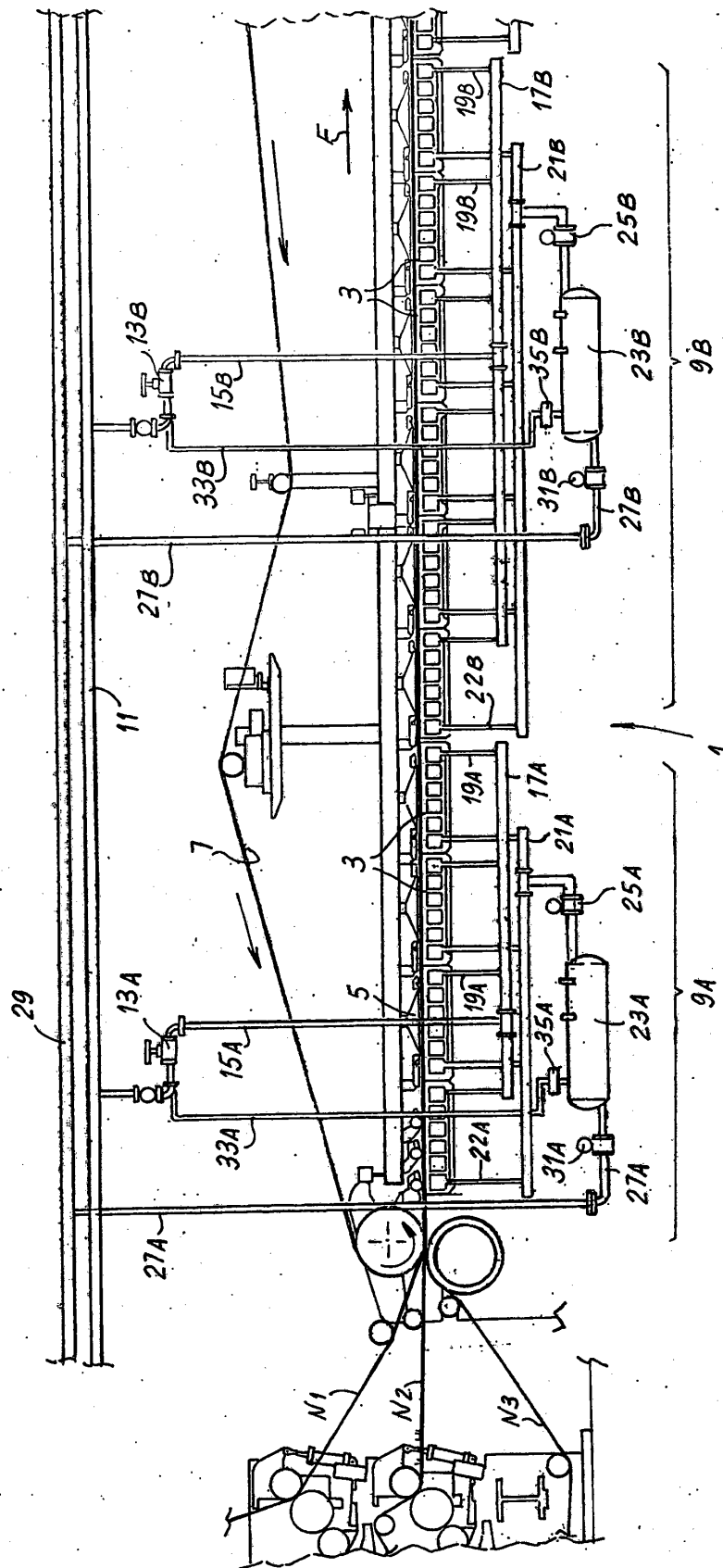


Fig. 2

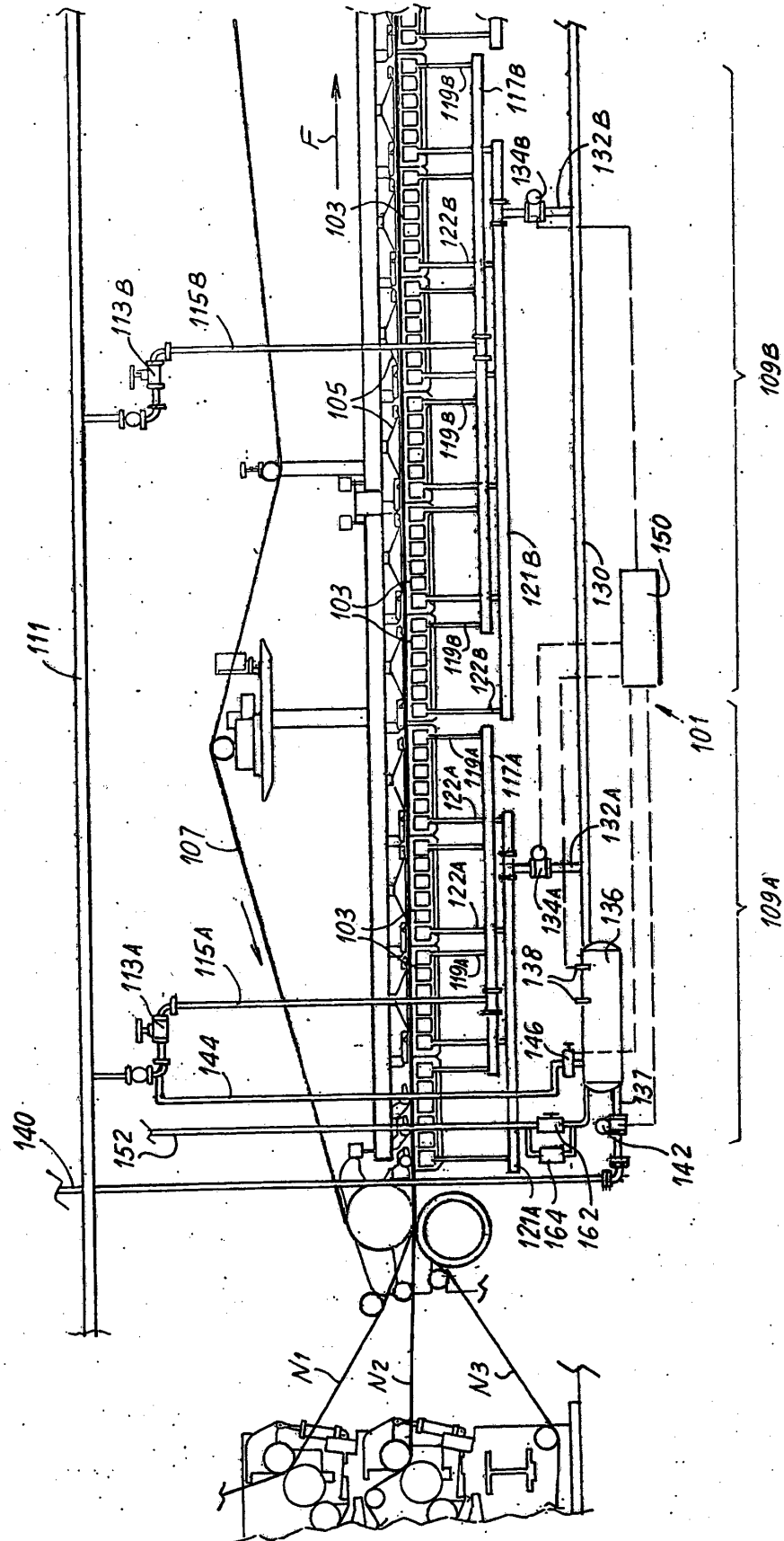
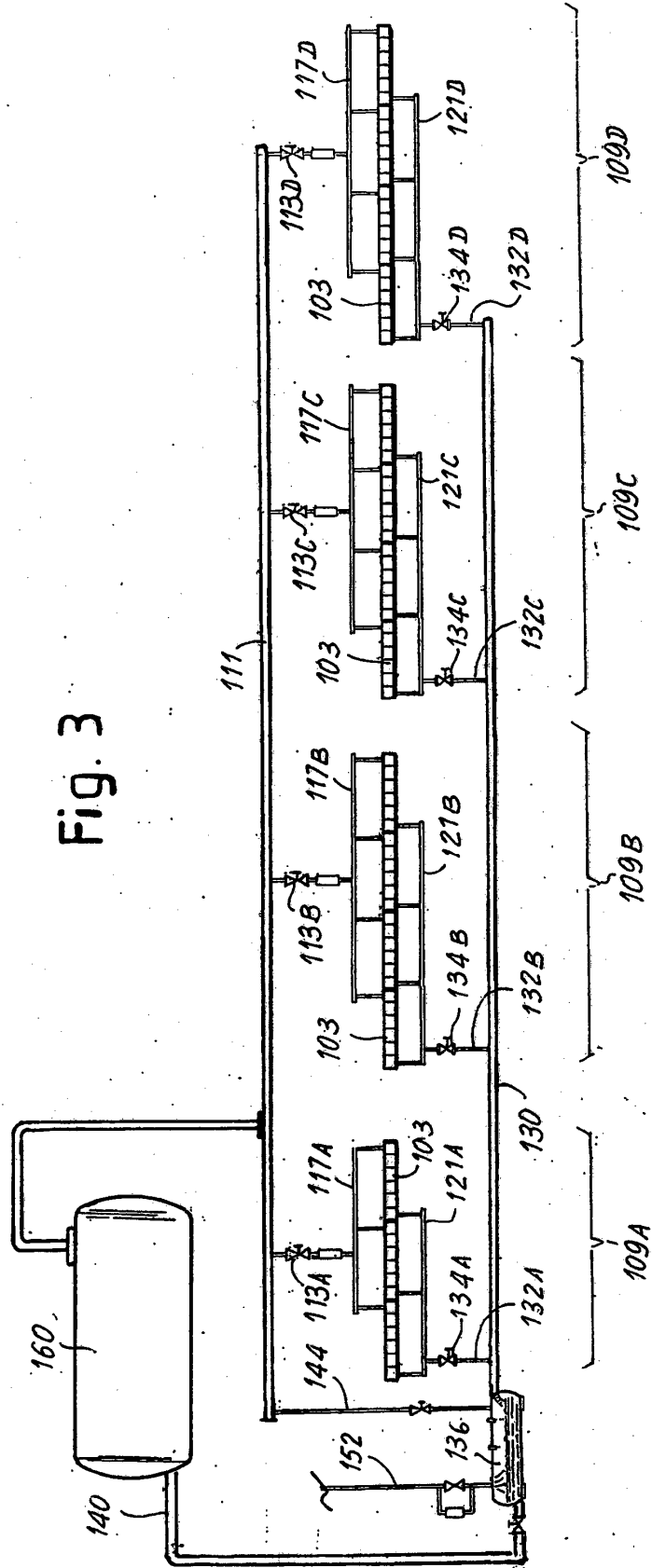
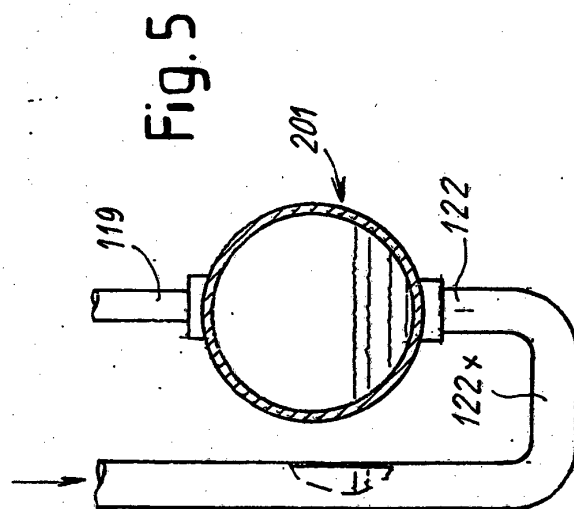
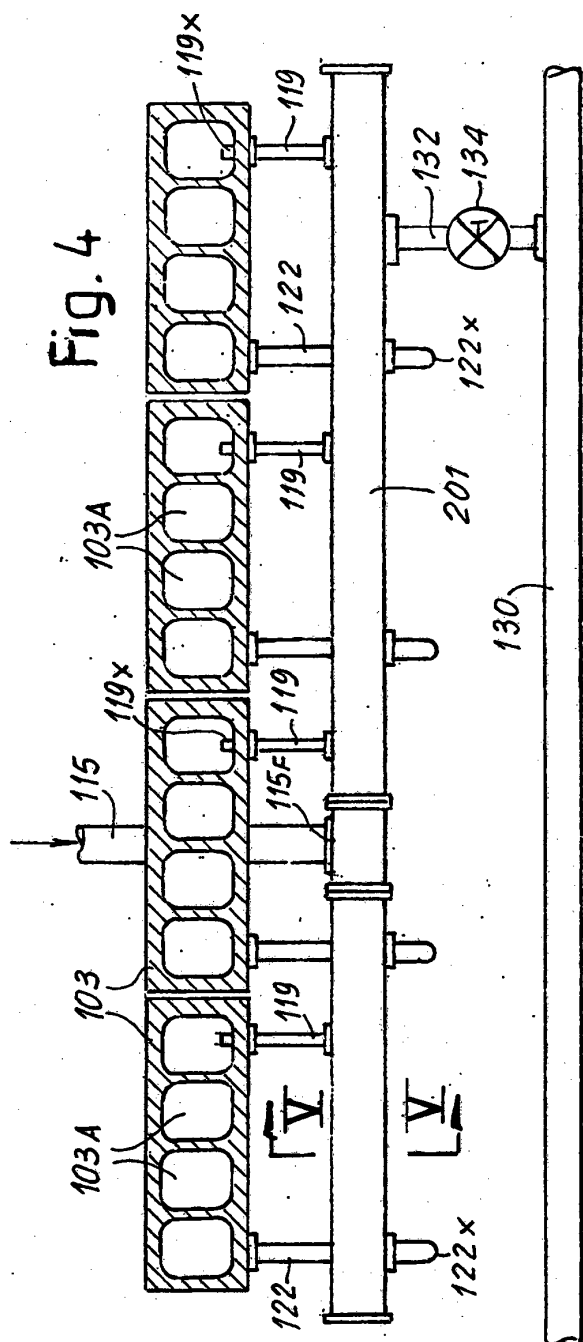


Fig. 3





REFERENCES CITED IN THE DESCRIPTION

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