Title: AN APPARATUS FOR WASHING AND DEWATERING PULP, A SYSTEM FOR CONTROLLING SUCH AN APPARATUS, AND A METHOD FOR PROCESSING PULP IN SUCH AN APPARATUS

Abstract: A method for processing pulp in an apparatus for washing and dewatering pulp, and a system for controlling this apparatus, the apparatus comprising two rotatable press rolls (102, 104) having a permeable outer surface (106, 108), the press rolls (102, 104) defining a press nip (112) between them, in which press nip (112) the pulp is pressed, at least one of the press rolls (102, 104) being movable in relation to the other press roll (102, 104) to vary the press nip, and the processing of the pulp in the apparatus is determined by a set of variable operating parameters variable during operation, the distance between the press rolls (102, 104) being included in said set; at least one desired value for a specific control parameter is set, the specific control parameter being included in a group of control parameters; the specific control parameter is measured; and at least two of the variable operating parameters of said set is adjusted during operation, where the distance between the press rolls (102, 104) is one of said at least two variable operating parameters, to keep the difference between the set desired value and the value of the measured specific control parameter below a certain level.
FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
AN APPARATUS FOR WASHING AND DEWATERING PULP, A SYSTEM FOR CONTROLLING SUCH AN APPARATUS, AND A METHOD FOR PROCESSING PULP IN SUCH AN APPARATUS

Technical Field

The present invention relates to a method for processing pulp, especially cellulose-containing pulp, in an apparatus for washing and dewatering pulp, especially cellulose-containing pulp, comprising two rotatable press rolls having a permeable outer surface, and a vat in which the press rolls are installed, the press rolls defining a press nip between them, in which press nip the pulp is pressed, and the apparatus is arranged to feed the pulp in the direction of rotation of the press rolls through the press nip, at least one of the press rolls being moveable in relation to the other press roll to vary the press nip, and the processing of the pulp in the apparatus is determined by a set of variable operating parameters which are variable during operation. Further, the present invention relates to a system for controlling an apparatus of the above-mentioned type, and to an apparatus of the above-mentioned type comprising a system for controlling such apparatus.

Background of the Invention

When producing cellulose-based products, a roll press is frequently used for washing and dewatering the cellulose-based pulp. The pulp is passed between two co-operating press rolls installed in the roll press, the press rolls having a perforable outer surface, a so-called mantle surface, whereby the outer surface is permeable to liquid pressed out of the pulp, and the pulp is pressed in the roll nip, or the press nip, between the press rolls, whereby liquid is pressed out of the pulp. The roll press also includes one or more washing zones prior to the press nip. One example of such a roll press is disclosed in EP 1 035 250, where the central axes of the press rolls are lying in substantially the same horizontal plane, and the pulp is fed in the direction of rotation of the press rolls through the press nip and the pulp is passing the press nip between the press rolls from below upwards.

US 3,730,079 discloses a press comprising two press rolls rotatable about parallel axes, wherein one of the press rolls is laterally movable relative to the other to vary the cross-section of the therebetween press nip. Pressing force is applied to the laterally movable press roll by a plurality of separate link systems actuated by individual fluid pressure operated actuators. Pneumatically expansible
tubes or springs are provided to urge the movable press roll away from the other. The object of this press is to maintain the axes of the press rolls parallel while permitting relative lateral movement of the press rolls.

However, there is a need for an improved processing of pulp in an apparatus for washing and dewatering pulp comprising two rotatable press rolls, which more accurately provides pulp with the quality which is desired, and which increases the capacity of the apparatus.

**The Object of the Invention**

The object of the present invention is thus to provide an improved processing of pulp in an apparatus for washing and dewatering pulp comprising two rotatable press rolls.

**Summary of the Invention**

The above mentioned object is achieved by providing a method as defined in the appended claim 1, and by a system as defined in the appended claim 11.

By the present invention, the performance and the flexibility of the apparatus can be improved with regard to the desired value for a specific control parameter, whereby the capacity of the apparatus is improved. By the present invention, it is easier to keep a specific control parameter within a desired and suitable range, whereby the desired quality of the pressed pulp is attained in an efficient way. The use of the press nip as a variable operating parameter, i.e. the active adjustment of the press nip/distance between the press rolls during operation, improves the flexibility and performance of the apparatus, and a requested process result is attained in an efficient way. By the present invention, the performance of the apparatus is improved since the washing efficiency and the capacity are increased. The capacity of the apparatus is increased since a larger amount of pulp, having a more correct certain quality, per time unit can be produced. By the present invention, it is possible to come closer to the maximum capacity which the apparatus can manage. An improved processing of pulp in an apparatus for washing and dewatering pulp comprising two rotatable press rolls is thus provided by the present invention.

The desired value for a specific control parameter can be set by the operator during the operation of the apparatus, and also changed during operation. The adjustment of the variable operating parameters in order to keep said difference
below the certain level can be performed according to different kinds of algorithms or techniques, depending on the number of variable operating parameters being adjusted. For example, several operating parameters can be adjusted simultaneously, or one operating parameter can be adjusted at a time, and thereafter another.

By "during operation" is meant during ongoing operation of the apparatus, i.e. the operating parameters are adjustable while the apparatus is continuously running, idle running or while pressing and washing pulp, without being forced to shut down the apparatus. The axes of rotation of the press rolls can be in substantially the same horizontal plane, and the movable press roll is then laterally movable in relation to the other, or the axes of rotation of the press rolls can be positioned in other ways. The axes of rotation of the press rolls can, for example, be in substantially the same vertical plane, and the movable press roll is then movable in a substantially vertical direction, upwards or downwards.

According to an advantageous embodiment of the method according to the present invention, the method is further characterized by setting at least one desired value for two or more specific control parameters, and by adjusting at least two of the variable operating parameters of said set during operation to keep said difference below the certain level. This further improves the performance and the flexibility of the apparatus, whereby a desired quality of the pressed pulp can be attained in a more efficient way.

According to a further advantageous embodiment of the method according to the present invention, the movable press roll is urged away from the other by means of at least one hydraulic driving device. This improves the performance and the flexibility of the apparatus, whereby a desired quality of the pressed pulp can be attained in a more efficient way.

According to another advantageous embodiment of the method according to the present invention, the method is further characterized by including the torque of the press rolls and the linear load as variable operating parameters in said set, and by adjusting at least the torque of the press rolls during operation to keep said difference below the certain level. This further improves the performance and the flexibility of the apparatus, whereby a desired quality of the pressed pulp can be attained in a more efficient way.
According to still another advantageous embodiment of the method according to the present invention, the method is further characterized by including the vat pressure and the rotation speed of the press rolls as variable operating parameters in said set, and by adjusting at least one of these parameters during operation to keep said difference below the certain level. The inventors have found that this further improves the performance and the flexibility of the apparatus.

According to yet another advantageous embodiment of the method according to the present invention, outlet pulp consistency is included as a control parameter in said group. Tests performed by the inventors show that this further improves the performance and the flexibility of the apparatus, and that a desired quality of the pressed pulp can be attained in an even more efficient way.

According to an advantageous embodiment of the method according to the present invention, the vat pressure is included as a control parameter in said group. The inventors have found that this further improves the performance and the flexibility of the apparatus.

According to a further advantageous embodiment of the method according to the present invention, the method is further characterized by including the distance between the press rolls, the torque of the press rolls and/or the linear load as control parameters in said group. Hereby the performance and the flexibility of the apparatus are further improved, and a desired quality of the pressed pulp is attained in a more efficient way.

According to a further advantageous embodiment of the method according to the present invention, the method is further characterized by providing the apparatus with a pulp distribution device for each press roll for distributing pulp on the respective press roll, and by including the ratio between the rotation speed of the press roll and the flow rate of the pulp from the pulp distribution device as a control parameter in said group. Tests performed by the inventors show that this further improves the performance and the flexibility of the apparatus, and that a desired quality of the pressed pulp can be attained in an even more efficient way.

According to another advantageous embodiment of the method according to the present invention, the method is further characterized by including the flow rate of the pulp from the pulp distribution device as a variable operating parameter in said set, and by adjusting this variable operating parameter during operation to keep said difference below the certain level. Tests performed by the inventors
show that this improves the performance and the flexibility of the apparatus, and
that a desired quality of the pressed pulp is attained in an even more efficient way.

According to an advantageous embodiment of the system according to the
present invention, the setting means are adapted to set at least one desired value
for two or more specific control parameters, and the adjustment means are
adapted to adjust at least one of the variable operating parameters of said set
during operation to keep said difference below the certain level.

According to a further advantageous embodiment of the system according
to the present invention, the means for adjusting the distance between the press
rolls comprise at least one hydraulic driving device for urging the movable press
roll away from the other.

According to another advantageous embodiment of the system according
to the present invention, the torque of the press rolls and the linear load are included
as variable operating parameters in said set, and the adjustment means
comprise means for adjusting the torque of the press rolls during operation.

According to still another advantageous embodiment of the system
according to the present invention, the vat pressure and the rotation speed of the
press rolls are included as variable operating parameters in said set, and the ad-
justment means comprise means for adjusting the vat pressure, means for adjust-
ing the rotation speed of the press rolls, during operation.

According to yet another advantageous embodiment of the system accord-
ing to the present invention, outlet pulp consistency is included as a control pa-
parameter in said group, the setting means are adapted to set at least one desired
value for the outlet pulp consistency, and the measuring means comprise means
for measuring the outlet pulp consistency.

According to an advantageous embodiment of the system according to the
present invention, vat pressure is included as a control parameter in said group,
the setting means are adapted to set at least one desired value for the vat pres-
sure, and the measuring means comprise means for measuring the vat pressure.

According to a further advantageous embodiment of the system according
to the present invention, the distance between the press rolls, the torque of the
press rolls and/or the linear load are included as control parameters in said group,
the setting means are adapted to set at least one desired value for the distance
between the press rolls, the torque of the press rolls and/or the linear load, and the measuring means comprise means for measuring any of these control parameters.

According to another advantageous embodiment of the system according to the present invention, the apparatus comprises a pulp distribution device for each press roll for distributing pulp on the respective press roll, the ratio between the rotation speed of the press roll and the flow rate of the pulp from the pulp distribution device is included as a control parameter in said group, the setting means are adapted to set at least one desired value for said ratio, and the measuring means comprise means for measuring said ratio.

According to yet another advantageous embodiment of the system according to the present invention, the flow rate of the pulp from the pulp distribution device is included as a variable operating parameter in said set, and in that the adjustment means comprise means for adjusting the flow rate of the pulp from the pulp distribution device.

The advantageous effects of each above-mentioned embodiment of the system correspond to the above-mentioned advantageous effects resulting from the corresponding embodiment of the method disclosed above.

Further advantageous embodiments of the method and system according to the present invention emerge from the detailed description of preferred embodiments.

By the addition of each variable operating parameter and each control parameter, it is possible to further improve the performance and the flexibility of the apparatus with regard to the desired value for one or several specific control parameters.

The above mentioned object is also achieved by providing an apparatus as defined in the appended claim 21.

The above mentioned object is also achieved by providing a plant as defined in the appended claim 23.

**Brief Description of the Drawings**

The present invention will now be described, for exemplary purposes, in more detail by way of embodiments and with reference to the enclosed drawings, in which:
Fig. 1 is a schematic view of an embodiment of the apparatus for washing and dewatering pulp provided with an embodiment of the system for controlling it according to present invention,

Fig. 2 is a schematic view illustrating a part of the embodiment of the apparatus according to the present invention,

Fig. 3 is a schematic flow schedule illustrating aspects of the method according to the present invention, and

Fig. 4 is a schematic side view of another embodiment of the apparatus for washing and dewatering pulp to which embodiment the system according to the present invention can be applied.

**Detailed Description of Preferred Embodiments**

Fig. 1 schematically shows an embodiment of the apparatus for washing and dewatering cellulose-containing pulp according to the present invention provided with an embodiment of the system according to the present invention schematically illustrated with blocks. The apparatus comprises a first rotatable press roll 102 and a second rotatable press roll 104, each press roll 102, 104 having a permeable outer surface 106, 108 which is perforated, i.e. provided with apertures, whereby the outer surface 106, 108 is permeable to filtrate pressed out of the pulp. The shape of the apertures is normally circular, but any shape is possible. The press rolls 102, 104 comprise a number of filtrate channels 110 radially inwards of the outer surface 106, 108 to lead evacuated filtrate away. The two press rolls 102, 104 defines a press/roll nip 112 between them, in which press nip 112 the pulp is pressed, and are arranged to rotate in opposite directions, the left press roll 102 being arranged to rotate in counter clockwise direction and the right press roll 104 being arranged to rotate in clockwise direction. The apparatus is arranged to feed the pulp in the direction of rotation of the press rolls 102, 104 through the press nip 112. The axes of rotation of the press rolls 102, 104 being in substantially the same horizontal plane, and the apparatus is arranged to feed the pulp through the press nip 112 in a substantially vertical direction from below upwards.

One of the press roll 102, 104, herein the first press roll 102, is laterally movable in relation to the other press roll 104 to vary the press nip 112 under the operation of the apparatus. The processing of the pulp in the apparatus is determined by a set of variable operating parameters which are variable during operation.
The apparatus comprises a casing which includes a vat 114, 116, 118 in which the press rolls 102, 104 are installed, the vat 114, 116, 118 partly enclosing the outer surface 106, 108 of each press roll 102, 104, whereby a gap 124, 125 for each press roll 102, 104 is defined, limited by the vat 114, 116, 118 and the outer surface 106, 108 of the respective press roll 102, 104. The vat 114, 116, 118 can be pressurized and comprises a first side vat segment 114 which partly encloses the outer surface 106 of the first press roll 102, and a second side vat segment 116 which partly encloses the outer surface 108 of the second press roll 104.

Said casing comprises a first casing member 115 which extends between the ends of the first press roll 102 and to which the first side vat segment 114 is mounted, and a second casing member 117 which extends between the ends of the second press roll 104 and to which the second side vat segment 116 is mounted. The first casing members 115 is pivotable about a first axle 121 and the second casing members 117 is pivotable about a second axle 123, whereby the casing members 115, 117, together with their side vat segments 114, 116, are movable between a closed position and an opened position for providing access to the press rolls 102, 104. Further, the vat 114, 116, 118 comprises a central vat segment 118 partly enclosing the outer surface 106, 108 of the press rolls 102, 104 between the press nip 112 and the side vat segments 114, 116.

The apparatus comprises a first pulp distribution device 126 for distributing pulp on the first press roll 102 and a second pulp distribution device 128 for distributing pulp on the second press roll 104. The pulp distribution devices 126, 128 are arranged to distribute pulp to the gap 124 along the whole length of each press roll 102, 104. The pulp distributed on the outer surface 106, 108 of the press roll 102, 104 forms a mat on the press rolls 102, 104. Herein, the pulp distribution device 126, 128 is in the form of a pulp distribution screw. However, other kinds of pulp distribution devices are possible. The pulp distribution device 126, 128 can also comprise several separate pulp distribution means distributed one after the other along the longitudinal extension of the press roll 102, 104. Each pulp distribution device 126, 128 is connectable to a pulp supplying system via connection means 140, 142, and the supplying system supplies pulp to each pulp distribution device 126, 128.

The apparatus also includes a pulp transport screw (not shown), which for example can be in the form of a pulp disintegrating screw or a shredder screw, to-
wards which the pulp which has been pressed in the press nip 112 is conveyed.
The pulp transport screw extends parallelly to the longitudinal axes of the press rolls 102, 104, and is arranged to disintegrate the pulp and transport the pulp axially away from the press for further processing.

The system of the present invention is adapted to control the apparatus by controlling a set of variable operating parameters which are variable during operation and determine the processing of the pulp in the apparatus. The operating parameters include apparatus parameters and process parameters, where the value of a process parameter is a result of the apparatus parameters or other parameters. The following variable operating parameters are included in said set:

• the distance between the press rolls 102, 104, which corresponds to the cross-section of the press-nip 112, which is defined as an apparatus parameter;
• the torque of the press rolls 102, 104, which is defined as an apparatus parameter;
• the linear load which acts on the pulp in the press nip 112 and is affected by the torque of the press rolls 102, 104, which is defined as a process parameter;
• the vat pressure, i.e. the pressure within the vat, which is defined as a process parameter;
• the rotation speed of the press rolls 102, 104, which is defined as an apparatus parameter or a process parameter;
• inlet pulp consistency, which is defined as a process parameter; and
• the flow rate of the pulp from the pulp distribution device 126, 128, which is defined as a process parameter.

Further variable operating parameters can also be included in the set.

The system comprises setting means 160 for setting at least one desired value for a specific control parameter, the specific control parameter being included in a group of control parameters. The setting means 160 includes a keyboard 162 via which the control parameters is set, and the system includes a display means 164 for displaying the set control parameter. The following control parameters are included in said group:

• outlet pulp consistency;
• the vat pressure;
• the distance between the press rolls 102, 104;
• the torque of the press rolls 102, 104;
• the linear load;
• the flow rate of the pulp from the pulp distribution device 126, 128.
• the rotation speed of the press rolls 102, 104; and
• the ratio between the rotation speed of the press roll 102, 104 and the flow rate of the pulp from the pulp distribution device 126, 128.

Further control parameters can also be included in the group.

The system includes measuring means for measuring the specific control parameter, and the measuring means include means 168 for measuring the outlet pulp consistency, means 170 for measuring the vat pressure, means 172 for measuring the distance between the press rolls 102, 104, means 174 for measuring the torque of the press rolls 102, 104, means 175 for measuring the linear load, means 178 for measuring the rotation speed of the press roll 102, 104, means 180 for measuring the flow rate of the pulp from the pulp distribution device 126, 128, and means for 182 for measuring or calculating the above-mentioned ratio. Above-mentioned means for measuring are in the form of suitable sensors or equipment. The means 170 for measuring the vat pressure can be installed at various places in the vat, for example at lowest region/s in the vat to measure the vat pressure there. The linear load can for example be measured by providing the means 175 for measuring the linear load in connection to the bearings of the press rolls 102, 104, and determine the linear load from the measured load on the bearings.

The system includes adjustment means for adjusting one or several of the variable operating parameters of said set during operation to keep the difference between the set desired value and the value of the measured specific control parameter below a certain level. The certain level can be a positive value, for example close to zero, and the setting means 160 is adapted to set this certain level, for example via the keyboard 162 of the setting means 160. The adjustment means include means for adjusting the distance between the press rolls 102, 104, which means include hydraulic driving devices 202 for urging the laterally movable press roll 104 away from and towards the other press roll 102, and for providing and
keeping a specific distance between the press rolls 102, 104 (see fig. 2). However, other means for adjusting the distance between the press rolls 102, 104 are possible, such as means based on electromechanics. Further, the adjustment means include means for adjusting the torque of the press rolls during operation, which means are connected to the drive of the press rolls 102, 104, means for adjusting the vat pressure, which means are connected to the pressure controlling device of the vat, means for adjusting the rotation speed of the press rolls, which means are connected to the drive of the press rolls 102, 104, means for adjusting the flow rate of the pulp from the pulp distribution device 126, 128, which means are provided in the feed control of the pulp distribution devices 126, 128, and means for adjusting the inlet pulp consistency.

The adjustment means can be adapted to adjust only one variable operating parameter, or be adapted to adjust two or more variable operating parameters. When adjusting two or more variable operating parameters, the adjustment means can be adapted to adjust several operating parameters simultaneously, or adapted to adjust one operating parameter at a time, and thereafter another.

The adjustment means, the measuring means, the setting means and the display means are connected to a control device 166 adapted to control the adjustment means and adapted to retrieve data from the measuring means and the setting means. The control device 166 comprises a processor 167 and storing means 169 for storing data. The control device 166 includes means 182 for calculating said ratio from the measurement of the means 180 for measuring the flow rate of the pulp from the pulp distribution device 126, 128 and the means 178 for measuring the rotation speed of the press roll 102, 104.

The setting means 160 can be adapted to set at least one desired value for two or more specific control parameters, and the adjustment means are adapted to adjust at least one of the variable operating parameters of said set during operation to keep said difference below the certain level.

Fig. 2 schematically illustrates the pivotally mounting of the press rolls at the first end of the apparatus. The shaft 204 of the first press roll 102 and the shaft 206 of the second laterally movable press roll 104 are supported by bearings housed in bearing housings 208, 210. The bearing housing 208 of the first press roll 102 is fixedly attached to the casing 212 of the apparatus, and the bearing housing 210 of the laterally movable press roll 104 is movably attached to the
casing 212, whereby the second press roll 104 is movable in relation to casing 212 and laterally movable in relation the other press roll 102. The hydraulic driving device 202 is positioned between the shafts 204, 206 of the press rolls 102, 104 and is connected to the bearing housing 208, 210 of each press roll 102, 104. A corresponding hydraulic driving device is mounted at the second end of the apparatus. The hydraulic driving devices 202 are adapted to urge the laterally movable press roll 104 away from the other press roll 102 and towards the other press roll 102 for providing a specific distance between the press rolls 102, 104 and for keeping this distance. The means 174 for measuring the linear load is in the form of a load cell 201 connected to the hydraulic driving device 202.

Fig. 3 illustrates aspects of the method according to the present invention by way of a schematic flow schedule, which method is applicable to the apparatus shown in Fig. 1 and Fig. 4, for example, but can also be applied to other apparatus for washing and dewatering cellulose-containing pulp comprising two rotatable press rolls.

According to a first aspect of the method according to the present invention, the method is applicable to the apparatus shown in Fig. 1. The above-mentioned variable operating parameters are included in the set of variable operating parameters, at 301, and the above-mentioned control parameters are included in the group of control parameters, at 302. One desired value for a specific control parameter of said group is set, at 303. The specific control parameter is measured, at 304. If the difference between the set desired value and the value of the measured specific control parameter is above or equal to a certain level, X, one or several variable operating parameters of said set is/are adjusted, at 305, to decrease said difference. If the difference between the set desired value and the value of the measured specific control parameter is below the certain level, X, the operating parameters are maintained. The specific control parameter is measured continuously, and adjusted, if necessary, to keep the difference between the set desired value and the value of the measured specific control parameter below the certain level. Instead of setting one desired value, a desired value range including several values could be set. One desired value could also be set for two or more specific control parameters, for example a desired value for the linear load and a desired value for the vat pressure, etc.
According to a second aspect of the method according to the present invention, at least the distance between the press rolls, i.e. the size of the press nip, during operation is adjusted to keep said difference below the certain level, and this adjustment is performed by urging the movable press roll away from the other press roll or by urging the movable press roll towards the other press roll by means of at least one hydraulic driving device.

By means of the present invention, is possible to select different modes or pressing strategies by setting desired values for specific control parameters, and the performance of the apparatus is optimized with regard to the selected mode.

According to a third aspect of the method according to the present invention, a mode can be selected where a desired value for the vat pressure is set, whereby the performance of the apparatus is optimized with regard the capacity of the apparatus, irrespective of the present inlet pulp consistency or the flow rate of the pulp from the pulp distribution device. Hereby, the vat pressure is kept a substantially fixed level, and the torque of the press rolls and the distance between the press rolls, respectively, are adjusted according to the invention and to a value as large as possible. Advantageously, the torque of the press rolls is adjusted before the distance between the press rolls.

According to a fourth aspect of the method according to the present invention, a mode can be selected where a high desired value for the outlet pulp consistency is set, whereby the performance of the apparatus is optimized to deliver high consistency pulp. Hereby, the linear load is adjusted (by adjusting the torque of the press rolls), the vat pressure is adjusted and the distance between the press rolls is adjusted according to the invention and to a value as large as possible. Advantageously, first the linear load is adjusted to a value as large as possible, then the vat pressure is adjusted, and finally the distance between the press rolls.

According to a fifth aspect of the method according to the present invention, a mode can be selected where a desired value for the ratio between the rotation speed of the press roll and the flow rate of the pulp from the pulp distribution device is set, whereby it is guaranteed that all of the outer surface of the press roll is covered with pulp from the pulp distribution device. In this mode, also a desired value for the vat pressure is set to keep it a specific level, and the torque of the press rolls and the distance between the press rolls, respectively, are adjusted to a
value as large as possible. Advantageously, the torque of the press rolls is adjusted before the distance between the press rolls.

According to a sixth aspect of the method according to the present invention, a mode can be selected where a desired value for the distance between the press rolls is set. Hereby, the distance between the press rolls is measured, the measured distance is compared with the desired value for the distance, whereupon the distance is adjusted to keep the difference between the desired value for the distance and the value of the measured distance below a certain level, advantageously, the certain level is close to zero.

According to a seventh aspect of the method according to the present invention, a mode can be selected where a desired value for the linear load is set, and the distance between the press rolls is adjusted during operation to keep the difference between the desired value for the linear load and the value of the measured linear load below a certain level.

According to a further aspect of the method according to the present invention, the method is applicable to the apparatus for washing and dewatering cellulose-containing pulp shown in Fig. 4, which does no have a distribution device for each press roll for distributing pulp on the respective press roll, as in the apparatus disclosed in Fig. 1. Instead, a pulp inlet 406 for receiving pulp is positioned in the bottom of the vat, whereupon pulp is conveyed through the press nip 408 between the press rolls 402, 404 from below upwards. According to this aspect, the ratio between the rotation speed of the press roll and the flow rate of the pulp from the pulp distribution device is then excluded as a control parameter in said group, and the flow rate of the pulp from the pulp distribution device is excluded as a variable operating parameter in said set.

The operating parameters can be affected by changes in other operating parameters, while some operating parameters are kept unchanged. For example, an increase of the torque of the press rolls results in a decrease of the rotation speed of the press rolls, an increase of the vat pressure and the outlet pulp consistency, whereas the flow rate of the pulp from the pulp distribution device, the inlet pulp consistency and the distance between the press rolls are kept unchanged.
CLAIMS

1. A method for processing pulp in an apparatus for washing and dewatering pulp comprising two rotatable press rolls (102, 104) having a permeable outer surface (106, 108), and a vat (114, 116, 118) in which the press rolls (102, 104) are installed, the press rolls (102, 104) defining a press nip (112) between them, in which press nip (112) the pulp is pressed, and the apparatus is arranged to feed the pulp in the direction of rotation of the press rolls through the press nip (112), at least one of the press rolls (102, 104) being movable in relation to the other press roll (102, 104) to vary the press nip, and the processing of the pulp in the apparatus is determined by a set of variable operating parameters which are variable during operation, the method comprising the steps of:
   • including the distance between the press rolls (102, 104) as a variable operating parameter in said set;
   • setting at least one desired value for a specific control parameter, the specific control parameter being included in a group of control parameters;
   • measuring the specific control parameter; and
   • adjusting at least two of the variable operating parameters of said set during operation, where the distance between the press rolls (102, 104) is one of said at least two variable operating parameters, to keep the difference between the set desired value and the value of the measured specific control parameter below a certain level.

2. A method according to claim 1, characterized by setting at least one desired value for two or more specific control parameters, and by adjusting at least two of the variable operating parameters of said set during operation to keep said difference below the certain level.

3. A method according to claim 1, characterized by urging the movable press roll away from the other by means of at least one hydraulic driving device.

4. A method according to any of the claims 1 to 3, characterized by including the torque of the press rolls and the linear load as variable operating pa-
rameters in said set, and by adjusting at least the torque of the press rolls during
operation to keep said difference below the certain level.

5. A method according to any of the claims 1 to 4, characterized by
including the vat pressure and the rotation speed of the press rolls as variable op-
erating parameters in said set, and by adjusting at least one of these parameters
during operation to keep said difference below the certain level.

6. A method according to any of the claims 1 to 5, characterized by
including outlet pulp consistency as a control parameter in said group.

7. A method according to any of the claims 1 to 6, characterized by
including the vat pressure as a control parameter in said group.

8. A method according to any of the claims 1 to 7, characterized by
including the distance between the press rolls (102, 104), the torque of the press
rolls and/or the linear load as control parameters in said group.

9. A method according to any of the claims 1 to 8, characterized by pro-
viding the apparatus with a pulp distribution device (126, 128) for each press roll
(102, 104) for distributing pulp on the respective press roll (102, 104), and by in-
cluding the ratio between the rotation speed of the press roll (102, 104) and the
flow rate of the pulp from the pulp distribution device (126, 128) as a control pa-
rameter in said group.

10. A method according to claim 9, characterized by including the flow rate
of the pulp from the pulp distribution device (126, 128) as a variable operating pa-
rameter in said set, and by adjusting this variable operating parameter during op-
eration to keep said difference below the certain level.

11. A system for controlling an apparatus for washing and dewatering pulp
comprising two rotatable press rolls (102, 104) having a permeable outer surface
(106, 108), and a vat (114, 116, 118) in which the press rolls (102, 104) are in-
stalled, the press rolls (102, 104) defining a press nip (112) between them, in
which press nip (112) the pulp is pressed, and the apparatus is arranged to feed
the pulp in the direction of rotation of the press rolls through the press nip (112), at
least one of the press rolls (102, 104) being movable in relation to the other press
roll (102, 104) to vary the press nip, and the processing of the pulp in the appara-
tus is determined by a set of variable operating parameters which are variable
during operation, which system comprises setting means (160) for setting at least
one desired value for a specific control parameter, the specific control parameter
being included in a group of control parameters, and measuring means for meas-
uring the specific control parameter, **characterized** in that the distance between
the press rolls (102, 104) is included as a variable operating parameter in said set,
and in that the system comprises adjustment means for adjusting at least two of
the variable operating parameters of said set during operation, which adjustment
means comprise means for adjusting the distance between the press rolls (102,
104) during operation, to keep the difference between the set desired value and
the value of the measured specific control parameter below a certain level.

12. A system according to claim 11, **characterized** in that the setting
means (160) are adapted to set at least one desired value for two or more specific
control parameters, and the adjustment means are adapted to adjust at least two
of the variable operating parameters of said set during operation to keep said dif-
ference below the certain level.

13. A system according to claim 11, **characterized** in that the means for ad-
justing the distance between the press rolls (102, 104) comprise at least one hy-
draulic driving device for urging the movable press roll away from the other.

14. A system according to any of the claims 11 to 13, **characterized** in that
the torque of the press rolls and the linear load are included as variable operating
parameters in said set, and in that the adjustment means comprise means for ad-
justing the torque of the press rolls during operation.

15. A system according to any of the claims 11 to 14, **characterized** in that
the vat pressure and the rotation speed of the press rolls (102, 104) are included
as variable operating parameters in said set, and in that the adjustment means
comprise means for adjusting the vat pressure, means for adjusting the rotation speed of the press rolls (102, 104), during operation.

16. A system according to any of the claims 11 to 15, characterized in that outlet pulp consistency is included as a control parameter in said group, in that the setting means (160) are adapted to set at least one desired value for the outlet pulp consistency, and in that the measuring means comprise means (168) for measuring the outlet pulp consistency.

17. A system according to any of the claims 11 to 16, characterized in that vat pressure is included as a control parameter in said group, in that the setting means (160) are adapted to set at least one desired value for the vat pressure, and in that the measuring means comprise means (170) for measuring the vat pressure.

18. A system according to any of the claims 11 to 17, characterized in that the distance between the press rolls (102, 104), the torque of the press rolls and/or the linear load are included as control parameters in said group, in that the setting means (160) are adapted to set at least one desired value for the distance between the press rolls (102, 104), the torque of the press rolls (102, 104) and/or the linear load, and in that the measuring means comprise means (172, 174, 175) for measuring any of these control parameters.

19. A system according to any of the claims 11 to 18, characterized in that the apparatus comprises a pulp distribution device (126, 128) for each press roll (102, 104) for distributing pulp on the respective press roll (102, 104), in that the ratio between the rotation speed of the press roll (102, 104) and the flow rate of the pulp from the pulp distribution device is included as a control parameter in said group, in that the setting means (160) are adapted to set at least one desired value for said ratio, and in that the measuring means comprise means (178, 180) for measuring said ratio.

20. A system according to claim 19, characterized in that the flow rate of the pulp from the pulp distribution device is included as a variable operating pa-
rameter in said set, and in that the adjustment means comprise means for adjusting the flow rate of the pulp from the pulp distribution device (126, 128).

21. An apparatus for washing and dewatering pulp comprising two rotatable press rolls (102, 104) having a permeable outer surface (106, 108), and a vat (114, 116, 118) in which the press rolls (102, 104) are installed, the press rolls (102, 104) defining a press nip (112) between them, in which press nip (112) the pulp is pressed, and the apparatus is arranged to feed the pulp in the direction of rotation of the press rolls through the press nip (112), at least one of the press rolls (102, 104) being movable in relation to the other press roll (102, 104) to vary the press nip, and the processing of the pulp in the apparatus is determined by a set of variable operating parameters which are variable during operation, and the apparatus comprises a system for controlling the apparatus, characterized in that the system comprises the features which are mentioned in any of the claims 11 to 18.

22. An apparatus according to claim 21, characterized in that the apparatus comprises a pulp distribution device (126, 128) for each press roll (102, 104) for distributing pulp on the respective press roll (102, 104), and in that the system comprises the features which are mentioned in claim 19 or 20.

23. A plant for processing pulp, which plant comprises an apparatus for washing and dewatering pulp, characterized in that the apparatus comprises the features mentioned in claim 21 or 22.
Apparatus parameters are included in the set of variable operating parameters.

Control parameters are included in the group of control parameters.

A desired value for a specific control parameter of said group is set.

The specific control parameter is measured.

The difference between the set desired value and the value of the measured specific control parameter ≥ X?

Yes

One or several variable operating parameters of said set is/are adjusted.

New setting of a desired value for a control parameter?

No

Yes

No

Yes
### A. CLASSIFICATION OF SUBJECT MATTER

**IPC:** see extra sheet  
According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC:** D21C, D21D, B30B

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

SE, DK, FI, NO classes as above

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

#### EPO-INTERNAL, WPI DATA, PAJ

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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[X] Further documents are listed in the continuation of Box C.  
[ ] See patent family annex.

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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**Date of the actual completion of the international search:** 11 March 2009  
**Date of mailing of the international search report:** 1 March 2009

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International patent classification (IPC)
D21C 9/06 (2006.01)
D21C 9/18 (2006.01)
B30B 9/20 (2006.01)
D21D 1/40 (2006.01)

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Cited literature, if any, will be enclosed in paper form.
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