(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 536 518 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **92114426.7**

(51) Int. Cl.5: **B31F 1/28**

(22) Date of filing: **24.08.92**

(30) Priority: **11.10.91 JP 290416/91**

(43) Date of publication of application:
14.04.93 Bulletin 93/15

(84) Designated Contracting States:
CH DE FR GB IT LI NL

(71) Applicant: **MITSUBISHI JUKOGYO KABUSHIKI KAISHA**
5-1, Marunouchi 2-chome Chiyoda-ku
Tokyo(JP)

(72) Inventor: **Seki, Yukuharu, c/o Mihara Machinery Works**
Mitsubishi Jukogyo K.K., 5007, Itozaki-cho
Mihara-shi, Hiroshima-ken(JP)
Inventor: **Ohkawa, Haruo, c/o Mihara Machinery Works**
Mitsubishi Jukogyo K.K., 5007, Itozaki-cho
Mihara-shi, Hiroshima-ken(JP)
Inventor: **Baba, Kunitaka, c/o Mihara Machinery Works**
Mitsubishi Jukogyo K.K., 5007, Itozaki-cho
Mihara-shi, Hiroshima-ken(JP)

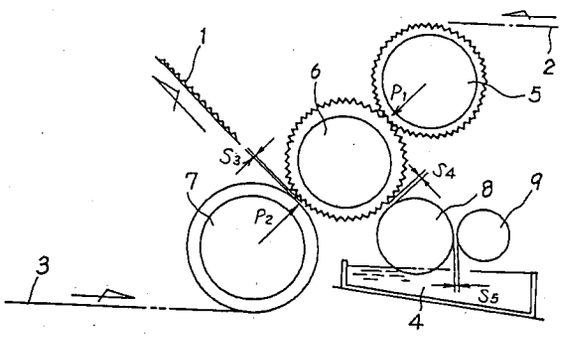
(74) Representative: **Henkel, Feiler, Hänzel & Partner**
Möhlstrasse 37
W-8000 München 80 (DE)

(54) Automatic setting system for a single-facer.

(57) An automatic setting system for a single-facer equipped in a corrugating machine is improved so that contact conditions between the various rolls can be automatically set in an ideal condition, thereby a productivity of corrugated cardboard sheets is enhanced, and manufacture of highly qualified corrugated cardboard sheets is made possible.

In a single-facer of a corrugating machine provided with contact pressure adjusting devices R_1 - R_2 for variably adjusting engaging conditions between rolls in the pairs of an upper corrugating roll 5 and a lower corrugating roll 6, the lower corrugating roll 6 and a pressure roll 7 and the like, and gap space adjusting devices R_3 - R_5 for variably adjusting engaging conditions between rolls in the pairs of the lower corrugating roll 6 and a pasting roll 8, the pasting roll 8 and a doctor roll 9, the lower corrugating roll 6 and the pressure roll 7 and the like, and thereby contact conditions between the respective rolls engaging with one another can be variably set; the above-mentioned respective adjusting devices R_1 -R_5 are actuated so that the contact conditions between the respective rolls engaging with one another can be adjusted so as to have predetermined values which have been preliminarily input, either by selectively operating keyboards 1A, 1B of a condition setting operation panel 11 on the basis of a specification of raw paper sheets used for manufacture or by operating in response to data received directly from a production management apparatus or control apparatus C possessing data of kinds, widths, etc. of raw paper webs loaded in a corrugating machine.

Fig. 2



EP 0 536 518 A1

BACKGROUND OF THE INVENTION:

Field of the Invention:

The present invention relates to a corrugating machine for manufacturing single-faced corrugated cardboard sheets, and more particularly to an automatic setting system for a single-facer therein, which can automatically and adjustably set contact pressures and gap spaces between rolls engaging with one another at predetermined values corresponding to conditions of raw paper webs (a core paper web and a liner) used for the manufacture.

Description of the Prior Art:

A general single-facer in a corrugating machine is constructed as shown in Fig. 9, and it is formed of principal elements consisting of an upper corrugating roll 5, a lower corrugating roll 6 adapted to mesh with the aforementioned upper corrugating roll 5 for shaping a core paper web 2 pinched and held therebetween into a corrugated shape, a pressure roll 7 for producing a continuous single-faced corrugated cardboard sheet 1 by making a pasted core paper web 2 and a liner 3 pass between the lower corrugating roll 6 and the pressure roll 7 while being pressurized, a pasting roll 8 for transferring a predetermined amount of paste 4 to crest portions of corrugations of the aforementioned shaped core paper web 2, a doctor roll 9 for adjusting an amount of transfer of paste to the above-mentioned pasting roll 8, and the like.

In addition, the pair of the upper corrugating roll 5 and the lower corrugating roll 6, the pair of the lower corrugating roll 6 and the pressure roll 7, the pair of the lower corrugating roll 6 and the pasting roll 8, and the pair of the pasting roll 8 and the doctor roll 9 are constructed respectively so that their mutual contact conditions may be variably set by means of a roll contact pressure adjusting device or a roll gap space adjusting device.

By the way, in the case of shaping the core paper web 2 into a corrugated shape, and in the case of sticking the core paper web 2 and the liner 3 together by means of the paste 4 transferred to the crest portions of the corrugations, it is conditionally necessary to apply an appropriate pressing force and to heat the paste 4, and so, in addition to the contact pressure (gap space) adjusting devices between the rolls, within the above-mentioned rolls 5, 6 and 7 are provided means capable of heating up to a high temperature by introducing (circulating) steam or high-temperature oil.

Here, description will be made on the construction and operation of the portion of the upper and lower corrugating rolls 5 and 6 with reference to Fig. 9. The upper corrugating roll 5 is pivotably supported by arms 13 via bearings not shown, and one end of the same arm 13 is swingably mounted to a frame 15 via a fulcrum pin 14, while the other end thereof is connected to a tip end of a piston rod of a pressurizing cylinder 16 via a pin 17. Also, the pressurizing cylinder 16 is supported from a bracket 18 which is fastened to the frame 15, and a bearing of the lower corrugating roll 6 is pinched and fastened between the frame 15 and the bracket 18. Adjustment of a contact pressure between the respective rolls 5 and 6 having the above-described structure, can be effected by varying the operating pressure of the above-described pressurizing cylinder 16.

Next, description will be made on the construction and operation of the portion of the lower corrugating roll 6 and the pressure roll 7.

The contact condition between the lower corrugating roll 6 and the pressure roll 7, that is, the gap space and the contact pressure between these rolls are one of the most important factors in the case of contemplating to realize evenness of a thickness of a corrugated cardboard sheet as well as a sticking state of the core paper web 2 and the liner 3 along the widthwise direction of the sheet, and so, reliable adjustment and control of them is required.

As shown in Figs. 10 and 11, the opposite ends of the pressure roll 7 whose center axis is denoted by reference character C are pivotably supported by bearings 20 which are embraced by eccentric bearings 19 whose center axis is denoted by reference character E, and the same eccentric bearings 19 are rotatably held by the frame 15 via bushes 21. In addition, to the above-described eccentric bearings 19 is fixedly secured a pressurizing lever 23 via tapered pins 22.

Furthermore, at one end of the pressurizing lever 23 is swingably supported a cylinder 29 via a pin 28, and a head of the same cylinder 29 is mounted to the frame 15 via a yoke pin 30. This cylinder 29 forms a pressure adjusting device between the lower corrugating roll 6 and the pressure roll 7.

Now description will be made on the roll gap space adjusting function between the lower corrugating roll 6 and the pressure roll 7.

The roll gap space adjusting device between the rolls 6 and 7 has the structure shown in Figs. 10 and 11, in which the opposite end portions of an eccentricity adjusting rod 24 are supported by the frame 15 via slide bushes 25 so as to be slidable in its axial direction, and further an outer end on one side of the adjusting rod 24 is threaded with a female screw and threadedly engaged with a screw rod not shown. A part of this screw rod is rotatably supported via a bearing by a bracket mounted to

the frame 15, and its tip end is directly connected via an axial joint with a shaft of a motor fixed on the same bracket.

Also, at the position on the above-mentioned rod 24 corresponding to the bearing portion of the pressure roll 7, a slider 26 provided with a slope is fixedly secured to the rod 24, hence by sliding the rod 24 in the axial direction via the motor, the pressurizing lever 23 and the eccentric bearings 19 are rotated via a slider 27 making slide contact with the slider 26 via a sloped surface (a), thus the position of the center axis C of the pressure roll 7 is arbitrarily moved, and thereby the gap space between the lower corrugating roll 6 and the pressure roll 7 can be adjustably set.

Owing to the above-described construction, the gap space between the lower corrugating roll 6 and the pressure roll 7 can be preset by the rotation of the eccentric bearing 19 driven via the aforementioned eccentricity adjusting rod 24, while the contact pressure between the lower corrugating roll 6 and the pressure roll 7 can be preset at a predetermined value by varying the operation pressure of the cylinder 29 for rotating the eccentric bearings 19 via the pressurizing lever 23 as described above.

Likewise, for the pair of the lower corrugating roll 6 and the pasting roll 8 and for the pair of the pasting roll 8 and the doctor roll 9 also, roll gap space adjusting devices not shown are equipped so that a predetermined transfer amount of paste determined depending upon a thickness of a raw core paper web 2 and the like can be controlled and an appropriate amount of paste 4 can be applied to the crest portions of the corrugated waves.

In the prior art, upon resetting of contact conditions between rolls as a result of order change, while observing displayed values of the contact pressures and the roll gap spaces of the respective pairs of rolls, the contact pressures and the roll gap spaces were adjusted (corrected) by operating push buttons, and after the respective values have been individually reset, manufacture of the corrugated cardboard sheets 1 was commenced for the first time. Therefore, not only much time was necessitated for resetting, but also a high degree of skill (experience) was necessitated for the resetting work, and due to complexity of the operations, a possibility of erroneous operations was not small.

As described above, as adjusting items for engaging conditions between rolls which were important in a single-facer for manufacturing a single-faced corrugated cardboard sheet in the prior art, setting of contact pressures to be applied between the upper corrugating roll and the lower corrugating roll and between the lower corrugating roll and the pressure roll as well as setting of gap spaces to be formed between the lower corrugating roll and the pressure roll, between the lower corrugating roll and the pasting roll and between the pasting roll and the doctor roll were known, and it was necessary to set these items at predetermined values (optimum conditions) corresponding to the thicknesses and paper sheet widths of raw paper webs to be fed for manufacturing corrugated cardboard sheets such as a core paper web, a liner and the like.

Heretofore, however, upon setting of the conditions of these respective portions, the method of variably correcting the conditions by an operator manipulating push-button switches on the basis of values individually measured and displayed on meters and thereby adjusting them to predetermined conditions corresponding to the status of the above-mentioned raw paper webs, was employed, and so, there were distribution of quality of products depending upon skill (experience) of an operator, as well as a risk of occurrence of unacceptable product sheets caused by erroneous operations. In addition, a loss in time caused by change of setting was also large, and there were various problems such as lowering of an availability factor of a system and the like. The present invention has been worked out in order to resolve the above-mentioned problems in the prior art.

SUMMARY OF THE INVENTION:

It is therefore one object of the present invention to provide an improved corrugating machine which is free from the above-described disadvantages of the corrugating machine in the prior art.

A more specific object of the present invention is to provide a corrugating machine, in which contact conditions between the respective pairs of rolls engaging with one another can be automatically set at optimum conditions depending upon various conditions (specifications) such as widths, thicknesses, etc. of raw paper webs such as a core paper web, a liner and the like.

According to one feature of the present invention, there is provided a corrugating machine equipped with a single-facer including contact pressure adjusting devices for variably adjusting engaging conditions between rolls in the pairs of an upper corrugating roll and a lower corrugating roll, the lower corrugating roll and a pressure roll, and the like, and gap space adjusting devices for variably adjusting engaging conditions between rolls in the pairs of the lower corrugating roll and a pasting roll, the pasting roll and a doctor rolls, the lower corrugating roll and the pressure roll, and the like, so that contact conditions between the respective rolls engaging with one another can be variably set, which machine comprises an automatic setting sys-

tem for the single-facer, which is provided with a condition setting operation panel and constructed in such manner that the respective adjusting devices may be actuated by selectively operating keyboards of the operation panel on the basis of a specification of a raw paper web used for manufacture, and thereby the contact pressures and the gap spaces between the respective rolls engaging with one another can be adjusted to predetermined set values which has been preliminarily input.

According to another feature of the present invention, there is provided a corrugating machine equipped with a single-facer including contact pressure adjusting devices for variably adjusting engaging conditions between rolls in the pairs of an upper corrugating roll and a lower corrugating roll, a lower corrugating roll and a pressure roll, and the like, and gap space adjusting devices for variably adjusting engaging conditions between rolls in the pairs of a lower corrugating roll and a pasting roll, the pasting roll and a doctor roll, the lower corrugating roll and the pressure roll, and the like so that contact conditions between the respective rolls engaging with one another can be variably set, which machine comprises an automatic setting system for the single-facer, which is provided with a production management apparatus or control apparatus which possesses data of kinds, sheet widths, etc. of a raw paper web used for manufacture of corrugated cardboard sheets and constructed in such manner that the respective adjusting devices may be actuated in response to data received directly from the production management apparatus or control apparatus, and thereby the contact pressures and the gap clearances between the respective rolls engaging with one another can be adjusted to predetermined set values which have been preliminarily set.

According to the present invention, owing to provision of contact pressure adjusting devices and gap space adjusting devices, the contact conditions between the respective rolls engaging with one another can be variably preset, and also, by selectively operating keyboards on a condition setting operation panel depending upon a specification (thicknesses, widths, etc.) of raw paper webs used for manufacture the above-mentioned respective adjusting devices are actuated, and thereby the contact conditions between the respective rolls engaging with one another can be adjusted to predetermined set values which have been preliminarily input. Furthermore, by electrically connecting a production management apparatus or control apparatus possessing data of a specification (thickness, widths, etc.) of raw paper webs used for manufacture to the above-described adjusting devices, the contact conditions between the respective rolls engaging with one another can be adjusted to predetermined set values which have been preliminarily input.

Accordingly, it is possible to automatically preset theoretically or empirically ideal conditions for a specification such as lateral widths of corrugated cardboard sheets, thicknesses of raw paper webs (core paper webs and liners) and the like, and to apply them to the conditions between the rolls engaging with one another. Also, it becomes possible to perform resetting of a single-facer according to order change, in a short period of time and moreover automatically, and therefore, various effects and advantages such as reduction of erroneous operations, improvements of a productivity, and the like can be obtained.

The above-mentioned and other objects, features and advantages of the present invention will become more apparent by reference to the following description of one preferred embodiment of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

In the accompanying drawings:

Fig. 1 is a block diagram showing an automatic setting system having control modes X and Y according to one preferred embodiment of the present invention;

Fig. 2 is a schematic cross-section side view of a single-facer according to one preferred embodiment of the present invention;

Fig. 3 is a block diagram of the automatic setting system having a control mode X in Fig. 1;

Fig. 4 is a schematic diagram showing adjusting condition values to be stored in a memory device in Fig. 3;

Fig. 5 is a block diagram of the automatic setting system having a control mode Y in Fig. 1;

Fig. 6 is a flow chart of a controller shown in Fig. 3;

Fig. 7 is a schematic diagram showing one example of a daily operation schedule of a production management apparatus;

Fig. 8 is a flow chart of a controller shown in Fig. 5;

Fig. 9 is a cross-section side view of a general single-facer to be equipped in a corrugating machine;

Fig. 10 is an enlarged partial cross-section view showing a contact pressure adjusting mechanism and a gap space adjusting mechanism between a lower corrugating roll and a pressure roll in the single-facer shown in Fig. 9; and

Fig. 11 is an enlarged cross-section view of a part of the mechanism shown in Fig. 10.

DESCRIPTION OF THE PREFERRED EMBODIMENT:

In a corrugating machine according to the present invention shown in Fig. 2, a general construction of a single-facer equipped in the corrugating machine and a series of operations of the single-facer for manufacturing a single-faced corrugated cardboard sheet 1, are similar to those described in the preceding section relating to the prior art. Now, a subject matter of the present invention is a system for automatically setting contact pressures and gap spaces between rolls engaging with one another which are important upon manufacture of the above-described corrugated cardboard sheets 1, in corresponding to a specification of raw paper webs (a core paper web 2 and a liner 3), and in the following description will be made on the construction and operation of the single-facer.

In the single-facer, in a series of working steps of corrugating a core paper web 2 into a wave-shape, sticking it with a liner 3 fed through a separate route via paste 4 transferred to crest portions of the corrugations, and thereby forming a continuous single-faced corrugated cardboard sheet 1 as shown in Fig. 2, it is a most important factor for improving quality of the sheet 1 to adjust contact pressures P_1 and P_2 between an upper corrugating roll 5 and a lower corrugating roll 6 and between the lower corrugating roll 6 and a pressure roll 7, as well as a gap space S_3 between the lower corrugating roll 6 and the pressure roll 7, a gap space S_4 between the lower corrugating roll 6 and a pasting roll 8, and a gap space S_5 between the pasting roll and a doctor roll 9 to predetermined values.

In this connection, these inter-roll contact pressures P_1 and P_2 and inter-roll gap spaces S_3, S_4 and S_5 are set at predetermined values (ideal conditions) depending upon a specification such as quality of paper, widths of paper webs, etc. of raw paper webs used for manufacture of the single-faced corrugated cardboard sheet 1, and mainly the above-mentioned contact pressures P_1 and P_2 are determined depending upon a raw paper web width, while the gap spaces S_3, S_4 and S_5 are determined depending upon a thickness of a raw paper web.

In the prior art also, the method of detecting partial variations of contact conditions between the rolls which would be changed by variations of a temperature and other conditions by providing a load cell (a pressure transducer) or the like, feeding back the detection signals via a controller to corresponding adjusting devices, and thereby correcting the contact conditions, was proposed.

However, a system for automatically performing setting of engaging conditions of the entire rolls on the basis of data which have been preliminarily input, was not present in the past, and at the time of order change, resetting of all the adjusting devices was carried out by an operator changing displayed values of the above-described pressures and gap spaces P_1, P_2, S_3, S_4 and S_5 respectively to predetermined values by manipulating push-buttons.

Now, explaining the construction of the system according to the present invention, these predetermined values (conditions) obtained theoretically or experimentally are preliminarily input to a memory device M, then by selectively designating a specification (a raw paper web width, a raw paper web thickness) of a corrugated cardboard sheet 1 to be manufactured, the respective contact pressure adjusting devices R_1 and R_2 and the respective gap space adjusting devices S_3, S_4 and S_5 are actuated via a controller 10, which will be described later, and thereby the contact conditions between the rolls engaging with one another can be adjustably set.

In Fig. 1, reference character X designates one example of a condition setting operation panel (selection matrix) 11. As shown in this figure, selection key A is a selection key to be used in the case of manufacturing corrugated cardboard sheets 1 having a narrow width by making use of a thin liner 3 and a thin core paper web 2, and similarly, selection key R shown in this figure is a selection key to be used in the case of manufacturing corrugated cardboard sheets 1 having a broad width by making use of a thick liner 3 and a thick core paper web 2.

In addition, reference characters R_1 - R_5 designate contact condition adjusting devices between rolls in the various roll pairs shown in Fig. 2, among which reference characters R_1 and R_2 designate adjusting devices for the contact pressures P_1 and P_2, respectively, between the upper corrugating roll 5 and the lower corrugating roll 6 and between the lower corrugating roll 6 and the pressure roll 7, and reference characters R_3, R_4 and R_5 designate adjusting devices for the gap spaces S_3, S_4 and S_5, respectively, between the lower corrugating roll 6 and the pressure roll 7, between the pressure roll 7 and the pasting roll 8, and between the pasting roll 8 and the doctor roll 9.

A general construction of an automatic setting system for a single-facer according to one preferred embodiment of the present invention is shown in a block form in Fig. 3, in which on keyboards 1A and 1B are disposed selection keys A to R shown in Fig. 1, and in a memory device M are stored adjusting condition values to be set for the respective adjusting devices R_1 - R_5 according

to the conditions shown in Fig. 4.

In addition, a flow chart representing functions of the controller 10 in Fig. 3 and exchanges of signals among the keyboards 1A and 1B, the memory device M and the respective adjusting devices R_1 - R_5 in Fig. 3, is shown in Fig. 6. Describing now the functions of the controller 10 with reference to Fig. 6, in Step-1 setting of the keyboards is effected, in Step-2 memory contents corresponding to the selected key X are picked up from the adjusting condition values stored in the memory device M, that is, condition values to be set as the contact pressures P_1 and P_2 and gap spaces S_3, S_4 and S_5 are selected, and the selected values are sent as commands to the adjusting devices R_1 - R_5. If the instructed values represent an ideal condition, then adjustment is completed and operations are commenced, but if the system cannot follow the commands, the command is repeated again.

By way of example, in the selection matrix shown in Fig. 1, it is assumed that for the selection key A, the conditions of P_1 = 10 kg/cm^2, P_2 = 20 kg/cm^2, S_3 = 0.3 mm, S_4 = 0.2 mm and S_5 = 05 mm were preliminarily input, while for the selection key I, the conditions of P_1 = 50 kg/cm^2, P_2 = 60 kg/cm^2, S_3 = 0.5 mm, S_4 = 0.3 mm and S_5 = 0.8 mm were preliminarily input, and they have been respectively stored in the controller 10.

Next, description will be made on the operation of the automatic setting system with reference to Fig. 1. In the above-described construction, in the case of manufacturing corrugated cardboard sheets 1 having a narrow width by making use of a thin liner 3 and a thin core paper web 2, an operator is necessitated only to selectively actuate the selection key A on the condition setting operation panel 11, and thereby the above-described setting conditions between the respective rolls are transmitted to the corresponding adjusting devices via the controller 10.

Describing this point in more detail, as exemplified in the preceding paragraphs, the contact pressure P_1 is set at 10 kg/cm^2 by the actuation of the adjusting device R_1, and the contact pressure P_2 is set at 20 kg/cm^2 by the actuation of the adjusting device R_2. Likewise, the gap space S_3 is set at 0.3 mm by means of the adjusting device R_3, the gap space S_4 is set at 0.2 mm by means of the adjusting device R_4 and the gap space S_5 is set at 0.5 mm by means of the adjusting device R_5.

As described above, by selectively actuating the selection keys A - R on the condition setting operation panel 11, the conditions corresponding to the corrugated cardboard sheets to be manufactured are transmitted and instructed to the respective inter-roller contact condition adjusting devices R_1 - R_5 so that the engaging conditions between the rolls in the respective roller pairs may be set at the most ideal conditions. It is to be noted that while the paper sheet widths were classified into two grades and the thicknesses of the raw paper webs (core paper webs 2, liners 3) were respectively classified into three grades in the illustrated selection matrix, if necessary, various different modes of classification could be employed such that the above-mentioned classification is modified into further fined classification or into a little coarse classification.

Alternatively, according to the control mode Y shown in Fig. 1, in place of the above-described condition setting operation panel 11, the respective inter-roll contact condition adjusting devices R_1 - R_5 are actuated via the controller 10 by signals representing a specification of corrugated cardboard sheets (kinds, sheet widths and the like of a core paper web 2 and a liner 3) which are transmitted from a production management apparatus or control apparatus 12 equipped in the corrugating machine, and in this case also, similarly to the above-described case of the control mode X, predetermined inter-roll engaging conditions can be set. This mode of control has a characteristic advantage that since resetting of the inter-roll contact conditions following an order change is carried out according to commands issued from the production management apparatus 12, selection operations for the above-described selection keys A - R are not necessitated and perfect automation can be realized.

The construction relating to this mode of control will be explained with reference to a block diagram shown in Fig. 5. Fig. 5 is a block diagram showing a general construction of a modified embodiment, in which a keyboard used in the embodiment shown in Fig. 3 is not used, but operations are carried out by directly receiving data from a production management apparatus (control apparatus) C. In addition, Fig. 7 shows one example of a general operation schedule in one day, which is preliminarily set in the production management apparatus C. In the example shown in Fig. 7, the machine is operated under three different conditions in one day, and the conditions for the raw paper webs and the liners (these conditions being the same as those shown in Fig. 1) during the respective operations as well as the corresponding operation periods are preset.

Fig. 8 is a flow chart of the operations of the controller 10, which shows exchanges of signals with external units (the production management apparatus C, the memory device M and the respective adjusting devices R_1 - R_5). With reference to Fig. 8, in Step-1 the controller 10 receives data from the production management apparatus C, and

in Step-2 the controller 10 selects from the memory contents of the memory device M the conditions of a raw material width, sheets and liners under the preset condition. Corresponding ones of these selected conditions are instructed to the adjusting devices R_1 - R_5. If these instructed values are ideal, then the adjustment is completed and the operation is commenced, but if this instruction is not ideal, then the instruction is again repeated. Thereafter, the operation is continued, and the operation is finished.

The automatic setting system according to the present invention is constructed and operated in the above-described manner, and since engaging conditions between rolls necessitated in a single-facer can be entirely and automatically preset by inputting a specification (widths and thicknesses) of raw paper webs such as a liner 3, a core paper web 2 and the like used for manufacture of corrugated cardboard sheets 1, various effects and advantages such that a setting time can be shortened or corrugated cardboard sheets 1 of high quality can be manufactured stably, can be obtained.

As described in detail above, according to the present invention, contact conditions between various rolls engaging with one another can be automatically set, and moreover, into ideal conditions depending upon various conditions (specification) such as raw paper, widths, thicknesses, etc. of a core paper web and a liner used for manufacture of corrugated cardboard sheets.

Accordingly, a resetting time following an order change can be shortened and also, since there is no need to individually adjust the respective ones of a plurality of sets of adjusting devices (contact pressure adjusting devices and gap space adjusting devices), erroneous operations by an operator are reduced (reduction of an occurrence rate of loss paper sheets). In addition, maintenance of quality of corrugated cardboard sheets without relying upon skill of an operator, can be realized, also a high degree of skill and experience can be made unnecessary, and it is possible to improve a productivity and to continuously manufacture corrugated cardboard sheets of high quality.

While a principle of the present invention has been described above in connection to preferred embodiments of the invention, it is intended that all matter contained in the above description and illustrated in the accompanying drawings shall be interpreted to be illustrative and not in a limiting sense.

Claims

1. A corrugating machine equipped with a single-facer including contact pressure adjusting devices for variably adjusting engaging conditions between rolls in the pairs of an upper corrugating roll and a lower corrugating roll, the lower corrugating roll and a pressure roll, and the like, and gap space adjusting devices for variably adjusting engaging conditions between rolls in the pairs of the lower corrugating roll and a pasting roll, the pasting roll and a doctor roll, said lower corrugating roll and the pressure roll, and the like, so that contact conditions between the respective rolls engaging with one another can be variably set; characterized in that said corrugating machine comprises an automatic setting system for said single-facer, which is provided with a condition setting operation panel (11) and constructed in such manner that said respective adjusting devices (R_1 - R_5) may be actuated by selectively (A - R) operating keyboards (1A, 1B) on said operation panel (11) on the basis of a specification of a raw paper web used for manufacture, and thereby the contact pressures and the gap spaces between the respective rolls (5, 6, 7, 8, 9) engaging with one another can be adjusted to predetermined set values which have been preliminarily input (M).

2. A corrugating machine equipped with a single-facer including contact pressure adjusting devices for variably adjusting engaging conditions between rolls in the pairs of an upper corrugating roll and a lower corrugating roll, a lower corrugating roll and a pressure roll, and the like, and gap clearance adjusting devices for variably adjusting engaging conditions between rolls in the pairs of the lower corrugating roll and a pasting roll, the pasting roll and a doctor roll, said lower corrugating roll and the pressure roll, and the like, so that contact conditions between the respective rolls engaging with one another can be variably set; characterized in that said corrugating machine comprises an automatic setting system for said single-facer, which is provided with a production management apparatus or control apparatus (12) which possesses data of kinds, sheet widths, etc. of a raw paper web used for manufacture of corrugated cardboard sheets and constructed in such manner that said respective adjusting devices (R_1 - R_5) may be actuated in response to data received directly from said production management apparatus or control apparatus (12), and thereby the contact pressures and the gap spaces between the respective rolls (5, 6, 7, 8, 9) engaging with one another can be adjusted to predetermined set values which have been preliminarily set.

3. A corrugating machine as claimed in Claim 1, characterized in that on the keyboards (1A, 1B) on said operation panel (11) are indicated various combinations (A - R) of widths of a core paper web (2) and a liner (3) used for manufacture of a corrugated cardboard sheet as well as thicknesses and kinds of the respective core paper web (2) and liner (3) so that any one of them may be picked up, and said predetermined set values are input to a memory device (M) as adjustment commands to be issued to said contact pressure adjusting devices (R_1, R_2) and said gap space adjusting devices (R_3 - R_5) in correspondence respectively to said combinations (A - R).

4. A corrugating machine as claimed in Claim 2, characterized in that said production management apparatus or control apparatus (12) possesses data of various combinations of widths of a core paper web (2) and a liner (3) used for manufacture of a corrugated cardboard sheet as well as thicknesses and kinds of the respective ones, and said predetermined set values are input to a memory device (M) as adjustment commands to be issued to said contact pressure adjusting devices (R_1, R_2) and said gap space adjusting devices (R_3 - R_5) in correspondence respectively to said combinations.

Fig. 1

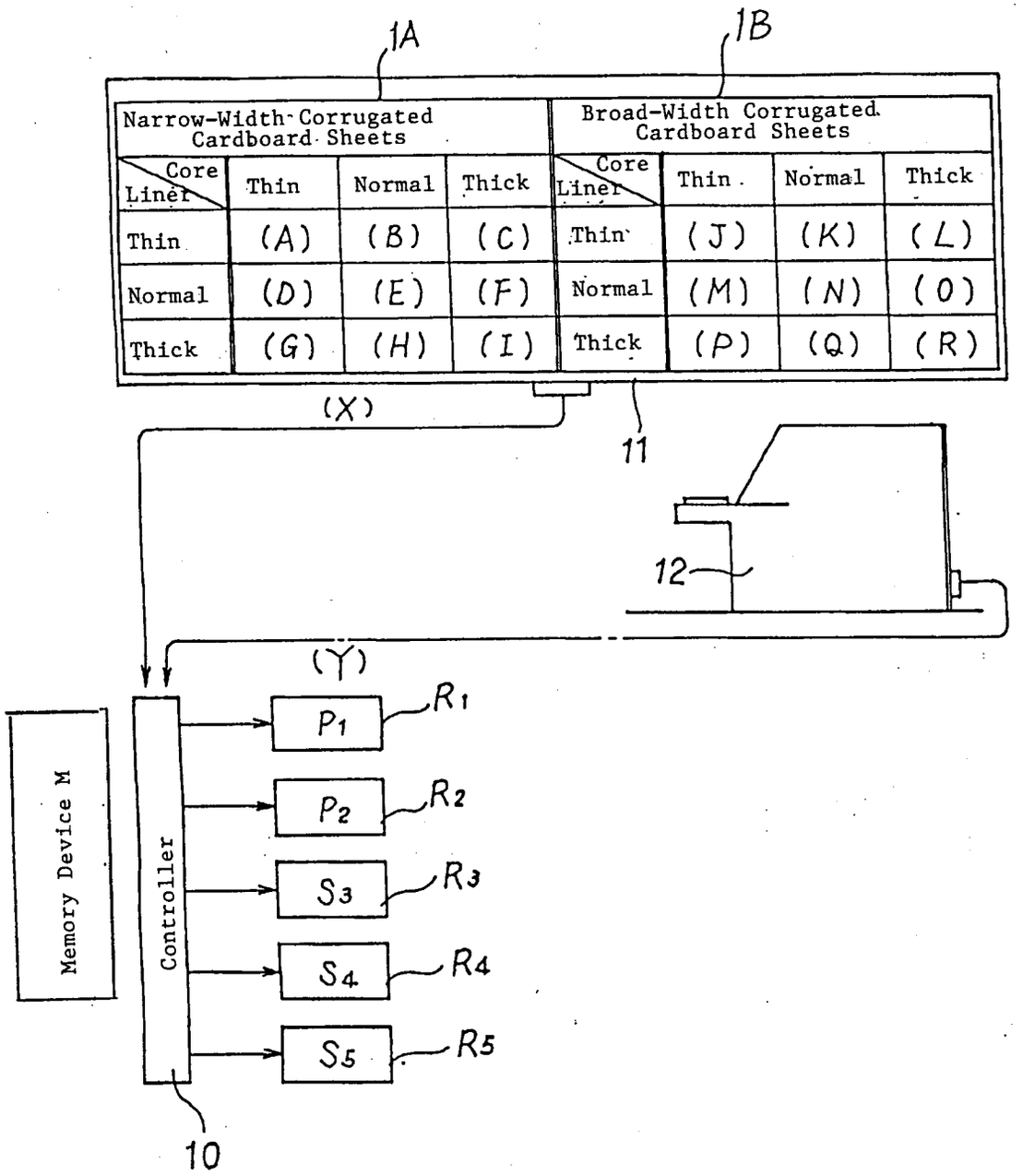

1A
1B
Narrow-Width Corrugated Cardboard Sheets
Broad-Width Corrugated Cardboard Sheets
Core Liner
Thin
Normal
Thick
(A) (B) (C)
(D) (E) (F)
(G) (H) (I)
(J) (K) (L)
(M) (N) (O)
(P) (Q) (R)
(X)
11
12
(Y)
Memory Device M
Controller
10
P1
P2
S3
S4
S5
R1
R2
R3
R4
R5

Fig. 2

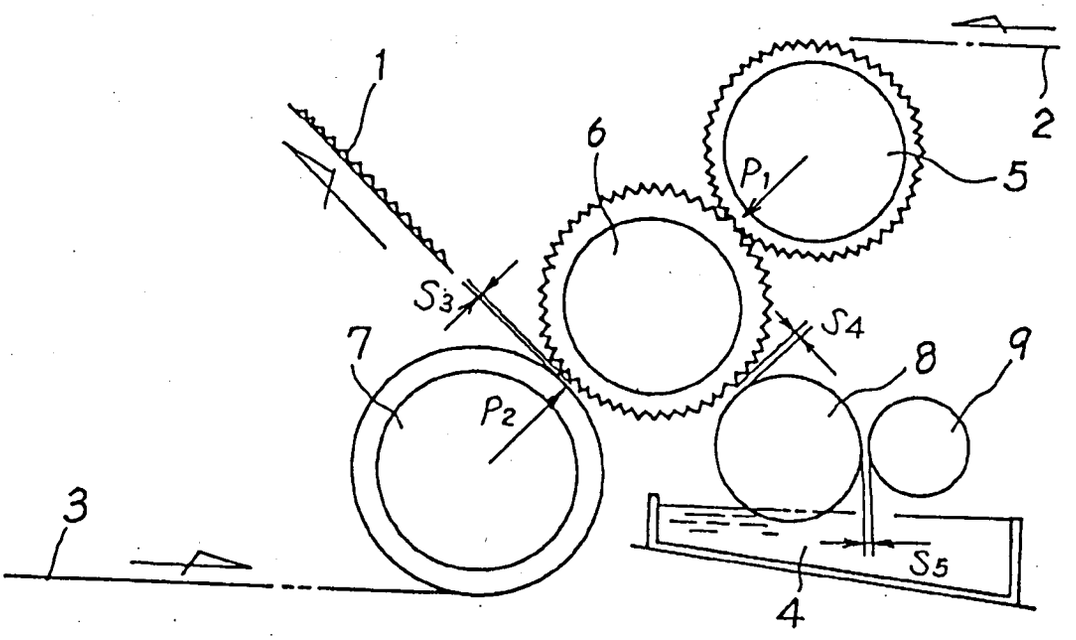


Fig. 3

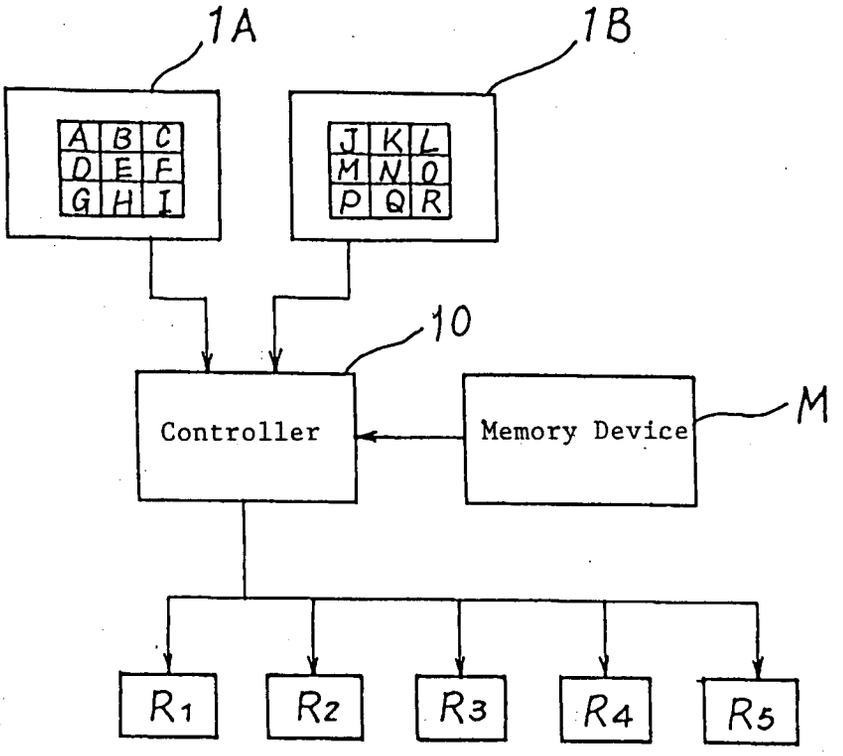


Fig. 4

	R1	R2	R3	R4	R5
A	10	20	0.3	0.2	0.5
B					
C					
I	50	60	0.5	0.3	0.8
R					

Fig. 5

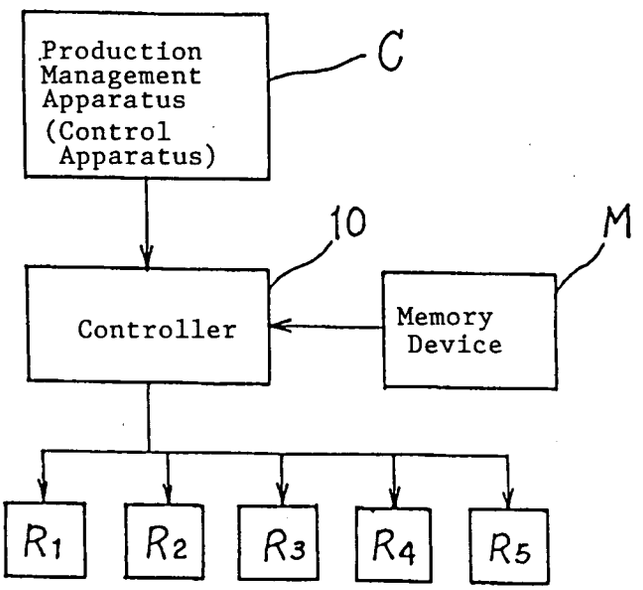

Production Management Apparatus (Control Apparatus)
C
10
M
Controller
Memory Device
R1
R2
R3
R4
R5

Fig. 6

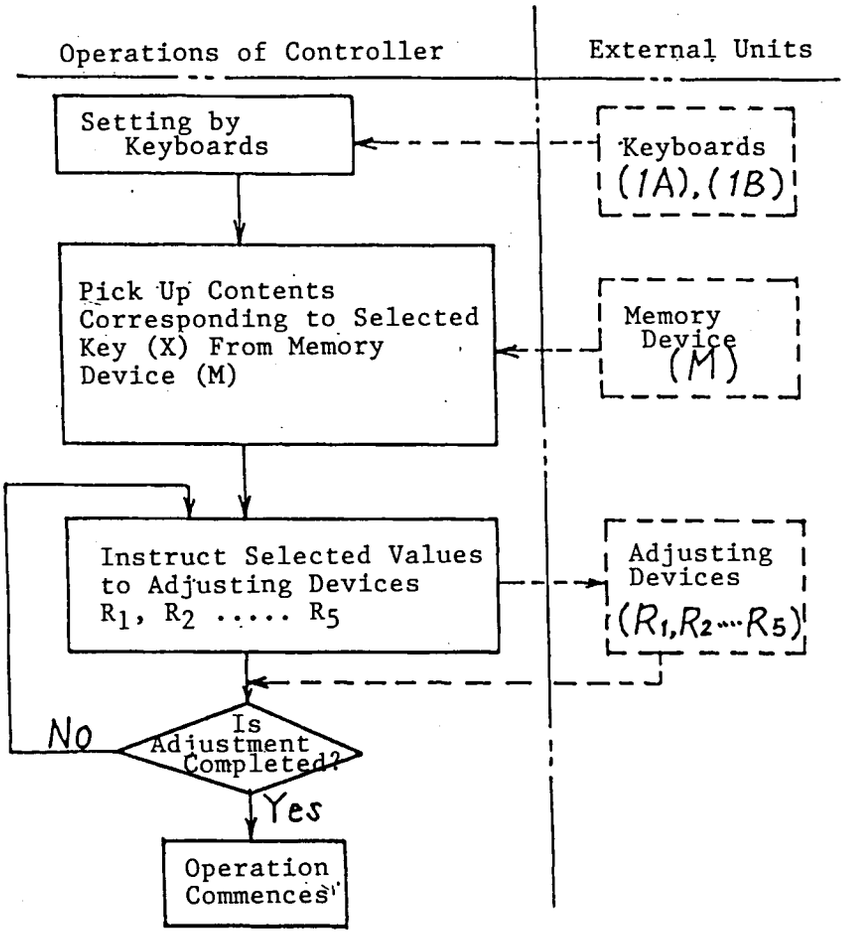


Fig. 7

Conditions	Raw Material			Operation Period		
	Narrow/Broad	Sheets	Liner			
1	Narrow	Thin	Normal	1H →		
2	Narrow	Normal	Thick		2H →	
3	Broad	Thin	Thin			3H →

Fig. 8

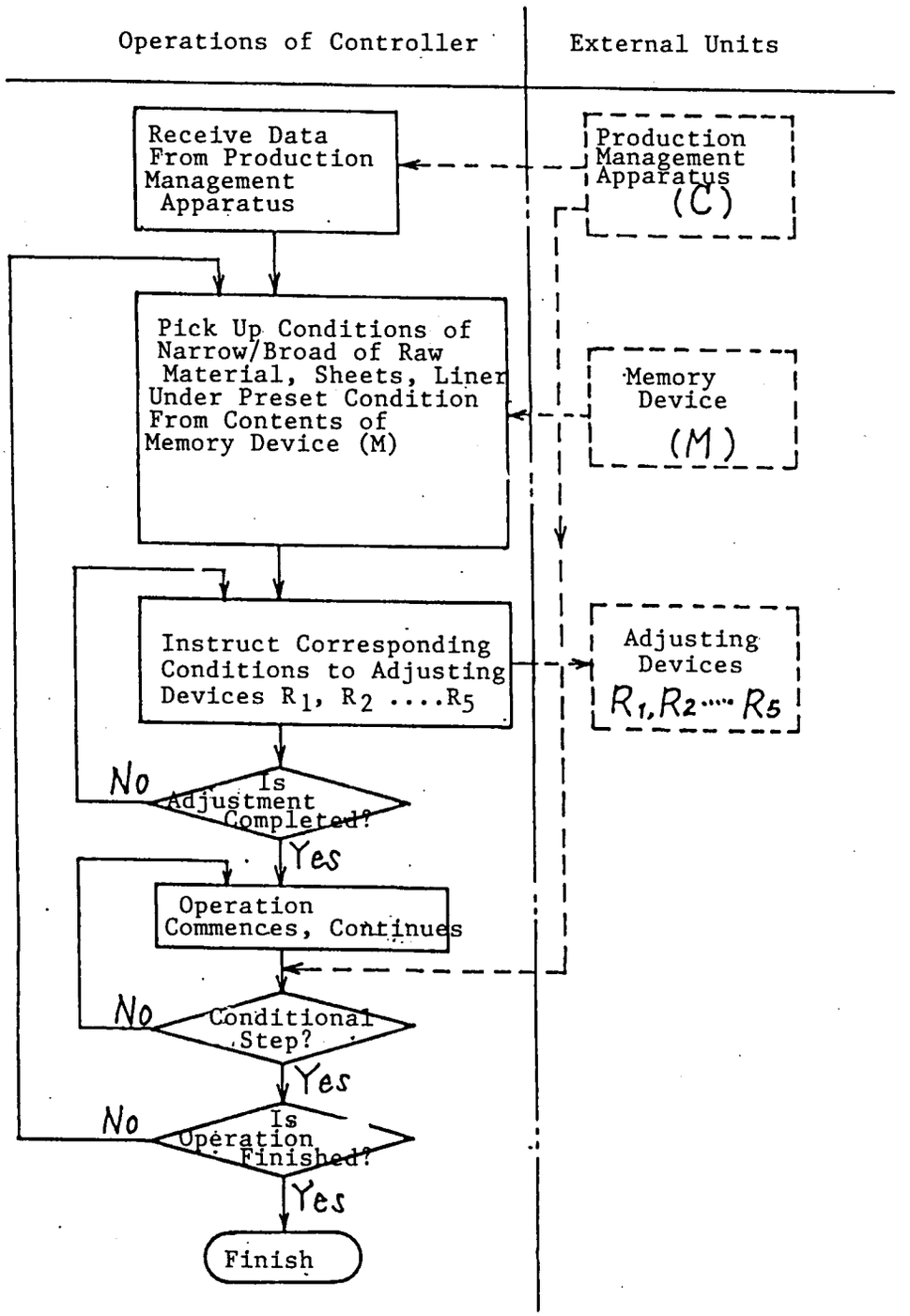

Operations of Controller
External Units
Receive Data From Production Management Apparatus
Production Management Apparatus (C)
Pick Up Conditions of Narrow/Broad of Raw Material, Sheets, Liner Under Preset Condition From Contents of Memory Device (M)
Memory Device (M)
Instruct Corresponding Conditions to Adjusting Devices R1, R2 ....R5
Adjusting Devices R1, R2 .... R5
No
Is Adjustment Completed?
Yes
Operation Commences, Continues
No
Conditional Step?
Yes
No
Is Operation Finished?
Yes
Finish

Fig. 9

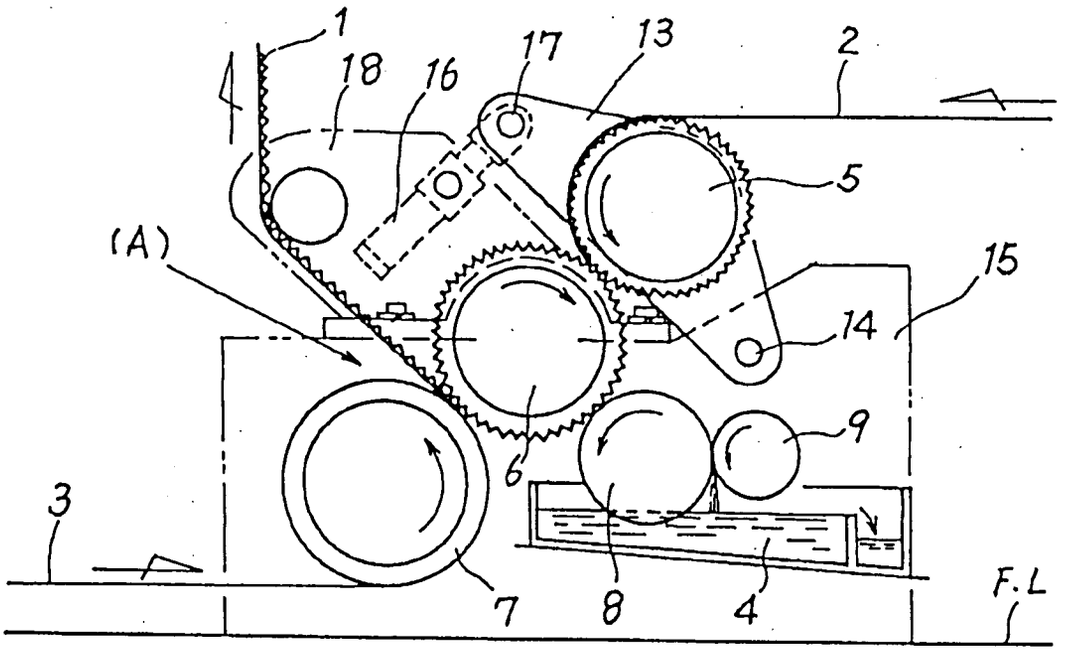

1
18
16
17
13
2
5
(A)
15
14
9
6
3
7
8
4
F.L

Fig. 10

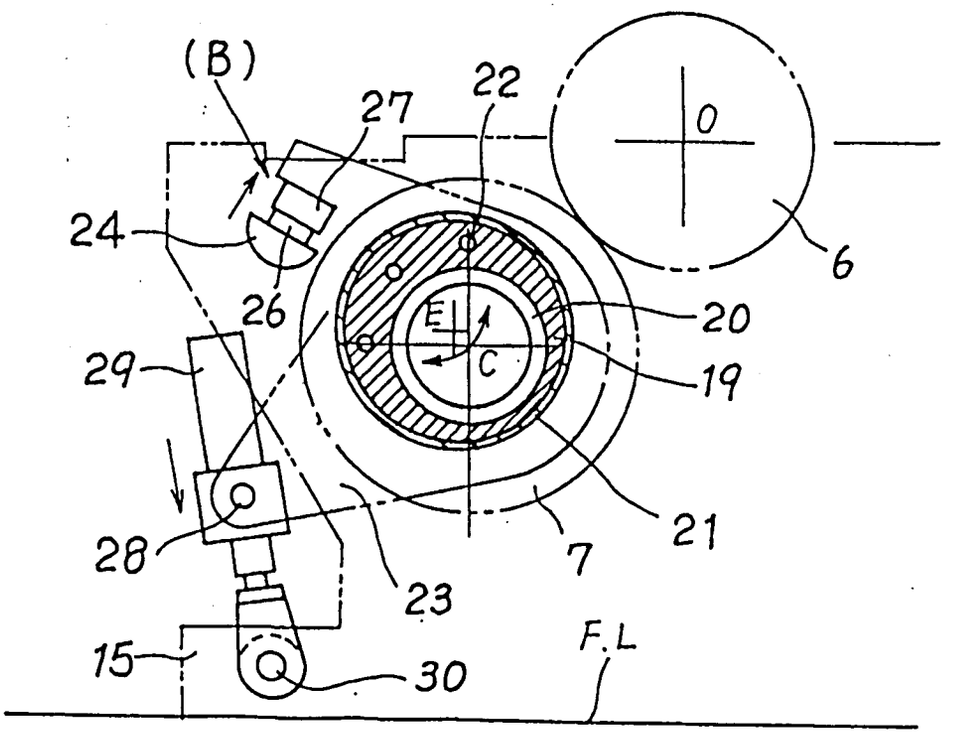
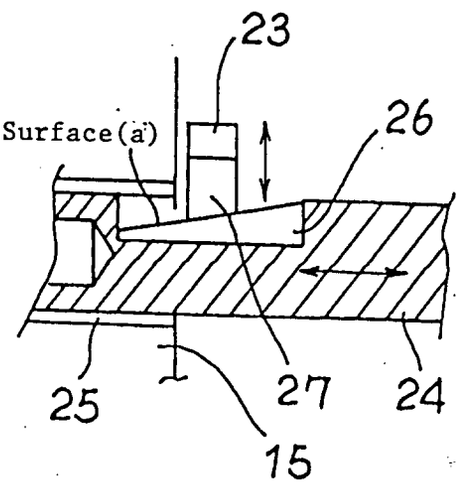

(B)
27
22
O
24
6
26
20
E
C
29
19
28
21
7
23
F.L
15
30

Fig. 11



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 11 4426

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 383 414 (MITSUBISHI JUKOGYO KABUSHIKI KAISHA) ---	1,2	B31F1/28
A	WO-A-8 701 987 (HCH.SIEGLER PAPIER UND WELLPAPPENWERKE KG) ---	1,2	
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 119 (M-945)(4062) 6 March 1990 & JP-A-13 16 257 (RENGO CO.LTD.) 21 December 1989 * abstract * -----	1,2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B31F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 JANUARY 1993	ROBERTS P.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)