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

(11) EP 2 287 397 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.02.2011 Bulletin 2011/08

(51) Int Cl.:
D21F 9/00 *(2006.01)* ***D21G 1/00*** *(2006.01)*

(21) Application number: **10250985.8**

(22) Date of filing: **27.05.2010**

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

(30) Priority: **01.08.2009 JP 2009180237**

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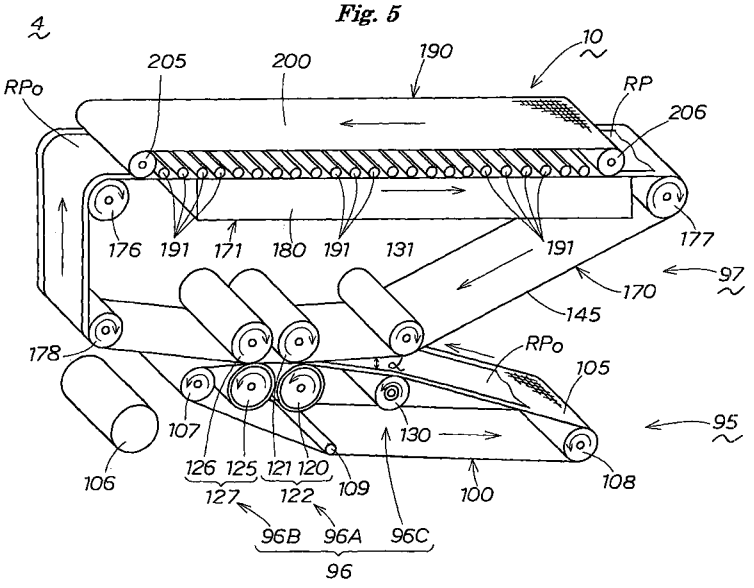
(54) Regenerated paper smoothing device of used paper recycling apparatus, paper making device, and used paper recycling apparatus

(57) In a very narrow used paper processing space of a used paper recycling apparatus of furniture size, the present invention presents a recycled paper smoothing technology for manufacturing securely into a wrinkle-free and smooth recycled paper from wet paper made and formed in a paper making processing unit of a paper making unit. The recycled paper smoothing processing unit (10) is formed as pressing means for pressing the entire wet paper (RP_0) conveyed on a smooth surface belt (145) with a uniform pressure from the upper side in a heating and drying unit (171), and includes a covering belt conveyor (190) having a covering belt (200) running while covering the entire wet paper (RP_0) on the smooth surface belt (145) in an enclosed state together with the smooth surface belt (145), and a plurality of pressing rollers (191) disposed at specified intervals in the running direction of the covering belt (200) for pressing this covering belt (200) from the upper side, and therefore the wet paper (RP_0) made and formed in the paper making net conveyor (100) is securely reproduced as a wrinkle-free and smooth recycled paper RP.

Fig. 5



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a regenerated paper smoothing device of used paper recycling apparatus, a paper making device, and a used paper recycling apparatus, and more particularly to a regenerated or recycled paper smoothing technology in a used paper recycling apparatus of furniture size, installed at the site of origin of used paper, for recycling and processing into reusable paper at the site without discarding the generated used paper.

Description of the Related Art

[0002] Used paper of various types such as used and unnecessary documents occurs not only in government offices or private companies, but also in daily life or general household. Used paper is usually discarded, incinerated, or disposed as refuse.

[0003] On the other hand, in the global concern about effective use of limited resources on earth, various technologies have been developed to regenerate and recycle the used paper being disposed and discarded so far.

[0004] Such used paper recycling technologies are mostly installed and executed in the paper making industry, and the used paper recycling plant requires, like the ordinary paper making plant, a vast land, an immense investment, and a huge quantity of water and chemicals for the purpose of high speed and mass production and high quality of recycled paper.

[0005] For recycling of used paper, a tremendous manual labor is needed for collecting used paper, and used paper collection involves various problems, such as mixing of foreign matter by multiple garbage collectors, defective classification due to lack of knowledge about used paper recycling, and entry of harmful objects, and if used paper is collected, in order to regenerate or recycle by 100 percent as recycled paper, final checking by specialists and cleaning works are needed. On the other hand, confidential documents are not easily recycled and are mostly incinerated, and the recycling rate is low.

[0006] To solve these problems of used paper recycling, an effective method is the development of a technology capable of recycling at the site of origin of used paper, and from such point of view, a new system is developed and proposed by the present applicant, for example, in Japanese Patent Application Laid-Open No. 2007-308837 as a used paper recycling apparatus.

[0007] This used paper recycling apparatus is a realization of used paper recycling technology of large scale such as used paper recycling plant in a small size that can be installed in a small shop or a room in general household, and includes, in an apparatus case of furniture size, a pulp making unit for macerating and beating used paper to manufacture used paper pulp, a paper making unit for making recycled paper from the used paper pulp manufactured in this pulp making unit, and a control unit for driving and controlling the pulp making unit and the paper making unit in cooperation, in which the paper making unit includes a paper making process unit for manufacturing wet paper from the used paper pulp sent from the pulp making unit, and a drying process unit for manufacturing recycled paper by drying the wet paper manufactured in this paper making process unit, and these two process units are composed in a form of belt conveyor having a running belt for processing and conveying the used paper pulp.

[0008] The used paper is macerated and beaten in the pulp making unit to become used paper pulp, and then this used paper pulp is conveyed on the running belt of the belt conveyor in the paper making unit, and is filtered and dewatered, squeeze and dewatered, and heated and dried, and is formed into recycled paper. In this case, in the stage of pulp, the used paper is decomposed to fiber level, and the printed characters and diagrams are completely decomposed and lost, and cannot be restored, so that leak or disclosure of confidential information or personal information composed in printed characters and diagrams can be securely prevented.

BREIF SUMMARY OF THE INVENTION

[0009] It is a primary object of the present invention to present a novel generated paper smoothing technology of a used paper recycling apparatus having solved such conventional problems.

[0010] It is other object of the present invention to present a recycled paper smoothing technology capable of recycling securely into a smooth and wrinkle-free recycled paper from wet paper made and formed in a paper making process unit of a paper making unit, in a very narrow used paper processing space of a used paper recycling apparatus of furniture size to be installed not only in a large office, but also in a small shop or a room in general household, by further improving the configuration of the drying process unit in the paper making unit of the used paper recycling apparatus.

[0011] To achieve these objects, the recycled paper smoothing device of the used paper recycling apparatus of the present invention is for smoothing the recycled paper, being installed in a paper making unit for manufacturing recycled paper from a used paper pulp manufactured in the pulp making unit of a preceding process, in the used paper recycling apparatus of furniture size to be installed at the site of origin of the used paper, in which the paper making unit comprises a paper making belt conveyor unit for manufacturing wet paper from the used paper pulp by making the used paper pulp and a drying belt conveyor unit for manufacturing recycled paper by drying the wet paper made and formed in the paper making belt conveyor unit, and the recycled paper smoothing device is provided in the drying belt conveyor unit, in a

heating and drying unit of the drying belt conveyor unit, the recycled paper smoothing device is formed as pressing means for pressing the entire wet paper conveyed on a smooth surface belt from the upper side at a uniform pressure, and this pressing means comprises a covering belt conveyor having a covering belt running while covering the entire wet paper on the smooth surface belt in a state enclosed together with the smooth surface belt, and a plurality of pressing rollers arranged at specified intervals in the running direction of the covering belt for pressing the covering belt from the upper side.

[0012] Preferred embodiments include the following.

(1) The covering belt conveyor has the covering belt formed as an endless belt running while covering the entire wet paper on the smooth surface belt in a state enclosed together with the smooth surface belt, and a drive motor for moving and driving this covering belt.

(2) The covering belt is formed of a mesh belt having numerous mesh cells for passing and releasing the moisture heated and evaporated from the wet paper on the smooth surface belt to the upper side.

(3) The mesh of the mesh belt of the pressing means is set at 12 to 40 mesh cells.

(4) The running speed of the mesh belt is controlled to be synchronized with the running speed of the smooth surface belt in the drying process unit.

(5) The configuration of the pressing roller is determined so as to form a flat smoothing action surface for smoothing and processing the entire wet paper , in cooperation between the lower side of the covering belt and the upper side of the smooth surface belt.

(6) The pressing roller is formed as a solid metal roller having an outside diameter size capable of maintaining a pressing roller interval for forming and maintaining the smoothing action surface of the covering belt, and is supported rotatably.

(7) In the drying process unit, the smooth surface belt for conveying and supporting the lower side of the wet paper is hated by a heater from the lower side.

(8) The heater is formed as a heater plate sliding on the opposite side of the conveying and supporting side of the wet paper on the smooth surface belt, and the wet paper on the smooth surface belt is heated indirectly and dried by the smooth surface belt heated by this heater plate.

[0013] The paper making device of the used paper recycling apparatus of the present invention is applied in a paper making device of a used paper recycling apparatus of furniture size to be installed at the site of origin of used paper, being a paper making deice for manufacturing recycled paper from used paper pulp manufactured in a pulp making unit of a preceding process, including:

a paper making belt conveyor unit for manufacturing wet paper from a slurry-like pulp suspension mixed of water and used paper pulp sent from the pulp making device, a drying belt conveyor unit for manufacturing recycled paper by drying the wet paper manufactured in this paper making belt conveyor unit, and a dewatering roll unit for squeezing and dewatering the wet paper at a linkage part of the paper making belt conveyor unit and the drying belt conveyor unit, in which the drying belt conveyor unit includes recycled paper smoothing processing means for processing and discharging the wet paper made and formed in the paper making belt conveyor unit as a smooth recycled paper, and this recycled paper smoothing processing means is composed of the recycled paper smoothing device mentioned above.

[0014] The used paper recycling apparatus of the present invention includes, in an apparatus case of furniture size, a pulp making unit for manufacturing used paper pulp by macerating and beating used paper, a paper making unit for manufacturing recycled paper by making from the used paper pulp manufactured in this pulp making unit, and a control unit for driving and controlling the pulp making unit and the paper making unit in cooperation, in which the paper making unit is composed of the paper making device described above.

[0015] According to the recycled paper smoothing device of the used paper recycling apparatus of the present invention, in the heating and drying unit of the drying belt conveyor unit for composing the drying process unit of the paper making unit, pressing means is formed to press the entire wet paper conveyed on the smooth surface belt from the upper side at a uniform pressure, and this pressing means includes a covering belt conveyor having a covering belt running while covering the entire wet paper on the smooth surface belt in a state enclosed together with the smooth surface belt, and a plurality of pressing rollers arranged at specified intervals in the running direction of the covering belt for pressing the covering belt from the upper side, and therefore in a very narrow used paper processing space of a used paper recycling apparatus of furniture size that can be installed not only a large office but also in a small shop or a general household room, the wet paper made and formed in the paper making process unit can be securely reproduced as a smooth and wrinkle-free recycled paper.

[0016] That is, the wet paper made and formed in the paper making belt conveyor unit (the paper making process unit) for manufacturing wet paper from used paper pulp is heated and dried in the heating and drying unit of the drying belt conveyor unit for composing the next drying process unit, while being conveyed on the smooth surface belt, and the entire wet paper is pressed at a uniform pressure from the upper side by the recycled paper smoothing device formed as pressing means.

[0017] In this case, the pressing means includes a covering belt conveyor having a covering belt running while covering the entire wet paper on the smooth surface belt

in a state enclosed together with the smooth surface belt, and a plurality of pressing rollers arranged at specified intervals in the running direction of the covering belt for pressing the covering belt from the upper side, and therefore the wet paper on the smooth surface belt conveyed and passed through the heating and drying unit is covered by the covering belt conveyor from the upper side, and is heated and dried as being enclosed in a sandwich state with a uniform pressure from the upper and lower sides, by a specified pressing force of the plurality of pressing rollers disposed continuously.

[0018] In other words, the wet paper is heated and dried while being held in a flat state by the sandwich structure of specified pressure, and wrinkle and warp formed on the wet paper in the preceding process of paper making process can be effectively removed and eliminated, and occurrence of wrinkle or warp of wet paper by the heating and drying action can be effectively prevented, so that a smooth recycled paper is reproduced on the whole.

[0019] Moreover, the covering belt of the covering belt conveyor is formed of a mesh belt composed of numerous mesh cells capable of passing and releasing the moisture heated and evaporated from the wet paper on the smooth surface belt to the upper side, and hence in spite of the presence of the covering belt, the steam generated by heating of the wet paper can be effectively dissipated and lifted, and the drying process can be promoted smoothly.

[0020] Further, since the running speed of the mesh belt for composing the covering belt is controlled to be synchronized with the running speed of the smooth surface belt in the drying process unit, the wet paper is heated and dried, while the sandwich structure is maintained stably.

[0021] These and other objects and features of the present invention will be appreciated by reading the detailed description made in conjunction with the accompanying drawings, and novel facts pointed out in the claims thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Fig. 1 is a front sectional view of an overall outline configuration of a used paper recycling apparatus in a preferred embodiment of the present invention.

Fig. 2 is a side sectional view of an overall outline configuration of the same used paper recycling apparatus.

Fig. 3 is a circuit diagram of configuration of a used paper circulation route of a beating unit of the used paper recycling apparatus.

Fig. 4 is a block diagram of configuration of a pulp concentration adjustment unit of the used paper recycling apparatus.

Fig. 5 is a perspective view of an overall outline configuration of a paper making unit of the used paper recycling apparatus.

Fig. 6 is a perspective view of outline configuration of the used paper recycling apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0023] A preferred embodiment of the present invention is specifically described below while referring to the accompanying drawings. Throughout the drawings, same reference numerals refer to same components or elements.

Preferred Embodiment 1

[0024] The used paper recycling apparatus of the present invention is shown in Fig. 1 to Fig. 6, and this used paper recycling apparatus 1 is specifically installed at the site of origin of used paper, and it is an apparatus for recycling into a re-usable paper at the site without discarding the generated used paper UP, and the used paper UP includes confidential documents of government offices or private companies, personal letters and others in the general household, and other used and unnecessary documents.

[0025] The used paper recycling apparatus 1 is a furniture size as shown in Fig. 6, that is, small in size and shape similar to furniture, such as document rack, locker, office desk, copier or personal computer used in an office, and mainly includes, as shown in Fig. 1, a pulp making unit 2, a pulp concentration adjustment unit 3, a paper making unit (paper making device) 4, and an apparatus control unit (control unit) 5, and the paper making unit 4 includes a recycled paper smoothing processing unit (recycled paper smoothing device, recycled paper smoothing processing means) 10 as a characteristic component of the present invention.

[0026] These apparatus component units 2 to 5 are built in a compact design to be installed in an apparatus case 6. The apparatus case 6 is a furniture size as mentioned above, and may be designed in specific dimensions and shapes appropriately depending on the purpose or application. The apparatus case 6 in the illustrated preferred embodiment is a rectangular box having dimensions and shapes similar to a copier installed and used in a general office, and the top plate of the apparatus case 6 has an inlet 7 which is opened and closed for supplying used paper UP, and an discharge port 8 is provided at the side for discharging recycled paper RP, RP, ... At the lower edge portion of this discharge pott 8, a recycled paper receiving tray 9 is detachably provided for receiving recycled paper RP, RP, ... discharged from the discharge port 8.

[0027] The pulp making unit 2 is a process location for manufacturing used paper pulp by macerating and beating the used paper UP, and is composed of a macerating unit 20 for agitating, crushing and macerating the used

paper UP, and a beating unit 21 for beating the used paper UP macerated in the macerating unit 20.

[0028] The macerating tank 25 has the inlet 7 formed in its ceiling wall as shown in Fig. 2 for charging and supplying the used paper UP, and a discharge port 28 is provided in its bottom wall for discharging the macerated used paper pulp UPP to the downstream side. The inner volume of the macerating tank 25 is determined depending on the number of sheets of used paper UP to be processed in batch. In the illustrated preferred embodiment, the macerating tank 25 has a capacity of agitating and treating (in batch) a total of about 500 sheets (about 2000 g) of used paper UP of A4 format PPC (plain paper copier) by adding about 98 liters of water. In this case, the concentration of the used paper pulp UPP to be macerated is about 2%. The concentration is adjusted by supplying water from the water feed device 27, and this water feed device 27 is a part of the pulp concentration adjustment unit 3 described below.

[0029] The inlet 7 has a structure to be opened and closed to the outside of a case cover 6a of the apparatus case 6. The discharge port 28 is opened and closed by an opening and closing valve 29, and communicates with a used paper pulp circulation route 49 described below. At the location of the discharge port 28, a debris filter 30 is provided for removing obstacles for the next beating process, such as clips, staples, pins and others used for binding the used paper UP, UP, ...

[0030] The opening and closing valve 29 opens and closes specifically by the crank motion of a crank mechanism 36 driven by a drive motor 35. The drive motor 35 is specifically an electric motor, and this drive motor 35 is electrically connected to the apparatus control unit 5.

[0031] The agitating device 26 is provided inside of the macerating tank 25, and includes an agitation impeller 40 and a drive motor 41.

[0032] The agitation impeller 40 has its rotation shaft 40a supported rotatably in an upright position in the central position of the bottom of the maceration tank 25, and is rotatable in the horizontal direction, and the lower end of the rotation shaft 40a is driven and coupled to a rotation shaft 41a of the drive motor 41 by way of transmission means 42 composed of a transmission pulley 42a, a transmission belt 42b, and a transmission pulley 42c.

[0033] The water feed device 27 is to supply water W into the macerating tank 25, and forms a beating concentration adjustment unit 3A of the pulp concentration adjustment unit 3 as described below.

[0034] The water feed device 27 in the illustrated preferred embodiment includes, as shown in Fig. 1, a white water collection tank 45, a water feed pump 46 for beating concentration adjustment, and a water feed tank 47 for paper making concentration adjustment. The white water collection tank 45 is, as described below, designed to collect white water W (pulp water of very low concentration filtered through a paper making mesh in the paper making process) filtered and dewatered in the paper making unit 4, and the white water W collected in the white water collection tank 45 is first supplied into the macerating tank 25 from the water feed pump 46, and then into a concentration adjustment tank 85 described below from the water feed pump 47.

[0035] In this relation, in the bottom of the macerating tank 25, a weight sensor 48 is provided, and the used paper UP, UP, ... and the water to be processed in batch in the macerating tank 25 are weighed and controlled, and the weight sensor 48 is electrically connected to the apparatus control unit 5.

[0036] The weight sensor 48 of the illustrated preferred embodiment is a load cell, and is designed to sense and measure the total weight of weight of macerating tank 25, and weight of used paper UP, UP, ... and water charged and supplied in the macerating tank 25.

[0037] In a specific control constitution of the macerating unit 20, in the first place, when the inlet 7 is opened by the operator, and the used paper UP, UP, ... are charged into the macerating tank 25, the weight is sensed and measured by the weight sensor 48, and when reaching a specified weight (number of sheets), the operator is informed of it by sound and/or display. According to the display, when the operator closes the inlet 7, the water feed device 27 is driven, and the water W in the white water collection tank 45 is supplied by the water feed pump 46 into the macerating tank 25 by the portion corresponding to the charged weight of used paper UP, UP, ... (the number of sheets).

[0038] When the operator closes the outlet 7 after charging an arbitrary amount of used paper UP, UP, ... into the macerating tank 25 from the inlet 7 (an amount smaller than the specified weight (number of sheets)), the weight is sensed and measured by the weight sensor 48, and the water feed device 27 is driven, and the water W corresponding to the measured result is supplied by the water feed pump 46 into the macerating tank 25 from the white water collection tank 45.

[0039] In the illustrated preferred embodiment, as mentioned above, when PPC used paper UP of A4 format is supplied into the macerating tank 25 by about a maximum capacity, about 500 sheets (about 2000 g), at this moment, it is noticed to the operator by sound and/or display, and by the closing operation of the inlet 7, about 98 liters of water is supplied from the water feed device 27, or when an arbitrary amount of used paper UP, UP, ... is supplied (an amount smaller than the specified weight (number of sheets)), the water corresponding to the supplied amount of used paper is added to the water feed device 27, and the concentration of the used paper pulp UPP to be macerated is controlled and adjusted to about 2%.

[0040] Thus, in the agitating device 26, the used paper UP, UP, ... charged into the macerating tank 25 from the charging opening of the apparatus case 6, that is, the inlet 7 are agitated and mixed for a specified time (10 to 20 minutes in the illustrated preferred embodiment) in the water supplied from the water feed device 27 by normal and reverse rotation of the agitation impeller 40 by

the drive motor 41, and thereby the used paper UP, UP, ... are macerated and beaten into used paper pulp UPP.

[0041] The discharge port 28 of the macerating tank 25 is closed by the opening and closing valve 29 during operation of the macerating unit 20, and flow of used paper UP or used paper pulp UPP from the macerating tank 25 into the used paper pulp circulation route 49 is blocked, while the discharge port 28 is opened by the opening and closing valve 29 during operation of the beating unit 21 described later, and the flowing and circulating loop of the used paper pulp UPP from the macerating tank 25 into the used paper pulp circulation route 49 is allowed.

[0042] The beating unit 21 is a process location for beating the used paper UP macerated in the macerating unit 20, and is specifically designed to pressurize and beat the used paper UP macerated in the macerating unit 20, and to grind and pulverize (into micro-fibers) the inks forming characters and patterns on the used paper UP (printing inks forming characters and patterns on the used paper UP by various printing technologies, or inks forming characters and patterns on the used paper UP by pencil, ball-point pen, fountain pen, and other writing tools).

[0043] This beating unit 21 includes a grinder 50 as a principal component. This grinder 50 includes, as shown in Fig. 3, a pair of beating disks 51, 52 rotated and driven relatively, and the pair of beating disks 51, 52 have beating action surfaces 51a, 52a disposed oppositely and concentrically across a tiny beating gap G.

[0044] The beating gap G of the beating action surfaces 51a, 52a of the grinder 50 is determined so as to be narrowed gradually, as described below, from the grinder 50 in an initial period of beating process to the grinder 50 in a later period.

[0045] In the beating unit 21 of the present preferred embodiment, as shown in Fig. 3, the used paper pulp circulation route 49 having one grinder 50 is formed, and the used paper pulp UPP is circulated and beaten for a specified time by way of the grinder 50 in a circulation system.

[0046] By execution of the beating process in the used paper pulp circulation route 49, in spite of the small and narrow process space in the apparatus case 6 of furniture size, a used paper pulp beating process route of basically infinite length not limited in length is formed, and the beating process space equally compared with the beating process of a large-scale apparatus is realized, and an optimum beating effect is obtained depending on the purpose.

[0047] Moreover, one grinder 50 carries out the whole beating process throughout the entire process of the beating process, and this one grinder 50 has the functions of a plurality of grinders from the grinder in an initial period of beating process to the grinder in a later period. More specifically, the beating gap G of the beating action surfaces 51a, 52a of the grinder 50 is controlled and adjusted so as to be narrower gradually from the initial period to the final period of the beating process.

[0048] The grinder 50 of the illustrated preferred embodiment is disposed, as shown in Fig. 2, adjacently to the macerating tank 25 of the macerating unit 20, on an apparatus machine body 54 composing the apparatus case 6, and as shown in Fig. 3, it further includes a beating tank 55 communicating with the macerating tank 25 of the macerating unit 20, the pair of beating disks 51, 52 provided relatively and rotatably in this beating tank 55, a rotation drive source 56 for relatively rotating the pair of beating disks 51, 52, and gap adjusting means 57 for adjusting the beating gap G of the pair of beating disks 51, 52.

[0049] The beating tank 55 is formed in a closed cylindrical shape for accommodating the pair of beating disks 51, 52, and has a supply port 55a for supplying the used paper pulp UPP from the upstream side, and a discharge port 55b for discharging the beaten used paper pulp UPP to the downstream side.

[0050] More specifically, the supply port 55a is opened in the center of the bottom of the beating tank 55 toward the vertical direction, and the discharge port 55b is opened at the cylindrical side of the beating tank 55 toward the horizontal direction. The supply port 55a and the discharge port 55b are connected to communicate with the macerating tank 25 of the macerating unit 20, respectively by way of circulation pipings 49a, 49b as shown in Fig. 3, and the discharge port 55b is further connected to communicate with a used paper pulp collection tank 60 by way of a discharge piping 59.

[0051] Reference numeral 61 shows a direction changeover valve, by the changeover operation of this direction changeover valve 61, the used paper pulp UPP discharged from the discharge port 55b is selectively returned to the macerating tank 25, or collected in the used paper pulp collection tank 60. The direction changeover valve 61 is specifically an electromagnetic valve, and is electrically connected to the apparatus control unit 5.

[0052] Of the pair of beating disks 51, 52, one is a fixed side beating disk fixed in the rotating direction, and other is a rotating side beating disk which is rotatable. In the illustrated preferred embodiment, the upper side beating disk 51 is the rotating side, and the lower side beating disk 52 is the fixed side, and the rotating side beating disk 51 of the upper side is disposed oppositely to the fixed side beating disk 52 of the lower side, concentrically and rotatably across a tiny beating gap G. The rotating side beating disk 51 is driven and coupled to a drive motor 56 by way of a rotation main shaft 64 pivoted rotatably to the fixed side of the apparatus machine body 54 and movably in the axial direction.

[0053] Although not shown specifically, the rotation main shaft 64 is rotatably pivoted on an elevating member of the gap adjusting means 57, and the rotating side beating disk 51 is concentrically and integrally attached at its leading end, and its base end part is driven and coupled integrally in the rotating direction and relatively movably

in the axial direction on the rotation shaft of the drive motor 56.

[0054] The drive motor 56 is a rotation drive source, and relatively rotates the pair of beating disks 51, 52, and specifically an electric motor is used, and the drive motor 56 as its drive source is electrically connected to the apparatus control unit 5.

[0055] The opposite sides 51a, 52a of the both beating disks 51, 52 forming the tiny beating gap G mutually collaborate to form beating action surfaces. These opposite beating action surfaces 51a, 52a are formed as wheel sides having a multiplicity of abrasive grains bonded by a bonding agent. The both beating action surfaces 51a, 52a are, as shown in Fig. 3, formed in a taper shape continuously increased in the diameter size in the mutually opposite directions, and are formed as annular flat surfaces parallel to each other at the outermost peripheral edges, and these annular flat surfaces form the beating gap G.

[0056] In other words, in the pair of beating disks 51, 52, in the central position of the beating action surface 52a of the fixed side beating disk 52, an inlet 70 is formed to communicate coaxially with the supply port 55a of the beating tank, and the two annular flat surfaces formed on the outer peripheral edges of the beating action surfaces 51a, 52a of the pair of beating disks 51, 52 form an outlet 71 communicating with the discharge port 55b of the beating tank 55 and having the beating gap G.

[0057] On the outer circumference of the rotating side beating disk 51, a plurality of blades 72, 72, ... are formed at specified intervals in the circumferential direction, and these blades 72, 72, ... push out the used paper pulp UPP discharged from the outlet 71 in pumping action toward the discharge port 55b of the beating tank 55b by centrifugal force by rotation of the rotating side beating disk 51.

[0058] By the drive motor 56 as the drive source, when the rotating side beating disk 51 is rotated and driven to the fixed side beating disk 52, the used paper pulp UPP supplied into a beating space B by way of the supply port 55a of the beating tank 55 and the inlet 70 from the macerating tank 25 of the macerating unit 20 flows into the beating space B from the inlet 70, and passes through this beating space B, and is pressurized and beaten by the relatively rotating beating action surfaces 51a, 52a, and the inks forming the characters and patterns on the used paper UP are ground and pulverized, and then it is discharged by way of the discharge port 55b of the beating tank 55 from the outlet 71.

[0059] At the time of discharge from this outlet 71, the used paper pulp UPP is further pressurized and beaten at the location of the outlet 71 having the beating gap G, and is pulverized to a specified micron size (to become micro-fiber) defined by this beating gap G.

[0060] In this regard, in the present preferred embodiment, as mentioned above, in the circulation system beating process disposing only one grinder 50 in the used paper pulp circulation route 49 (see Fig. 3), this one grinder 50 has the functions of a plurality of grinders from the grinder in an initial period of beating process to the grinder in a terminal period, and more specifically, the beating gap G of the grinder 50 is controlled and adjusted by the gap adjusting means 57 so as to be narrower gradually from the initial period to the final period of the beating process.

[0061] The gap adjusting means 57 is not particularly illustrated, but is designed to move the pair of beating disks 51, 52 relatively in the rotation axial direction, to control and adjust the beating gap G of these beating disks 51, 52, and is mainly composed of moving means (not shown) for moving the rotating side beating disk 51 in the rotation axial direction, that is, in the axial direction of a rotation main shaft 64, and a drive source 66 for driving this moving means. The drive source is specifically an electric motor, and this drive motor 66 is electrically connected to the apparatus control unit 5.

[0062] By the rotation of this electric motor 66, the rotating main shaft 64 is moved up and down by way of the moving means, and therefore the rotating side beating disk 51 formed integrally with the rotation main shaft 64 is moved in the vertical direction to the fixed side beating disk 52, that is, in the rotation axial direction, and the beating gap G between the two beating disks 51, 52 is controlled and adjusted.

[0063] For this purpose, a position detection sensor (not shown) is provided for detecting the ascending and descending position of the rotating side beating disk 51, and depending on the result of detection by this position detection sensor, the drive motor 66 is driven and controlled. The position detection sensor is electrically connected to the apparatus control unit 5.

[0064] The beating gap G of the beating disks 51, 52 is controlled and adjusted by the gap adjusting means 57 in the circulation system beating process by the used paper pulp circulation route 49 shown in Fig. 3, in mutual interaction with a circulation pump 69 which is circulating means.

[0065] That is, in Fig. 3, the used paper pulp UPP macerated by the macerating unit 20 is circulated through the used paper pulp circulation route 49 by the circulation pump 69, and is beaten by the grinder 50, and at this time the beating gap G of the beating action surfaces 51a, 52a of the grinder 50 is controlled by the gap adjusting means 57 so as to be narrower gradually from the initial period to the terminal period of the beating process.

[0066] In the used paper pulp circulation route 49, the macerating tank 25 of the macerating unit 20 is included, and in this beating process, the agitating device 26 of the macerating unit 20 is driven and controlled, and the macerating unit 20 is driven simultaneously with the beating unit 21. That is, in the circulation system beating process, the used paper pulp UPP flows out into the used paper pulp circulation route 49 from the macerating tank 25, while the used paper pulp UPP beaten by the grinder 50 flows into the macerating tank 25, and therefore in the macerating tank 25, the used paper pulp UPP of different

degrees of beating is mixed, and by the agitating action by the agitating device 26, the degree of beating of the used paper pulp UPP in the macerating tank 25 is made uniform, and the beating process is promoted.

[0067] The used paper pulp collection tank 60 is a location for collecting the used paper pulp UPP beaten and pulverized to a desired size by the beating unit 21, and the used paper pulp UPP collected herein is mixed and adjusted to a paper making concentration corresponding to the finished paper quality of the recycled paper RP to be regenerated as a pulp suspension PS by the pulp concentration adjustment unit 3, and is sent to the paper making unit 4 in a next paper making process.

[0068] The pulp concentration adjusting unit 3 is a weight type device for adjusting the concentration of the used paper pulp UPP supplied in the paper making unit 4, by measuring the weight and adjusting the mixing rate of used paper UP and water W supplied into the apparatus, and more specifically as shown in Fig. 4, it includes a beating concentration adjusting unit 3A, a paper making concentration adjusting unit 3B, and a pulp concentration adjusting unit 3C.

[0069] The beating concentration adjusting unit 3A is to adjust the beating concentration of the used paper pulp UPP in the pulp making unit 2, corresponding to the beating efficiency by the beating unit 21, and as mentioned above, it is mainly composed of the water feed pump 46 and the beating concentration control unit 75 for adjusting the beating concentration of the water feed device 27.

[0070] The supply amount of white water W by the water feed pump 46 of the beating concentration adjusting unit 3A is preferred to be set so that the beating concentration of the used paper pulp UPP macerated and beaten by the agitating device 26 may be, for example, the maximum concentration allowable for the beating capacity of the grinder 50 of the beating unit 21 for executing the next step of the beating process, and in the illustrated preferred embodiment, it is set to be a beating concentration of about 2% as mentioned above.

[0071] The beating concentration control unit 75 drives and controls the water feed pump 46 so as to supply a necessary amount of water W into the macerating tank 25, as mentioned above, depending on the result of measurement from the weight sensor 48. This beating concentration control unit 75 composes a part of the apparatus control unit 5 as described below.

[0072] The paper making concentration adjusting unit 3B is to adjust the paper making concentration of the used paper pulp UPP in the paper making unit 4, to an appropriate concentration corresponding to the finished paper quality of the recycled paper RP to be regenerated, and is more specifically deigned to adjust the concentration of the used paper pulp UPP manufactured in the pulp making unit 2 by a division system, and it mainly includes a division extraction unit 80, a suspension preparing unit 81, and a paper making concentration control unit 82.

[0073] The division extraction unit 80 is to divide and extract by a specified small portion from the total volume of the used paper pulp UPP manufactured in the pulp making unit 2 in the preceding process, and includes a used paper pulp supply pump 86 for division and extraction for extracting the used paper pulp UPP of the used paper pulp collection tank 60 and sending to a concentration adjusting tank 85.

[0074] The suspension preparing unit 81 is to prepare a pulp suspension PS of a specified concentration by adding a prescribed amount of water W for concentration adjustment to the specified small portion of the used paper pulp UPP divided and extracted by the division extraction unit 80, and mainly includes a water feed pump 47 of the water feed device 27.

[0075] Although not shown specifically, in the bottom of the concentration adjusting tank 85, same as in the case of the macerating tank 25 mentioned above, a weight sensor 87 composed of a load cell is provided, and is designed to measure and control the amount of the used paper pulp UPP and water W for concentration adjustment supplied into the concentration adjusting tank 85, and the weight sensor 87 is electrically connected to the apparatus control unit 5.

[0076] The paper making concentration control unit 82 controls by interacting the division extraction unit 80 and the suspension preparing unit 81, and forms a part of the apparatus control unit 5, and controls the pumps 86, 47 of the division extraction unit 80 and the suspension preparing unit 81 by interaction so as to execute the following step of the paper making concentration adjusting process.

[0077] First of all, from the whole volume of the used paper pulp UPP collected into the used paper pulp collection tank 60 from the beating unit 21 (in the illustrated preferred embodiment, about 2000 g of used paper UP + 100 L of water W), the used paper pulp UPP of a specified portion (1 L in the illustrated preferred embodiment) is divided by the used paper pulp supply pump 86, and is transferred and contained in the concentration adjusting tank 85. As a result, its weight is sensed and measured by the weight sensor 87, and the result is sent to the apparatus control unit 5.

[0078] In succession, corresponding to the specified portion of the divided used paper pulp UPP, diluting water W is supplied by the water feed pump 47 into the concentration adjusting tank 85 from the white water collection tank 45 by a specified volume (9 L in the illustrated preferred embodiment, actually as weighed and measured by the weight sensor 87).

[0079] As a result, in the concentration adjusting tank 85, the used paper pulp UPP of beating concentration (2% in the illustrated preferred embodiment) and the water W are mixed and diluted, and a pulp suspension PS of a specified concentration (about 0.2% concentration or target concentration in the illustrated preferred embodiment) is mixed and prepared.

[0080] The target concentration of the pulp suspension PS to be prepared is determined in consideration of the paper making capacity in the paper making unit 4 de-

scribed below on the basis of the results of the preliminary experiment, and it is set to about 0.2% in the illustrated preferred embodiment as mentioned above.

[0081] In this way, the pulp suspension PS prepared to the paper making concentration (0.2%) of the target concentration in the concentration adjusting tank 85 is transferred and supplied into a pulp supply tank 89 from the concentration adjusting tank 85 by a first suspension supply pump 88, and is stored in preparation for the next process of paper making unit 4. Thereafter, this paper making concentration adjustment process is repeated similarly for the entire volume of the used paper pulp UPP in the used paper pulp collection tank 60. The pulp supply tank 89 is provided with a second suspension supply pump 90 for sending the pulp suspension PS into a paper making belt conveyor 95 of the paper making unit 4.

[0082] An agitating device 91 is provided in the pulp supply tank 89, and by the agitating action of this agitating device 91, the paper making concentration of the entire stored and held pulp suspension PS is uniformly kept at a specific value.

[0083] As described herein, the concentration adjustment by the paper making concentration adjusting unit 3 is not done in batch of whole volume, but is done in divided portions, that is, in small portions, and the water consumption is saved substantially, and the concentration adjusting tank 85 can be reduced in size and shape substantially, and hence the used paper recycling apparatus 1 is entirely built in a compact design.

[0084] The pulp concentration control unit 3C is to drive and control the beating concentration adjusting unit 3A and the paper making concentration adjusting unit 3B in interlock, and specifically by receiving the pulp concentration control information (the charging amount of the used paper UP, the water supply amount into the macerating tank 25, the beating concentration of the used paper pulp UPP, etc.) from the beating concentration control unit 75 of the beating concentration adjusting unit 3A, the paper making concentration information (the target paper making concentration of the used paper pulp UPP, the division extraction amount of the used paper pulp UPP from the used paper pulp collection tank 60, the water supply amount into the concentration adjusting tank 85, etc.) for adjusting the concentration of the used paper pulp UPP manufactured in the pulp making unit 2 to the target concentration (the paper making concentration) depending on this control information sent to the paper making concentration control unit 82 of the paper making concentration adjusting unit 3B, and thereby the paper making concentration adjusting process is executed.

[0085] The paper making unit 4 is a process location for manufacturing recycled paper RP from the used paper pulp UPP manufactured in the pulp making unit 2, and is mainly composed of, as shown in Fig. 1 and Fig. 5, a paper making belt conveyor unit 95, a dewatering roll unit 96, and a drying belt conveyor unit 97, and the drying belt conveyor unit 97 is provided with a recycled paper smoothing processing unit (recycled paper smoothing device, recycled paper smoothing processing means) 10 which is the characteristic component of the present invention as described above.

[0086] The paper making belt conveyor unit 95 is a location for manufacturing wet paper by making from slurry-like pulp suspension PS composed of the water W and the used paper pulp UPP sent from the pulp supply tank 89 of the pulp making unit 2, and mainly includes a paper making net conveyor 100 and a pulp supply unit 101.

[0087] The paper making net onveyor 100 is for conveying the pulp suspension while making paper therefrom, and a mesh belt 105 of paper making mesh structure composed of numerous mesh cells is disposed for filtering and dewatering the pulp suspension PS while running straightly in its running direction.

[0088] Specifically, the paper making net onveyor 100 includes the mesh belt 105 of an endless belt form for conveying the pulp suspension while making paper from pulp suspension PS, and a drive motor 106 for driving and moving this mesh belt 105.

[0089] The plate member of the paper making mesh structure for composing the mesh belt 105 is a material capable of filtering and dewatering the pulp suspension PS appropriately by way of the numerous mesh cells of the paper making mesh structure, and preferred materials include polypropylene (PP), polyethylene terephthalate (PET), polyamide (PA) (generally known as Nylon, a registered trademark), stainless steel (SUS), and other corrosion resistant materials, and in the illustrated preferred embodiment, a PET-made mesh belt 105 excellent in heat resistance is used.

[0090] The paper making mesh structure of the mesh belt 105 is preferably a material of fine mesh cells and fine weaving cells, and specifically, depending on the desired characteristics of the obtained paper, the following points are taken into consideration.

(1) Mesh size of mesh belt 105

[0091] The mesh size of the mesh belt 105 is preferably 25 mesh cells to 80 mesh cells, and in the illustrated preferred embodiment, the mesh belt 105 of 50 mesh cells is used.

(2) Fiber diameter of mesh cells of mesh belt 105

[0092] The mesh structure of the mesh belt 105 is determined not only by the mesh size (mesh cells) but also by the mesh fiber diameter. At the same number of mesh cells, when the fiber diameter is larger, the mesh size is smaller, and when the diameter is smaller, the mesh size is larger, and this relation is expressed by the mesh voids or air permeability ($cm^3/cm^2/sec$), that is, the rate of permeating air.

[0093] For example, when the mesh size is fine and the permeability is poor, the water filtration rate is low, and, as a result, the shape and size of the pulp supply

unit 101 described below are extended in the running direction of the mesh belt 105, and the apparatus becomes large in size. To the contrary, when the mesh size is coarse and the permeability is excellent, the pulp supply unit 101 is short and the apparatus is small in size, but the recycled paper RP is rough in paper quality, and the difference in smoothness of face and back surfaces becomes significant, and the smoothness of the paper is poor.

[0094] In consideration of these conditions, the mesh belt 105 is formed in a mesh structure small in mesh fiber diameter, large in the number of mesh cells, and not lowered in the permeability, in order to prevent the used paper pulp UPP from slipping out of the mesh cells of the mesh belt 105 in the paper making process, and in the illustrated preferred embodiment, the mesh belt 105 is a 50-mesh PET-made mesh belt 105 of plain weaving. This mesh belt 105 has been experimentally proved to produce an excellent paper quality without causing any particular problem in writing.

[0095] The width dimension of the mesh belt 105 set at a specified width dimension slightly larger than the width dimension of the recycled paper RP to be manufactured from the pulp suspension PS.

[0096] The mesh belt 105 is, as shown in Fig. 1 and Fig. 5, suspended and supported rotatably by way of a drive roller 107, a dewatering roll unit 96, a driven roller 108, and a support roller 109, and is driven and coupled to the drive motor 106 by way of the drive roller 107.

[0097] The paper making process length in the mesh belt 105 is determined in a range of upper side running direction length of the mesh belt 105 in the apparatus case 6 of furniture size (in the illustrated preferred embodiment, the lateral direction length from the pulp supply unit 101 to the dewatering roll unit 96 in Fig. 1).

[0098] The running speed of the mesh belt 105 is set in consideration of various conditions in the paper making process, and preferably set at 0.1 m/min to 1 m/min, and set at 0.2 m/min in the illustrated preferred embodiment. By contrast, in large-scale plant such as conventional used paper recycling factory, the running speed of the mesh belt of this type is set at least at 100 m/min or more, or even more than 1000 m/min in a faster version.

[0099] As shown in Fig. 1 and Fig. 5, the mesh belt 105 is disposed so as to run obliquely upward and straightly toward its running direction, and in the limited space of installation, the paper making process length can be extended considerably, and the filtering and dewatering rate is enhanced in the relation with the paper making mesh structure of the mesh belt 105.

[0100] The drive motor 106 for moving and driving the mesh belt 105 is specifically an electric motor, and is connected electrically to the apparatus control unit 5. This drive motor 106 is also used as the running and driving source of the dewatering roll unit 96 and the drying belt conveyor unit 97 described below.

[0101] The pulp supply unit 101 is a location for supplying a pulp suspension PS onto the mesh belt 105 from the pulp making unit 2, and although not specifically shown, by this pulp supply unit 101, the pulp suspension PS is spread uniformly on the top surface of the mesh belt 105. The pulp supply unit 101 is provided at the start end position of the paper making process of the paper making net conveyor 100.

[0102] By the second suspension supply pump 90, the pulp suspension PS supplied into the pulp supply unit 101 from the pulp supply tank 89 is stored and reserved by a specified amount in this pulp supply unit 101, and by this reserving action, it is diffused uniformly on the top surface of the mesh belt 105. The pulp suspension PS diffused uniformly on the top surface of the mesh belt 105 is conveyed together with the mesh belt 105 by the driving action of the mesh belt 105 in the arrow direction, and is filtered by weight by the mesh cells of the mesh belt 105, and is dewatered, and wet paper RP_0 (water content 90 to 85% in the illustrated preferred embodiment) is obtained.

[0103] The white water W filtered and dewatered by this mesh belt 105 (pulp water of ultra-low concentration filtered by the paper making mesh in the paper making process) is collected in the white water collection tank 45 of the water feed device 27 as mentioned above.

[0104] The dewatering roll unit 96 forms a location for squeezing and dewatering the wet paper RP_0 on the mesh belt 105 at the linkage position of the paper making belt conveyor unit 95 and the drying belt conveyor unit 97 described below.

[0105] Specifically, a smooth surface belt 145 mentioned below of the drying belt conveyor unit 97 at the downstream side, and the mesh belt 105 of the paper making belt conveyor unit 95 at the upstream side are disposed in upper and lower layers as shown in Fig. 1 and Fig. 5, and the upper and lower adjacent portions of the smooth surface belt 145 and the mesh belt 105 are formed at the linkage portion, and at this linkage portion, the dewatering roll unit 96 rolls and compresses the mesh belt 105 and the smooth surface belt 145 from upper and lower sides, thereby dewatering the wet paper in compressed state.

[0106] The dewatering roll unit 96 includes at least a preliminary dewatering roll unit 96A, and a final dewatering roll unit 96B as principal components.

[0107] The dewatering roll unit 96 in the illustrated preferred embodiment includes, as shown in Fig. 1, the preliminary dewatering roll unit 96A, the final dewatering roll unit 96B, and an angle defining roll unit 96C as assisting means, as principal components.

[0108] The preliminary dewatering roll unit 96A is for squeezing and dewatering preliminarily the wet paper RP_0 on the mesh belt 105, and specifically includes a preliminary squeezing roll pair 122 consisting of a preliminary dewatering roll 120 rolling on the mesh belt 105 from the lower side, and a preliminary press roll 121 rolling and pressing on the smooth surface belt 145 from the upper side in collaboration with the preliminary dewatering roll 120.

[0109] By the preliminary squeezing roll pair 122 consisting of the preliminary dewatering roll 120 and the preliminary press roll 121, the mesh belt 105 and the smooth surface belt 145 are rolled and squeezed from both upper and lower sides at a specified preliminary pressure in a compressed state, and the water content in the wet paper RP_0 on the mesh belt 105 is removed preliminarily.

[0110] In this case, the preliminary pressure, that is, the preliminary squeezing force of the preliminary dewatering roll unit 96A for preliminarily squeezing and dewatering the wet paper RP_0 on the mesh belt 105 is set at a magnitude so as not to destroy the wet paper RP_0 of high water content, and in the illustrated preferred embodiment, the preliminary squeezing force is determined so that the water content of the wet paper RP_0 on the mesh belt 105 after preliminary dewatering process may be in a range of 80 to 75%.

[0111] The final dewatering roll unit 96B is for obtaining a dry paper specified water content (recycled paper) RP by further squeezing and dewatering the wet paper RP_0 on the mesh belt 105 after preliminary dewatering by the preliminary dewatering roll unit 96A, and specifically includes at least one set of a final squeezing roll pair 127 consisting of a final dewatering roll 125 rolling on the mesh belt 105 from the lower side, and a final press roll 126 rolling and pressing on the smooth surface belt 145 from the upper side in cooperation with the final dewatering roll 125.

[0112] By the final squeezing roll pair 127 consisting of the final dewatering roll 125 and the final press roll 126, the mesh belt 105 and the smooth surface belt 145 are rolled and squeezed from both upper and lower sides at a specified final pressure in a compressed state, and the water content in the wet paper RP_0 on the mesh belt 105 is finally removed, and a dry paper of specified water content, that is, recycled paper RP is obtained.

[0113] In this case, the final pressure, that is, the final squeezing force of the final dewatering roll 96B for finally squeezing and dewatering the wet paper RP_0 on the mesh belt 105 is set to such a magnitude for obtaining a specified dewatering effect securely about the preliminarily dewatered wet paper RP_0, and in the illustrated preferred embodiment, it is set so that the water content of the dry paper (recycled paper) RP on the mesh belt 105 after the final dewatering process may be in a range of 70 to 65%.

[0114] These rolls 120, 121, 125, 126 in the dewatering roll unit 96 are not specifically shown, but as being driven and coupled to the single drive motor 106 by driving and coupling means of gear mechanism, all rolls 120, 121,125,126 are rotated and driven in mutual interaction.

[0115] In this case, these rolls 120, 121,125,126 are rotated and controlled so as to roll and contact mutually at a slight rotating speed difference mutually on the outer circumferential surfaces of the upper and lower rolls 120, 125 and the outer circumferential surfaces of 121, 126, on the contact surfaces (the lower side of the mesh belt 105 and the upper side of the smooth surface belt 145) of the mesh belt 105 and the smooth surface belt 145 rolled and squeezed in a compressed state between the outer circumferential surfaces.

[0116] Specifically, the rotating speed of the upper side preliminary and final press rolls 121, 126 is set slightly larger than the rotating speed of the lower side preliminary and final dewatering rolls 120, 125, and therefore the running speed of the smooth surface belt 145 is set slightly larger than the running speed of the mesh belt 105. In such configuration, as described below, when the wet paper RP_0 squeezed and dewatered by the dewatering roll unit 96 is transferred and conveyed to the lower side of the upper side smooth surface belt 145 from the upper side of the lower side mesh belt 105, a tension is applied to the wet paper RP_0, and wrinkling of the wet paper RP_0 is effectively prevented.

[0117] The angle defining roll unit (angle defining means) 96C is for assisting the squeezing and dewatering action of the preliminary dewatering roll unit 96A and the final dewatering roll unit 96B to be effective, and it is provided at the upstream side of the preliminary dewatering roll unit 96A, and defines the inclination angle between the mesh belt 105 and the smooth surface belt 145 inserted in the preliminary dewatering roll unit 96A.

[0118] The angle defining roll unit 96C is specifically for defining the inclination angle between the mesh belt 105 and the smooth surface belt 145 inserted in the preliminary dewatering roll unit 96A, and more specifically it includes a mesh belt guide roll 130 rolling on the mesh belt 105 from the lower side, and defining the insertion angle of the mesh belt 105 in the preliminary dewatering roll unit 96A, and a smooth surface belt guide roll 131 rolling on the smooth surface belt 145 from the upper side, and defining the insertion angle of the smooth surface belt 145 in the preliminary dewatering roll unit 96A.

[0119] By the mesh belt guide roll 130, the insertion angle of the mesh belt 105 in the preliminary dewatering roll unit 96A is defined, and by the smooth surface belt guide roll 131, the insertion angle of the smooth surface belt 145 in the preliminary dewatering roll unit 96A is defined, and therefore the inclination angle between the mesh belt 105 and the smooth surface belt 145 is indirectly determined in a specified range.

[0120] The inclination angle of the mesh belt 105 and the smooth surface belt 145 is determined so as to prevent effectively the wet paper RP_0 from returning to slurry by re-absorption of a large volume of squeezed water into the wet paper RP_0 after the water contained in the wet paper RP_0 is once squeezed substantially to the upstream side of the preliminary dewatering roll unit 96A by the preliminary dewatering action by the preliminary dewatering roll unit 96A.

[0121] That is, by the preliminary dewatering roll 120 and the preliminary press roll 121 of the preliminary dewatering roll unit 96A, when the mesh belt 105 and the smooth surface belt 145 on which the wet paper RP_0 is mounted at the upper side are squeezed and rolled from the upper and lower sides in a compressed state, the

water content in the wet paper RP_0 is squeezed out to the upstream side of the both rolls 120, 121.

[0122] In this case, if the inclination angle α between the mesh belt 105 and the smooth surface belt 145 is too large, at a position near the upstream side of the both rolls 120, 121, the upper side smooth surface belt 145 is apart from the wet paper RP_0 on the lower side mesh belt 105, and hence a part of the abundant squeezed water contained in the wet paper RP_0 may be absorbed again in the wet paper RP_0, and the wet paper RP_0 may become slurry again.

[0123] By contrast, when the inclination angle α between the mesh belt 105 and the smooth surface belt 145 is small, at a position near the upstream side of the both rolls 120, 121, the upper side smooth surface belt 145 is pressed to the wet paper RP_0 on the lower side mesh belt 105, and hence all of the water squeezed from the wet paper RP_0 drops to the lower side by way of the mesh belt 105, and is not absorbed again in the wet paper RP_0, and the wet paper RP_0 may be prevented from becoming slurry again.

[0124] The inclination angle α between the mesh belt 105 and the smooth surface belt 145 is preferably set in a range of 1 to 20 degrees as a result of various tests, preferably 3 to 7 degrees, and it is set at 5 degrees in the illustrated preferred embodiment.

[0125] Thus, by driving of the drive motor 106, the rolls 120, 121, 125, 126 of the preliminary dewatering roll unit 96A and the final dewatering roll unit 96B in the dewatering roll unit 96 are put in rotation, and first by the preliminary squeezing roll pair 122 in the preliminary dewatering roll unit 96A, the mesh belt 105 and the smooth surface belt 145 are rolled and squeezed from both upper and lower sides in a compressed state at a specified preliminary pressure, and the water contained in the wet paper RP_0 on the mesh belt 105 is preliminarily removed (in the illustrated preferred embodiment, the water content in the wet paper RP_0 is reduced from 90 to 85% to 80 to 75%).

[0126] In succession, by the final squeezing roll pair 127 in the final dewatering roll unit 96B, the mesh belt 105 and the smooth surface belt 145 are rolled and squeezed from both upper and lower sides in a compressed state at a specified final pressure, and the water contained in the wet paper RP_0 on the mesh belt 105 is finally removed, and the dry paper of specified water content, that is, the recycled paper RP is obtained (in the illustrated preferred embodiment, the wet paper RP_0 of water content of 80 to 75% is dewatered to the dry paper RP of water content of 70 to 65%). In this series of process, the white water W squeezed and dewatered from the wet paper RP_0 is collected in the white water collection tank 45 in the water feed device 27.

[0127] The wet paper RP_0 squeezed and dewatered by the dewatering roll unit 96 is transferred and conveyed to the lower side of the upper side smooth surface belt 145 from the upper side of the lower side mesh belt 105, at a downstream side location of the dewatering roll unit 96, and is conveyed together with the smooth surface belt 145, and is dried by the drying belt conveyor unit 97 in the drying process.

[0128] This transfer action is considered to be caused by a smooth surface structure of the smooth surface belt 145. That is, the surface of the lower side mesh belt 105 is a fine rough surface having multiple fine continuous pores, whereas the surface of the upper side smooth surface belt 145 is a smooth surface without pores, and hence the dry paper RP_0 slightly containing water seems to be adsorbed by the surface tension against the surface of the smooth surface belt 145.

[0129] The drying belt conveyor unit 97 is a location for manufacturing the recycled paper RP by further heating and drying the dry paper RP squeezed and dewatered in the dewatering roll unit 96, and is mainly composed of a drying conveyor 170, a heating and drying unit 171, and the recycled paper smoothing processing unit (recycled paper smoothing device, recycled paper smoothing processing means) 10.

[0130] The drying conveyor 170 is for smoothing and conveying the wet paper RP_0 squeezed and dewatered in the dewatering roll unit 96, and mainly includes the smooth surface belt 145, and the drive moor 106 for driving and moving this smooth surface belt 145.

[0131] The smooth surface belt 145 is to convey the wet paper RP_0 while heating and drying, and is specifically an endless belt connected and formed in an annular shape of a specified length of a plate material of smooth surface structure having a specified width. The plate material of smooth surface structure is finished in an appropriate smooth surface at one side of the surface of the wet paper RP_0, and is made of a material capable of withstanding the heating action of the heating and drying unit 171 described below, and preferably an elastic heat resistant material is used such as fluorine resin or stainless steel, and a fluorine resin belt is used in the illustrated preferred embodiment.

[0132] This smooth surface belt 145 is, as shown in Fig. 1, rotatably supported and held by way of a drive roller 176, a driven roller 177, the dewatering roll unit 96, and a driven roller 178, and is driven and coupled to the drive motor 106 by way of the drive roller 176.

[0133] The drive motor 106 for driving and moving the smooth surface belt 145 is commonly used as the running and driving source of the paper making net conveyor 100 and the dewatering roll unit 96, and also a covering belt 200 mentioned below.

[0134] The heating and drying unit 171 is a location for heating and drying the wet paper RP_0 on the smooth surface belt 145 and the covering belt 200 of the recycled paper smoothing processing unit 10, and specifically the smooth surface belt 145 conveying and supporting the lower side of the wet paper RP_0 is heated from the lower side by a heater plate 180 disposed in the midst of its running route.

[0135] This heater plate 180 in the illustrated preferred embodiment is specifically formed as a heater plate slid-

ing and contacting with the opposite side of the conveying and supporting side of the wet paper RP_0 on the smooth surface belt 145, and is provided in the horizontal running portion of the running route of the smooth surface belt 145, and is disposed to slide and contact with the opposite side of the upper side of the holding side of the wet paper RP_0 on the smooth surface belt 145, that is, the lower side. Hence, the wet paper RP_0 on the smooth surface belt 145 is indirectly heated and dried by way of the smooth surface belt 145 heated by the heater plate 180.

[0136] The recycled paper smoothing processing unit (recycled paper smoothing device, recycled paper smoothing processing means) 10 is formed as pressing means for pressing the entire wet paper RP_0 conveyed on the smooth surface belt 145 of the drying conveyor 170 with a uniform pressure from the upper side, in the heating and drying unit 171.

[0137] The recycled paper smoothing processing unit 10 formed as pressing means specifically includes a covering belt conveyor 190, and a plurality of pressing rollers 191, 191, ..., as shown in Fig. 1 and Fig. 5.

[0138] The covering belt conveyor 190 runs while covering the entire wet paper RP_0 on the smooth surface belt 145 in an enclosed or sandwiched state together with the smooth surface belt 145, and a covering belt 200 for covering the entire wet paper RP_0 from the upper side is disposed to run straightly in a same horizontal direction in an overlapped state with the smooth surface belt 145.

[0139] Specifically, the covering belt conveyor 190 includes the covering belt 200 formed as an endless belt conveying and carrying the wet paper RP_0 on the smooth surface belt 145 in an enclosed or sandwiched state together with the smooth surface belt 145, and the drive motor 106 for moving and driving this covering belt 200.

[0140] The covering belt 200 is specifically made of a mesh belt of an air permeable mesh structure formed of numerous mesh cells for permeating the steam heated and evaporated from the wet paper RP_0.

[0141] The plate member of the permeable structure for composing the covering belt 200 is a material capable of passing and releasing the moisture heated and evaporated from the wet paper RP_0 on the smooth surface belt 145 smoothly to the upper side by way numerous mesh cells, and preferred materials are same as in the case of the mesh belt 105 of the paper making unit 4 mentioned above, including polypropylene (PP), polyethylene terephthalate (PET), polyamide (PA) (generally known as Nylon, a registered trademark), stainless steel (SUS), and other corrosion resistant materials, and in the illustrated preferred embodiment, a PET-made mesh belt 200 excellent in heat resistance is used.

[0142] The permeable mesh structure of the mesh belt 200 is preferably a material of fine mesh cells and fine weaving cells, and specifically, the material is selected depending on the desired characteristics of the obtained paper, same as in the case of the mesh belt 105 of the paper making unit 4 mentioned above.

[0143] For example, the mesh size of the mesh belt 200 is set larger than that of the mesh belt 105 of the paper making unit 4, due to difference in the purpose, and is preferably set at about 12 mesh cells to 40 mesh cells (about four times of the mesh size of the mesh belt 105), and in the illustrated preferred embodiment, the mesh belt 200 of 25 mesh cells is used.

[0144] The mesh belt 200 is not particularly strict in the design conditions as compared with the mesh belt 105 forming the core of the paper making unit 4, as far as having appropriate properties, including the heat resistance to withstand the high temperature of heating and drying, and the permeability for passing the steam heated and evaporated from the wet paper RP_0, and in the illustrated preferred embodiment, the mesh belt 200 is a plain-woven PET-made mesh belt of 25 mesh cells.

[0145] The width dimension of the mesh belt 200 is set to a same width dimension as the smooth surface belt 145 in order to overlap with the smooth surface belt 145 and enclose the wet paper RP_0 in a sandwich state.

[0146] The mesh belt 200 is suspended and supported rotatably by way of a drive roller 205, a driven roller 206, and pressing rollers 191, 191, ..., as shown in Fig. 1 and Fig. 5, and is driven and coupled to the drive motor 106 by way of the drive roller 205.

[0147] The covering range of the mesh belt 200 on the wet paper RP_0 (recycled paper RP) is set opposite to the heater plate 180 in a horizontal running portion in the running route of the smooth surface belt 145.

[0148] The pressing rollers 191, 191, ... are for pressing the mesh belt 200 from the upper side, and are arranged in plural parallel rows at specific intervals in the running direction of the covering belt 200 in the covering range of the covering belt 200 on the wet paper RP_0 (recycled paper RP), and therefore the covering belt 200 presses the wet paper RP_0 on the smooth surface belt 145 with a uniform pressure in the overall length of the covering range, and the wet paper RP_0 (recycled paper RP) is not warped or wrinkled, and it is configured to finish the opposite side of the surface of the one side of the wet paper RP_0 (recycled paper RP) contacting with the surface of the smooth surface belt 145 to an appropriate smooth surface.

[0149] These pressing rollers 191, 191, ... are formed as solid cylindrical rolls of small diameter made of a material of high rigidity, and the configuration of these pressing rollers 191, 191, ... is determined to form an average smoothing action surface for smoothing and processing the entire wet paper RP_0 (recycled paper RP) at least in cooperation between the lower side of the covering belt 200 and the upper side of the smooth surface belt 145.

[0150] The pressing rollers 191, 191, ... in the illustrated preferred embodiment are formed as solid metal rollers having an outside diameter dimension capable of holding a pressing roller disposition interval for forming and maintaining the smoothing action surface of the covering belt 200, and are rotatably supported on an apparatus machine body 54 (a specific supporting structure

is not shown).

[0151] The number of the pressing rollers 191, 191, ... is not specified, and may be increased or decreased appropriately depending on the purpose in a range satisfying the above conditions.

[0152] In the heating and drying unit 171 of the drying belt conveyor unit 97, the lower side of the wet paper RP_0 is conveyed and supported by the smooth surface belt 145, and its upper side is covered, conveyed and supported by the mesh belt 200, and the plurality of pressing rollers 191, 191, ... of small diameter disposed at narrow pitches press the mesh belt 200 from the upper side with a uniform pressure.

[0153] As a result, by the both belts 145, 200, the wet paper RP_0 is held and conveyed with a uniform pressure, and wrinkles and warps of the wet paper RP_0 caused in the preceding process of the paper making process can be effectively eliminated and removed, and occurrence of wrinkle or warp of the wet paper by the heating and drying action by the heater plate 180 can be effectively prevented, and by an adequate permeability of the mesh belt 200 of the upper side, the whole surface of the wet paper RP_0 can be uniformly dried, so that the wet paper RP_0 is reborn as a recycled paper (dry paper) RP of a smooth surface on the whole.

[0154] The running speed of the mesh belt 200 is controlled in synchronism with the running speed of the smooth surface belt 145 of the drying conveyor 170 in the drying process unit, and a recycled paper of smooth and desired paper quality is obtained.

[0155] If the running speed of the mesh belt 200 of the upper side is not synchronized with the conveying speed of the smooth surface belt 145 at the lower side, the wet paper RP_0 (or dry paper (recycled paper RP)) may be loosened and wrinkled, or may be torn apart, to the contrary, by an excessive tension, and desired smoothing and processing effects are not obtained. To prevent the inconvenience, the running speed of the mesh belt 200 must be synchronized with the conveying speed of the smooth surface belt 145 of the drying process unit 170.

[0156] In the illustrated preferred embodiment, the driving sources of the both belts 145, 200 are a common drive motor 106, and the running speeds of the both belts 145, 200 are synchronized by the mechanical structure of the drive transmission system.

[0157] At the downstream side of the heating and drying unit 171 in the smooth surface belt 145, a peeling member 210 is provided, and the dry paper dried and conveyed on the smooth surface belt 145, that is, the recycled paper RP (water content 10 to7%) is sequentially peeled from the holding side of the smooth surface belt 145.

[0158] In this relation, at the terminal end position of the running route of the smooth surface belt 145 at the downstream side of this peeling member 210, a fixed size cutter unit 211 is provided, and the recycled paper RP peeled off from the smooth surface belt 145 is cut to a specified size (an A4 format in the illustrated preferred embodiment), and is discharged from the discharge port 8 of the apparatus case 6.

[0159] The apparatus control unit 5 is for controlling automatically in mutual cooperation of the actions of the drive parts of the pulp making unit 2, the pulp concentration adjustment unit 3, and the paper making unit 4, and is specifically composed of a microcomputer including a CPU, ROMs, RAMs, and I/O ports.

[0160] This apparatus control unit 5 incorporates programs for executing the pulp making process of the pulp making unit 2, the concentration adjusting process of the concentration adjustment unit 3, and the paper making process of the paper making unit 4, by interacting with each other, and also stores various items of information necessary for driving of the components 2 (20, 21), 3 (3A, 3B), and 4 (95, 96, 97, 10), for example, the driving time and rotating speed of the agitating device 26 in the macerating unit 20, the water feed timing and water feed amount of the water feed device 27, the driving time and circulation amount of the circulation pump 69 in the beating unit 21, the driving time and rotating speed of the grinder 50, the adjusting timing and beating gap G adjusting amount of the gap adjusting means 57, the running speed of the conveyors 100, 170 in the paper making unit 4, the driving time of the heating and drying unit 171, and the operation timing of the fixed size cutter unit 211, preliminarily as data, or from the keyboard as appropriate selective input data.

[0161] In the apparatus control unit 5, as mentioned above, the weight sensors 48, 87, and the drive units 35, 41, 56, 61, 66, 106 are connected electrically, and the apparatus control unit 5 controls these drive units 35, 41, 56, 61, 66, 106 according to the measured values and the control data.

[0162] The used paper recycling apparatus 1 having such configuration is started when the power source is turned on, and the components 2 (20, 21), 3 (3A, 3B), and 4 (95, 10, 96) are controlled automatically by the apparatus control unit 5 in mutual interaction, and the used paper UP, UP, ... charged in the inlet 7 of the apparatus case 6 are macerated and beaten by the macerating unit 20 and the beating unit 21 in the pulp making unit 2, and the used paper pulp UPP is manufactured, and further a pulp suspension PS of a paper making concentration is manufactured in the pulp concentration adjusting unit 3, and this pulp suspension PS is manufactured in the paper making belt conveyor unit 95, the dewatering roll unit 96, and the drying belt conveyor unit 97 of the paper making unit 4, and recycled paper RP is obtained, which is discharged into the recycled paper receiving tray 9 from the discharge port 8 of the apparatus case 6.

[0163] In this case, the recycled paper smoothing processing unit 10 in the drying belt conveyor unit 97 of the paper making unit 4 formed as pressing means for pressing the entire wet paper RP_0 (recycled paper RP) conveyed on the smooth surface belt 146 with a uniform pressure from the upper side in the heating and drying

unit 171, and this pressing means 10 includes a covering belt conveyor 190 having a covering belt 200 running while covering the entire wet paper RP_0 (recycled paper RP) on the smooth surface belt 145 by carrying together with the smooth surface belt 145, and a plurality of pressing rollers 191, 191, ... disposed at specified intervals in the running direction of the covering belt 200 for pressing this covering belt 200 from the upper side, and therefore in a very narrow used paper processing space of the used paper recycling apparatus 1 of furniture size to be installed not only in a large office but also in a small shop or a general household room, the wet paper RP_0 manufactured on the paper making net conveyor 100 in the paper making process unit can be securely reproduced as a wrinkle-free and smooth recycled paper RP.

[0164] That is, the wet paper RP_0 manufactured in the paper making belt conveyor unit (the paper making process unit) 95 is conveyed, heated and dried by the smooth surface belt 145 in the heating and drying unit 171 of the next drying belt conveyor unit (the drying process unit) 97, and the entire wet paper is pressed with a uniform pressure from the upper side by the recycled paper smoothing processing unit (the recycled paper smoothing device, recycled paper smoothing processing means) 10 formed as pressing means.

[0165] In this case, the recycled paper smoothing processing unit 10 includes a covering belt conveyor 191 having a covering belt 200 running while covering the entire wet paper RP_0 (recycled paper RP) on the smooth surface belt 145 by carrying together with the smooth surface belt 145, and a plurality of pressing rollers 191, 191, ... disposed at specified intervals in the running direction of the covering belt 200 for pressing this covering belt 200 from the upper side, and therefore the wet paper RP_0 (recycled paper RP) on the smooth surface belt 145 for conveying and passing the heating and drying unit 171 is covered by the covering belt conveyor 190 from the upper side, and is pressed by the plurality of pressing rollers 191, 191, ... disposed continuously with a specified pressure uniformly from the upper and lower sides in a sandwich state, and is hence heated and dried.

[0166] In other words, the wet paper RP_0 (recycled paper RP) is heated and dried while being held in a flat state by the sandwich structure at a specified pressure, and wrinkles and warps formed in the wet paper RP_0 in the preceding process of the paper making process can be effectively eliminated and removed, and occurrence of wrinkle or warp of the wet paper RP_0 (recycled paper RP) by the heating and drying action can be effectively prevented, and a recycled paper of a smooth surface on the whole can be obtained.

[0167] Moreover, since the covering belt 200 of the covering belt conveyor 190 is formed as a mesh belt composed of numerous mesh cells capable of passing and releasing the moisture heated and evaporated from the wet paper RP_0 on the smooth surface belt 145 to the upper side, in site of the presence of the covering belt 200, the steam generated by heating of the wet paper RP_0 can be effectively lifted and dissipated, and the drying process is promoted smoothly.

[0168] Besides, since the running speed of the mesh belt for composing the covering belt 200 is controlled in synchronism with the running speed of the smooth surface belt 145 in the drying process unit, the wet paper RP_0 is heated and dried while being held in the sandwich structure stably.

[0169] The foregoing preferred embodiment may be modified in design as described below.

[0170] For example, the specific configuration of the recycled paper smoothing processing unit (the recycled paper smoothing device, recycled paper smoothing processing means) 10 may not be limited to the configuration of the illustrated preferred embodiment, but may be formed in other configuration having similar functions.

[0171] In the illustrated preferred embodiment, for instance, the drive motor 106 for moving and driving the smooth surface belt 145 is also used as the moving and driving source of the covering belt 200, and hence the running speeds of the two belts 145, 200 are synchronized by the mechanical structure of the drive transmission system, but the belts 145, 200 may be separately driven by independent and individual driving sources, and these driving sources may be controlled synchronously and electrically by the apparatus control unit 5.

[0172] As the present invention may be embodied in several forms without departing from the spirit of essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within metes and bounds of the claims, or equivalence of such metes and bounds thereof are therefore intended to be embraced by the claims.

Claims

1. A recycled paper smoothing device of a used paper recycling apparatus for smoothing a recycled paper, being installed in a paper making unit for manufacturing recycled paper from a used paper pulp manufactured in a pulp making unit of a preceding process, in the used paper recycling apparatus of furniture size to be installed at the site of origin of the used paper,
   wherein the paper making unit comprises a paper making belt conveyor unit for manufacturing wet paper from the used paper pulp by making the used paper pulp and a drying belt conveyor unit for manufacturing recycled paper by drying the wet paper made and formed in the paper making belt conveyor unit, and the recycled paper smoothing device is provided in the drying belt conveyor unit,
   in a heating and drying unit of the drying belt conveyor unit, the recycled paper smoothing device is formed as pressing means for pressing the entire

wet paper conveyed on a smooth surface belt from the upper side at a uniform pressure, and
this pressing means comprises a covering belt conveyor having a covering belt running while covering the entire wet paper on the smooth surface belt in a state enclosed together with the smooth surface belt, and a plurality of pressing rollers arranged at specified intervals in the running direction of the covering belt for pressing the covering belt from the upper side.

2. The recycled paper smoothing device of the used paper recycling apparatus of claim 1,
wherein the covering belt conveyor has the covering belt formed as an endless belt running while covering the entire wet paper on the smooth surface belt in a state enclosed together with the smooth surface belt, and a drive motor for moving and driving this covering belt.

3. The recycled paper smoothing device of the used paper recycling apparatus of claim 1 or 2,
wherein the covering belt is formed of a mesh belt having numerous mesh cells for passing and releasing the moisture heated and evaporated from the wet paper on the smooth surface belt to the upper side.

4. The recycled paper smoothing device of the used paper recycling apparatus of claim 1,
wherein the mesh of the mesh belt of the pressing means is set at 12 to 40 mesh cells.

5. The recycled paper smoothing device of the used paper recycling apparatus of claim 1,
wherein the running speed of the mesh belt is controlled to be synchronized with the running speed of the smooth surface belt in the drying process unit.

6. The recycled paper smoothing device of the used paper recycling apparatus of claim 1,
wherein the configuration of the pressing roller is determined so as to form a flat smoothing action surface for smoothing and processing the entire wet paper , in cooperation between the lower side of the covering belt and the upper side of the smooth surface belt.

7. The recycled paper smoothing device of the used paper recycling apparatus of claim 6,
wherein the pressing roller is formed as a solid metal roller having an outside diameter size capable of maintaining a pressing roller interval for forming and maintaining the smoothing action surface of the covering belt, and is supported rotatably.

8. The recycled paper smoothing device of the used paper recycling apparatus of claim 1,
wherein in the drying process unit, the smooth surface belt for conveying and supporting the lower side of the wet paper is hated by a heater from the lower side.

9. The recycled paper smoothing device of the used paper recycling apparatus of claim 8,
wherein the heater is formed as a heater plate sliding on the opposite side of the conveying and supporting side of the wet paper on the smooth surface belt, and the wet paper on the smooth surface belt is heated indirectly and dried by the smooth surface belt heated by the heater plate.

10. A paper making device of a used paper recycling apparatus applied in a used paper recycling apparatus of furniture size to be installed at the site of origin of used paper, being a paper making deice for manufacturing recycled paper from used paper pulp manufactured in a pulp making device of a preceding process, comprising:

a paper making belt conveyor unit for manufacturing wet paper from a slurry-like pulp suspension mixed of water and used paper pulp sent from the pulp making device,
a drying belt conveyor unit for manufacturing recycled paper by drying the wet paper manufactured in this paper making belt conveyor unit, and
a dewatering roll unit for squeezing and dewatering the wet paper at a linkage part of the paper making belt conveyor unit and the drying belt conveyor unit,
wherein the drying belt conveyor unit includes recycled paper smoothing processing means for processing and discharging the wet paper made and formed in the paper making belt conveyor unit as a smooth recycled paper,
this recycled paper smoothing processing means is formed as pressing means for pressing the entire wet paper conveyed on the smooth surface belt with a uniform pressure from the upper side, in the heating and drying unit of the drying belt conveyor unit, and
this pressing means includes a covering belt conveyor having a covering belt running while covering the entire wet paper on the smooth surface belt in an enclosed state together with the smooth surface belt, and a plurality of pressing rollers disposed at specified intervals in the running direction of the covering belt for pressing this covering belt from the upper side.

11. A used paper recycling apparatus comprising, in an apparatus case of furniture size, a pulp making unit for manufacturing used paper pulp by macerating and beating used paper, a paper making unit for manufacturing recycled paper by making from the used paper pulp manufactured in this pulp making

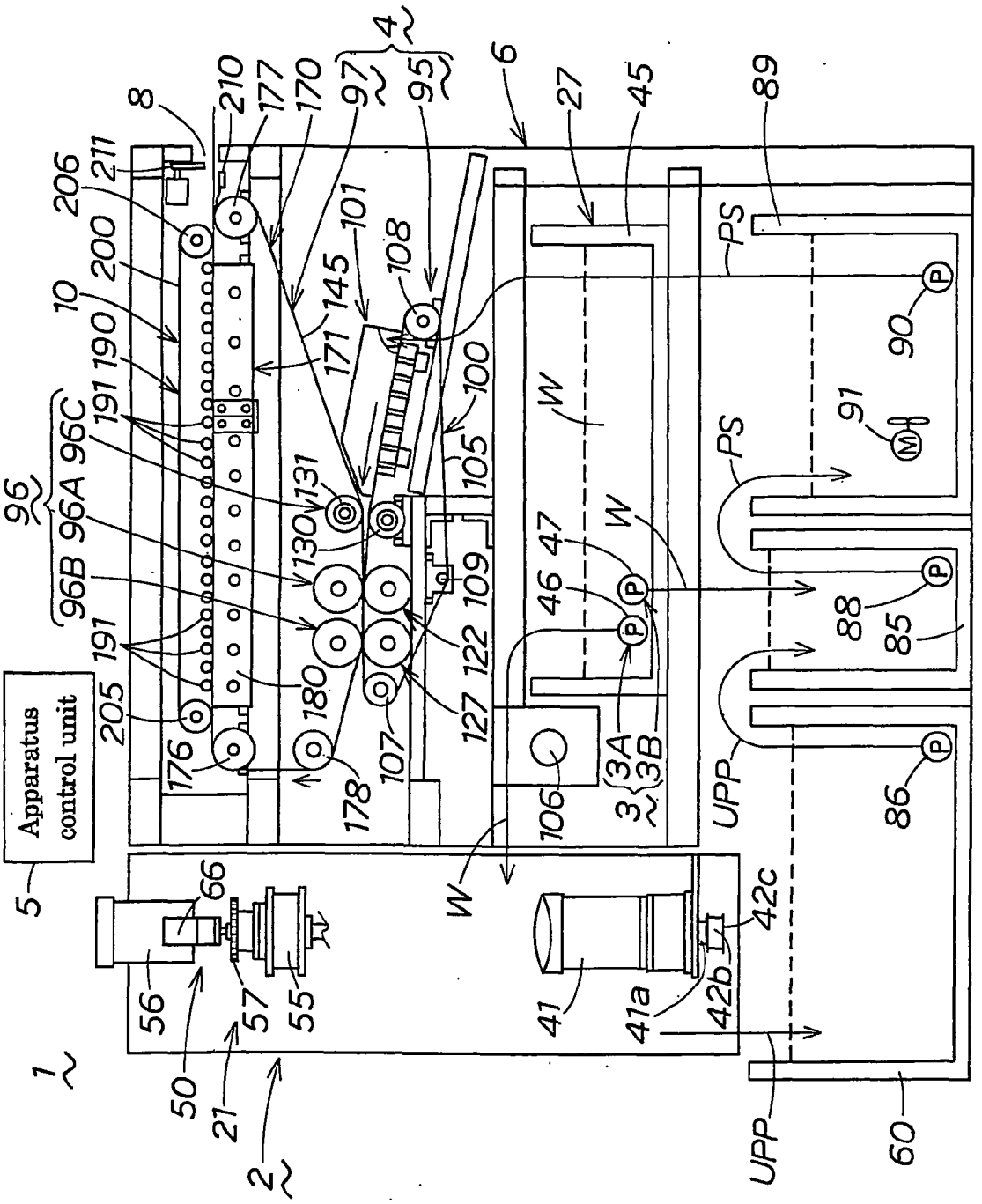
unit, and a control unit for driving and controlling the pulp making unit and the paper making unit in cooperation,

wherein the paper making unit includes a paper making belt conveyor unit for manufacturing wet paper from a slurry-like pulp suspension mixed of water and used paper pulp sent from the pulp making device, a drying belt conveyor unit for manufacturing recycled paper by drying the wet paper manufactured in this paper making belt conveyor unit, and a dewatering roll unit for squeezing and dewatering the wet paper at a linkage part of the paper making belt conveyor unit and the drying belt conveyor unit,

the drying belt conveyor unit includes recycled paper smoothing processing means for processing and discharging the wet paper made and formed in the paper making belt conveyor unit as a smooth recycled paper,

this recycled paper smoothing processing means is formed as pressing means for pressing the entire wet paper conveyed on the smooth surface belt with a uniform pressure from the upper side, in the heating and drying unit of the drying belt conveyor unit, and this pressing means includes a covering belt conveyor having a covering belt running while covering the entire wet paper on the smooth surface belt in an enclosed state together with the smooth surface belt, and a plurality of pressing rollers disposed at specified intervals in the running direction of the covering belt for pressing this covering belt from the upper side.

Fig. 1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3B
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96C
97
100
101
105
106
107
108
109
122
127
130
131
145
171
176
177
178
180
190
191
200
205
206
210
211
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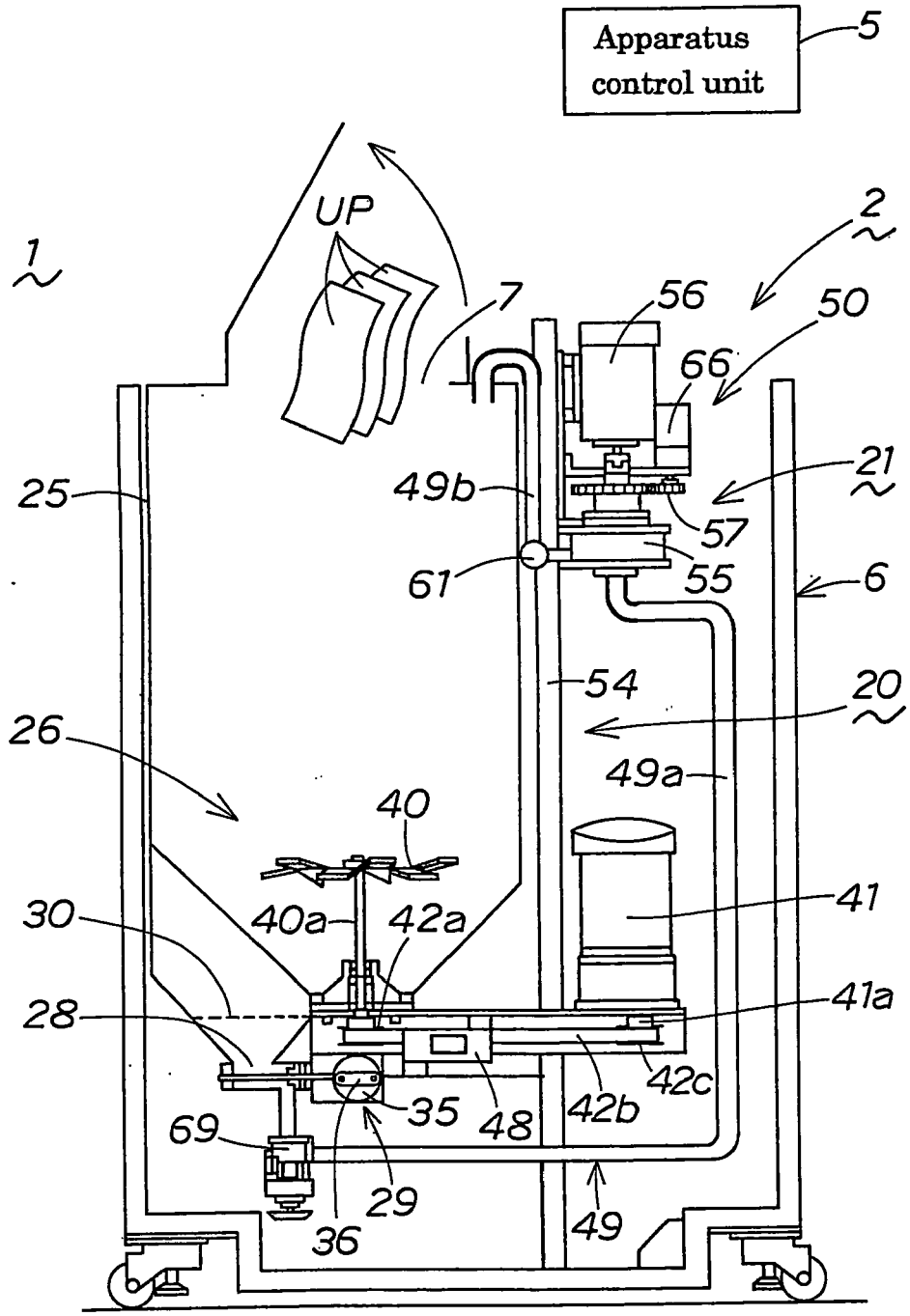
UPP
W

Fig. 2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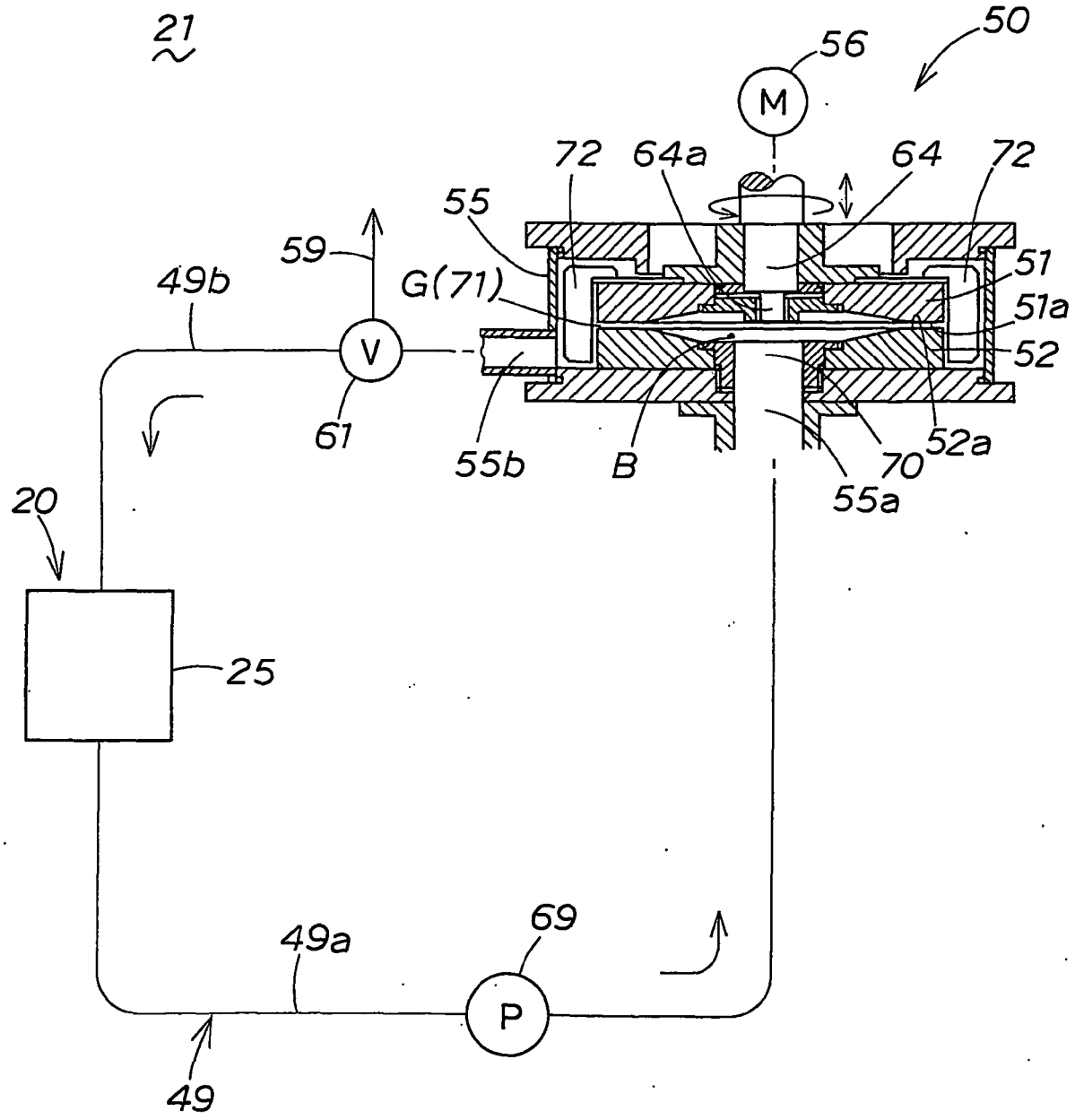
49

Fig. 3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M
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64a
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72
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59
49b
G(71)
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B
70
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55a
20
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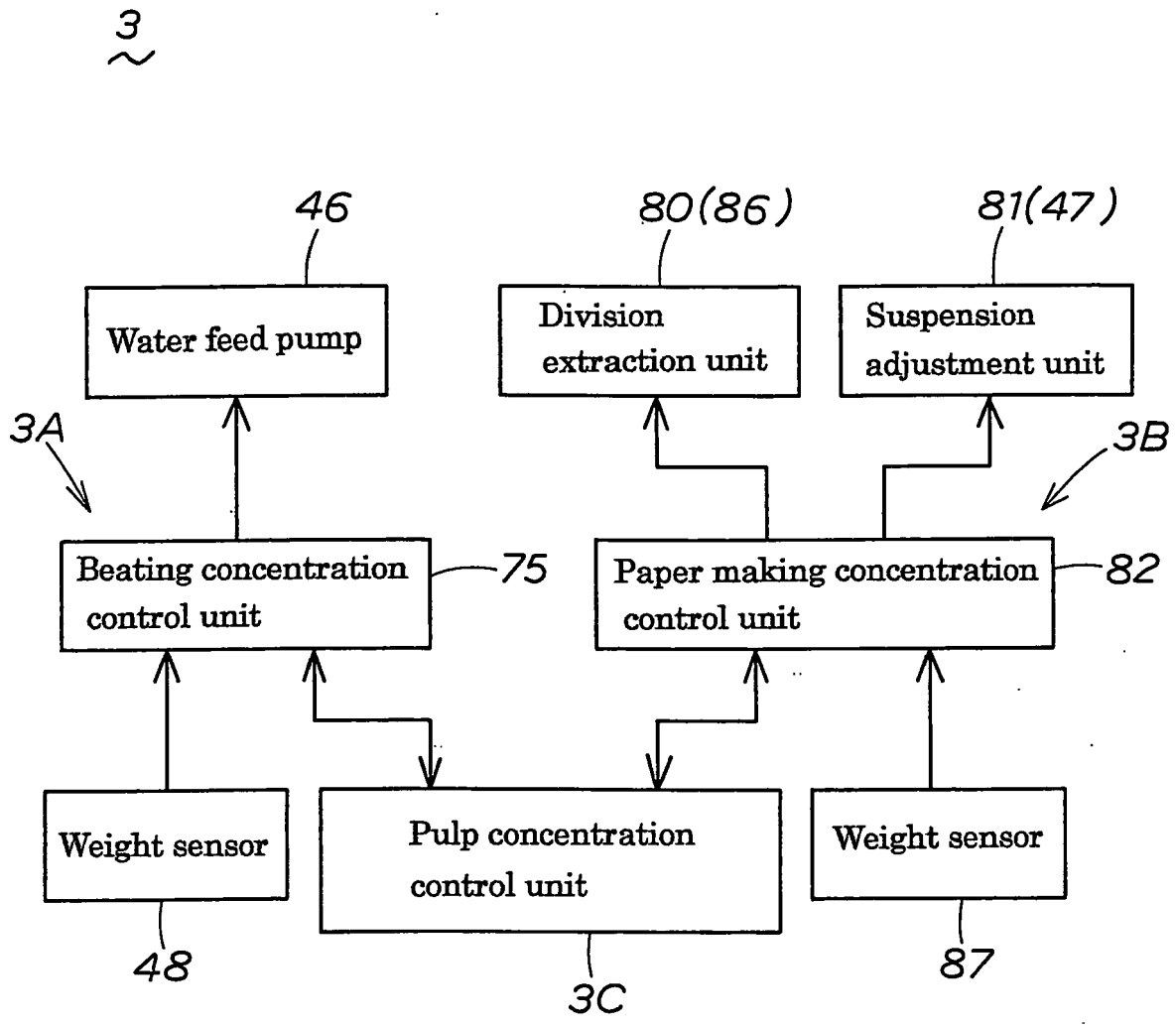
69
49a
P
49

Fig. 4


3
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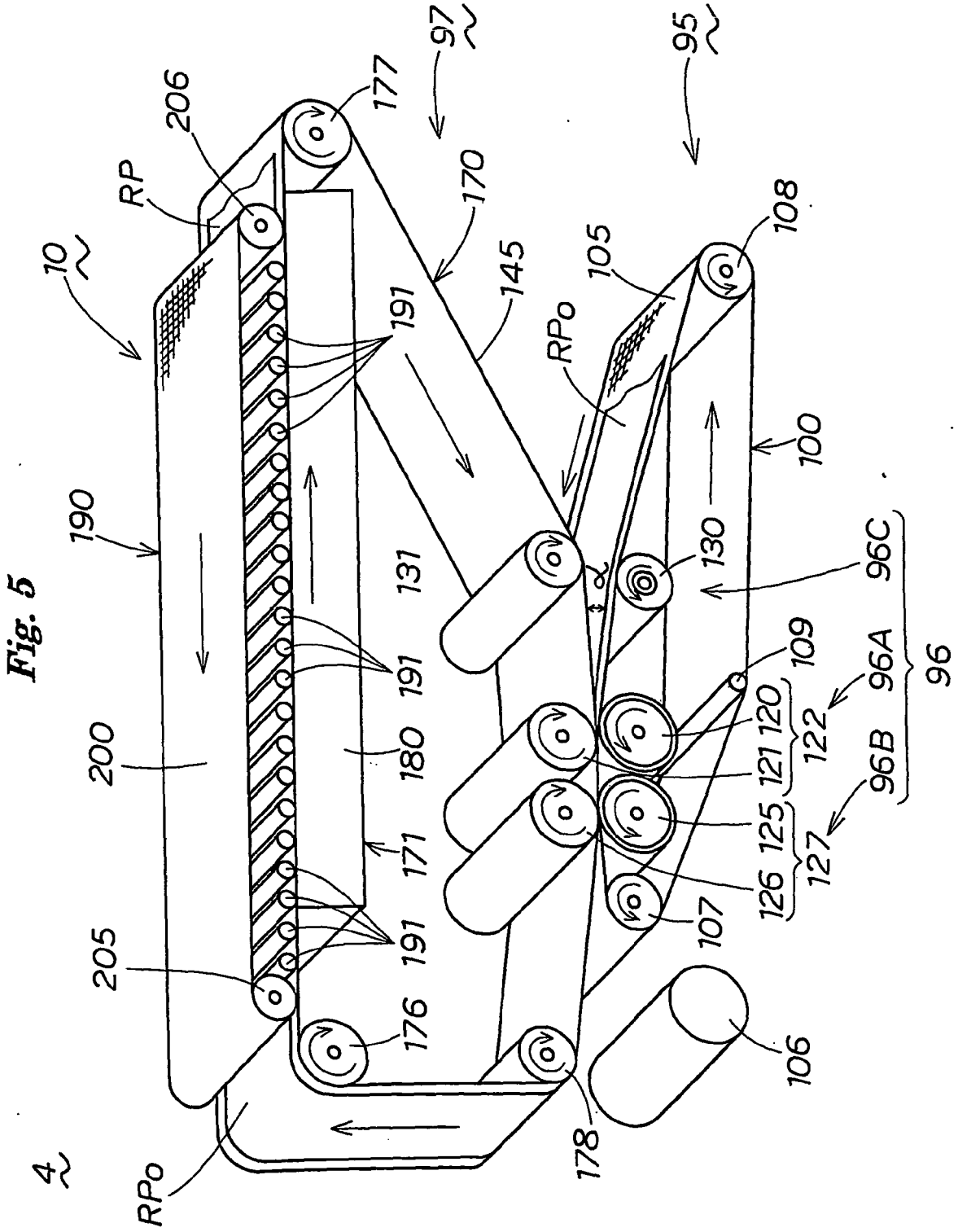
80(86)
81(47)
Water feed pump
Division extraction unit
Suspension adjustment unit
3A
3B
Beating concentration control unit
75
Paper making concentration control unit
82
Weight sensor
Pulp concentration control unit
Weight sensor
48
3C
87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96B
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130
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177
178
180
190
191
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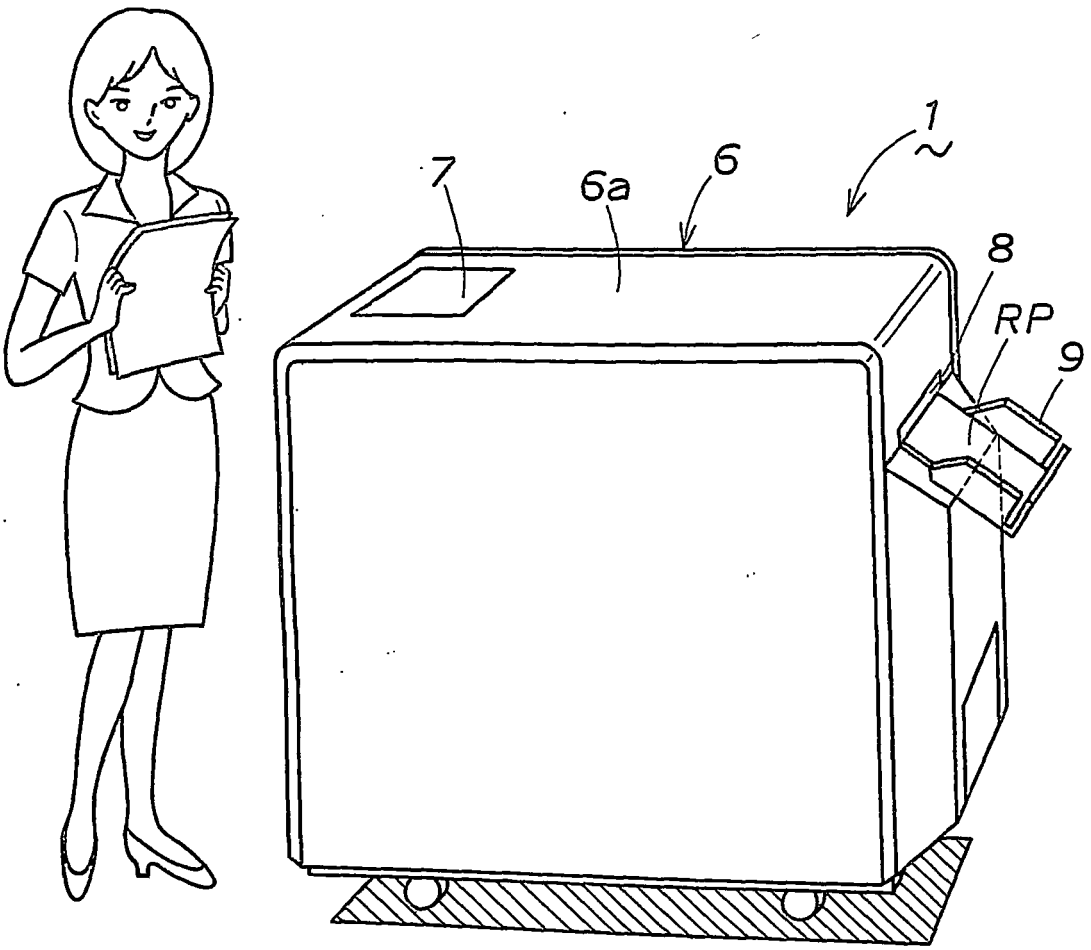
206
RP
RPo
RPo

Fig. 5

Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 10 25 0985

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 014 826 A2 (SEED CO LTD [JP]) 14 January 2009 (2009-01-14) * paragraph [0029] - paragraph [0032] * * paragraph [0126] - paragraph [0131]; figures 1,2 *	1-11	INV. D21F9/00 D21G1/00
A	DE 10 2007 024581 A1 (VOITH PATENT GMBH [DE]) 27 November 2008 (2008-11-27) * the whole document *	1,10,11	
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TECHNICAL FIELDS SEARCHED (IPC)

D21F
D21G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 January 2011	Gast, Dietrich

CATEGORY OF CITED DOCUMENTS

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18-01-2011

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