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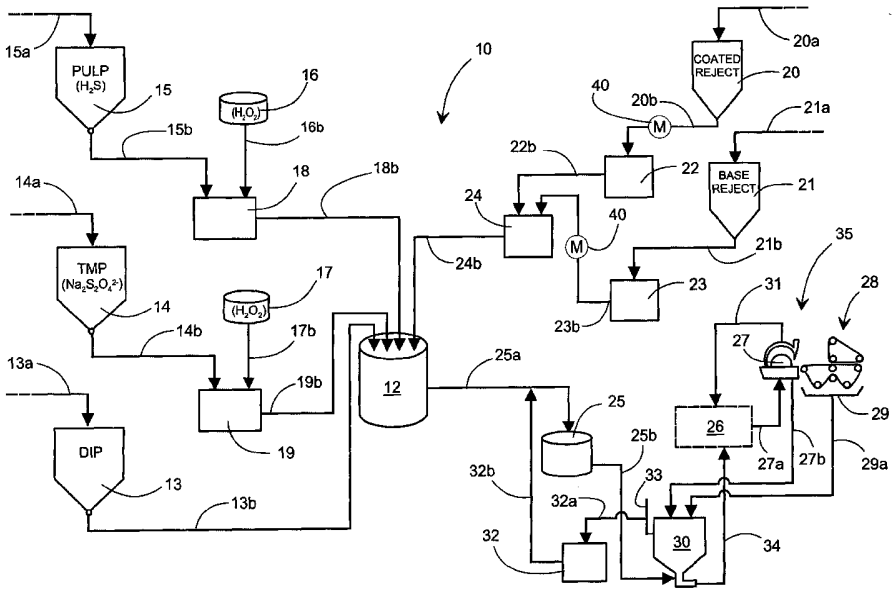
(54) Title: METHOD IN A PAPER OR PULP PROCESS TO CONTROL THE CHEMICAL STATE OF THE PULP AND CIRCULATION WATER SYSTEM



(57) Abstract: The invention relates to a method in a paper or pulp process to control the chemical state of the pulp and circulation water system (10). In the said process one or more raw-material components (PROCESS WATER, TMP, PULP, REJECT) diluted in liquid, possible fillers, and one or more additives are mixed to form stock. In the method, the elctro-chemical state of at least one raw-material component (PROCESS WATER, TMP, PULP, REJECT) and/or the stock is regulated, without the regulation substantially affecting the pH values of the raw-material components (PROCESS WATER, TMP, PULP, REJECT) and/or of the stock.

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METHOD IN A PAPER OR PULP PROCESS TO CONTROL THE CHEMICAL STATE OF THE PULP AND CIRCULATION WATER SYSTEM

The present invention relates to a method in a paper or pulp process to control the chemical state of the pulp and circulation water system, in which said process one or more raw-material components diluted in liquid, possible fillers, and one or more additives are mixed to form stock.

At paper mills, various fibrous raw-material components are stored in storage towers. These are advantageously combined, to create a wet-formable stock, i.e. a watery sludge of fibres and other raw materials for manufacturing paper.

The said raw-material components can be, for example, mechanicals pulps, for instance mechanical pulps from chips and groundwood pulps (SGW, RMP, TMP, etc.) or chemical pulps, such as cellulose. Nowadays, a large amount of deinked waste paper fibre, i.e. so-called DIP pulp (DeInked Pulp) is also used, along with the reject pulp that arises during production, sometimes even in large quantities, and which is also taken as one of the raw-material components in stock preparation, to utilize it as efficiently as possible.

According to the state of the art, the control of the chemical state of the pulp and circulation water system, for example, the control of phase changes, significantly affects the success of the papermaking process. The chemical state can be used to affect such things as the runnability properties of the machine, the paper quality, the dirtying of the machine, the environmental load, and the operation of the waste-water treatment plant of the paper or pulp mill. Disequilibrium in the chemical state can lead to sedimentation, gas formation, and diminished retention in the stock, for example.

According to the state of the art, several variables, such as pH level, salt content, and temperature are regulated in an attempt to control the chemical state. This takes place, for example, by adding chemicals after the raw materials have been mixed.

If the raw-material components must be held in the storage towers for a inconveniently long period, for example during a break in production, changes in their chemical state that are detrimental to the process may take place. Thus, for example, bacterial activity may result in the formation of sulphur compounds, such as hydrogen sulphide, in chemical pulps. Similar problems also appear with DIP and reject pulps.

The changes in the chemical state of the raw-material components cause uncontrollable reactions when the components are mixed in the mixing tank of the paper machine. For example, sedimentations or gases that lead to porosity in the paper web can then arise. Such factors substantially weaken the runnability properties of the paper machine.

According to the state of the art, the pH value, i.e. the acidity level, presently appears to be an important variable, for example, in controlling the chemical state of the raw-material components of the paper process, as changes take place in the charge level and solubility of the wood material when the pH value changes. Good pH-value control is an essential variable in achieving even retention, i.e. the percentage of solids remaining in the web in the wire section compared to that in the headbox feed. Further, the pH value affects not only the retention substances, but also the action of other additives, the control of the phase changes, the runnability and dirtying of the machine, and the quality of the paper.

The pH value is controlled with the aid of lye or sulphuric acid, which can be dosed, for example, into the wire pit,

either automatically or manually. Careful control movements are essential, as sudden changes can cause pH shocks or other disturbances. A sudden change in the pH value will cause the sedimentation of a dissolved or dispersed substance. Control of the pH value is slow, because the regulating chemical must be allowed to enter the fibre and the pH measurement point must be located to provide the measurement result after a specific delay.

On the other hand, controlling the pH value with the said substances introduces additives, such as sodium and sulphur, which are detrimental to the process, and which for their part will cause problems, such as reduced retention, in the wire section.

The pH value is usually well controlled in the pulp and circulation water system of a paper machine. However, attempts to control phase changes in the paper process have generally taken place through sensitive control of the pH value, thus affecting, for instance the general runnability of the machine, due to the varying charge level.

In the paper and pulp process, the state of the art is also represented by the measurement of the charge levels of the liquids, for example, through the definition of the zeta potential. However, as this is a complicated way to carry out definition, it is very difficult and cannot be carried out with complete reliability directly from the production environment.

The present invention is intended to create an new type of method in a paper or pulp process to control the chemical state of the pulp and circulation water system. The paper process can also be held to include board and pulp manufacture. The characteristic features of the method according to the invention are listed in the accompanying Claim 1.

It has been observed that there may be quite natural significant differences in the electrochemical states of the raw-material components, without any particular disturbing factors. Thus sedimentation or gas formation, for instance, can occur in the stock. The pilot-stage research has also shown that differences between the electrochemical states of the raw-material components have a significant effect on their mutual miscibility and the formation of bounds between them. The method according to the invention is characterized by the regulation in the pulp and circulation water system of the electrochemical state of at least one raw-material component and/or the stock. The regulation can be carried out on, for example, a raw-material component, on part of it, or on a mixture of two or more raw-material components, before the stock formation, or, for example, on the stock in the short circulation, or before it is fed from the headbox to the web-formation section.

In the method according to the invention no essential changes are caused in the pH values of the raw-material components and/or of the stock. This has the effect of substantially reducing, among other things, the dosing cycle of additives, caused by the operating manner according to the state of the art.

In the method according to the invention, when a raw-material component and/or stock is in the reduction area, its electrochemical state is regulated, for example, by equalizing it or increasing it in relation to the other pulp components, according to one preferred embodiment by using a suitable oxidizing or reducing compound or substance, while the electrochemical state of a raw-material component in the oxidizing area is regulated by using a suitable reducing or oxidizing compound or substance.

According to a second preferred embodiment, the electrochemical state of a raw-material component or stock can be regulated by connecting it to a selected potential level by means of an external source of alternating or direct current. Thus no additives are required. Further, the regulation by means of chemical can be used in conjunction with regulation using an external power source. In regulation carried out using an external power source, the polarity can also be reversed.

According to a third preferred embodiment, in the method according to the invention the electrochemical state of the process can be regulated through the order of mixing the raw-material components. The order can be optimized to suit different running situations.

The method according to the invention substantially improves the control of the chemical state, the paper quality, and the runnability of the machine in general, besides reducing the environmental load. Further, corrosion in the machine structures and in the pulp and circulation water systems is significantly reduced and the formation of gas diminishes, leading to a substantial improvement in the reliability of consistency measurements, among other things.

Further, the method according to the invention can also be used to advantageously affect the retention of the wire section, the amount of fines, and possible bacteria growths in the liquid. This further reduces the need for chemicals. In addition, the method according to the invention brings further advantages in improved paper strength and formation and in the control of the paper-web edges, which significantly affects the effective production capacity.

The other characteristic features of the method according to the invention will be apparent from the accompanying Claims

while other advantages to be gained are stated in the description section.

In the following, examples of embodiments relating to the method according to the invention are examined with reference to the accompanying drawings, in which

Figure 1 shows a schematic example of one embodiment of the method according to the invention,

Figure 2a shows a schematic example of a second embodiment of the method according to the invention, and

Figure 2b shows a schematic example of a third embodiment of the method according to the invention.

Figure 1 shows a diagram of one preferred embodiment of the method according to the invention, which depicts very roughly on a schematic level the pulp and circulation water system 10 of a paper machine 35.

In the pulp system, the storage towers 15, 14, 13 for the raw-material components (PULP, TMP, DIP) are shown. Raw materials are brought to them along lines 15a, 14a, 13a, for example, from a pulp mill, pulp pretreatment plants, such as disintegration (bale pulper) and grinding, or other similar places (not shown). From the storage towers 15, 14, the PULP and TMP pulps are lead along lines 15b, 14b through possible cleaners, defibrators, or other operational devices (not shown) to their dosing tanks 18, 19. The dispersed DIP pulp 13 can also be lead along a line 13b direct to the mixing tank 12. From the PULP and TMP dosing tanks 18, 19, the pulp is dosed to lines 18b, 19b, through possible beating stages (not shown), to the mixing tank 12.

On the paper machine 35, the headbox 27 and wire section 28 of which are shown in Figure 1, even large amounts of reject pulp can arise at times, the necessary means for collecting and processing which, such as conveyors and machine pulpers (not shown), are arranged in connection with the machine 35. Situations that create reject pulp arise, for example, during web breaks, and particularly when problematically operating production is being start up, when reject pulp is formed at the production speed and over the production width of the machine 35.

Reject also arises during actual production running, as does, on a smaller scale, for example, edge strips cut on the machine 35 and edge parts cut from reels during finishing, which annually represents a considerable amount of highly processed raw material, obtained from large production inputs. Depending on the type of machine and the point at which the reject pulp arises, the reject pulp may be coated or uncoated, i.e. so-called base reject.

Generally, separate processing is arranged for both types of reject, including collection lines 20a, 21a for leading the reject pulp, for example, from machine pulpers (not shown) to the storage towers 20, 21 for coated and uncoated reject. The coated reject is led on from the storage tower 20 along line 20b to the reject tank 22 and on along line 22b to the reject pulp dosing tank 24. The uncoated reject is led along line 21b, for example, through precipitation (not shown) to the reject tank 23, and from there along line 23b to the same dosing tank 24 as the coated reject. From there, the reject pulp is dosed in a suitable ratio over line 24b to the mixing tank 12.

In the mixing tank 12, the raw-material components are mixed together to form a so-called high consistency pulp, which is led along line 25a to the machine tank 25. From the machine tank 25, the high consistency pulp is dosed over the line 25b

to the wire pit 30, in which it dilutes to form stock. The stock is transferred over line 34 to the short circulation 26 of the paper machine 35, which incorporates, for instance, hydro-cyclone cleaning and deaeration devices, as well as filters and pumps (not shown).

In the short circulation 26, the stock is diluted, sorted, and transferred by a head feed pump (not shown) along line 27a to the headbox 27, which is used to spread the stock evenly to the subsequent wire section 28. In the wire section 28, the stock is wet-formed to create a paper web, when most of the water is removed from it.

In the headbox 27, a bypass circulation 31 is arranged, which is used to return excess stock that has been led there to the deaeration (not shown) of the short circulation 26. From the headbox 27 and the subsequent wire section 28, devices 29 are used to collect the so-called tail water, which contains both water and also material not retained in the web (0-water).

The tail water is led by lines 27b, 29a to the wire pit 30, from which it is reused at various points in the pulp systems and the short circulation 26. Besides the tail water, chemically purified water and raw water are generally used in the processes, all of which together are referred to in the following as process water. An overflow 33 is arranged in the wire pit 30, the tail water from which is led by line 32a to the circulation water tank 32. Water is added from this, for example, over line 32b to the connecting line 25a between the mixing tank 12 and the machine tank 25.

The addition of fillers and additives, diluted to suitable proportions (not shown), takes place, for example, in connection with the wire pit 30.

It should be noted that the above description of the pulp and circulation water systems of a paper machine 25 is given by way of a rough example, so that it lacks, for example, inessential operating devices from the point of view of the invention, such as defibrators, pulpers, grinders, precipitators, sorters, and other intermediate storage. In addition, implementations of the systems may also differ from each other, due to the paper grades being manufactured and the machine concepts.

The method according to the invention can be advantageously applied not only to the pulp and circulation water systems 10 shown in the embodiment example, but also, for example, to a board machine and the pulp manufacturing process.

In the method according to the invention, the electrochemical state of at least one raw-material component PROCESS WATER, TMP, PULP, REJECT, DIP, and/or the stock formed from them is controlled by regulation. According to one preferred embodiment, an attempt is made to equalize the electrochemical states of the raw-material components, before mixing them together. Thus, in addition to the aforementioned pulps, the process waters and generally the substances (for example, fillers and additives) mixed into the liquids in the processes described can also be regarded as raw-material components.

The electrochemical state of a raw-material component PROCESS WATER, TMP, PULP, REJECT, DIP can be expressed, for example, as the level of its electrical potential. In the method according to the invention, the regulation of the electrochemical state of a raw-material component PROCESS WATER, TMP, PULP, REJECT, DIP involves according to a first embodiment either raising or lowering the level of its potential, in such a way that the electrochemical states of the raw-material components fed into the mixing tank 12 are essentially more equalized than before their regulation, without substantially altering the pH value of the components, due to a rise or drop in the level of their

electrochemical potential. According to a second preferred embodiment, the difference between the electrochemical states of the raw-material components can also be increased, to eliminate detrimental reactions and to increase advantageous reactions.

If the raw-material component PROCESS WATER, TMP, PULP, REJECT, DIP is in the oxidizing range before it is led to the mixing tank, according to a first embodiment a reducing agent (for example, sulphur dioxide, SO_2) is added to it, to reduce the value of the electrical potential of the raw-material component to the chosen level, or else an oxidizing agent (for example, hydrogen peroxide H_2O_2) is added, to raise the value of the electrical potential to a chosen level that is advantageous to the mixing to be carried out with the other pulp components.

Correspondingly, if the chemical state of the raw-material component is in the reducing range, the substance added to it is an oxidizing agent (for example, H_2O_2), which raises the electrical potential to the chosen level. If it is desired to lower the potential, a reducing agent, for example SO_2, is added. In the method, it is essential for the said reducing or oxidizing agents to be added not to affect the pH value of the raw-material components.

Figure 1 shows an example, in which the bleaching of a mechanical pulp TMP 14, carried out by using reducing dithionite ($Na_2S_2O_4^{2-}$), significantly lowers the potential of the raw-material component, leading to unfavourable reactions in the process. According to a preferred embodiment, hydrogen peroxide (H_2O_2), for example, which has a known reducing effect, can be added from the tank 17. The addition is made through the line 17b to the dosing tank 19, essentially before the mixing tank 12, and thus before the formation of the stock. The addition of the hydrogen peroxide 17 raises the electrochemical state of the TMP pulp in question to a level at which it does not react

when mixed with the other raw-material components PULP, REJECT, thus preventing disturbances that diminish the runnability of the machine 35, for example.

Correspondingly, extremely detrimental hydrogen sulphide (H_2S), which strongly lowers the raw-material components into the reducing zone, can arise in chemical pulp PULP or especially in reject pulp. This can be oxidized by adding, for example, hydrogen peroxide (H_2O_2) from a tank 16 to the dosing tank 18 through a line 16b, essentially before the mixing tank 12. Oxidizing can also be carried out simply by using pure air. The electrochemical state of the pulp component PULP will then rise to a favourable level, thus preventing detrimental reactions when it is mixed with the other components TMP, REJECT, DIP.

It should be noted that the electrochemical states of the raw-material components may differ also very naturally, without any specific factor. The differences in level in the electrochemical states of the raw-material components caused by the aforementioned dithionite and hydrogen sulphide are only individual factors and in no way restrict the scope of protection of the method according to the invention.

Thus, the electrical potentials of the raw-material components PROCESS WATER, TMP, PULP, REJECT, DIP are regulated before they are fed into the mixing tank 12, or the electrochemical state of the stock formed from the raw-material components is regulated to an optimal level, thus preventing detrimental chemical reactions, which cause, for example, sedimentation or air bubbles in the stock. Differences in the electrochemical states of the raw-material components or mixtures formed from them are permitted, in order to find the optimal level, depending, for example, on the running situation/manner, or on the other properties of the raw-material components.

An attempt is made to make any possible chemical sedimentation take place, for example, only in the wire section 28 of the paper machine 35 and to create optimal retention, so that it will not create problems, for example, in the mixing tank 12 or in the headbox 27. Instead of continuous regulation, regulation can also take place, to suit the situation, as a shock effect in pulses, and not continuously. Using a shock effect, violent changes will be created in the electrochemical state, so that a live bacterial strain will not thrive, as it cannot withstand violent changes in its living conditions. Regulation can take place also according to the process equipment, or by selecting an optimal liquid for each process.

Further, the electrochemical state of the stock formed from the raw-material components can be regulated after the formation of the stock, however, essentially before it is fed out of the headbox 27 of the paper machine 35 to the wire section 28.

In the method according to the invention, the minimum requirement for determining the electrochemical state is only a single measurement of the electrical potential, in which the electrical potential of the liquid is measured in relation to a chosen reference electrode. If the potential distribution is uneven, the number of measurement locations can be increased to determine the average potential level. Examples of the said electrode are Fe, Pt, Rst, Cu, Au, Ag. In pilot-stage tests, it has been observed that the raw-material components' potential levels can vary between, for example, - 800 mV, PULP and +350 mV, REJECT.

According to a second preferred embodiment, the correction of an electrochemical disequilibrium can be achieved in place of, or possibly along with the chemical additions described above, by means of an external alternating or direct current source 40.

In order to correct the chemical state with the aid of an external current source 40, one or several electrodes 40 connected to an external power supply are arranged, for example, in the dosing tanks 18, 19, 22, 23, 24, or before or after them. This embodiment is most advantageous, for example, for implementing regulation that takes place in pulses and/or by reversing polarity.

Further, according to a third preferred embodiment, the order of mixing the raw-material components PULP, TMP, DIP, REJECT can be used to equalize or increase their electrochemical states. For example, the two raw-material components with the lowest potential levels are mixed first, and then these are mixed with the component with the next lowest level, and so on.

All of the types of regulation described above can be used singly or in combinations. Further, in regulation it is possible to use, in addition to or besides the above types, gas and/or salts, and/or a magnetic field, and in general all methods of regulation based on electromagnetic radiation. In addition, lasers and ultrasound can be used in regulation.

Figures 2a and 2b show further additional application examples of preferred embodiments of the method according to the invention. In both, the differences between the electrochemical states of the raw-material components, or of the divided parts of individual raw-material components are increased.

In the embodiment example shown in Figure 2a, the electrochemical state of a raw-material component TMP used in the manufacture of newsprint is regulated in such a way as to reduce, or even in certain cases to omit entirely, the most cost-intensive amount of pulp required in the manufacture of the paper grade in question. The regulation of the electrochemical state takes place by leading at least part of the TMP pulp to the manipulation M 40 of the electrochemical state, after which both the

manipulated raw-material component TMP_M and the unmanipulated raw-material component TMP are mixed together. The difference in potential created between the components creates advantageous reactions, thus allowing the amount of pulp to be reduced.

Figure 2b shows a second embodiment example, in which the difference in the electrochemical state of the TMP pulp relative to the REJECT pulp is increased M 40 prior to them being combined. Correspondingly in this case, the increase in the difference between the electrochemical states of the raw-material components TMP, REJECT allows the PULP component to be reduced, and, in the best case, for it to be omitted.

In addition to the measurement of the electrical potential, the electrochemical state of the raw-material components can be measured using other forms of electrochemical measurement, such as the measurement of electrochemical noise, current measurement, measurement of the linear polarization resistance, and frequency measurement. In the measurement of electrochemical noise (EN, Electrochemical Noise), the potential or current noise, i.e. the fluctuation at a low frequency and amplitude, is measured between two identical electrodes. In the measurement of linear polarization resistance (LPR) the speed of the oxidizing reactions taking place on the surface of a sensor is measured. The measurement reacts to such things as changes in the conductivity and temperature of an electrolyte, i.e. diluting liquid, and the concentrations of the oxidizing components.

In the method according to the invention, the chemical state can also be controlled by means of electro-flocculation. In this embodiment, two or more electrodes of different models (for example, plates, rods, spheres), between which the direct/alternating current ratio and/or the polarity is altered, can be arranged in parallel and/or in series. Further,

the regulation parameters are affected by the electrode materials used. The diluted raw-material component of the process water, or the stock is arranged to circulate through electrodes arranged in parallel in a bank of electrodes.

According to a first embodiment exploiting electro-flocculation, the elements in the raw-material components and/or in the stock can be charged electrically, so that the electrochemical conditions of the raw-material component and/or the stock can be regulated to be advantageous to the process.

According to a second electro-flocculation embodiment, disturbing substances can be collected from the raw-material components and/or the stock onto electrodes, to prevent them from disturbing the process.

According to a third electro-flocculation embodiment, the materials of the electrodes can be advantageously selected so that additives, which charge the fibres and/or particles in a raw-material component and/or the stock, thus advantageously affecting the electrochemical state of the process, can be released from them.

The method according to the invention can also be used to advantageously affect the retention in the wire section, because conditions favourable to retention can also be created by regulating the electrochemical state of the stock, thus reducing the need to use retention agents. Further, the formation and strength of the paper improve and the bacterial activity in the process water diminishes. The runnability and level of cleanliness of the machine 35 also improve.

Yet another application of the method according to the invention is the improvement of the properties of the edge parts of the paper web. According to the state of the art, the strength of the edge parts of the paper web is weaker than that of the

web on average. In part, this is due to the fact that the temperature distribution of the drying cylinders (not shown) of the dryer section of the paper machine 35 is uneven, so that the ends of the cylinders are hotter than the central part.

When applying the method according to the invention to the problem, process water, the electrochemical state of which has been regulated according to the method of the invention in an advantageously direction in terms of the desired effect, is added to the edge parts of the headbox 25 of the paper machine 35. This also improves the properties of the edge parts of the paper web, thus increasing the effective width of the web.

It should be understood that the above description and the related figures are only intended to illustrate the method according to the present invention. Thus, the invention is in no way restricted to the embodiments described above or defined in the Claims, instead, many different variations and adaptations of the invention, which are possible within the scope of the inventive idea defined in the accompanying Claims, will be obvious to one versed in the art.

CLAIMS

1. A method in a paper or pulp process to control the chemical state of the pulp and circulation water system (10), in which said process one or more raw-material components (PROCESS WATER, TMP, PULP, REJECT) diluted in liquid, possible fillers, and one or more additives are mixed to form stock, characterized in that the electrochemical state of at least one raw-material component (PROCESS WATER, TMP, PULP, REJECT) and/or the stock is regulated, without the regulation substantially affecting the pH values of the raw-material components (PROCESS WATER, TMP, PULP, REJECT) and/or of the stock.

2. A method according to Claim 1, characterized in that the electrochemical state of the raw-material component (PROCESS WATER, TMP, PULP, REJECT) and/or the stock is regulated by adding a reducing agent, such as sulphur dioxide SO_2, to it.

3. A method according to Claim 1 or 2, characterized in that the electrochemical state of the raw-material component (PROCESS WATER, TMP, PULP, REJECT) and/or the stock is regulated by adding an oxidizing agent (16, 17), such as hydrogen peroxide H_2O_2, to it.

4. A method according to Claims 1 - 3, characterized in that the electrochemical state of the raw-material component (PROCESS WATER, TMP, PULP, REJECT) is regulated with the aid of an external current source.

5. A method according to Claims 1 - 4, characterized in that the electrochemical state of the raw-material component (PROCESS WATER, TMP, PULP, REJECT) is regulated with the aid of an external magnetic field.

6. A method according to Claims 1 - 5, characterized in that the electrochemical state of the raw-material component

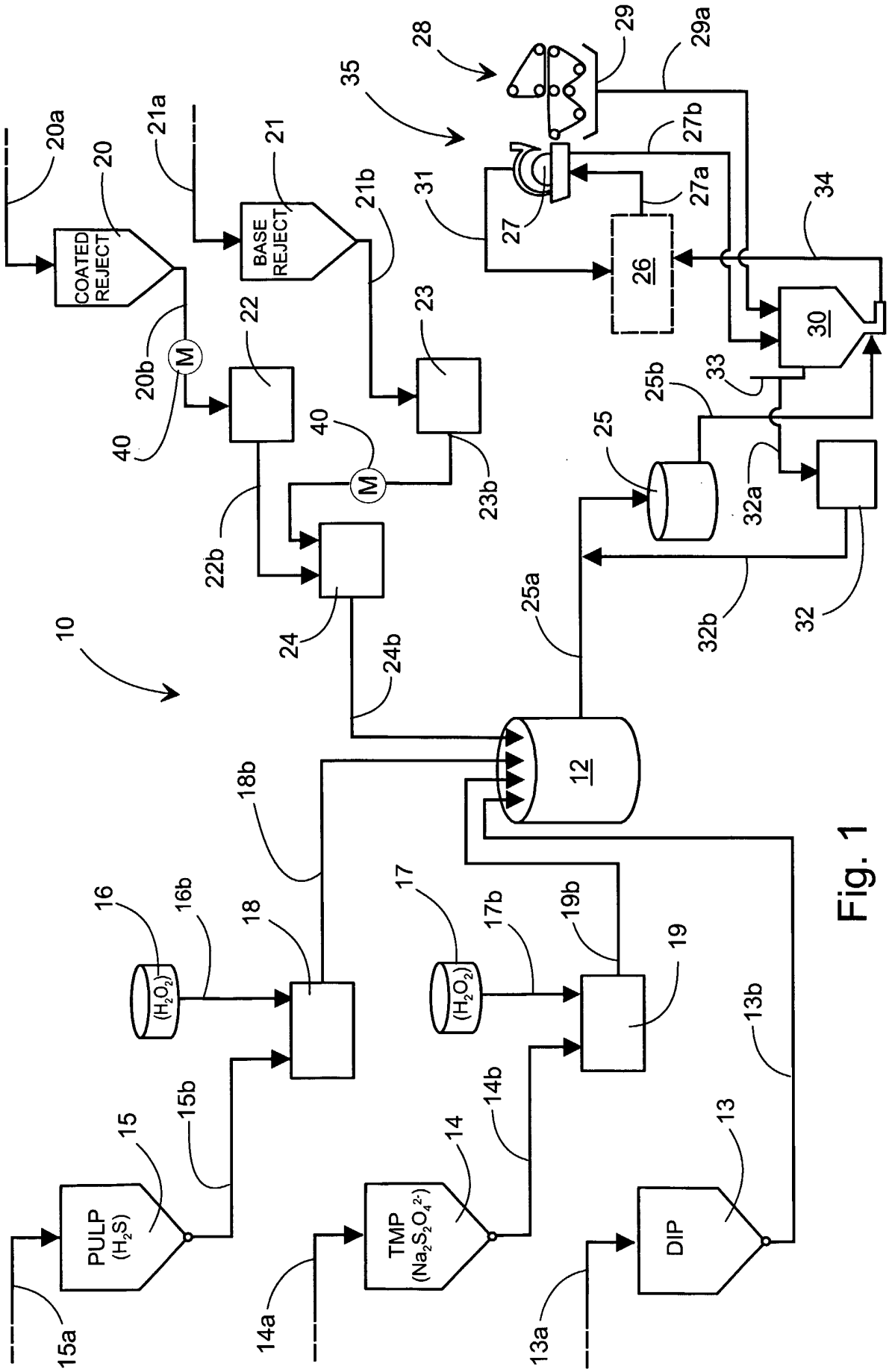
(PROCESS WATER, TMP, PULP, REJECT) is regulated with the aid of a gas.

7. A method according to any of Claims 1 - 6, characterized in that the electrochemical state of the raw-material component (PROCESS WATER, TMP, PULP, REJECT) is determined by measuring the electrochemical state of the dilution liquid in relation to at least one reference electrode.

8. A method according to any of Claims 1 - 7 characterized in that the electrochemical state of the raw-material component (PROCESS WATER, TMP, PULP, REJECT) is regulated before it is fed into the mixing tank (12).

9. A method according to any of Claims 1 - 8, characterized in that the regulation of the electrochemical state is carried out in pulses and/or by changing polarity.

10. A method according to any of Claims 1 - 9, characterized in that at least one raw-material component (PROCESS WATER, TMP, PULP, REJECT) is divided into at least two parts and the electrochemical state of at least one part is regulated before the parts are combined to achieve the desired reactions.


PULP
(H_2S)
TMP
($Na_2S_2O_4^{2-}$)
DIP
COATED REJECT
BASE REJECT
(H_2O_2)
(H_2O_2)
M
M
10
12
15a
14a
13a
15
14
13
15b
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20b

Fig. 1

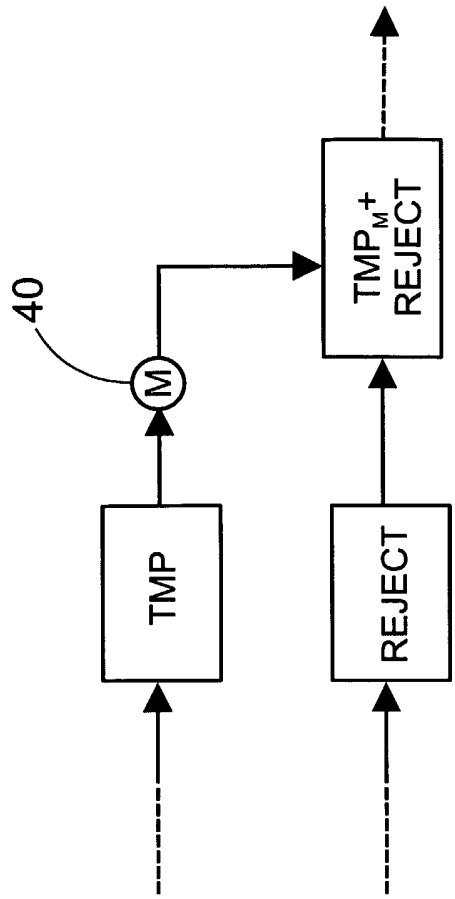

Fig. 2b

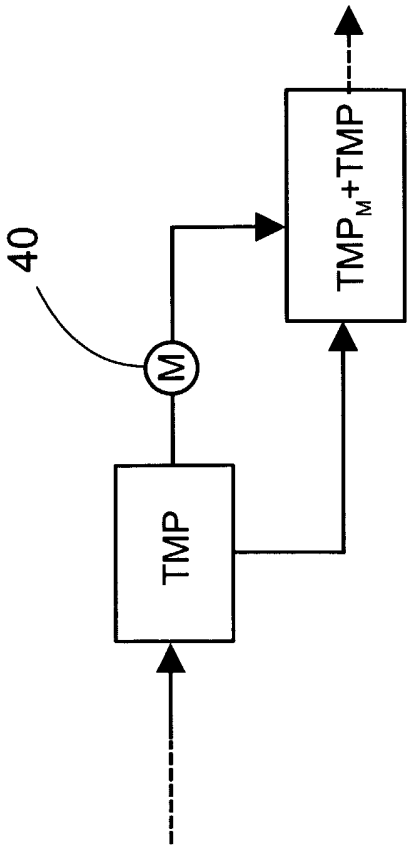

Fig. 2a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 02/00684

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21F 1/66
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21F

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4532007 A (PER-OLLE NOREN), 30 July 1985 (30.07.85), column 1, line 21 - line 49, abstract -- --------	1,3

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 December 2002	05 -12- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Olov Jensén/ELY Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/10/02

International application No.
PCT/FI 02/00684

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4532007 A	30/07/85	AT 22135 T	15/09/86
		AU 560874 B	16/04/87
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		CA 1200353 A	11/02/86
		DE 3273203 D	00/00/00
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		SE 0076788 T3	
		FI 78752 B,C	31/05/89
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		JP 58501546 T	16/09/83
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		SE 442414 B	23/12/85
		SE 8105591 A	23/03/83
		WO 8301080 A	31/03/83