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(54) **METHOD OF CONTROLLING FILTRATE FLOWS AND STORING OF FILTRATES OF A FIBRE
LINE IN A PULP MILL**

VERFAHREN ZUR STEUERUNG VON FILTRATFLÜSSEN UND LAGERUNG VON FILTRATEN
EINER FASERSTRASSE IN EINEM ZELLSTOFFWERK

PROCÉDÉ DE COMMANDE DES ÉCOULEMENTS DE FILTRATS ET DE STOCKAGE DES
FILTRATS D'UNE CHAÎNE DE FIBRES DANS UNE USINE DE PÂTE À PAPIER

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Description

[0001] The present invention relates to a method of controlling filtrate flows and storing of filtrates of a fibre line in a pulp mill. Preferably, the method according to the invention is suitably used in conjunction with a pulp storage tank. As an especially preferred application could be mentioned different kinds of pulp tanks in a sulphate cellulose mill, e.g. a blow tank in a digester plant, where the filtrates are arranged to flow according to the counter-current principle on both sides of the tank.

[0002] At a pulp mill, pulp is treated in several different process stages. After digestion, impurities are removed from the pulp, the pulp is oxygen-delignified and bleached with various chemicals in several steps. Between the various steps, the pulp is typically washed in one or several washing step/-s. The aim here is to keep the amount of clean wash water as small as possible in order to decrease the evaporation need or the amount of waste water. For this reason, the wash waters are typically arranged to flow at least partially according to the counter-current principle. According to the counter-current principle the wash waters are introduced into the last washer at the end of the washing line. The filtrate from this washer is introduced countercurrent to the pulp flow into the next (i.e. the second last) washer to be used as wash water. The filtrate from this washer is again introduced countercurrently into the next washer. By using an arrangement of this kind the pulp can be washed clean with a fairly small amount of wash water and the impurities removed from the pulp are obtained in the form of a relatively highly concentrated solution. This solution can be further concentrated, e.g. through evaporation, and then combusted.

[0003] The above-described counter-current principle is utilised in the washing lines of practically all pulp mills. The amount of wash water moving countercurrently is generally represented by a dilution factor. When the dilution factor is for instance 2.5, the amount of wash water supplied to the washing step is 2.5 cubic metres per pulp ton larger than the amount of water being removed along with the pulp from the washing step. In order to reach a uniform washing result, the aim is to keep the dilution factor as steady as possible on the desired level over the entire area of the washing line. If the dilution factor varies, the cleanliness of the pulp and the concentration of recovered solution vary.

[0004] The level changes in the pulp storage tanks in a washing line arranged according to the counter-current principle make it difficult to keep the dilution factor steady. Traditionally, the aim has been to maintain the consistency of the pulp in the storage tank as uniform as possible, whereby it is typically about 10 %. Then, there are nine tons of filtrate in the tank per one pulp ton. Naturally, when the amount of pulp in the tank changes, the amount of filtrate changes as well. When the amount of pulp in the tank increases, more filtrate is entrained in the pulp in the pulp tank. This filtrate originates, in the travel di-

rection of the pulp, from the filtrate taken from the process stage after the tank, and has thus been introduced into the washer preceding the pulp storage tank to be used as wash liquid. In this case, the dilution factor of the process stage after the tank needs to be increased, or even some of the filtrate introduced into the preceding washer to be used as wash liquid needs to be introduced directly, i.e. bypassing the washing devices after the tank. When the amount of pulp in the tank decreases, less filtrate is entrained in the pulp in the tank, in other words, filtrate is freed from the tank. Consequently, not as much filtrate can be taken anymore from the process after the tank to be used as wash liquid in the washer preceding the tank, and the dilution factor in the process stage after the tank needs to be decreased or excess filtrates need to be taken past the washers in front of the pulp tank. The variation of the dilution factor due to the fluctuation of the level in the pulp tank results in variation in the washing result.

[0005] In the concepts according to prior art the above-mentioned problem is solved by using, beside the pulp storage tank, a storage tank for filtrate, which is nearly as large as the one for pulp. When the pulp level in the storage tank rises, the required filtrate is taken from the filtrate storage tank, in which the filtrate level drops. When the level in the pulp storage tank drops, the discharged filtrate is led into the filtrate storage tank. Thereby, the dilution factor can be maintained on the desired level in the washers on both sides of the storage tank and the variation in the washing result and the other above-mentioned problems are avoided.

[0006] The above-described filtrate storage tank fulfils its function, but is, nevertheless, a very expensive structural element. The volume of the pulp storage tanks is typically several thousands of cubic metres. A filtrate storage tank is typically nearly as large as, or at least almost a half of, the pulp storage tank. Such a tank is obviously very expensive and takes a lot of space. Moreover, the tank requires a pump of its own for pumping the filtrate as well as pipelines and valves for controlling the flows.

[0007] Most of the washers used in pulp mills are provided with a filtrate tank of their own, but the possibility to use the tanks for controlling filtrate flows is very limited. There are two practical circumstances that prevent the use of the filtrate tanks of washers for controlling the flows. Firstly, their volume, which is of the order of about 50 - 200 m³, is only a fraction of that of the pulp storage tanks and filtrate storage tanks, which is of the order of 1000 - 10000 m³. Secondly, said tanks are in most cases a part of the suction leg utilised by the washers, whereby the level in the tanks is hardly allowed to vary at all in order not to change the suction/partial vacuum subjected to the pulp to be washed in the washer by the suction leg. US 4303470 describes pulp treatment systems having pulp storage tanks and tanks which act to store filtrates for further use. WO 2004/072363 describes a system to dilute pulp in the lower part of a high-consistency pulp tower which can be used for storage of pulp.

[0008] In the concept according to the present invention it is possible to solve, in the best case even completely, the above-discussed problem related to the variation of the dilution factor without any expensive tank and the pumping associated therewith.

[0009] In the concept according to the invention the pulp tank acts at the same time also as a filtrate storage tank. When the amount of pulp in the tank changes, the consistency of the pulp in the tank is changed, and not, as traditionally, the volume of the pulp and the level in the tank. When the amount of pulp in the tank decreases, the level in the tank is maintained relatively constant, but the consistency of the pulp pumped into the tank is decreased. Similarly, when the amount of pulp in the tank increases, the consistency of the pulp therein is increased. Thereby, the amount of filtrate existing/stored together with the pulp in the tank hardly changes at all and there is no need to change the dilution factor in the washers around the tank. In the method according to the invention, it is advantageous to calculate the amount of filtrate in the tank and aim at keeping it essentially constant. The above terms 'relatively constant' or 'essentially constant' refer to a situation, in which the range of variation of the amount of filtrate in the pulp storage tank is $\pm 15\%$, preferably $\pm 10\%$.

[0010] In the fibre line of a pulp mill there is typically a pulp storage tank between the digester plant and the washing of brown stock. The next pulp tank is typically between the treatment of brown stock and bleaching. A third large pulp tank is situated between bleaching and a paper machine or a pulp drying machine. According to the counter-current principle, the filtrate circulations continue typically over the pulp tank located after the digester plant. In most cases, the counter-current washing is situated entirely in front of the pulp tank prior to bleaching, but there are also several cases, in which one washing device is located after this pulp tank. In some cases, the filtrates from bleaching are brought to the washing of brown stock, whereby the filtrate circulations naturally continue over the pulp tank prior to bleaching. In the last washer at bleaching, water from the paper machine or pulp drying machine is generally used as wash water. Thus, the filtrate circulations also continue over the tank for bleached pulp. In addition to the storage tanks for bleached pulp, there is typically a tank that acts, as described in the above, as a filtrate or water storage tank. This tank is called, for instance, a white water tank. Accordingly, there is a plurality of pulp tanks in a pulp mill, in conjunction with which the method according to the invention may be applied. When applying the invention, the filtrate storage tanks may be either omitted completely or replaced with smaller tanks than before. In both cases, substantial savings are achieved in terms of space requirement and investment costs in the mill.

[0011] From prior art it is known that the aim is to maintain the consistency of the pulp in the storage tank as uniform as possible so that no consistency fluctuations would be allowed to interfere the dilution carried out at

the bottom of the tank. At the bottom of the tank, the pulp is traditionally diluted in two steps. A part of the filtrate received from the process stage after the tank, or of the dilution liquid arranged to come from elsewhere, is delivered, for instance in proportion to the production, directly to the vicinity of the mixer at the bottom of the tank, whereby the pulp is diluted and the mixer functions better. The rest of the filtrate is delivered between the tank and the pulp pump controlled by consistency control. By means of these two flows the pulp in the tank at the consistency of about 10 % is diluted to desired consistency. Thus, the purpose of the filtrate delivered directly to the bottom of the tank is to dilute the pulp that is being discharged from the tank in the vicinity of the mixer, whereby the retention time of the filtrate in the tank is a few minutes at the most. This dilution cannot be compared to the dilution in the method according to the invention, where the purpose is primarily to store excess filtrate even for several hours in the pulp storage tank and only secondarily, to allow the consistency of the pulp stored in the tank to change, whereby the pulp may also be diluted.

[0012] It is a characteristic feature of the method according to a preferred embodiment of the present invention of controlling filtrate flows and storing of filtrates of a fibre line in a pulp mill that filtrate is stored in a pulp storage tank regardless of the amount of pulp in the pulp storage tank by changing the average consistency of the pulp in the storage tank.

[0013] It is a characteristic feature of the method according to a second preferred embodiment of the present invention of controlling filtrate flows and storing of filtrates of a fibre line in a pulp mill that filtrate is introduced into the pulp storage tank, when the amount of pulp in the pulp storage tank changes, regardless of the amount of pulp in the storage tank.

[0014] It is a characteristic feature of the method according to a third preferred embodiment of the present invention of controlling filtrate flows and storing of filtrates of a fibre line in a pulp mill that the amount of filtrate in the pulp storage tank is maintained essentially constant, when the amount of pulp in the pulp storage tank changes.

[0015] Other characteristic features of the method according to the present invention are disclosed in the appended claims.

[0016] The invention is particularly applicable when the process stage succeeding the pulp tank is carried out at low consistency, whereby the fluctuation of the consistency of the pulp in the tank is not deteriorious, as the pulp will nonetheless be diluted to a desired low consistency level. Such process stages carried out at low consistency are for instance knot separation and screening, a reactor or washer operating at low consistency, such as a traditional drum filter or a wash press.

[0017] In the following, the present invention will be explained in more detail with reference to the appended figures, of which

Figure 1 shows a fibre line of a pulp mill according to prior art, in which the filtrate storage tanks are shown side by side with the pulp storage tanks,

Figure 2 shows an arrangement for a fibre line of a pulp mill according to a preferred embodiment of the invention, in which said filtrate storage tanks are not required, and

Figure 3 shows an arrangement according to another preferred embodiment of the invention, in which the embodiment of Figure 2 is completed with a preferable control method for filtrate flows.

[0018] Figure 1 shows an example of a prior art fibre line of a pulp mill. Pulp is digested and washed in a continuous digester 1, from which the pulp is blown to a first washer, i.e. to a pressure diffuser 2. From the pressure diffuser the pulp flows to a first pulp storage tank, i.e. to a blow tank 3. Adjacent to the pulp storage tank there is a filtrate storage tank 4, by the changes of the level in which the changes of the level in the pulp storage tank are compensated. After the first pulp storage tank 3, impurities are typically removed from the pulp at low consistency and subsequently, the pulp is washed in a next washing device 5. After this step, the pulp is oxygen-delignified in a reactor 6 and washed in a washing device 7. Next, the pulp is led to second pulp storage tank 8, adjacent to which there is second filtrate storage tank 9 to compensate the changes of the level in the storage tank 8. After this, the pulp is washed once again in a washing device 10 prior to a first bleaching reactor 11. The pulp is bleached in three steps in reactors 11, 13 and 15, respectively. After each reactor, the pulp is washed in a washing device 12, 14 and 16, respectively. From the last washer 16 of the fibre line, the pulp is taken to a storage tank 17 for bleached pulp. Especially if more than one pulp grade is produced by the fibre line, this stage may include a plurality of adjacent pulp storage tanks. Next to the pulp storage tank or tanks there is a filtrate or water storage tank 18, by the change of the level in which the changes of the level in the pulp storage tank 17 are compensated. From the bleached pulp storage tank 17 the pulp is taken to a paper machine or a pulp drying machine 19, in which the pulp is dewatered almost completely through infiltration, pressing and evaporation.

[0019] In the following, some typical wash water arrangements according to the counter-current principle in a fibre line are discussed further with reference to Figure 1 of prior art. Fresh water 20 is brought to the paper machine or pulp drying machine, which can, in a way, also be regarded as a pulp washer, which water, after being infiltrated through the fibre web, passes either directly or via the storage tank 18 to the last washer 16 of the fibre line. The second arrangement according to the counter-current principle starts from the washer 10, to which also fresh water or condensate 21 is supplied. The filtrate displaced by this water or condensate 21 is led either directly or via the tank 9 to the washer 7. The filtrate displaced

in the washer 7 is led to the washer 5, from which the displaced filtrate is led either directly or via the tank 4 to the washer 2. The filtrate displaced in the washer 2 is led to the digester 1, in which it displaces black liquor, from which excess water is evaporated before combustion. The aim with Figure 1 is to show, in a simplified manner, the arrangements for those waters and filtrates of a fibre line according to prior art that are most relevant to the method according to the invention. In addition to the shown arrangements, a fibre line includes a plurality of various other arrangements, such as dilutions and filtrate tanks for washers, which are not shown in this context.

[0020] Figure 2 shows a few preferable embodiments of the invention for a fibre line according to Figure 1. Pulp is digested and washed in a continuous digester 1, from which the pulp is blown to a first washer 2, which is nowadays often a pressure diffuser. From the washer 2, the pulp flows to a first storage tank, i.e. to blow tank 3. Adjacent to the pulp storage tank 3 there is no filtrate storage tank, but possible excess filtrates from a washer 5 are returned through a pipe line 22 either directly or entrained with the pulp, or both ways, to the pulp storage tank 3. After the first pulp storage tank 3, impurities are typically removed from the pulp at low consistency and subsequently, the pulp is washed in a next washing device 5. After this step, the pulp is oxygen-delignified in a reactor 6 and washed in a washing device 7. Next, the pulp is led to a second pulp storage tank 8. Adjacent to this pulp storage tank either, there is no filtrate storage tank, but possible excess filtrates from a washer 10 are returned through a pipeline 23 either directly or entrained with the pulp, or both ways, to the tank 8. After this, the pulp is washed once again in the washing device 10 prior to a first bleaching reactor 11. The pulp is bleached in three steps in reactors 11, 13 and 15, respectively. After each reactor, the pulp is washed in a washing device 12, 14 and 16, respectively. From the last washer 16 of the fibre line, the pulp is taken to a bleached pulp storage tank 17. Especially if more than one pulp grade is produced by the fibre line, this stage may include a plurality of adjacent pulp storage tanks. Adjacent to these pulp storage tanks either, there are no filtrate storage tanks, but possible excess filtrates from a paper machine or pulp drying machine 19 are returned through a pipeline 24 either directly or entrained with the pulp, or both ways, to the storage tank 17. From the bleached pulp storage tank the pulp is taken to the paper machine or pulp drying machine 19, in which the pulp is dewatered almost completely through infiltration, pressing and evaporation.

[0021] The wash waters are arranged in the concept according to Figure 2 in a similar way, i.e. according to the counter-current principle, as in the prior art concept according to Figure 1. Fresh water 20 is brought to the paper machine or pulp drying machine, which can, in a way, be also regarded as a pulp washer, which water passes either directly or via the pulp storage tank 17 to the last washer 16 of the fibre line. The second arrangement according to the counter-current principle starts

from the washer 10, to which also fresh water or condensate 21 is supplied. The filtrate displaced by this water or condensate 21 is led directly to the washer 7. In addition to this, filtrate is led to the pulp storage tank 8, if so required. The filtrate displaced in the washer 7 is led to the washer 5, from which the displaced filtrate is led directly to the washer 2. In addition to this, filtrate is led to the pulp storage tank 3, if so required. The filtrate displaced in the washer 2 is led to the digester 1, in which it displaces black liquor, from which excess water is evaporated before combustion. The aim with Figure 2 is to show, in a simplified manner, those arrangements for the waters and filtrates of a fibre line, that are most relevant to the method according to the invention, in three positions of the fibre line. It is to be noted that the present invention is applicable in all shown positions of the fibre line or, if so required, only in some of said positions. In addition to the shown arrangements, a fibre line includes a plurality of various other arrangements, such as dilutions and filtrate tanks for washers, which are not shown in this context.

[0022] As mentioned in the above, in the concept according to the invention the excess filtrate is returned, either entrained with the pulp or directly, to the pulp storage tank. To put it more accurately, the excess filtrate can be returned to the pulp storage tank either as pure filtrate, whereby it is advantageous that it is spread evenly on top of the pulp layer in the tank in order to avoid the development of significant differences in the consistency, or together with the pulp by introducing it into the feeding device for pulp. The excess filtrate can also be mixed with the pulp earlier, for instance by bringing it to the outlet (usually a screw) of the washer or to some other position on the suction side or discharge side of the feed pump for pulp. This returned filtrate dilutes the pulp in the tank, whereby there is more filtrate in the tank in proportion to the amount of pulp therein and the average consistency of the pulp decreases. Thus, it is possible to store a required amount of filtrate in the tank, even if varying amounts of pulp were stored therein. It is preferable to provide the dilution according to the invention so that it is mixed with the pulp flowing into the tank, whereby the pulp flowing in the pulp line is diluted and the pipe resistance due to the flow is decreased, thus diminishing the required pumping efficiency. At the same time it is ensured that the provided dilution is mixed with the pulp evenly. If the filtrate is introduced directly into the tank, it is advantageous to introduce it so that it is mixed with the pulp as evenly as possible. To this end, it would be advantageous to spray the filtrate above the pulp surface by means of nozzles. The filtrate can also be delivered to one point from the side of the tank, but then the filtrate is not mixed with the pulp too evenly, especially if the pulp surface is situated above the delivery point. If the filtrate is not mixed evenly, some pulp at a lower consistency than required by the next process stage may pass to the bottom of the tank. This could interfere the next process stage and is therefore an unwanted phenome-

non. If the consistency of the pulp in the tank changes relatively slowly and remains above the consistency of the next process stage, it is easy to dilute the pulp leaving the tank to a desired consistency level. If the consistency of the pulp in the tank varies, there is no use to deliver filtrate to the bottom of the tank in proportion to the production. It is advisable to deliver filtrate controlled by a consistency controller. As soon as the consistency control requires more filtrate between the pulp tank and the pulp pump, the filtrate flow directly to the bottom of the pulp tank is also increased at the same time. Consequently, the pulp consistency remains on a suitable level in the vicinity of the mixer and the consistency of the pulp flowing to the next process stage remains on the desired level.

[0023] As for the method according to the invention, it is thus essential that the average consistency of the pulp in the pulp storage tank can be affected. Sometimes the pulp flow channels through the pulp tank, whereby the pulp entering the tank flows relatively fast to the bottom of the tank and out therefrom. Then, most of the pulp in the tank remains immobile. This is, from the viewpoint of the method according to the invention, an unwanted phenomenon, since in this case the changes of the consistency of the incoming pulp are hardly allowed to affect the average consistency of the pulp in the storage tank. The channelling in the pulp tank can be prevented for instance by a device that spreads the pulp evenly over the cross-sectional area of the tank. It is advisable to use a device of this kind in conjunction with the method according to the invention, if there is any risk or tendency for channelling in the pulp storage tank.

[0024] Figure 3 shows in more detail a concept that applies the method according to the present invention with related level and flow controls. Pulp 31 is led to a washer 32, in which the pulp is washed by wash water 33. The washed pulp 34 leaving the washer 32 at a consistency of about 10 % is led to a pulp storage tank 37. The filtrate 35 displaced in the washer 32 is led to a filtrate storage tank 36. The pulp 39 leaving the storage tank 37 is diluted with the filtrate from the washer 32 to a low consistency and led to a washer 40. The washer 40 may be, for instance, a wash press or a drum filter, to which the pulp is typically fed at a consistency of 1 - 4 %. The pulp 39 is washed in the washer 40 with wash water 41, the filtrate 43 displaced by which is led to a filtrate storage tank 44. The washed pulp 42 is led to the subsequent process stages. The filtrate collected in the filtrate storage tank 44 of the washer 40 is used as wash water 33 in the washer 32 and for diluting 38 the pulp 39 leaving the storage tank. If excess filtrate is collected in the filtrate storage tank 44 of the washer 40 after these primary purposes of use and the level in the filtrate tank 44 tends to rise, this excess filtrate is led, controlled by a level controller 47, either directly via a valve 45 to the pulp storage tank 37 or via a valve 46 into the pulp 34 entering the storage tank 37, or both ways 45 and 46. The set value in the level controller 47 is relatively high, for instance

about 80 % of the height of the filtrate tank 44, whereby it removes from the filtrate tank 44 of the washer 40 only the excess filtrate that enters it. The filtrate tanks 36, 44 of both washers 32, 40, respectively, are provided with respective level controllers 55, 54 to monitor the level of the filtrate so that it is not allowed to sink too low during the operation. The level controller 55 monitors the bottom level in the filtrate tank 36 and the level controller 54 monitors the bottom level in the filtrate tank 44. The aim is to maintain the dilution factor as steady as possible in the washer 32. A dilution factor controller 48 controls the amount of wash water 33 entering the washer 32 so as to achieve the desired dilution factor. The aim is to maintain the consistency of the pulp 39 introduced into the washer 40 as uniform as possible on a desired low level. A consistency controller 49 controls the filtrate 38 mixed with the pulp 39 so that the desired consistency is achieved. A level controller 50 measures the amount of filtrate in the pulp storage tank and aims at keeping it as uniform as possible by controlling the set value of the dilution factor controller 51 of the washer 40. As soon as the value of the dilution factor 51 rises, more filtrate enters the filtrate tank 44, and therethrough the pulp storage tank 37, and the level 50 tends to rise, and vice versa. If the total amount of filtrate taken by the wash water 33, dilution filtrate 38 and the level controller 55 is higher than the amount 43 of filtrate entering the filtrate tank 44, the level in the filtrate tank 44 tends to drop. In order to prevent excessive drop of the level, the level controller 52, the set value of which is lower than that of the level controller 47 and higher than that of the level controller 54, controls also the set value of the dilution factor controller 51 of the washer 40. The selector 53 for maximum value selects the higher one of the values controlled by the level controllers 50 and 52 to be used as a set value for the dilution factor controller 51. In order to prevent excessive fluctuation of the dilution factor 51, the values controlled by the level controllers 50 and 52 are limited to a suitable range around the normal set value.

[0025] By means of the arrangement and control model according to the invention shown in Figure 3, the dilution factors of the washing line can be maintained relatively steady, even if the amount of pulp in the pulp storage tank would vary a lot. As soon as the amount of pulp in the storage tank 37 decreases, the amount of pulp entering the washer 40 will be higher than the amount of pulp leaving the washer 32. Entrained with the pulp entering the washer 40 there is also a lot of filtrate and the level in the filtrate tank 44 of the washer 40 tends to rise, whereby the level controller 47 leads the excess filtrate back to the tank 37 and thereby the amount of filtrate therein hardly changes at all. As soon as the amount of pulp in the storage tank 37 increases, less pulp will enter the washer 40 than leaves the washer 32. The high amount of pulp leaving the washer 32 entrains a lot of filtrate and the level in the filtrate tank 44 of the washer 40 tends to drop, whereby the level controller 47 decreases the excessive dilution led into the tank 37. Then the

consistency and amount of the pulp in the tank increases, but the amount of filtrate therein hardly changes at all. When the amount of pulp leaving the washer 32 is substantially higher than the amount of pulp entering the washer 40, it may happen that the tank 44 runs out of excess filtrate and the control of the level controller 47 reaches zero. Should the level in the filtrate tank 44 continue to drop in this situation, the level controller 52 will set a higher dilution factor for the washer 40, whereby more filtrate will enter the filtrate tank 44. Not even this is necessarily enough, if the difference between the productions is significant or hardly any pulp is discharged from the storage tank 37, and therefore the level in the filtrate tank 44 will continue to drop. In this situation, the level controller 54 ensures that the filtrate level does not drop too low. It is extremely rare, however, that the production levels differ so much from one another around the pulp tank 37 that the result is this situation. If no new pulp enters the storage tank 37 at all, all the pulp in the tank can be discharged through the washer 40. Then, all the filtrate entering the filtrate tank 44 is returned to the tank 37 and the amount of filtrate therein hardly changes at all. If, for some reason, the amount of filtrate in the storage tank 37 differs from normal, the level controller 50 guides the dilution factor 51 of the washer 40 so that the amount of filtrate eventually settles on the desired level.

[0026] In the concept according to Figure 3, the desired dilution factor is applied in the washer preceding the pulp storage tank and the dilution factor of the washer succeeding the storage tank is fine-adjusted, as required, in order to maintain the total amount of filtrate substantially constant. The adjustment can also be performed the other way around. In this case, an external constant dilution factor is maintained in the washer succeeding the storage tank and the dilution factor in the washer preceding the storage tank is fine-adjusted, as required. This is advantageous for instance in the case of a bleached pulp storage tank, when the "washer" succeeding the tank is a paper machine or a pulp drying machine. Then, such an amount of water is supplied to the paper machine or pulp drying machine that is advantageous and necessary for the operation thereof. The excess water collected in the filtrate tank is stored in the pulp storage tank. If the total amount of water in the pulp storage tank and in the filtrate tank changes, the dilution factor in the last washer at bleaching can be fine-adjusted so that the total amount remains on the desired level. In this case, it is more advantageous to perform the adjustment this way around, since it is substantially easier to change the dilution factor in the washer than e.g. the amounts of water delivered to a paper machine. If there are washers on both sides of the storage tank, it is more or less a matter of taste to decide which way to perform the adjustment.

[0027] As appears from the above, the control model according to the invention works correctly as long as the process on both sides of the storage tank 37 is run on such production levels that are fairly close to one another

and the amount of pulp in the tank does not change rapidly. The control model works properly also in situations, in which the amount of pulp in the storage tank 37 decreases rapidly. In situations, in which the amount of pulp in the storage tank 37 increases rapidly, it is necessary to bypass the washer 40, whereby the efficiency of the operation of the washing line is compromised. In practise, such periods are, however, always fairly short.

[0028] As can be observed from the above, a method of new type for controlling the filtrates of a fibre line of a pulp mill, arranged according to the counter-current principle, has been developed. The method simplifies and intensifies the processes of said industrial sector substantially. Likewise, it is worth noticing that the method according to the invention may also be utilised in several other connections and arrangements than in the above-mentioned ones. For instance in such arrangements, in which the number and positions of the washers differ from the above, if there are other process steps between the washers, and in connections between a batch digester and various washers and tanks, just to mention a few cases. The method according to the invention can be used in conjunction with all pulp tanks of the fibre line or in conjunction with only a few, desired ones. When applying the invention, the filtrate storage tanks can be either omitted completely or replaced with considerably smaller tanks than before.

Claims

1. Method of controlling filtrate flows and storing of filtrates of a fibre line in a pulp mill, **characterised in that** filtrate is stored in a pulp storage tank (3, 8, 17, 37) regardless of the amount of pulp in the pulp storage tank (3, 8, 17, 37) by changing the average consistency of the pulp in the storage tank (3, 8, 17, 37).
2. A method according to claim 1, **characterised in that** filtrate is introduced into the pulp storage tank (3, 8, 17, 37), when the amount of pulp in the pulp storage tank (3, 8, 17, 37) changes.
3. A method according to claim 1, **characterised in that** the amount of filtrate in the pulp storage tank (3, 8, 17, 37) is maintained substantially constant, when the amount of pulp in the pulp storage tank (3, 8, 17, 37) changes.
4. A method according to anyone of the preceding claims, **characterised in that** filtrate is returned to the storage tank (3, 8, 17, 37), when the amount of pulp in the storage tank (3, 8, 17, 37) decreases, so that the average consistency of the pulp in the storage tank (3, 8, 17, 37) decreases.
5. A method according to claim 4, **characterised in that** the amount of filtrate returned from a washer

(5, 10, 19, 40) succeeding the pulp storage tank (3, 8, 17, 37) is increased.

6. A method according to claim 4 or 5, **characterised in that** filtrate is returned to the pulp storage tank (3, 8, 17, 37), to its inlet, to the discharge screw of a washer (2, 7, 16, 32) or to the suction side or discharge side of the feed pump of the pulp storage tank (3, 8, 17, 37).
7. A method according to anyone of the preceding claims 1 - 3, **characterised in that** the increase of the amount of filtrate collected in the storage tank (3, 8, 17, 37) is prevented by increasing the average consistency of the pulp in the storage tank (3, 8, 17, 37), when the amount of pulp increases.
8. A method according to claim 7, **characterised in that** the amount of filtrate returned from the washer (5, 10, 19, 40) succeeding the pulp storage tank (3, 8, 17, 37) is decreased.
9. A method according to anyone of the preceding claims, **characterised in that** the excess liquid collected in the filtrate tank (44) of the pulp washer (40) is led to the pulp storage tank (37) with the help of a level controller (47).
10. A method according to anyone of the preceding claims, **characterised in that** the amount of filtrate collected in the pulp storage tank (37) is measured and maintained substantially constant with the help of a level controller (50).
11. A method according to anyone of the preceding claims, **characterised in that** a special spreader is used when pulp and/or filtrate is introduced into the pulp storage tank (3, 8, 17, 37), by which spreader the pulp and/or filtrate is spread over the cross-sectional area of the entire tank (3, 8, 17, 37) in order to prevent channelling.

Patentansprüche

1. Verfahren zur Regelung der Filtratflüsse und Lagerung der Filtrate einer Faserlinie in einer Zellstofffabrik, **dadurch gekennzeichnet, dass** Filtrat in einem Zellstofflagertank (3, 8, 17, 37) unabhängig von der im Zellstofflagertank (3, 8, 17, 37) vorhandenen Stoffmenge durch Änderung der durchschnittlichen Stoffkonsistenz im Lagertank (3, 8, 17, 37) gelagert wird.
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** Filtrat in den Zellstofflagertank (3, 8, 17, 37) eingeleitet wird, wenn sich die Stoffmenge im Zellstofflagertank (3, 8, 17, 37) ändert.

3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Filtratmenge im Zellstofflagertank (3, 8, 17, 37) im Wesentlichen konstant gehalten wird, wenn sich die Stoffmenge im Zellstofflagertank (3, 8, 17, 37) ändert. 5
4. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** Filtrat in den Lagertank (3, 8, 17, 37) rückgeführt wird, wenn die Stoffmenge im Lagertank (3, 8, 17, 37) sinkt, sodass die durchschnittliche Konsistenz des Zellstoffs im Lagertank (3, 8, 17, 37) sinkt. 10
5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Menge des aus einem auf den Zellstofflagertank (3, 8, 17, 37) folgenden Wäschers (5, 10, 19, 40) rückgeführten Filtrats erhöht wird. 15
6. Verfahren nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** Filtrat in den Zellstofflagertank (3, 8, 17, 37), zu dessen Einlauf, zur Austragsschnecke eines Wäschers (2, 7, 16, 32) oder auf die Saugseite oder die Förderseite der Speisepumpe für den Zellstofflagertank (3, 8, 17, 37) rückgeführt wird. 20
7. Verfahren nach einem der vorhergehenden Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Erhöhung der im Lagertank (3, 8, 17, 37) gesammelten Filtratmenge dadurch verhindert wird, dass die durchschnittliche Zellstoffkonsistenz im Lagertank (3, 8, 17, 37) erhöht wird, wenn die Stoffmenge zunimmt. 25 30
8. Verfahren nach Anspruch 7, **dadurch gekennzeichnet, dass** die Menge des aus dem auf den Zellstofflagertank (3, 8, 17, 37) folgenden Wäschers (5, 10, 19, 40) rückgeführten Filtrats gesenkt wird. 35
9. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die im Filtrat-tank (44) des Zellstoffwäschers (40) gesammelte, überschüssige Flüssigkeit mittels eines Niveaureglers (47) in den Zellstofflagertank (37) geführt wird. 40
10. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Menge des im Zellstofflagertank (37) gesammelten Filtrats gemessen und mittels eines Niveaureglers (50) im Wesentlichen konstant gehalten wird. 45 50
11. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** ein spezieller Verteiler eingesetzt wird, wenn Zellstoff und/oder Filtrat in den Zellstofflagertank (3, 8, 17, 37) eingeleitet werden, wobei der Zellstoff und/oder das Filtrat mit diesem Verteiler über die Querschnittsfläche des gesamten Tanks (3, 8, 17, 37) verteilt wird/werden, um die Bildung von Kanälen zu verhindern. 55

Revendications

1. Procédé pour le contrôle des courants de filtrat et pour le stockage des filtrats d'une ligne de production de fibres dans une usine de pâte à papier, **caractérisé en ce que** du filtrat est stocké dans un réservoir de stockage de pâte (3, 8, 17, 37) indépendamment de la quantité de pâte présente dans le réservoir de stockage (3, 8, 17, 37) en changeant la concentration moyenne de la pâte dans le réservoir de stockage (3, 8, 17, 37).
2. Procédé selon la revendication 1, **caractérisé en ce que** du filtrat est introduit dans le réservoir de stockage de pâte (3, 8, 17, 37) quand la quantité de pâte dans le réservoir de stockage (3, 8, 17, 37) change.
3. Procédé selon la revendication 1, **caractérisé en ce que** la quantité de filtrat dans le réservoir de stockage de pâte (3, 8, 17, 37) est essentiellement maintenue à une valeur constante quand la quantité de pâte dans le réservoir de stockage de pâte (3, 8, 17, 37) change.
4. Procédé selon l'une des revendications précédentes, **caractérisé en ce que** du filtrat est retourné dans le réservoir de stockage (3, 8, 17, 37) quand la quantité de pâte dans le réservoir de stockage (3, 8, 17, 37) diminue, de façon que la concentration moyenne de la pâte dans le réservoir de stockage (3, 8, 17, 37) diminue.
5. Procédé selon la revendication 4, **caractérisé en ce que** la quantité de filtrat retourné d'un laveur (5, 10, 19, 40) qui suit le réservoir de stockage (3, 8, 17, 37) est augmentée.
6. Procédé selon la revendication 4 ou 5, **caractérisé en ce que** du filtrat est retourné dans le réservoir de stockage (3, 8, 17, 37), à son entrée, à la vis de décharge d'un laveur (2, 7, 16, 32) ou au côté d'aspiration ou de refoulement d'une pompe d'alimentation pour le réservoir de stockage de pâte (3, 8, 17, 37).
7. Procédé selon l'une des revendications précédentes 1 à 3, **caractérisé en ce que** l'augmentation de la quantité de filtrat ramassé dans le réservoir de stockage (3, 8, 17, 37) est prévenue en augmentant la concentration moyenne de la pâte dans le réservoir de stockage (3, 8, 17, 37) quand la quantité de pâte augmente.
8. Procédé selon la revendication 7, **caractérisé en ce que** la quantité du filtrat retourné du laveur (5, 10, 19, 40) qui suit le réservoir de stockage de pâte (3, 8, 17, 37) est diminuée.

9. Procédé selon l'une des revendications précédentes, **caractérisé en ce que** le surplus de liquide ramassé dans le réservoir de filtrat (44) du laveur de pâte (40) est mené dans le réservoir de stockage de pâte (37) à l'aide d'un contrôleur de niveau (47). 5
10. Procédé selon l'une des revendications précédentes, **caractérisé en ce que** la quantité du filtrat ramassé dans le réservoir de stockage (37) est mesurée et maintenue essentiellement constante moyennant un contrôleur de niveau (50). 10
11. Procédé selon l'une des revendications précédentes, **caractérisé en ce qu'**un distributeur spécial est utilisé quand de la pâte et/ou du filtrat est/sont introduit(e)(s) dans le réservoir de stockage (3, 8, 17, 37), la pâte et/ou le filtrat étant distribué(e)(s) à travers la superficie de la section transversale du réservoir entier (3, 8, 17, 37) pour prévenir la formation de canaux. 15
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Fig. 1

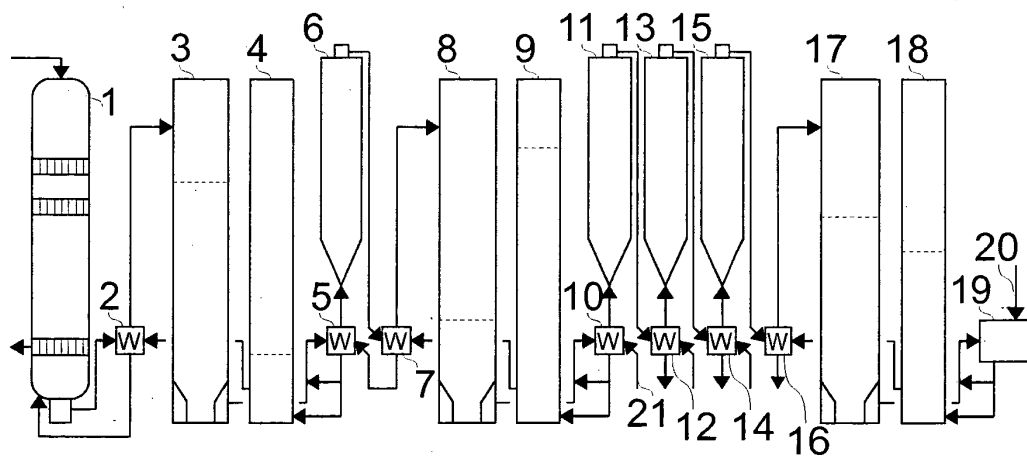


Fig. 2

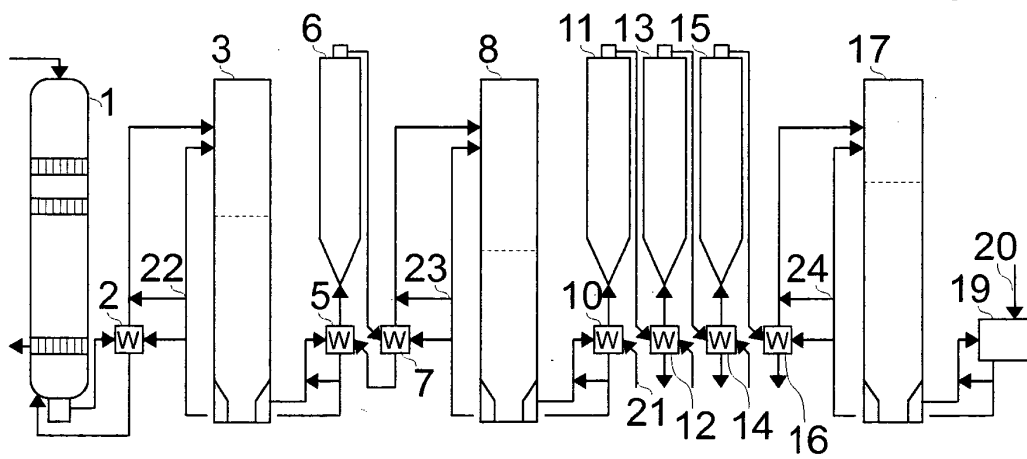
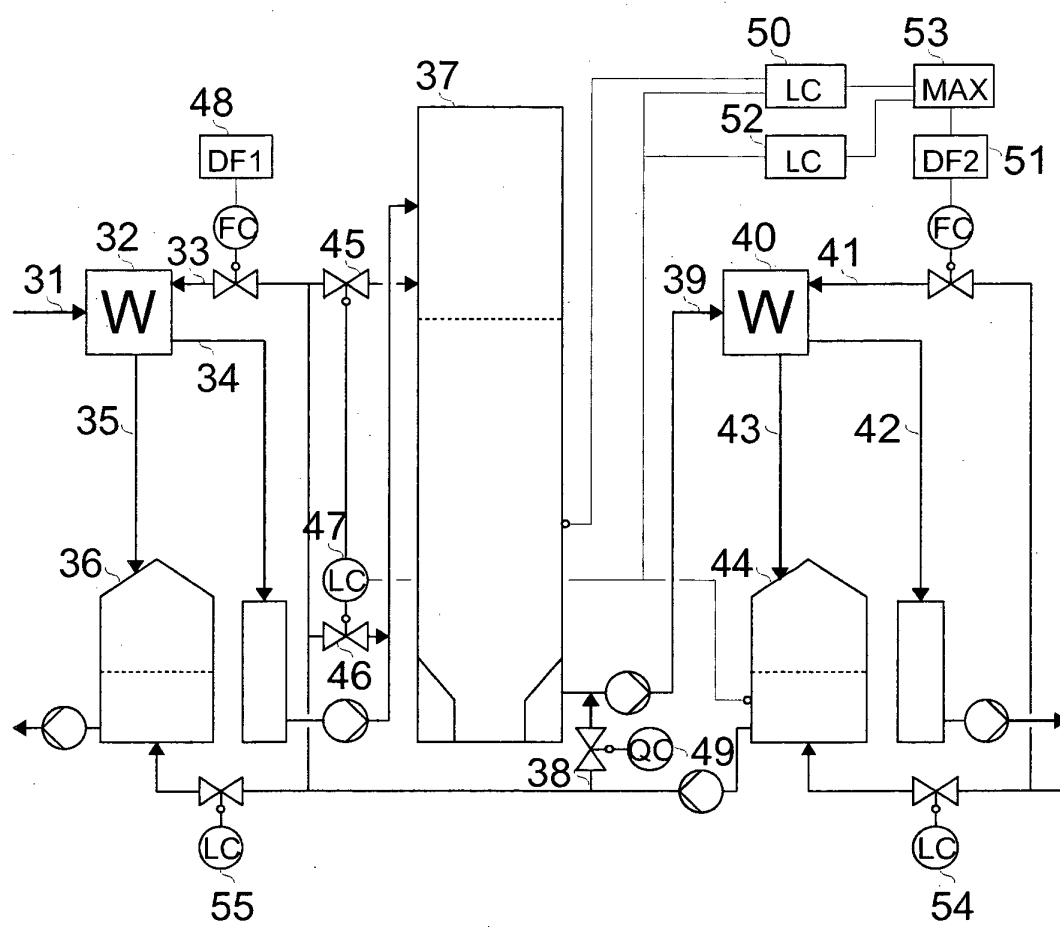


Fig. 3



REFERENCES CITED IN THE DESCRIPTION

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