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(54) **METHOD AND DEVICE FOR THE CONTINUOUS COOKING OF CHEMICAL PULP**

VERFAHREN UND VORRICHTUNG ZUR KONTINUIERLICHEN KOCHUNG VON ZELLSTOFF  
PROCEDE ET DISPOSITIF DE CUISSON CONTINUE DE PATE CHIMIQUE

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## Description

### Technical field

**[0001]** The present invention relates to a novel top separator for wood chips positioned within the top of a digester, a method for producing pulp, preferably sulphate cellulose, with the aid of continuous digester systems using the top separator and an apparatus comprising said top separator.

### Background and summary of the invention

**[0002]** Environmental demands has forced our industry to develop improved cooking and bleaching methods. One recent breakthrough within the field of cooking is ITC™, which was developed in 1992-1993. ITC™ is described in WO-9411566, which shows that very good results concerning the pulp quality may be achieved. ITC™ is mainly based on using almost the same temperature (relatively low compared to prior art) in all cooking zones in combination with moderate alkaline levels. The ITC™-concept does not merely relate to the equalization of temperatures between different cooking zones, but a considerable contribution of the ITC™-concept relates to enabling an equalized alkaline profile also in the lower part of the counter-current cooking zone.

**[0003]** Moreover, it is known that impregnation with the aid of black liquor can improve the strength properties of the fibers in the pulp produced. The aim of the impregnation is, in the first place, to thoroughly soak each chip so that it becomes susceptible, by penetration and diffusion, to the active cooking chemicals which, in the context of sulphate cellulose, principally consist of sodium hydroxide and sodium sulphide.

**[0004]** If, as is customary according to prior art, a large proportion of the white liquor is supplied in connection with the impregnation, there will exist no distinct border between impregnation and cooking. This leads to difficulties in optimizing the conditions in the transition zone between impregnation and cooking.

In US 5.089.086 is shown a method where cooking liquor is added to the fibre material in the digester after the wood chips are transferred to the upper part of the digester and below the top separator.

Now it has been found that surprisingly good results can be achieved when:

1. Keeping a low temperature but a high alkali content in the beginning of a concurrent cooking zone of the digester;
2. Withdrawing a substantial part of a highly alkaline spent liquor that has passed through at least the concurrent cooking zone; and
3. Supplying a substantial portion of the withdrawn spent liquor that has a relatively high amount of rest-alkali, to a point that is adjacent the beginning of an impregnation zone.

**[0005]** This leads to a reduced H-factor demand, reduced consumption of cooking chemicals and better heat-economy. Additionally, the novel method leads to production of pulp that has a high quality and a very good bleachability, which means that bleach chemicals and methods can be chosen with a wider variety than before for reaching desired quality targets (brightness, yield, tear-strength, viscosity, etc.) of the finally bleached pulp. This novel process is defined in more detail in our co-pending application PCT/SE97/00192.

**[0006]** The present invention relates to a preferred top separator, a method and an apparatus for practising the above. In connection with the continuous cooking of cellulose containing fibre material, it comprises impregnation of the fibre material with an impregnation liquid in an impregnation vessel and cooking of the impregnated fiber material in a digester, the impregnation vessel and the digester being connected to each other by a transfer circulation, which, via a feed line, feeds the fibre material from an outlet end of the impregnation vessel to the top of the digester, which feed-line comprises a separator for separation of free liquid from the fibre material and, which via a return line, feeds separated liquid back to the outlet end of the impregnation vessel for use as transfer liquid for the impregnated fibre material. According the inventive top separator, method and apparatus is cooking liquid added to the fibre material in the top separator and after separation of the free liquid, in the top separator, downstream said separation of liquid in said top separator under the influence of an upwards feeding screw in the top separator.

**[0007]** According to conventional technique for withdrawal of liquid from the cooking system, this is normally done directly from the withdrawal strainer of the digester itself. Alternatively in connection with a two vessel system the impregnation vessel, may be supplied with fresh cooking liquor and equipped with a screening device, from which some of the withdrawn liquid is transferred to a recovery plant, possibly after first having passed a flash cyclone. The use of such a screening device involves a considerable cost, due to a special construction of the impregnation vessel being necessary, assembly of conduits and installation of screens, blind plates, nozzles, a possible central line and different instruments in addition to labour for assembling, welding etc. In addition to this there are difficulties in optimizing the withdrawal at this point. Moreover the operating costs of such a screening device is not neglectable. Furthermore the addition of white liquor (fresh cooking liquid) within the impregnation vessel or in the transfer circulation line leads to difficulties in optimizing the process. Firstly when supplying to the impregnation vessel it can be difficult to achieve sufficient mixing of the added white liquor in the impregnation vessel, leading to varying levels of alkaline in different parts. Secondly different kind of wood chips may consume varying amounts of alkaline, making it more difficult to optimize the conditions in the impregnation vessel. It is even claimed that the above might have a bad influence on

cost and the quality of pulp, since if a too high amount of alkaline exists in connection with the mechanical action of the outlet scraper might deteriorate fibre strength.

**[0008]** The object of the present invention is to improve and simplify the cooking department with respect to withdrawal and supply of liquid from the cooking system. This is achieved by the use of a new method in connection with a new separator, also leading to a simplified construction of the impregnation vessel with resulting savings in material and costs and to a better way of optimizing withdrawal and supply of liquid thereby also creating conditions for a better utilisation of the cooking liquid.

**[0009]** The top separator for wood chips according to the invention is characterised by the characterising features of claim 1.

**[0010]** According to a further aspect of the invention, i.e. according to the inventive method making use of said top separator, a first part, less than 100%, preferably less than 95% and more preferred less than 90% of the liquid which is separated from the fibre material in the top separator is recirculated to be used as transfer liquid for the impregnated fibre material and/or to be re-used in connection with the impregnation vessel, either as a transfer liquid or as an impregnation liquid, and that cooking liquid is added after separation of transfer liquid to the chips in the separator via a number of symmetrically positioned inlet apertures in a ring-shaped conduit positioned around the top of the feed screw in order for said cooking liquid to be intimately mixed with the fibre material which is poor in liquid, by influence of the upwards feeding screw in the top separator, before the chips and the cooking liquor are fed out from the screw.

**[0011]** Further the apparatus according to the invention is characterised in that it comprises a connection, which via a branch stretches from the liquid chamber of the separator to a recovery plant for withdrawal via branch of a second part of the liquid which is separated by the separator from the cooking system, and that the top separator has a cylindrical upper part which is located above a cylindrical screen part, which is surrounded by said liquid chamber, whereby the upward feeding screw co-operates with the upper part and the screen part, and that said line for cooking liquor is connected to the separator via an annual ring shaped conduit, which surrounds said upper part and which, via a number of symmetrically positioned inlet apertures in the upper part communicates with the screw room for even addition and intimate mixing-in of cooking liquor into the fibre material by means of influence of the screw before the chips and the cooking liquid are fed out from the screw.

**[0012]** According to a preferred embodiment of the invention, the mixture of fibre material and impregnation liquid is fed through the entire impregnation vessel, without liquid being withdrawn from the cooking via the impregnation vessel, besides which a second part of the liquid which is separated in the separator is transferred to recovery.

**[0013]** It is preferred that the second part of the withdrawn liquid is allowed to flash before the recovery.

**[0014]** The second part of the withdrawn liquid may suitably constitute at most 20 m<sup>3</sup>/ADMT of pulp and at least 0.5 m<sup>3</sup>/ADMT of pulp, preferably at least 2 m<sup>3</sup>/ADMT of pulp and more preferred at least 4 m<sup>3</sup>/ADMT of pulp. It is suitable that liquid is separated from the fibre material in a controlled amount, so that the fibre material contains at least 0.5 m<sup>3</sup> free liquid/ADMT of pulp.

**[0015]** According to the invention, cooking liquid is added to the separator after separation of liquid in order to be intimately mixed with the fibre material which is poor in liquid, by influence of an upwards feeding screw in the top separator.

**[0016]** The said second part of liquid is suitably withdrawn from said return line via a branch line, directly or indirectly, outside the fibre material to the recovery without any essential part thereof being recirculated to the digester.

**[0017]** The invention will in the following be further explained by an example, with reference to the drawings.

Fig. 1 shows schematically a preferred two vessel digester according to the invention.

Fig. 2 shows a preferred embodiment of a separator positioned in the upper part of the digester according to figure 1.

Fig. 3 is a cross-sectional view of a further embodiment of a separator according to the present invention;

Fig. 4 shows a diagram presenting the advantages related to the H-factor when using the invention;

Fig. 5 shows which conditions were used in the laboratory for one of the ITC-references and one of the cooking methods according to the invention (so called modified ITC);

Fig. 6 shows test data related to peroxide consumption and brightness for the present (compact) method compared to a conventional process;

Fig. 7 shows test data related to tensile index and tear index for the present (compact) method compared to a conventional process;

Fig. 8 shows test data related to tensile index and tear index for the present compact method compared to a conventional process;

Fig. 9 shows test data related to Cl charge and brightness for the present (compact) method compared to a conventional process

**[0018]** The invention is described in connection with the production of sulphate pulp with wood chips as raw material, but it is of course applicable for production of other types of pulp and with any type of suitable raw materials consisting of cellulose containing fibre material, e.g. bagasse, saw dust, etc.

**[0019]** The apparatus which is schematically shown in figure 1 comprises a vertical steaming vessel 1, a horizontal steaming vessel 2, a vertical impregnation vessel

3 and a vertical digester 4, which operates according to the steam-liquid phase principle. The horizontal steaming vessel may be excluded if wished. The chips are fed through a line 5 to the vertical steaming vessel 1, to which low pressure steam or alternatively flash steam is added through a line 6 for heating of the chips and decreasing their content of air. Separated air can be removed through a line 7, which is connected to the horizontal steaming vessel 2. This pre-steaming is conducted at atmospheric pressure. The heated chips are measured with a chip meter, which is arranged in a connection 8 between the two steaming vessels 1, 2, which connection 8 also comprises a low pressure feeder 9, which sluices the chips into the horizontal steaming vessel 2, in which the pressure is 1-1.5 bar overpressure. The chips fall from the pressurised steaming vessel 2 into a chute 10, which has a high pressure feeder 11 arranged in its lower part. A certain level of liquid is maintained in the chute 10.

**[0020]** Between the high pressure feeder 11 and the impregnation vessel 3, there is a top circulation, which comprises a feed line 12 for a mixture of chips and impregnation liquid, and a return line 13 for separated impregnation liquid. A downwards feeding top separator 14 is arranged in the top of the impregnation vessel 3 for feeding of the chips into the impregnation vessel at the same time as a part of the impregnation liquid is separated off and is pumped with a pump 15 through the return line 13, back to the high pressure feeder 11. The high pressure feeder 11 is equipped with a rotor with pockets, whereby one pocket always is in low pressure position, to be in open connection with the steaming vessel 2 and one pocket always, at the same time, is in high pressure position, to be in open connection with the impregnation vessel 3 via the feed line 12, which is connected to the top of the impregnation vessel. When a rotor pocket, which is filled with chips, arrives in high pressure position, that is in direct connection with the top circulation, it is flushed clean by the liquid from the return line 13, and the suspension of chips and impregnation liquid is fed into the top of the impregnation vessel 3 via the feed line 12. Liquid, in a circulation loop 17, which is equipped with a pump 16, is at the same time feeding chips from the chute 10 into one of the pockets of the high pressure feeder so that this pocket is filled with chips. The circulation loop 17 is, via a line 18, connected with a level tank 19, which in its turn, via a line 20, is connected to the return line 13 of the top circulation.

**[0021]** Suitable impregnation liquid, which may comprise black liquor and white liquor and optionally other chemicals, is added to the top circulation. Black liquor is added through a line 21 and white liquor through a line 22, which two lines are connected to the return line 13, via the line 20.

**[0022]** The impregnation vessel 3, itself, is, in accordance with the present invention, in the shown embodiment, completely free from an arrangement for withdrawal of liquid from the impregnation phase of the cooking system, at a location between the inlet 23 and the outlet

24 of the impregnation vessel. Consequently, the impregnation vessel 3 presents a longish cylindrical tube, which is completely free from a cost increasing withdrawal screen for withdrawal of liquid from the impregnation phase and removal of this liquid from the cooking system.

**[0023]** Between the impregnation vessel 3 and the digester 4, there is a transfer circulation, which comprises a feed line 25 for the mixture of impregnated chips and liquid and a return line 26 for separated liquid. The feed line 25 is, by one of its ends, connected to an outlet end 27 of the impregnation vessel 3, which outlet end 27 thus comprises said outlet 24, and by its other end, to a top separator 28, which is arranged in the top of the digester 4 for separation of liquid from the chip-liquid mixture that has been fed in.

**[0024]** As is more readily apparent from figure 2, the top separator 28 has a vertically arranged screw 29, which is driven by a motor 30, and a cylindrical body, in which the screw 29 rotates and which has a lower screen part 31 and a thereby following, upper part 32 which is not broken through and presents a free upper edge 33. The screen part 31 is surrounded by a concentric wall 34, which is not broken through, for formation of a liquid chamber 35, there between for collection of liquid, which is pressed out through the screen part 31 under influence of the screw 29.

The screenface 31 is preferably designed in accordance with our design described in PCT/SE94/00315, i.e. by the use of rigid vertically arranged rods, which are welded onto support rings so as to form gaps of about 3-10 mm, preferably about 4-7 mm, there between.

A ring shaped supply conduit 36 is arranged around the screw 29 within the area of the part 32, which is not broken through. Holes 37 are arranged in the supply conduit 36 and the part 32 which is otherwise not broken through for addition of white liquor and possibly other liquid to the chips, which moves upwards in the screw room 38 and from which a large part of the free liquid has been pressed out through the screen part 31, just before. The supply space 36 and the withdrawal space 35 are separated in a sealed manner. In the preferred case the distance between the supply space 36 and the upper edge of the screen 31 is less than the diameter (Ds) of the screw 29. According to the alternative shown in fig. 2 they are positioned directly on top of each other, which is achieved by means of a concentric ring plate 69, e.g. by the use of welding. Also according to the shown embodiment the outer wall 34 of the withdrawal space 35 may be integral with the outer wall of the supply space 36.

The feed line 25 is connected to the bottom of the top separator 28. The return line 26 is connected to the liquid chamber 35. Medium pressure steam may be added via a line 39, to the upper steam room of the digester in the top of the digester 4 in connection with the top separator 28 in order to heat the chips (and free liquid) that are fed in by the screw 29 and which fall down over the free edge 33 of the part 32, which is not broken through.

**[0025]** The digester 4 has, within its middle part, a with-

drawal screen 40 for withdrawal of black liquor via a line 41, that is connected to a first flash cyclone 42, which is in connection with a second flash cyclone 43 via a line 44. Effluent from the second flash cyclone 43 is led via a line 45, completely or partly, to a recovery plant (not shown). The steam which is formed in the flash cyclones 42, 43 can be used in different locations in the cooking process, for example for the steaming in the steaming vessels 1, 2. In the digester there is, in addition to top and middle circulations, a bottom circulation, which comprises a withdrawal screen 46 and a circulation line 49, which is equipped with a pump 47 and a heat exchanger 48, and which comprises a central line 50 that mouths at the withdrawal screen 46. Wash liquid is added to the bottom part of the digester 4 via a line 51. The digested chips are fed out through an outlet in the bottom of the digester 4 and are led away through a line 52 for further treatment.

**[0026]** The top separator 28 is further, with its liquid chamber 35, connected with the other flash cyclone 43 via a connection 53 which, in the embodiment shown, comprises the return line 26 and a branch line 54 to the same. A prechosen amount of liquid from the cooking system is withdrawn through the connection 53, which thus takes place with an existing screen device, that is, the top separator 28 in the digester which thereby achieves yet another function when it takes over the function of the conventional withdrawal screen in the impregnation vessel. In an alternative embodiment, the withdrawn liquid is led directly to recovery, without passing the flash cyclone.

**[0027]** White liquor is added to the top of the digester 4, via a line 55 which passes a heat exchanger 56. This heat exchanger can alternatively be excluded. A line 57 connects the return line 26 with the line 55 for white liquor for addition of withdrawn liquid from the top separator 28, when wished. This line 57 can alternatively be excluded. A line 58 is, further, connected to the line 55 for white liquor, for addition of wash liquid when wished. The heat exchanger 56 may work with low pressure steam, medium pressure steam or flash steam.

**[0028]** Instead of withdrawing liquid from a screen section in the impregnation vessel, necessary withdrawal of liquid is thus conducted on the liquor side of the transfer circulation.

**[0029]** An advantage of the invention is that the transfer circulation does not need to be heated, which means that chips which are fed out from the impregnation vessel 3 can keep a lower temperature than before, for example 130°C as compared to previous 145°C, which in its turn has a beneficial effect on the pulp quality. The lower temperature in the transfer circulation will additionally decrease the risk of the problems which may occur in the top separator at the previously used high temperatures.

**[0030]** By adding the white liquor to the fibre material in connection with the top separator 28 downstream the location for the separation of the liquid, that is downstream the screen part 31, this addition of white liquor

becomes completely separated from the transfer circulation so that the entire amount of white liquor normally can be used in the digester 4. The inlet for the white liquor is preferably situated inside the top separator in a blind zone 32, which surrounds the screw 29 and which is located above the screen part 31 itself. A good mixing of chips and white liquor is thereby secured by means of the influence of the screw 29, before the chips and the white liquor are fed out from the screw and fall down into the steam room of the digester. It is beneficial that the chips contain at least a small amount of free liquid when they leave the screen part 31 and are fed up into the blind zone 32, in order to thereby prevent that white liquor is drawn down into the screen part and is pressed out into the liquid chamber.

**[0031]** The relation between liquid and wood at the inlet of the impregnation vessel can, for example, be 3.5/1, but the invention makes it possible to use larger amounts of liquid, as for example up to 6/1 and above. The pressure in the impregnation vessel can, for example, be 10 bar overpressure and the temperature can, for example, be kept at 115-120°C at the top or lower, for example 90-100°C. Any displacement of liquid by withdrawal of liquid from the cooking system does thus not take place in the impregnation vessel.

**[0032]** White liquor is added to the top of the digester in an amount which is enough to obtain the wished delignification of the chips. The impregnated chips avail the white liquor through diffusion. Steam is added to adjust the cooking temperature to the wished level, for example within 140-170°C.

**[0033]** The liquid which is pressed out from the screw 29 and is collected in the liquid chamber 35 can be distributed in a suitable way with respect to transfer liquid, which is fed to the impregnation vessel via the return line 26, liquid which is complementary to the white liquor which is withdrawn through the line 57, and liquid which is withdrawn from the cooking system via the connection 53, that is, the line 26 and the branch line 54. The relation can, in the order given, be 20-30 m<sup>3</sup>/ADMT of pulp (to the impregnation vessel), 0-4 m<sup>3</sup>/ADMT of pulp (via the line 57) and 0.5-10 m<sup>3</sup>/ADMT of pulp (via the branch line 54), or sometimes even as much as 12-15 m<sup>3</sup>/ADMT. By attaching a line between the withdrawal screen 40 and the top of the impregnation vessel 3 the system shown in Fig. 1 may easily be connected to run according to the novel process, which process is described in more detail in our co-pending application PCT/SE97/00192 and also in connection with figures 4 and 11 herein.

**[0034]** In Figure 3 there is shown a further embodiment of a separator to be used in connection with a steam/vapour phase digester, as described in figure 2. The separator of Fig. 3 is almost identical with the one shown in Fig. 2 except for the existence of a further supply space 25, being positioned below the first supply space 23. This further supply space 25 has as its object to provide for the possibility of supplying a further liquid to the up-moving chip pile. Especially for the possibility of supplying

black liquor in order to secure a minimum amount of free liquid flowing upwardly in the chips pile, to eliminate back flow of the cooking liquor supplied above, in 23.

**[0035]** As in fig. 2 circumjacent the screen basket 61 there is arranged a liquid collecting space 67, which may be connected to the return pipe circulation 15. Above the liquid collecting space 67, also circumjacent the screen basket 61, there is arranged a liquid supply space or opening 23 which is connected to the supply line 24 that supplies white liquor (F). The separator also has a plurality of inlet apertures 37 defined therein to subject the fiber chips with white liquor. The inlet apertures preferably has a total area that exceeds 400 mm<sup>2</sup>. More preferred, the total area of the inlet apertures is at least 500 mm<sup>2</sup>. Most preferred, the total area of the inlet apertures exceeds 600 mm<sup>2</sup> to achieve a sufficient flow into the chip pile. Between the outer peripheral wall 66 of the liquid collecting space 67 and the liquid supply space 23 respectively, and the digester shell 6 at the top, there exist an annular space 70 which opens up down into the upper part of the digester 6. The functioning of the top separator may be described as follows.

**[0036]** The thoroughly heated and impregnated chips are transferred by means of the supply line 21 into the bottom portion of the screen basket 61. Here the screw feeder 62 moves the chips upwardly at the same time as the transport liquid D is separated from the chips, by being withdrawn outwardly through the screen basket 61 and further out of the digester through return line 15. More and more liquid will be withdrawn from the chips during their transport within the screen basket 61. First the chips will reach the level of the first supply space 25 where a desired liquor, for instance black liquor, is supplied. Eventually, the chips will reach the level of the supply space 23. Here the desired amount of cooking liquor, preferably white liquor, is added through the supply space 23 and the openings 37, having a temperature and effective alkaline content in accordance with the invention.

**[0037]** In order to eliminate the risk of back flowing of the supplied liquid from the supply space 23 into the liquid collection space 67, a minor amount of free liquid (at least about 0.5 m<sup>3</sup>/ADT) should be left together with the chips, which free liquid will then be mixed with the supplied cooking liquor. As explained above this may also be achieved by means of supply of free liquid through the intermediate supply space 25. Preferably, about one m<sup>3</sup>/ADT should be left together with the fiber material. Additionally, the white liquor should be provided at a point that is downstream of the flow of the suspension of the fiber material and the free liquid that is being fed through the screw member.

**[0038]** At the top of the screen basket 61, the chips and the cooking liquor may flow over the upper edge thereof and fall into the steam liquid space 70 and further on to the top of the chips pile within the digester, where the concurrent cooking zone (B) starts.

**[0039]** A major advantage of the separation device is that they provide for establishing a distinguished change

of zones (they enable almost a total exchange of free liquid at this point), which means that for a two vessel system the desired conditions in the beginning of the concurrent zone (B) can easily be established.

5 In Fig. 4, there is shown a diagram comparing the H-factor for pulp produced according to a conventional ITC<sup>TM</sup>-cooking process and according to the cooking process of the present invention. The H-factor is a function of time and temperature in relation to the delignification process (degree of delignification) during the cooking process. The H-factor is used to control the delignification process of a digester, i.e., maintaining a certain H-factor principally leads to the same Kappa number of the produced pulp (remaining lignin content of the fiber material) independent of any temperature variations during the cooking process.

**[0040]** In Fig. 5, it is shown that the H-factor for pulp produced according to the present invention is extremely much lower (about 40-50% lower) compared to pulp produced according to ITC. This means that much lower temperatures may be used for the same retention time in order to reach a certain degree of delignification (Kappa number) and/or that smaller vessels for the cooking within a continuous digester can be used and/or that a lower Kappa number may be achieved with the same kind of basic equipment and/or that higher rate of production can be obtained.

**[0041]** The lower H-factor demand is achieved by a high alkali concentration and a low cooking temperature in the concurrent cooking zone, which presents one reference ITC-cook (ITC 1770) and one cook according to the present invention (modified ITC\* 1763). As shown, the temperature in the counter-current cooking zone, according to the present invention, is higher than in the concurrent zone but still lower than the temperature in the counter-current zone in the ITC-reference.

**[0042]** Fig. 6 shows results from TCF bleaching using the novel cooking process (so called "new concept") of the present invention compared to a conventional reference cooking process. The present invention provides a TCF-bleached pulp having extremely good bleachability, i.e. a higher brightness is achieved compared to the conventional process for the same amount of peroxide consumption, and also a higher brightness ceiling is obtained.

**[0043]** Fig. 7 shows the tear index relative to the tensile index. The test data compares results obtained by the novel cooking process ("new concept") of the present invention with a conventional cooking process ("ITC-reference").

**[0044]** Similarly, Fig. 8 compares test data for the novel process with those from a conventional process. As can be seen the present invention exhibits better tensile index compared to the conventional method.

55 **[0045]** Fig. 9 shows the brightness level by using the novel process ("new concept") with reference cooked pulp. The novel cooking process of the present invention exhibits a higher brightness compared to the convention-

al cooking process.

[0046] According to the novel process the black liquor supplied into the impregnation zone A has a high content of rest alkali, (effective alkali EA as NaOH), at least 13g/l, preferably about or above 16g/l and more preferred between 13-30g/l in the top of the impregnation zone A. This alkali mainly comes from the black liquor due to the high amount of alkali in the concurrent zone B of the digester 6h. Furthermore, the strength properties of the fibers are positively affected by the impregnation because of the high amount of sulphide. A major portion of the black liquor may directly (or via one flash tank) be fed into the impregnation zone A. The total supply of black liquor to the impregnation zone A may exceed 80% of the amount drawn off from the draw-off screen girdle section 104h, preferably more than 90% and optimally about 100% of the total flow, which normally is about 8-12 m<sup>3</sup>/ADT.

[0047] The retention time in the impregnation zone A should be at least 20 minutes, preferably at least 30 minutes and more preferred at least 40 minutes. However, a shorter retention time than 20 minutes, such as 15-20 minutes may also be used. The volume of the impregnation zone A may be larger than 1/11, preferably larger than 1/10 of the volume of the digester 6. Additionally, in the preferred embodiment, the volume V of the impregnation zone A should exceed 5 times the value of the square of the maximum digester diameter, i.e.,  $V = 5D^2$ , where D is the maximum diameter of the digester 6. The invention is not limited to what is described above, but can vary with the scope of the appendant claims. For example, the invention may also be performed in connection with an impregnation vessel having the inlet at the bottom and which accordingly has an upward flow of the chips. Furthermore it is understood that instead of an annular distribution ring for supply of cooking liquor, a number of nozzles may be used, or even spray nozzles as described in PCT/SE94/01230.

## Claims

1. A separator (7) for wood chips disposed in the feed line between an impregnation vessel and a digester and positioned within the top of the digester comprising:

a screw feeder (29) having an inlet end (25) and an outlet end (33) for feeding wood chips in an upward direction from the inlet end towards the outlet end of the screw feeder;  
 a rotatable shaft (63) in operative engagement with the screw feeder;  
 a drive unit (30) secured to the rotatable shaft for rotating the rotatable shaft;  
 a cylindrical body with a lower screen basket (31) and an upper part (32) enclosing the screw feeder; and

a liquid collecting space (35) enclosing the cylindrical screen basket (31) for separating a substantial portion of a free liquid, the liquid collecting space being in fluid communication with a return line (26) connected to the outlet end of the impregnation vessel; and  
 a distribution means (36;23) for supplying a cooking liquid to the fiber material, said distribution means (36,23) being positioned downstream of the collecting space (35) in relation to the flow of the chips **characterized in**

- **that** the distribution means is in the form of an annual ring-shaped conduit arranged around the screw (29) within the area of the upper part (32) of the cylindrical body,
- **that** the total area of passage way between the annual ring (36,23) and the inner of the separator exceeds about 400mm<sup>2</sup> in order to provide for sufficient flow capacity,
- said passage way is formed by a number of symmetrically positioned, circular holes (37) in the upper part (32) of the cylindrical body which is otherwise not broken through.

2. A separator according to claim 1 **characterized in** a recovery line (54) in fluid communication with said collecting space (35) to be withdraw a spent liquor from the return line fluid and conduct it to a recovery unit.
3. A separator according to claim 1 or 2 **characterized in that** said supply space (23) is positioned above the withdrawal space (35), whereby the distance between the upper edge of the screen (31;61) and said supply space (36;23) is less than the diameter (Ds) of the feed screw (29;62), preferably adjacently positioned by means of an outer wall (34) being integral for both the withdrawal space (35) and the supply space (36) and more, preferred directly above by means of a partition ring (69).
4. A separator according to any preceding claim **characterized in that** there is a further supply space (25), preferably positioned intermediate said first supply space (23) and the withdrawal space (35), for supply of a different liquid than the liquid supplied through the first supply space.
5. Method in connection with continuous cooking of cellulose containing fibre material, comprising impregnation of the fibre material with impregnation liquid in an impregnation vessel (3) and cooking of the impregnated fibre material in a digester (4), the impregnation vessel (3) and the digester (4) being connected to each other by means of a transfer circulation, which partly, via a feed line (25), feeds the fibre material from an outlet end (27) of the impregnation ves-

- sel (3) to the top of the digester (4) for separation of free liquid from the fibre material in a separator (28) having an upwards feeding screw (29) in the top separator (28), and partly, via a return line (26), feeds separated liquid from the top of the digester (4) to the outlet end (27) of the impregnation vessel (3) for use as transfer liquid for the impregnated fibre material, and wherein liquid, comprising cooking liquid, is added to the fibre material in the top of the digester (4), downstream said separation of liquid in relation to the flow of the chips,  
**characterized in that**, as a first part, less than 100%, preferably less than 95% and more preferred less than 90% of the liquid which is separated from the fibre material in the top separator is recirculated to be used as transfer liquid for the impregnated fibre material and/or to be re-used in connection with the impregnation vessel, either as a transfer liquid or as an impregnation liquid,  
 and that cooking liquid is added after separation of transfer liquid to the chips in the separator (28) via a number of symmetrically positioned inlet apertures in a ring-shaped conduit positioned around the top of the feed screw (29) in order for said cooking liquid to be intimately mixed with the fibre material which is poor in liquid, by influence of the upwards feeding screw (29) in the top separator (28), before the chips and the cooking liquor are fed out from the screw (29).
6. Method according to claim 5,  
**characterized in that** the mixture of fibre material and impregnation liquid is fed through the entire impregnation vessel (3) without liquid being withdrawn from the cooking process via the impregnation vessel.
7. Method according to claim 5 or 6,  
**characterized in that** a second part of the liquid which is separated in the separator (28) is led to recovery.
8. Method according to claim 7, **characterized in that** a third part of the liquid which is separated in the separator (28) is fed to the top of the impregnation vessel.
9. Method according to claim 7, **characterized in that** the second part of the withdrawn liquid is allowed to flash before the recovery.
10. Method according to any of the claims 5-9,  
**characterized in that** the second part of the withdrawn liquid constitutes at most 20 m<sup>3</sup>/ADMT of pulp and at least 0.5 m<sup>3</sup>/ADMT of pulp, preferably at least 2 m<sup>3</sup>/ADMT of pulp and more preferred at least 4 m<sup>3</sup>/ADMT of pulp
11. Method according to any of the claims 5-7,  
**characterized in that** liquid is separated from the fibre material in a controlled amount, so that the fibre material contains at least 0.5 m<sup>3</sup> free liquid/ADMT of pulp.
12. Method according to any of the claims 7-11,  
**characterized in that** the said second part of liquid is withdrawn from said return line (26) via a branch line (54), directly or indirectly, outside the fibre material to the recovery, without any essential part thereof being recirculated to the digester.
13. Apparatus for continuous cooking of cellulose containing fibre material, comprising an impregnation vessel (3) for impregnation of the fibre material with an impregnation liquid, a digester (4) and a transfer circulation, which has a feed line (25) for feeding the fibre material from the outlet end (27) of the impregnation vessel (3) to the top of the digester (4) for separation of free liquid from the fibre material by means of a top separator (28) having an upwards feeding screw (29) in the top separator, which top separator has a liquid chamber (35) for the separated liquid, and a return line (26) for recirculation of a first part of said separated liquid to the impregnation vessel (3), and a line (55) for addition of cooking liquor in connection with the top of the digester (4),  
**characterized in that** the apparatus comprises a connection (53), which via a branch (54) stretches from the liquid chamber (35) of the separator to a recovery plant for withdrawal via branch (54) of a second part of the liquid which is separated by the separator (28) from the cooking system,  
 and that the top separator (28) has a cylindrical upper part (32) which is located above a cylindrical screen part (31), which is surrounded by said liquid chamber (35), whereby the upward feeding screw (29) co-operates with the upper part (32) and the screen part (31), and that said line (55) for cooking liquor is connected to the separator (28) via an annual ring shaped conduit (36), which surrounds said upper part (32) and which, via a number of symmetrically positioned inlet apertures (37) in the upper part (32) communicates with the screw room (38) for even addition and intimate mixing-in of cooking liquor into the fibre material by means of influence of the screw (29) before the chips and the cooking liquid are fed out from the screw.
14. Apparatus according to claim 13,  
**characterized in that** the impregnation vessel is free from any screen device for withdrawal of liquid from the cooking system.
15. Apparatus according to claim 13 or 14,  
**characterized in that** said connection (53) comprises a flash cyclone (43).

16. Apparatus according to any of the claims 13-15, **characterized in that** said connection (53) comprises said return line (26) and a branch line (54) to the same.

### Patentansprüche

1. Separator (7) für Holzschnitzel in der Zufuhrleitung zwischen einem Tränkbehälter und einem Kocher, der im Kopf des Kochers angeordnet ist und folgendes umfaßt:

einen Schneckenförderer (29) mit einem Einlaßende (25) und einem Auslaßende (33) zur Zufuhr von Holzschnitzeln in Aufwärtsrichtung vom Einlaßende zum Auslaßende des Schneckenförderers;

einen drehbaren Schaft (63), der mit dem Schneckenförderer in Wirkeingriff steht;

eine an dem drehbaren Schaft befestigte Antriebseinheit (30) zum Drehen des drehbaren Schafts;

einen zylindrischen Körper mit einem unteren Siebkorb (31) und einem oberen Teil (32), der den Schneckenförderer umgibt; und

einen den zylindrischen Siebkorb (31) umgebenden Flüssigkeitssammelraum (35) zum Abtrennen eines wesentlichen Teils einer freien Flüssigkeit, wobei der Flüssigkeitssammelraum mit einer Rückföhrleitung (26), die mit dem Auslaßende des Tränkbehälters verbunden ist, in Fließverbindung steht; und

ein Verteilermittel (36; 23) zur Zufuhr einer Kochflüssigkeit zum Fasermaterial, wobei das Verteilermittel (36; 23) in bezug auf den Schnitzelstrom stromabwärts des Sammelraums (35) angeordnet ist;

#### **dadurch gekennzeichnet, daß**

- das Verteilermittel in Form einer kreisringförmigen Leitung, die im Bereich des oberen Teils (32) des zylindrischen Körpers um die Schnecke (29) angeordnet ist, vorliegt;

- die Gesamtfläche des Durchgangs zwischen dem Kreisring (36, 23) und dem Inneren des Separators mehr als etwa 400 mm<sup>2</sup> beträgt, damit sich ein ausreichender Strömungsdurchsatz ergibt,

- der Durchgang durch eine Reihe von symmetrisch angeordneten, kreisförmigen Löchern (37) im oberen Teil (32) des ansonsten nicht durchbrochenen zylindrischen Körpers ausgebildet ist.

2. Separator nach Anspruch 1, **gekennzeichnet durch** eine Rückgewinnungslei-

tung (54) in Fließverbindung mit dem Sammelraum (35) zum Abziehen einer Ablauge aus dem Rückföhrleitungsfluid und Zuföhren zu einer Rückgewinnungseinheit.

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3. Separator nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** der Zufuhrraum (23) oberhalb des Abzugsraums (35) angeordnet ist, wobei der Abstand zwischen der Oberkante des Siebs (31; 61) und dem Zufuhrraum (36; 23) kleiner ist als der Durchmesser (Ds) der Förderschnecke (29; 62), vorzugsweise mit Hilfe einer Außenwand (34), die sowohl für den Abzugsraum (35) als auch für den Zufuhrraum (36) integral ist, benachbart angeordnet ist und besonders bevorzugt mit Hilfe eines Trennrings (69) direkt darüber angeordnet ist.

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4. Separator nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** es einen weiteren Zufuhrraum (25), der vorzugsweise zwischen dem ersten Zufuhrraum (23) und dem Abzugsraum (35) angeordnet ist, zur Zufuhr einer Flüssigkeit, die von der durch den ersten Zufuhrraum zugeföhrten Flüssigkeit verschieden ist, gibt.

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5. Verfahren in Verbindung mit dem kontinuierlichen Kochen von cellulosehaltigem Fasermaterial, bei dem man das Fasermaterial in einem Tränkbehälter (3) mit Tränkflüssigkeit tränkt und das getränkte Fasermaterial in einem Kocher (4) kocht, wobei der Tränkbehälter (3) und der Kocher (4) über eine Transferzirkulation miteinander verbunden sind, welche teilweise über eine Zufuhrleitung (25) das Fasermaterial von einem Auslaßende (27) des Tränkbehälters (3) dem Kopf des Kochers (4) zur Abtrennung von freier Flüssigkeit von dem Fasermaterial in einem Separator (28) mit einer aufwärtsföhrnden Schnecke (29) im Kopfseparator (28) zuföhrt und teilweise über eine Rückföhrleitung (26) abgetrennte Flüssigkeit vom Kopf des Kochers (4) dem Auslaßende (27) des Tränkbehälters (3) zur Verwendung als Transferflüssigkeit für das getränkte Fasermaterial zuföhrt, und wobei man in bezug auf den Schnitzelstrom stromabwärts der Flüssigkeitsabtrennung Kochflüssigkeit umfassende Flüssigkeit zu dem Fasermaterial im Kopf des Kochers (4) gibt;

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**dadurch gekennzeichnet, daß** man als ersten Teil weniger als 100%, vorzugsweise weniger als 95% und besonders bevorzugt weniger als 90% der im Kopfseparator von dem Fasermaterial abgetrennten Flüssigkeit zur Verwendung als Transferflüssigkeit für das getränkte Fasermaterial und/oder zur Wiederverwendung in Verbindung mit dem Tränkbehälter entweder als Transferflüssigkeit oder als Tränkflüssigkeit rezirkuliert und nach der Abtrennung von Transferflüssigkeit über eine Reihe von symmetrisch

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- angeordneten Einlaßöffnungen in einer um den Kopf der Förderschnecke (29) angeordneten ringförmigen Leitung Kochflüssigkeit zu den Schnitzeln im Separator (28) gibt, damit die Kochflüssigkeit durch den Einfluß der aufwärtsfördernden Schnecke (29) im Kopfseparator (28) innig mit dem flüssigkeitsarmen Fasermaterial vermischt wird, bevor die Schnitzel und die Kochlauge aus der Schnecke (29) ausgetragen werden.
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6. Verfahren nach Anspruch 5, **dadurch gekennzeichnet, daß** man die Mischung aus Fasermaterial und Tränkflüssigkeit durch den gesamten Tränkbehälter (3) führt, ohne über den Tränkbehälter Flüssigkeit aus dem Kochprozeß abzuziehen.
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7. Verfahren nach Anspruch 5 oder 6, **dadurch gekennzeichnet, daß** man einen zweiten Teil der im Separator (28) abgetrennten Flüssigkeit der Rückgewinnung zuführt.
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8. Verfahren nach Anspruch 7, **dadurch gekennzeichnet, daß** man einen dritten Teil der im Separator (28) abgetrennten Flüssigkeit dem Kopf des Tränkbehälters zuführt.
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9. Verfahren nach Anspruch 7, **dadurch gekennzeichnet, daß** man den zweiten Teil der abgezogenen Flüssigkeit vor der Rückgewinnung flashen läßt.
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10. Verfahren nach einem der Ansprüche 5-9, **dadurch gekennzeichnet, daß** der zweite Teil der abgezogenen Flüssigkeit höchstens 20 m<sup>3</sup>/ADMT Zellstoff und mindestens 0,5 m<sup>3</sup>/ADMT Zellstoff, vorzugsweise mindestens 2 m<sup>3</sup>/ADMT Zellstoff und besonders bevorzugt mindestens 4 m<sup>3</sup>/ADMT Zellstoff ausmacht.
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11. Verfahren nach einem der Ansprüche 5-7, **dadurch gekennzeichnet, daß** man die Flüssigkeit in einer kontrollierten Menge von dem Fasermaterial abtrennt, so daß das Fasermaterial mindestens 0,5 m<sup>3</sup> freie Flüssigkeit/ADMT Zellstoff enthält.
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12. Verfahren nach einem der Ansprüche 7-11, **dadurch gekennzeichnet, daß** man den zweiten Teil der Flüssigkeit aus der Rückführleitung (26) über eine Abzwegleitung (54) direkt oder indirekt außerhalb des Fasermaterials zur Rückgewinnung abzieht, ohne einen wesentlichen Teil davon zum Kocher zu rezirkulieren.
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13. Vorrichtung zum kontinuierlichen Kochen von cellulosehaltigem Fasermaterial, umfassend einen Tränkbehälter (3) zum Tränken des Fasermaterials mit einer Tränkflüssigkeit, einen Kocher (4) und eine Transferzirkulation, die eine Zufuhrleitung (25) zur Zufuhr des Fasermaterials vom Auslaßende (27) des Tränkbehälters (3) zum Kopf des Kochers (4) zur Abtrennung von freier Flüssigkeit von dem Fasermaterial mit Hilfe eines Kopfseparators (28) mit einer aufwärtsfördernden Schnecke (29) im Kopfseparator aufweist, wobei der Kopfseparator eine Flüssigkeitskammer (35) für die abgetrennte Flüssigkeit und eine Rückführleitung (26) zur Rezirkulation eines ersten Teils der abgetrennten Flüssigkeit zum Tränkbehälter (3) aufweist, und eine Leitung (55) zur Zugabe von Kochlauge in Verbindung mit dem Kopf des Kochers (4), **dadurch gekennzeichnet, daß** die Vorrichtung eine sich über eine Abzweigung (54) von der Flüssigkeitskammer (35) des Separators zu einer Rückgewinnungsanlage erstreckende Verbindung (53) zum Abziehen eines zweiten Teils der durch den Separator (28) abgetrennten Flüssigkeit aus dem Kochsystem über die Abzweigung (54) aufweist und der Kopfseparator (28) einen zylindrischen oberen Teil (32) aufweist, der sich oberhalb eines zylindrischen Siebteils (31) befindet, welcher von der Flüssigkeitskammer (35) umgeben ist, wobei die aufwärtsfördernde Schnecke (29) mit dem oberen Teil (32) und dem Schneckenteil (31) zusammenarbeitet, und die Leitung (55) für Kochlauge mit dem Separator (28) über eine kreisringförmige Leitung (36) verbunden ist, welche den oberen Teil (32) umgibt und über eine Reihe von symmetrisch angeordneten Einlaßöffnungen (37) im oberen Teil (32) mit dem Schneckenraum (38) zur gleichmäßigen Zugabe und innigen Einmischung von Kochlauge in das Fasermaterial durch den Einfluß der Schnecke (29) vor dem Ausstragen der Schnitzel und der Kochflüssigkeit aus der Schnecke in Verbindung steht.
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14. Vorrichtung nach Anspruch 13, **dadurch gekennzeichnet, daß** der Tränkbehälter keine Siebvorrichtungen zum Abziehen von Flüssigkeit aus dem Kochsystem aufweist.
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15. Vorrichtung nach Anspruch 13 oder 14, **dadurch gekennzeichnet, daß** die Verbindung (53) einen Flash-Zyklon (43) umfaßt.
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16. Vorrichtung nach einem der Ansprüche 13-15, **dadurch gekennzeichnet, daß** die Verbindung (53) die Rückführleitung (26) und eine Abzwegleitung (54) dazu umfaßt.

## Revendications

1. Séparateur (7) pour copeaux de bois disposé dans la ligne d'alimentation entre une cuve d'imprégnation et un digesteur et positionné dans la partie supérieure du digesteur, comprenant :

un distributeur à vis (29) ayant une extrémité d'entrée (25) et une extrémité de sortie (33) pour alimenter des copeaux de bois dans une direction vers le haut depuis l'extrémité d'entrée vers l'extrémité de sortie du distributeur à vis ;  
 un arbre rotatif (63) en engagement fonctionnel avec le distributeur à vis ;  
 une unité d'entraînement (30) fixée à l'arbre rotatif pour faire tourner l'arbre rotatif ;  
 un corps cylindrique avec un panier à crible inférieur (31) et une partie supérieure (32) renfermant le distributeur à vis ; et  
 un espace de collecte de liquide (35) renfermant le panier à crible cylindrique (31) pour séparer une portion substantielle d'un liquide libre, l'espace de collecte de liquide étant en communication fluidique avec une ligne de retour (26) connectée à l'extrémité de sortie de la cuve d'imprégnation ; et  
 un moyen de distribution (36 ; 23) pour fournir un liquide de cuisson au matériau fibreux, ledit moyen de distribution (36, 23) étant positionné en aval de l'espace de collecte (35) par rapport à l'écoulement des copeaux,

#### caractérisé en ce que

- le moyen de distribution est sous forme d'un conduit annulaire arrangé autour de la vis (29) dans la région de la partie supérieure (32) du corps cylindrique,
- la superficie totale de passage entre l'anneau (36, 23) et l'intérieur du séparateur dépasse environ 400 mm<sup>2</sup> afin de fournir une capacité d'écoulement suffisante,
- ledit passage est formé par un certain nombre de trous circulaires positionnés symétriquement (37) dans la partie supérieure (32) du corps cylindrique qui est par ailleurs ininterrompu.

2. Séparateur selon la revendication 1, **caractérisé par** une ligne de récupération (54) en communication fluidique avec ledit espace de collecte (35) afin de prélever une liqueur usée du fluide de la ligne de retour et de l'amener à une unité de récupération.
3. Séparateur selon la revendication 1 ou 2, **caractérisé en ce que** ledit espace d'alimentation (23) est positionné au-dessus de l'espace de prélèvement (35), de sorte que la distance entre le bord supérieur du crible (31 ; 61) et ledit espace d'alimentation (36 ; 23) soit inférieure au diamètre (Ds) de la vis de distribution (29 ; 62), et est positionné de préférence en position adjacente au moyen d'une paroi extérieure (34) intégrale à la fois à l'espace de prélèvement (35) et à l'espace d'alimentation (36) et plus préférentiellement directement au-dessus par le

biais d'un anneau de séparation (69).

4. Séparateur selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** existe un espace d'alimentation supplémentaire (25), de préférence positionné entre ledit premier espace d'alimentation (23) et l'espace de prélèvement (35), pour l'alimentation d'un liquide différent du liquide fourni par le premier espace d'alimentation.
5. Procédé associé à la cuisson en continu de cellulose contenant une matière fibreuse, comprenant l'imprégnation de la matière fibreuse avec du liquide d'imprégnation dans une cuve d'imprégnation (3) et la cuisson de la matière fibreuse imprégnée dans un digesteur (4), la cuve d'imprégnation (3) et le digesteur (4) étant connectés l'un à l'autre au moyen d'une circulation de transfert, qui alimente en partie, par le biais d'une ligne d'alimentation (25), la matière fibreuse depuis une extrémité de sortie (27) de la cuve d'imprégnation (3) à la partie supérieure du digesteur (4) en vue de la séparation du liquide libre de la matière fibreuse dans un séparateur (28) ayant une vis de distribution vers le haut (29) dans le séparateur supérieur (28), et qui alimente en partie, par le biais d'une ligne de retour (26), le liquide séparé depuis la partie supérieure du digesteur (4) jusqu'à l'extrémité de sortie (27) de la cuve d'imprégnation (3) en vue de son utilisation comme liquide de transfert pour la matière fibreuse imprégnée, et où le liquide, comprenant le liquide de cuisson, est ajouté à la matière fibreuse dans la partie supérieure du digesteur (4), en aval de ladite séparation de liquide par rapport à l'écoulement des copeaux, **caractérisé en ce que**, en tant que première partie, moins de 100%, de préférence moins de 95%, et plus préférentiellement moins de 90% du liquide qui est séparé de la matière fibreuse dans le séparateur supérieur sont recirculés de manière à être utilisés comme liquide de transfert pour la matière fibreuse imprégnée et/ou de manière à être ré-utilisés en liaison avec la cuve d'imprégnation, soit sous forme de liquide de transfert soit sous forme de liquide d'imprégnation, et ce liquide de cuisson est ajouté après la séparation du liquide de transfert aux copeaux dans le séparateur (28) par le biais d'un certain nombre d'ouvertures d'entrée positionnées symétriquement dans un conduit de forme annulaire positionné autour de la partie supérieure de la vis de distribution (29) afin que ledit liquide de cuisson soit mélangé intimement avec la matière fibreuse qui ne contient pas beaucoup de liquide, sous l'action de la vis de distribution vers le haut (29) dans le séparateur supérieur (28), avant que les copeaux et la liqueur de cuisson ne soient évacués de la vis (29).
6. Procédé selon la revendication 5,

- caractérisé en ce que** le mélange de matière fibreuse et de liquide d'imprégnation est alimenté à travers l'ensemble de la cuve d'imprégnation (3) sans que du liquide ne soit extrait du processus de cuisson par le biais de la cuve d'imprégnation. 5
7. Procédé selon la revendication 5 ou 6, **caractérisé en ce qu'**une deuxième partie du liquide qui est séparé dans le séparateur (28) est amenée vers une récupération. 10
8. Procédé selon la revendication 7, **caractérisé en ce qu'**une troisième partie du liquide qui est séparé dans le séparateur (28) est acheminée à la partie supérieure de la cuve d'imprégnation. 15
9. Procédé selon la revendication 7, **caractérisé en ce qu'**on effectue un séchage éclair de la deuxième partie du liquide prélevé avant sa récupération. 20
10. Procédé selon l'une quelconque des revendications 5 à 9, **caractérisé en ce que** la deuxième partie du liquide prélevé constitue au plus 20 m<sup>3</sup>/ADMT de pâte à papier et au moins 0,5 m<sup>3</sup>/ADTM de pâte à papier, plus préférentiellement au moins 4 m<sup>3</sup>/ADMT de pâte à papier. 25
11. Procédé selon l'une quelconque des revendications 5 à 7, **caractérisé en ce que** le liquide est séparé de la matière fibreuse dans une quantité contrôlée, de sorte que la matière fibreuse contient au moins 0,5 m<sup>3</sup> de liquide libre/ADMT de pâte à papier. 30
12. Procédé selon l'une quelconque des revendications 7 à 11, **caractérisé en ce que** ladite deuxième partie du liquide est prélevée de ladite ligne de retour (26) par le biais d'une ligne de branchement (54), directement ou indirectement, en dehors de la matière fibreuse allant à la récupération, sans qu'une partie substantielle n'en soit recirculée vers le digesteur. 35
13. Appareil de cuisson continue de cellulose contenant de la matière fibreuse, comprenant une cuve d'imprégnation (3) pour l'imprégnation de la matière fibreuse avec un liquide d'imprégnation, un digesteur (4) et une circulation de transfert, qui a une ligne d'alimentation (25) pour amener la matière fibreuse de l'extrémité de sortie (27) de la cuve d'imprégnation (3) à la partie supérieure du digesteur (4) en vue de la séparation du liquide libre de la matière fibreuse par le biais d'un séparateur supérieur (28), ayant une vis de distribution vers le haut (29) dans le séparateur supérieur, lequel séparateur supérieur a une chambre de liquide (35) pour le liquide séparé et une ligne 40
- de retour (26) pour la recirculation d'une première partie dudit liquide séparé vers la cuve d'imprégnation (3), et une ligne (55) pour ajouter de la liqueur de cuisson en association avec la partie supérieure du digesteur (4), **caractérisé en ce que** l'appareil comprend une connexion (53) qui, par le biais d'un branchement (54), s'étend de la chambre de liquide (35) du séparateur vers une installation de récupération en vue du prélèvement par le biais du branchement (54) d'une deuxième partie du liquide qui est séparé par le séparateur (28) du système de cuisson, 45
- et **en ce que** le séparateur supérieur (28) a une partie supérieure cylindrique (32) qui est située au-dessus d'une partie de crible cylindrique (31) qui est entourée par ladite chambre de liquide (35), de sorte que la vis de distribution vers le haut (29) coopère avec la partie supérieure (32) et la partie de crible (31), et **en ce que** ladite ligne (55) pour la liqueur de cuisson soit connectée au séparateur (28) par le biais d'un conduit de forme annulaire (36), qui entoure ladite partie supérieure (32) et qui, par le biais d'un certain nombre d'ouvertures d'entrée positionnées symétriquement (37) dans la partie supérieure (32), communique avec la chambre de la vis (38) en vue de l'addition uniforme et du mélange intime de la liqueur de cuisson dans la matière fibreuse sous l'action de la vis (29) avant que les copeaux et le liquide de cuisson ne soient évacués hors de la vis. 50
14. Appareil selon la revendication 13, **caractérisé en ce que** la cuve d'imprégnation est exempte de tout dispositif de crible pour le prélèvement de liquide du système de cuisson. 55
15. Appareil selon la revendication 13 ou 14, **caractérisé en ce que** ladite connexion (53) comprend un cyclone éclair (43).
16. Appareil selon l'une quelconque des revendications 13 à 15, **caractérisé en ce que** ladite connexion (53) comprend ladite ligne de retour (26) et une ligne de branchement (54) vers celle-ci.

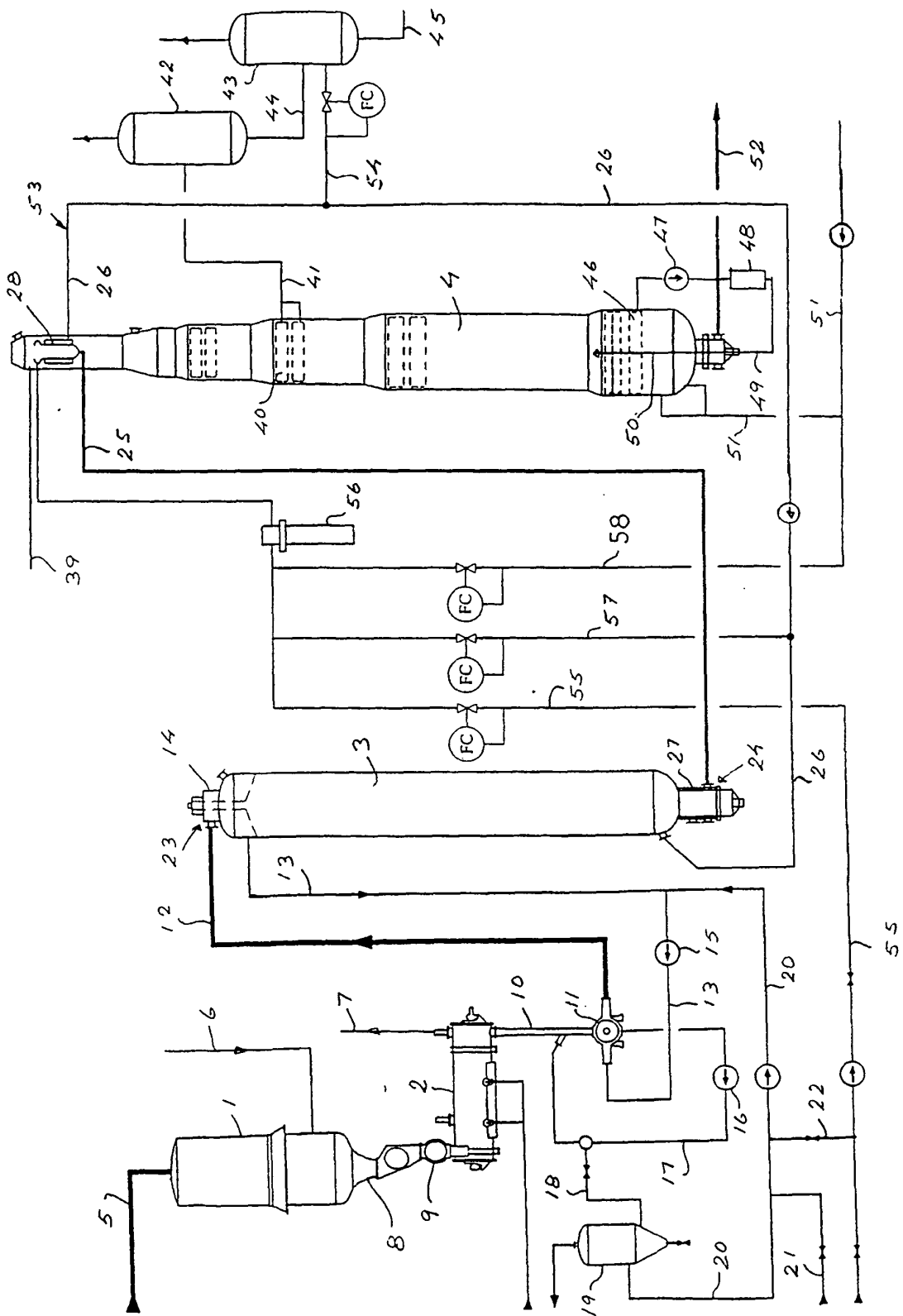


Fig. 1

Fig. 2

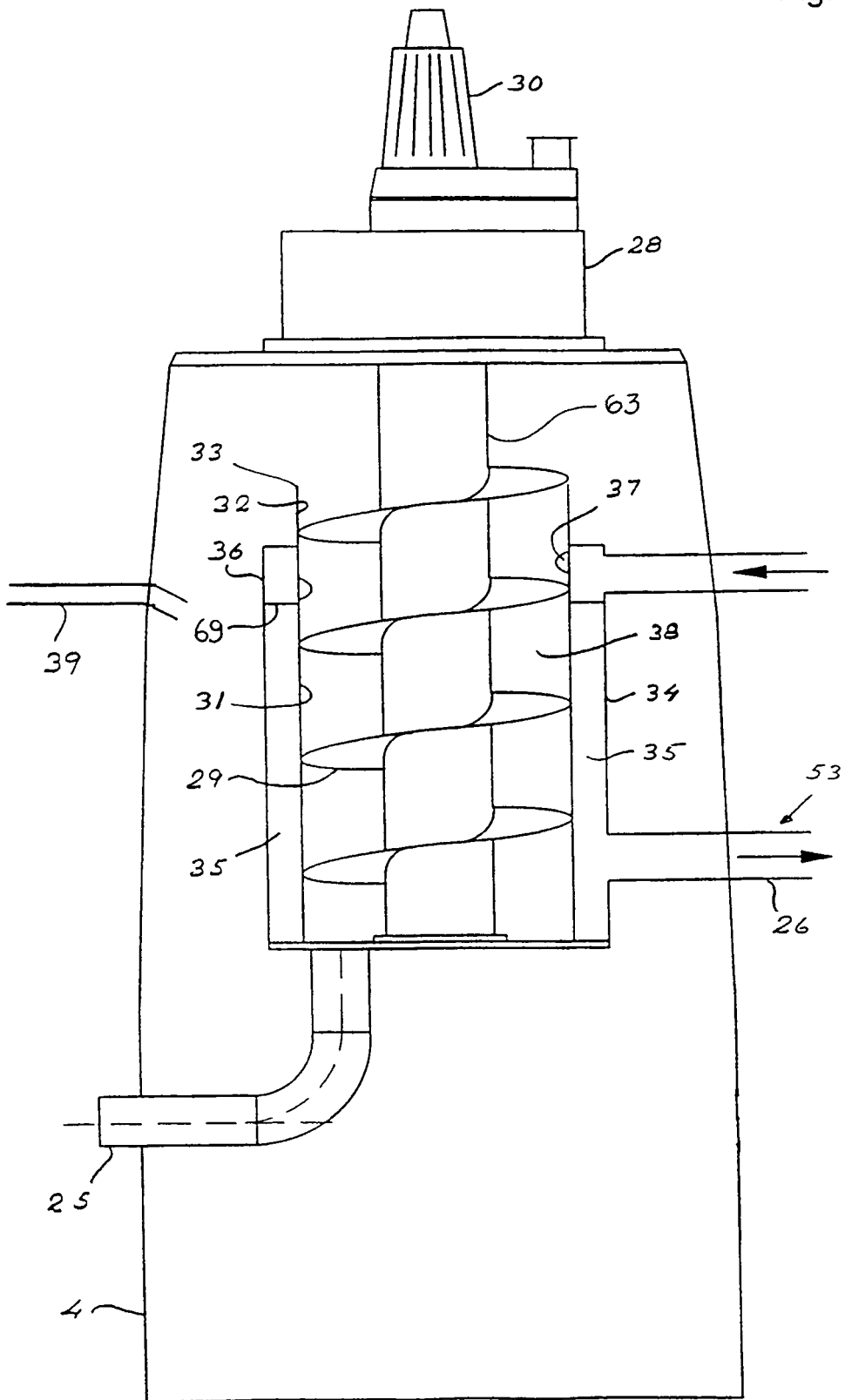
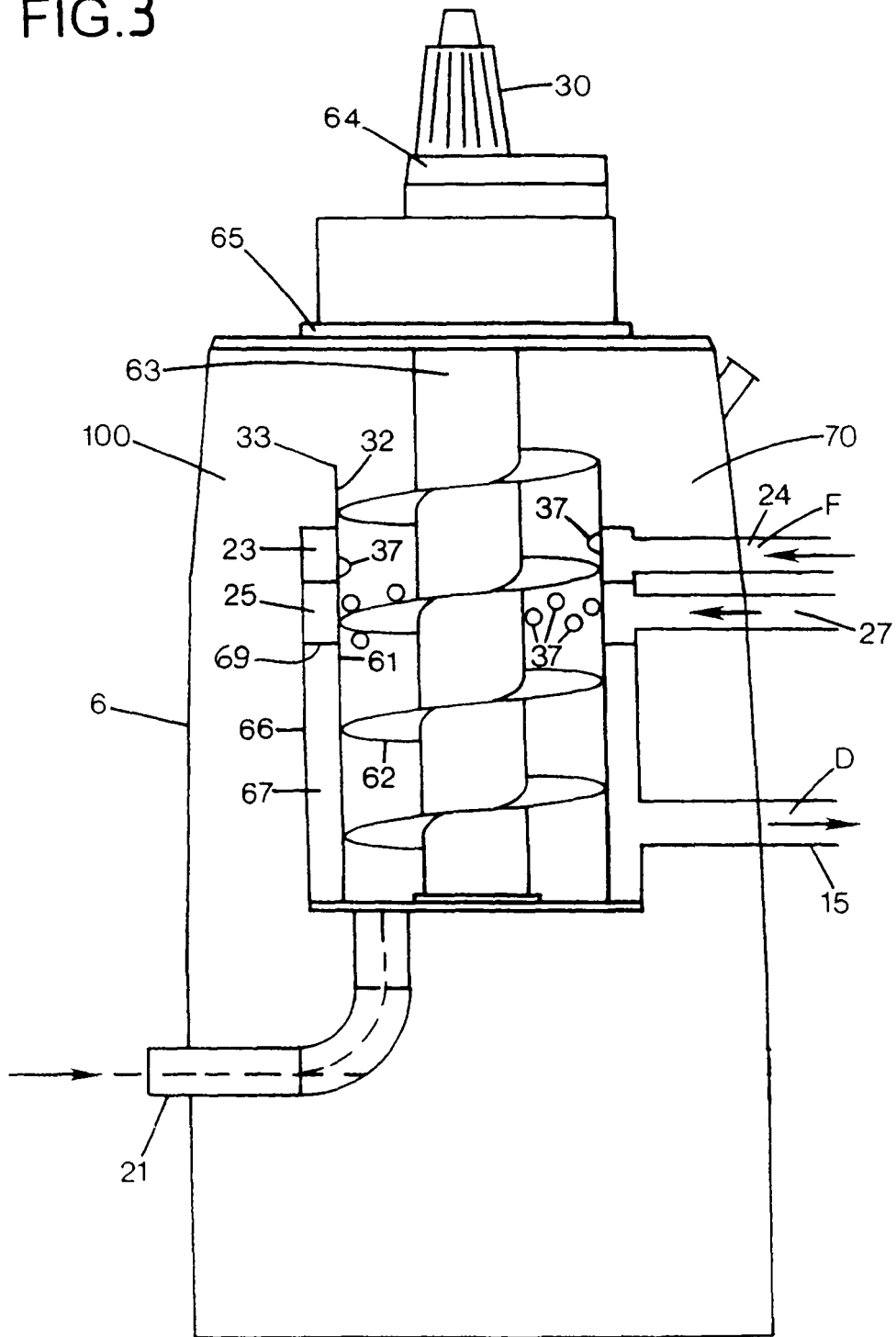


FIG.3



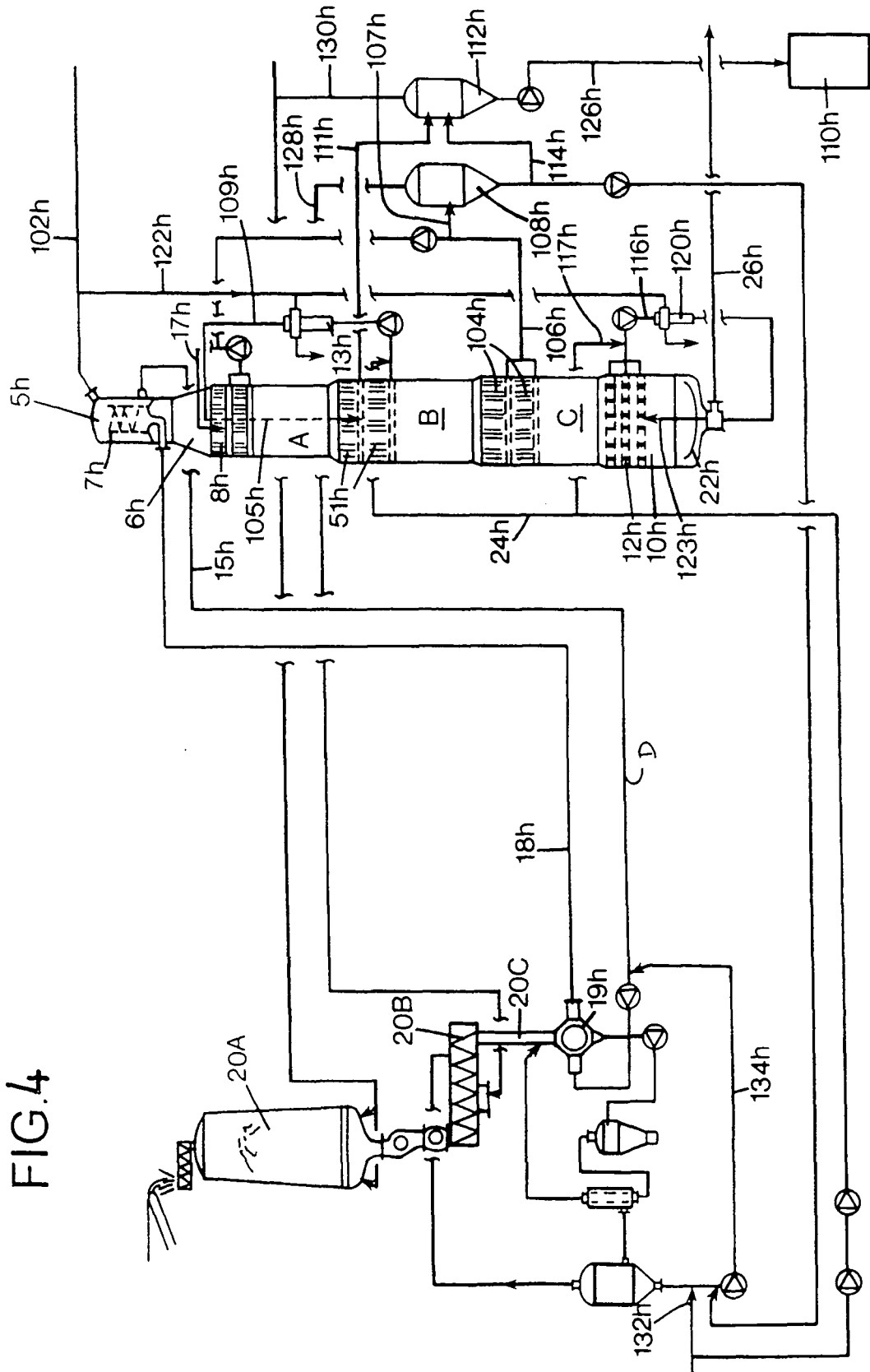
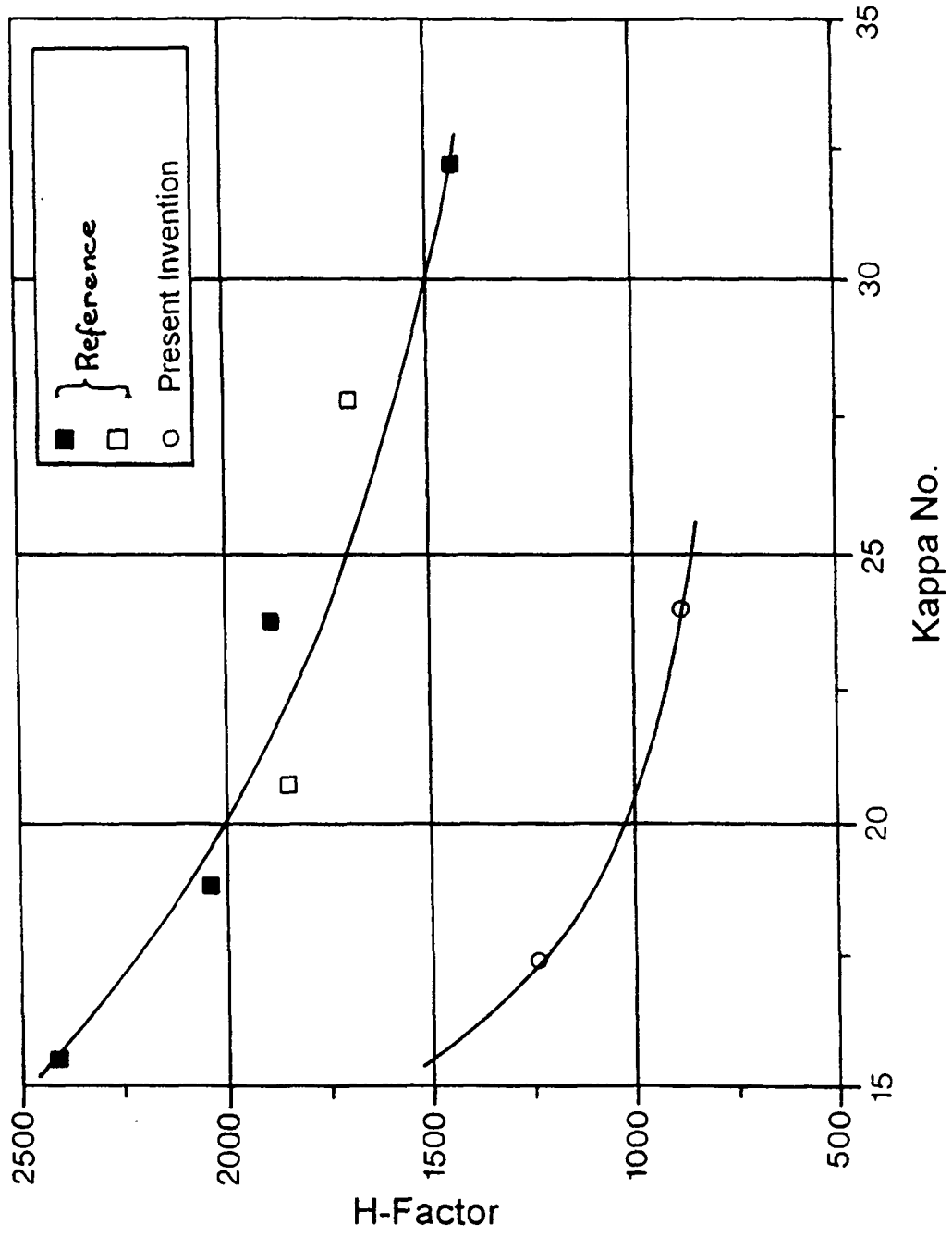


FIG. 4

FIG. 5



## FIG.6

## LABORATORY COOKING

## GENERAL CONDITIONS

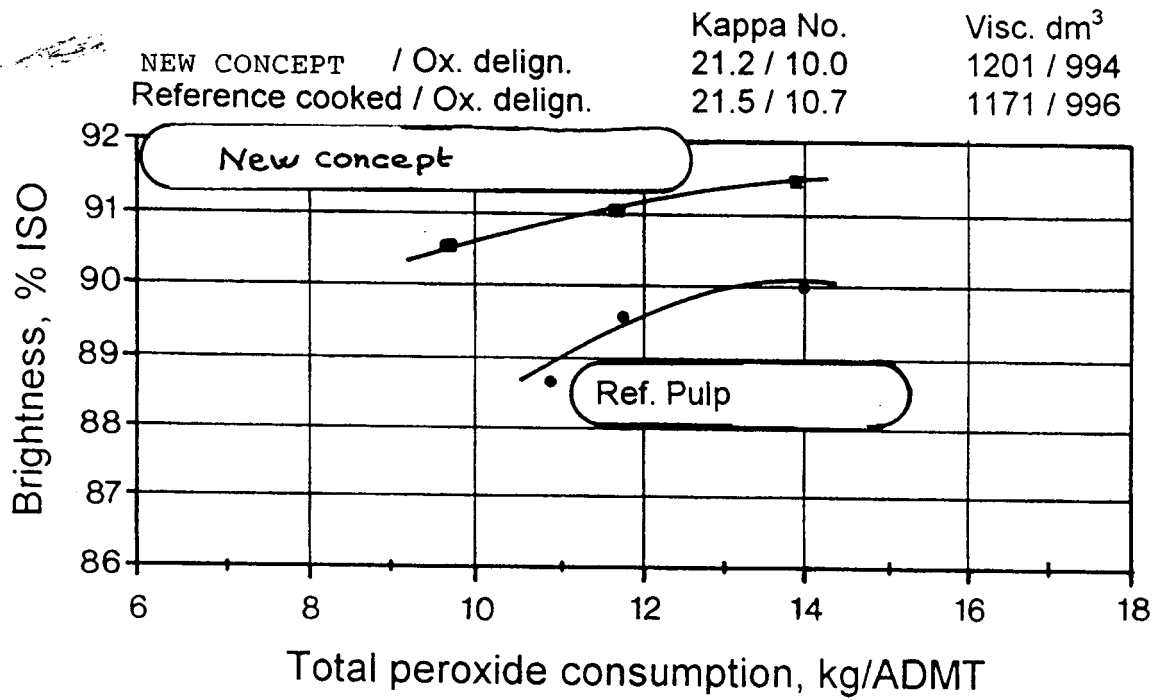
Wood specie:	Scandinavian softwood, chips
Steaming, minutes	5
Temperature, °C	110
Pressure, bar	1.0
Sulfidity, %	36.4

## SPECIFIC CONDITIONS

	Reference ITC 1770	Present Invention ITC 1763
Cook no.		
IMPREGNATION		
Time, minutes	45	45
Temperature, °C	125	125
Alkali consumption, kg EA/BDMT wood	99	92
CONCURRENT COOKING		
Time, minutes	120	120
Temperature, °C	160	145
Alkali consumption, kg EA/BDMT wood	63	66
COUNTERCURRENT COOKING		
Time, minutes	150	150
Temperature, °C	160	155
Alkali consumption, kg EA/BDMT wood	15	10
RESULTS		
H-Factor	1850	874
Alkali consumption, kg EA/BDMT wood	177	168

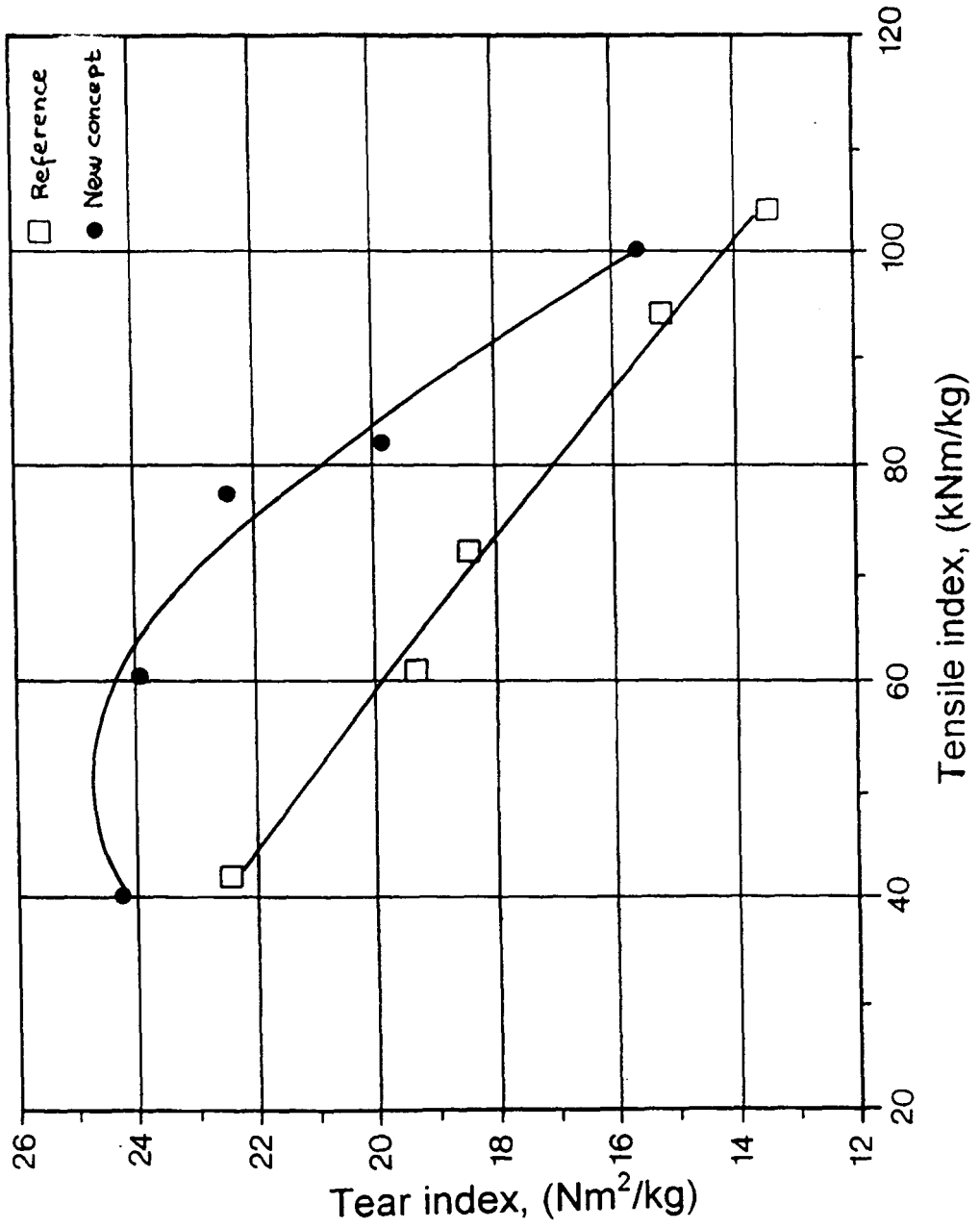
FIG. 7

Q(OP)(ZQ)(PO) bleaching of mill cooked SW pulp



# MILL RESULTS

FIG. 8



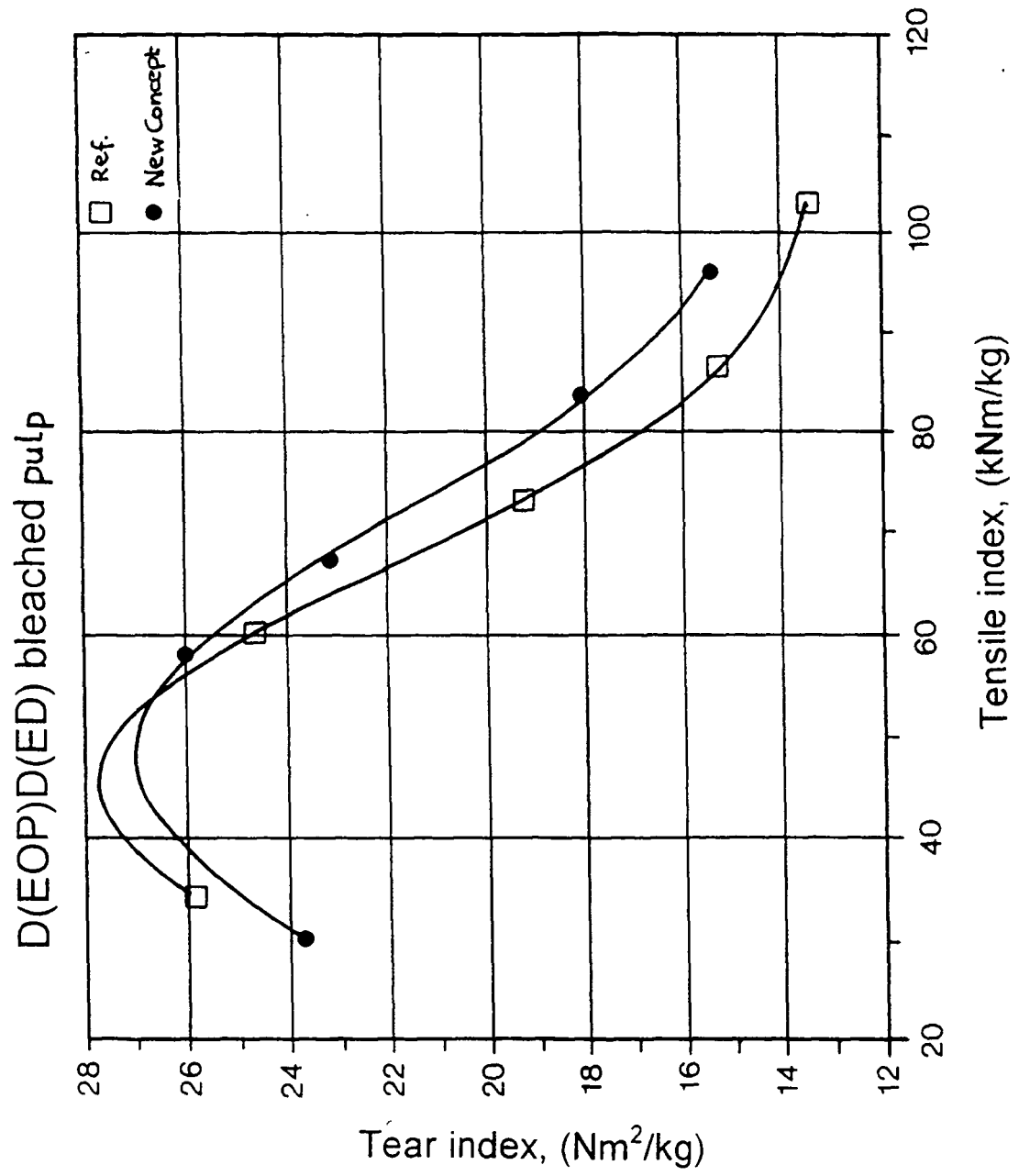


FIG. 9

NEW CONCEPT : O<sup>2</sup> Kappa 11.1 and visc. 1018 dm<sup>3</sup>/kg  
Reference cooked pulp: O<sup>2</sup> Kappa 11.2 and visc. 1014 dm<sup>3</sup>/kg

FIG.10

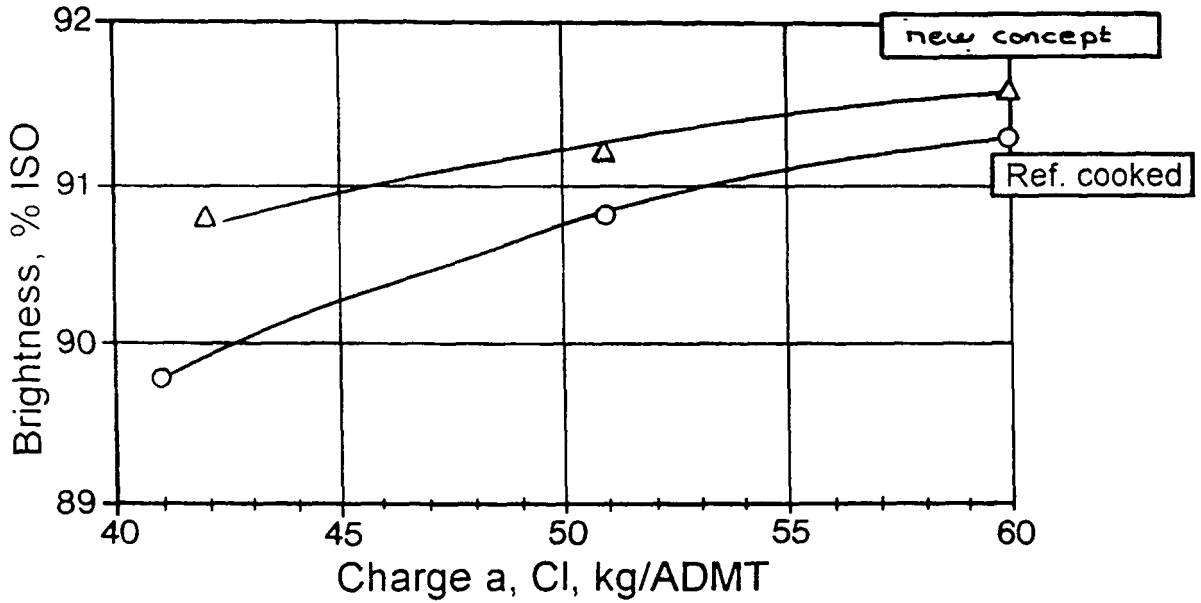
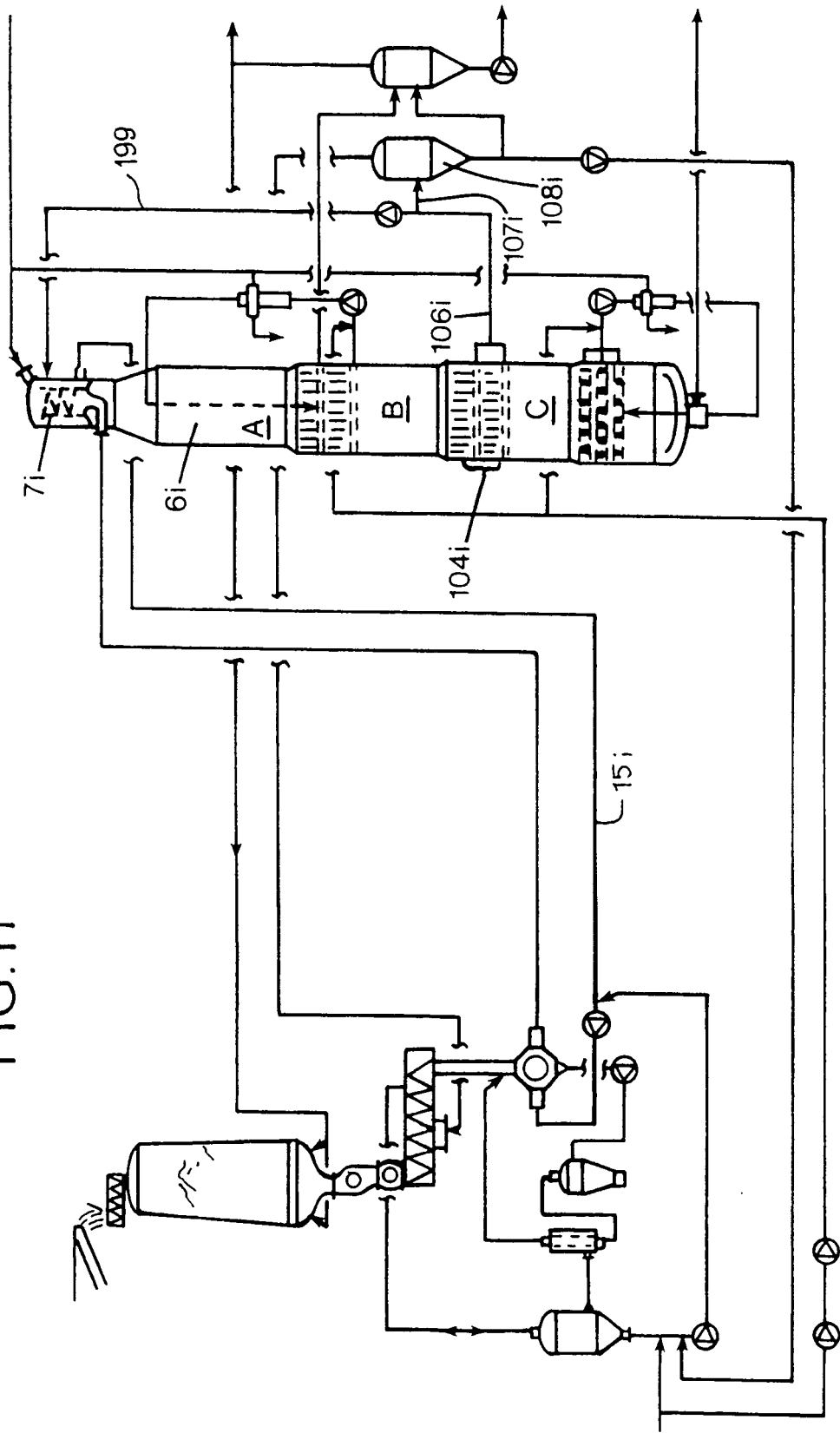


FIG.11



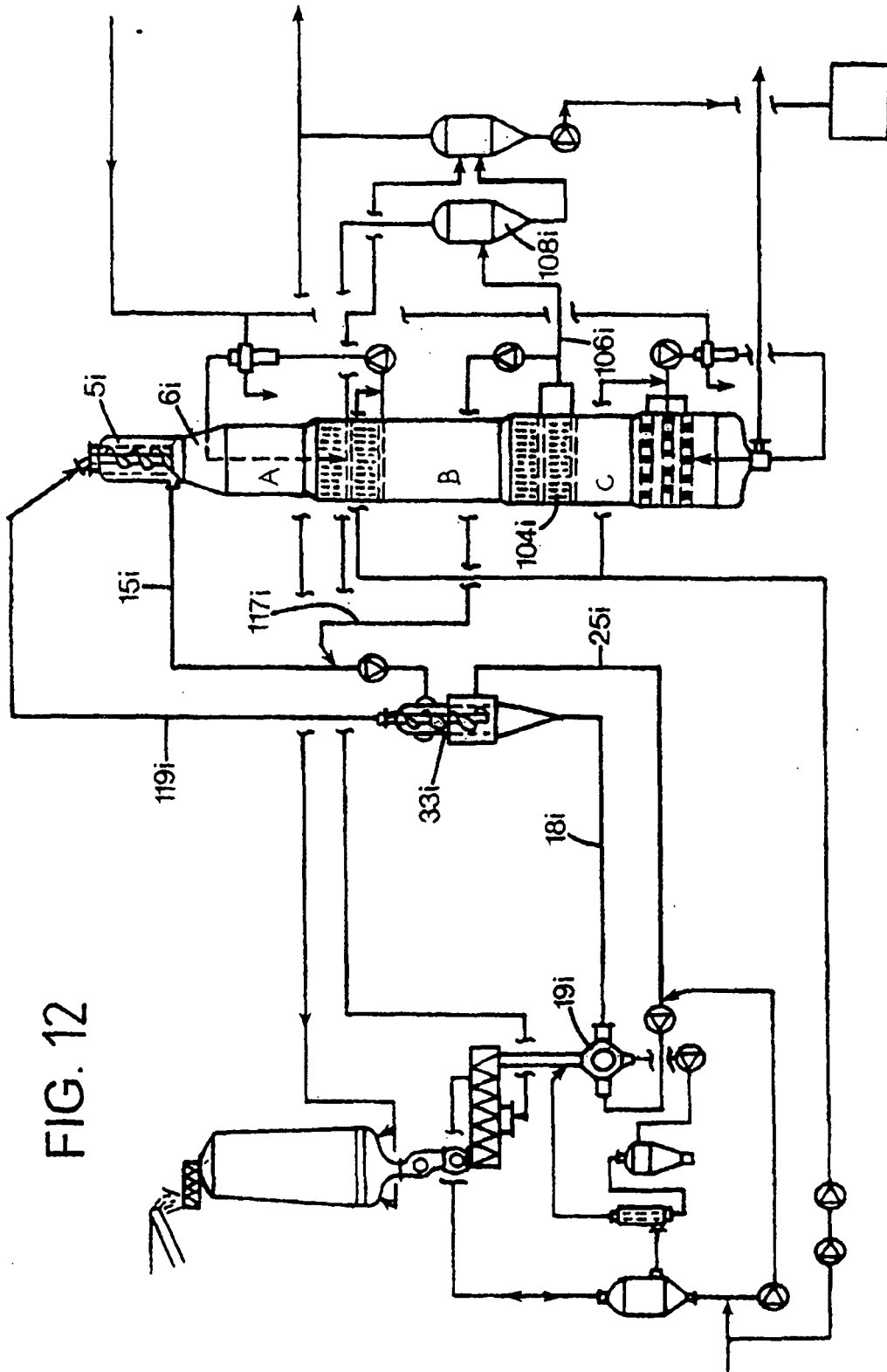


FIG. 12