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(54) **Process for improving retention and drainage in the manufacturing of paper, paperboard, cardboard**

(57) The present invention refers to the manufacturing process of paper, paperboard, cardboard and similar products (such as cellulose, fiber cement, etc.) in which, at different points of the wet end of the machine, an enhanced, concentrated, liquid smectite (avoiding here-with the need of an on-site preparation unit) and a natural or synthetic polymer are added.

The said retention and drainage agents can be added in any order, thus improving the retention, drainage, formation and drying, without affecting the whiteness and enhancing the physical values of the paper, paperboard, cardboard and other similar products.

In view of the problems generated by process of pri-

or art, it has been developed a retention and drainage system, called "TOP DUAL", recommended for the manufacturing of paper, paperboard, cardboard and other similar products, for acid, neutral and alkaline environments, in which basically two products or chemical compositions are added to the paper stock:

c) A liquid secondary retention and drainage agent, called VERSINQUI A-250, with which the necessity of an expensive on-site preparation equipment is eliminated and

d) A primary retention and drainage agent, called VERSINQUI;

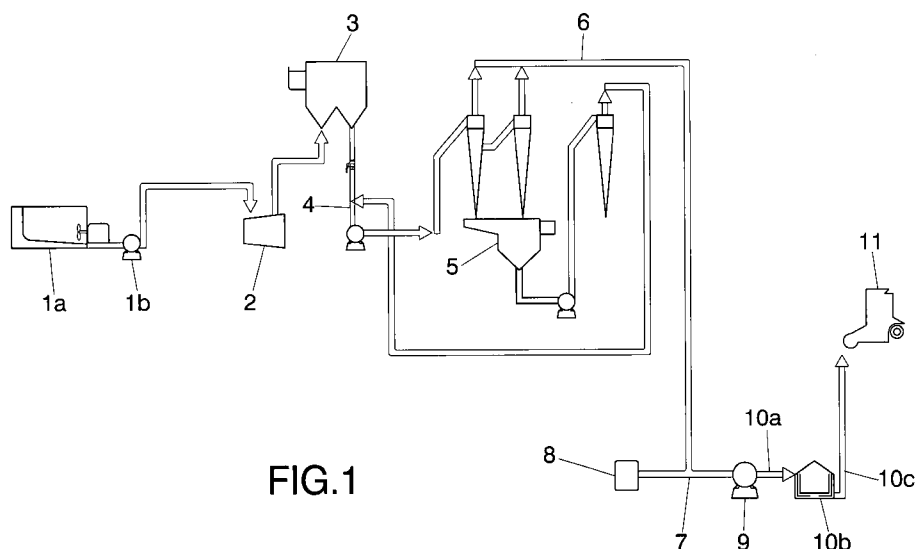


FIG.1

Description**DESCRIPTIVE NOTE**

5 **[0001]** The present invention generally refers to the manufacturing process of paper, paperboard, cardboard and similar products (such as cellulose, fiber cement, etc.) in which, at different points of the wet end of the machine, an enhanced, concentrated, liquid smectite (avoiding herewith the need of an on-site preparation unit) and a natural or synthetic polymer are added.

10 **[0002]** The said retention and drainage agents can be added in any order, thus improving the retention, drainage, formation and drying, without affecting the whiteness and enhancing the physical values of the paper, paperboard, cardboard and other similar products.

ANTECEDENTS

15 **[0003]** The retention and drainage systems aim at improving the drainage (the capacity to eliminate water) and the retention of fines and fillers which are part of the paper sheet.

[0004] These systems have evolved coming from one retention and drainage agent to two and more components used today. Each one of them shows advantages and disadvantages, while the systems most used are the ones based on microparticles.

20 **[0005]** The benefits expected from a retention and drainage system are the following:

- higher production (ton/hr);
- lower production costs;
- lower energy consumption;
- 25 - better stability and reliability of the production systems;
- less acidity in the system due to the decrease of aluminum sulphate and consequently fewer corrosion problems;
- better formation of the paper sheet (seen against the light);
- less porosity of the paper and
- less humidity of the paper.

30 **[0006]** Traditionally the paper machines have worked with retention agents, such as:

- natural polymers such as starch;
- synthetic polymers such as cationic, anionic, amphoteric and non-ionic polyacrylamides and
- 35 - polyethylene oxide.

[0007] These products have the characteristic to "retain" a higher number of solids in suspension (fines and fillers) than the stock on its own without these additives.

40 **[0008]** Therefore, these days it is common practice in the paper manufacturing industry to use stock retention and drainage aids.

[0009] In the prior art several stock retention and drainage aids are known, such as the polyacrylamides (PAM), polyethylenimines (PEI), polyamides and polyamines, mainly.

45 **[0010]** Thus, for example, in the US Patent N° 3.052.595 the use of polyacrylamides with filler is described and it is stated that advantageous results are obtained when bentonite provides 1 to 20% by weight of the mineral filler. In the British Patent N° 1.265.496 it is described how polyacrylamides are used to retain organic filler and cellulosic fines but that critical conditions have to be observed for successful operation, and particular modified acrylamides are described.

50 **[0011]** In the German Patent N° 2262906 it is proposed to improve the dewatering of cellulosic slurries by adding bentonite and a low molecular weight cationic polymer that serves as a poly-electrolyte. In the prior art, the amount of bentonite included in the pulp is generally between 0.02 and 2% by weight dry bentonite clay, based on dry weight of paper or pulp, and most preferably it is between 0.1 and 1%. The bentonite-type clay used in the invention may be one of the common commercially available bentonites (known as montmorillonite clays) such as "Wyoming bentonite" and "Fullers Earth", and may or may not be chemically modified, e.g. by alkali treatment to convert the calcium bentonite substantially to alkali (e.g. sodium, potassium or ammonium)bentonite.

55 **[0012]** Another document related to the subject of the present invention is the US Patent N° 4.753.710 granted to the company Allied Colloids in which a process is described according to which a cationic polymer, preferably polyethylenimine, a polyamine epichlorhydrin product, a polymer of diallyl dimethyl ammonium chloride, or a polymer of acrylic monomers is added to a watery cellulosic suspension before the last shearing stage, and bentonite is added after this shearing stage. This process allows for better retention, drainage, drying and web forming properties. The bentonite

used in the said process is called "Hydrocol".

[0013] Respectively, according to the paper production method described in the US Patent N° 5.178.730, granted to the company Delta Chemicals, there is added to the stock before the shearing stage a cationic polymer, which is preferably a tertiary or quaternary amine derivative of polyacrylamide, and after the shearing stage, before the head box, there is added a natural hectorite at a weight ration 0.5:1 - 10:1. The method according to this patent can be used in alkaline and acid paper production processes.

[0014] In the US Patent N° 5.876.563, of Allied Colloids, a cationic starch together with a cationic polymer and an anionic microparticulate material is used as the retention aid.

[0015] On the other hand, according to the Patent WO 99/14432 of Allied Colloids, the microparticulate aid is preferably bentonite, silica, a polysilicic acid, polysilicate microgel, or an aluminum-modified version thereof.

[0016] The use of silicate microparticles together with a cationic polymer in a retention system is described in the US Patent 5.194.120 of Delta Chemicals. The prevalent cation in the synthetic amorphous metal silicate was magnesium, and the polymer was preferably a tertiary or quaternary amine derivative of polyacrylamide, their weight ratio being between 0.03:1 and 30:1. By this method, retention, dewatering and formation were improved by using smaller amounts of retention aids than previously, and thus the costs were correspondingly lower.

[0017] Through the US Patent N° 4.305.781, granted to Allied Colloids in 1981, the use of a clay in combination with a synthetic polymer was introduced. Today this is known as the dual system (two components) or microparticulate system (particle size between nanometers and micrometers).

[0018] The combination and the adding order - first clay then polymer - increased drainage and retention. This patent was based on a non-ionic linear polymer.

[0019] Here below this and other systems of the prior art and their disadvantages will be described in detail:

[0020] The so-called ORGANOPOL system, described in Patent N° EP-A-0 235893, granted in the year 1979, consisted of two chemical products:

a) ORGANOSORB, which is an activated or modified bentonite, an inorganic pigment in powder, which is added as a slurry at 1.5 - 5% by weight in concentration, preferably 2.5% by weight to the level box. In the prior art, an automatic unit for the preparation of the dispersion of the bentonite in powder was used, an on-line continuous process, that is, not by batch, generating the following problems:

- no adequate swelling is produced, that is, no de-lamination of the bentonite is produced, since the dispersion residence time in the automatic bentonite preparation equipment is very short. Therefore the bentonite does not increase the retention capacity of the colloidal and semi-colloidal particles of organic and inorganic compounds present in the stock the paper, paperboard, cardboard and other similar products are made with;
- there are variations in the concentration of the bentonite dispersion added to the stock system the paper, paperboard, cardboard and other similar products are made with;
- the required equipment of continuous preparation is very big, complex, difficult to operate and handle and has a very high cost, (US \$ 80.000);
- the concentrations of bentonite above 5% by weight form very viscous, gel-like dispersions difficult to pump;

b) The ORGANOPOL polymer, which is an essentially linear cationic polyacrylamide with molecular weights of more than one million, three million and higher (according to Patent N° EP-A-0 235893) is added to the thin, diluted stock, after the pressure screen.

[0021] The polymer added at this point, does not allow to reduce the size of the floccules, no smaller, tougher and more uniform floccules are obtained, and therefore there is no good formation of the paper, paperboard or cardboard sheet.

[0022] The ORGANOPOL system presents the following disadvantages: loss of whiteness, with the consequent increase of the use of optical whiteners, the adverse impact of the retention and drainage and the complex handling of the bentonite.

[0023] Afterwards, in the US Patent N° 4.753.710 (corresponding to the Hydrocol process), granted in the year 1988, basically the same idea is presented, apart from the fact that the order of adding the two products to the machine is inverted, that is, first the polymer is added, and then the clay (a bentonite).

[0024] That patent is based on cationic linear polymers of high molecular weight before a shearing stage, and after the shearing stage the clay (bentonite) is added. Preferably at the last shearing point, which is the pressure screen.

[0025] It is important to point out that both patents, but especially the last one, make a big distinction at the shearing point. Additionally it focuses on a very specific type of polymer.

[0026] This system, known as Hydrocol, presents several problems:

- Necessity of an on-site preparation equipment of high cost, approx. US\$ 80.000;
- poor hydration of the bentonite (the maximum levels are not achieved);
- high consumption of the product (2 to 6 kilos per ton of paper);
- high energy consumption;
- more complex operation;
- loss of whiteness and
- excessive retention with a negative effect on the drainage.

[0027] Until today many dual systems have been presented, with the same objectives, but none have been able to overcome these inconveniences. Currently, the company CIBA, owner of several patents, should represent more than 50% of the systems used in paper plants in the world.

[0028] To give complete information, the existing systems are presented here below in a table explaining the basic operation principles:

System	Component 1	Component 2	Component 3
Particol (CIBA)	Cationic polyacrylamide	Colloidal silica	
Poliflex (CIBA)	Cationic polyacrylamide	Inverse anionic micro-emulsion	
Composil (EKA)	Cationic starch with high substitution degree	Polysilicic acid	
Positek (Nalco)	Cationic coagulant	High molecular weight flocculant	Borosilicate
Mosaic (Buckman)	Coagulant	Polyacrylamide	Microparticle (4 alternatives)

[0029] The before mentioned systems of the prior art present some advantages and disadvantages to be mentioned hereafter:

[0030] Particol has the advantage of using low application doses and its on-site preparation diminishes the possibility of losing effectiveness. The counterpart is the complex equipment at the client's plant.

[0031] Composil is a system which has good retention and drainage results, does not effect the strength properties and does not have any impact on the consumption of optical whiteners. However, the problem is that it is only effective in alkaline systems, it is expensive and good control must be kept on the dose (equipment).

[0032] Positek y Mosaic systems need more components, and therefore have more equipment and variables to control; they are more complex systems.

[0033] These and other inconveniences of the procedures of the prior art have been solved through the present invention, a detailed description of which will follow hereafter.

DETAILED DESCRIPTION OF THE INVENTION

[0034] In view of the problems generated by the before described systems, we have developed the following system:

[0035] According to the present invention a new retention and drainage system was developed, called "TOP DUAL", recommended for the manufacturing of paper, paperboard, cardboard and other similar products, for acid, neutral and alkaline environments, in which basically two products or chemical compositions are added to the paper stock:

- A liquid secondary retention and drainage agent, called VERSINQUI A-250, with which the necessity of an expensive on-site preparation equipment is eliminated and
- A primary retention and drainage agent, called VERSINQUI;

This flexible system, when compared to the ones described above, succeeds in improving the process of drainage, retention, the formation of the sheet and the drying, increasing the physical parameters and does not negatively affect the whiteness of the paper, cardboard, paperboard and other similar products.

[0036] Traditionally the polymers have been considered primary or of more importance to the process of manufacturing paper, paperboard and cardboard for the retention, drainage and formation. The microparticulate, dual and even trial (3 components) systems have come and presented an improvement regarding these variables and have been secondary to the principal (polymer).

[0037] In the present invention we have wanted to underline the significant contribution of the microparticle which is

responsible for the main improvement of the system. That is the reason why in the first place the product VERSINQUI A-250 is elaborated on, which, even though traditionally called "secondary" agent, brings about more improvement than the VERSINQUI, traditionally called "primary" agent.

BRIEF DESCRIPTION OF THE FIGURES

[0038]

Figure 1 shows in a drawing the stream of a plant where paper, paperboard, cardboard or other similar products (such as cellulose, fiber cement etc.) are manufactured, including the adding points for the treatment of retention and drainage of the present invention and

Figure 2 shows in a drawing the molecular structures of synthetic polymers used as retention agents. In figure 2, a represents a molecular structure of linear polymers, b represents a molecular structure of branched polymers and c represents a molecular structure of cross-linked polymers.

[0039] In particular, Figure 1 shows the following treatment equipments relevant from retention and drainage treatment point of view, including the points where the products of the present invention can be added:

- a) refined or non-refined stock tank (1a);
- b) refined or non-refined stock tank pump (1 b);
- c) refiner (2);
- d) level box (3);
- e) stock pump feeding the depuration stage (4);
- f) other depuration stages (5);
- g) feeding at the first stock depuration stage (6);
- h) arrival of the stock of the first stock depuration stage (7);
- i) feeding of the dilution water before the depurated stock enters (8);
- j) fan pump (9);
- k) entry of the pressure screen (10a);
- l) interior of the pressure screen (10b);
- m) exit of the pressure screen (10c) and
- n) head box (11).

[0040] When referring to Figure 1 in particular, it indicates the preferable points where the retention and drainage agents corresponding to the TOP DUAL system of the present invention should be added.

[0041] In particular, the novel secondary retention and drainage agent, VERSINQUI A-250, consists of a liquid formula, manufactured by the supplier, capable of being introduced via a pump and which contains as one of its main ingredients a smectite or a chemically modified version thereof, preferably a normal, activated or modified bentonite with a concentration in the formula higher than 6.5% by weight of the dispersion. This secondary formula allows, among other things, to strongly increase the specific, superficial area of the before mentioned smectite with which the retention capacity of fines, colloidal particles, semi-colloidal particles, organic and inorganic compounds present in the paper stock with which paper, paperboard, cardboard and other similar products are manufactured, is improved. Once the secondary agent VERSINQUI A-250 is added to the stock, it modifies the stock, which is flocculated by the action of the second component, called primary retention and drainage agent VERSINQUI.

[0042] In contrast with the adding of the before mentioned product ORGANOSORB supplied by the company CIBA, consisting of a bentonite slurry of less than 5% by weight, preferably 2.5% by weight of the bentonite in the dispersion, which is added to the level box (3), the secondary retention and drainage agent, VERSINQUI A-250, of the present invention can be added to the paper machine in the following points of the process, indicated in Figure 1:

- a) at the suction of the stock tank pump (1 b);
- b) at the level box (3);
- c) at the suction of the stock pump feeding the stock depuration stage (4);
- d) at other paper stock depuration stages (5);
- e) to accepted of the first stage of stock depuration (6);
- f) at the dilution water before the entry of the depurated stock (8);
- g) before the fan pump (9);
- h) before the pressure screen (10a);
- i) inside the pressure screen (10b) and

j) after the pressure screen (10c).

[0043] In particular, the secondary retention and drainage agent, object of the present invention, the novel liquid product VERSINQUI A-250, more easily retains the organic and inorganic compounds present in the stock the paper, paperboard, cardboard and other similar products (cellulose, fiber cement, etc.) are manufactured with, such as fines, fillers, glues, starch, lignine and hemicelluloses.

[0044] Adding the secondary retention and drainage agent of the present invention VERSINQUI A-250 before the fan pump and the primary retention and drainage agent VERSINQUI, consisting of a linear, branched or cross-linked polyacrylamide apart from starches, polyethylene oxides, dry strength resins, wet strength resins, organic and inorganic coagulants and other polymers, before and inside the pressure screen (10a, 10b) of the paper machine allow to obtain a higher general first-pass retention in the said machines.

[0045] Apart from that, adding the secondary retention and drainage agent VERSINQUI A-250 and the primary retention and drainage agent VERSINQUI at the indicated points of the paper machine allows to obtain smaller, tougher and more uniform floccules, with which a better formation of the paper sheet is obtained and it allows to enhance the physical parameters of the paper, paperboard, cardboard and other similar products, such as the longitudinal strength, the transversal strength, CMT, ring crush, Cobb, Mullen explosion, Denisson, etc.

[0046] Apart from that, through this system (process) the products added at the indicated points of the paper machine allow to increase the retention of the said paper machine with which a decrease in the consistence, and in the level of solids suspended in the "white water", in the water under the wire and the vats, is achieved.

[0047] Additionally, adding the secondary retention and drainage agent VERSINQUI A-250 and the primary retention and drainage agent VERSINQUI at the indicated points of the paper machine allows to work with lower consistences in the head box (11) of the paper machine, with which, among other things, a better distribution of the fibers in the wet sheet being formed on the wire or the vats is achieved.

[0048] Moreover, adding the secondary retention and drainage agent VERSINQUI A-250 and the primary retention and drainage agent VERSINQUI according to the present invention, allows to increase the drainage capacity of the paper stock, to produce a dryer sheet at the end of the wire or the vats, with which a substantial saving in the consumption of steam is achieved, apart from increasing the speed and with this the production of the paper machine and maintaining, moreover, the stability thereof.

[0049] Through the TOP DUAL retention and drainage system of the present invention it is possible to decrease the levels of dosage of the chemical product VERSINQUI A-250 to 150 g/ton of paper, equivalent to 40 g of smectite per ton/paper, and the polymer VERSINQUI to 50 g/ton paper, obtaining high levels of retention and drainage of the fiber very superior to those of the systems described in the prior art, for example the one called ORGANOPOL. With these before mentioned dosage levels a considerable saving in consumption and the consequent costs of the chemical products of the TOP DUAL retention and drainage system in the paper machine according to the invention is achieved.

[0050] The preferable dosage level of the secondary retention and drainage agent according to the invention, VERSINQUI A-250, consisting of a pumpable liquid formula prepared in the chemical product suppliers's plant, lies between 150 and 1.000 g/ton of paper; however, the dosage of the formula of the prior art consisting of a powder bentonite (ORGANOPOL system) lies between 2.000 and 6.000 g/ton of paper, where, moreover, in this last case a very big and expensive unit is used in the continuous process of the preparation of the bentonite dispersion. The said dosage of the retention and drainage agents VERSINQUI A-250/VERSINQUI according to the invention allows to improve the quality of the manufactured paper, complying with all the technical specifications and quality standards of the product manufactured in the paper machine.

[0051] In relation to the prior art, in particular the ORGANOPOL product of the company CIBA consists of a linear cationic polyacrylamide described in the patent N° EP-A-0 235893, granted in the year 1979, is applied in the dual retention system ORGANOPOL and is added to the thin, diluted paper stock after the last point of major shearing of the machine, that is after the pressure screen (10c) and flocculates the modified stock. However, the primary retention and drainage agent of the present invention, VERSINQUI, consisting of a linear, branched or cross-linked polyacrylamide, apart from starches, polyethylene oxides, dry strength resins, wet strength resins, organic and inorganic coagulants and other polymers, can be added before and inside the pressure screen (10a, 10b) to allow, in the first place, for the formation of big floccules in the modified stock, which, while passing through the before mentioned pressure screen, form smaller, tougher and more uniform floccules, with which a better formation of the sheet of paper, paperboard, cardboard or other similar product without lumps in the stock is achieved. In the process of the present invention it is also possible to add the primary retention and drainage agent VERSINQUI after the pressure screen (10c).

[0052] Another advantage of the present invention through the process of adding VERSINQUI at the indicated adding points, is that it allows to reduce the tearing of the paper sheets and, consequently, to increase the productivity of the paper machine, reducing, moreover, the solids in suspension at the effluent of the machine or plant.

[0053] Another advantage of the invention lies in the fact that adding the retention agent VERSINQUI at the indicated points of the paper machine allows to reduce the dosages of starch, glue and other chemical agents, maintaining the

values within the standard, reducing the BOD and COD indexes at the effluent of the paper machine with the consequent advantages from environmental contamination point of view.

[0054] Thanks to the retention and drainage agents and the system of adding thereof according to the present invention, it is possible to use more recycled fibers in the paper machine.

[0055] Finally, the system of the present invention allows to work in acid, neutral or alkaline environments and does not affect the whiteness of the paper.

[0056] The before mentioned primary retention and drainage agent VERSINQUI, which is a linear, branched or cross-linked polyacrylamide or a starch, polyethylene oxide (PEO), dry strength resin, wet strength resin, organic or inorganic coagulant or another polymer, flocculates the stock.

[0057] Adding the primary retention and drainage agent VERSINQUI according to the invention can be done at the following points of the paper machine:

a) between the stages of the manufacturing process of paper, paperboard, cardboard (1a) and (10c) of the stock stream of Figure 1 and preferably at the following points:

- before the fan pump (9);
- before the pressure screen (10a);
- inside the pressure screen (10b);
- after the pressure screen (10c).

[0058] The primary retention and drainage agent VERSINQUI can be formed by the following components:

- linear, branched or cross-linked polyacrylamides;
- starches;
- polyethylene oxides;
- dry strength and wet strength resins;
- organic and inorganic coagulants and
- other polymers.

[0059] The before mentioned primary retention and drainage agent is preferably prepared in the client's plant. If the ingredients are solid products, then the dissolution thereof is effectuated in an automatic powder dissolution unit, and if they are liquids, then it is effectuated by means of an on-line dosage pump. The dosage range of the primary retention agent lies between 50 and 10.000 g/ton of paper.

ADDING STAGES

[0060] A) The first stage for adding the chemical products of the retention and drainage system called TOP DUAL according to the present invention is developed in the refined or non-refined stock tank (1 a). This refined or non-refined stock is the result of the disintegration of the fibrous material: rags of cellulose, waste paper and brokers, etc., produced in the so-called "helix" or "pulper" according to a production schedule. This fibrous material converted in stock and after going through the depuration stages, screens, etc., arrives at the refined or non-refined stock tank (1a).

[0061] At the suction of the stock pump (1 b) of this refined or non-refined stock tank (1 a), as first adding point, a liquid chemical composition with retention and drainage properties according to the invention is added. This chemical composition corresponds to the product VERSINQUI A-250, secondary retention and drainage agent.

[0062] This stock with the agent VERSINQUI A-250 goes to the fan pump (9), pressure screen (10) and then to the head box (11). There are nine other possible points of adding, mentioned before, adequate for introducing the agent VERSINQUI A-250 to the paper stock to manufacture paper, paperboard, cardboard and similar products.

[0063] Adding the secondary agent VERSINQUI A-250, which is a liquid, pumpable product, manufactured in the plant of the supplier and which contains a smectite or a chemically modified version thereof, preferably a normal, activated or modified bentonite, is very easy, since it is preferably distributed in containers of 1.000 kg and a variable caudal pump is sufficient to adequately add this product. It is a simple installation: on a container, a second container is installed on a stand with the 1.000 kg of VERSINQUI A-250 product which is unloaded according to what the lower container consumes. Finally, during the course of the days, what is left inside the upper container is emptied and the container is changed. The lower container is connected to the dosage pump.

[0064] This first liquid composition, corresponding to the secondary retention and drainage agent called VERSINQUI A-250 has the following chemical formula:

General formula:	
Water (from 5 to approx. 95° C)	0 - 92%, by weight;
Dispersing agent	1 - 80%, by weight and
Smectite (clay)	8 - 50% by weight.

Application example:	
Warm water (40 - 60° C)	66.4%, by weight;
Sodium polyacrylate	9.1% by weight and
Smectite (clay)	24.5% by weight (preferably montmorillonite).

[0065] The preparation of this first liquid composition of the secondary agent VERSINQUI A-250, prepared in the supplier's plant, allows for a de-lamination of the smectite (clay) and, therefore, the specific, superficial area of the smectite is strongly increased, with which an increase in the retention of fines, colloidal particles, semi-colloidal particles of the organic and inorganic compounds present in the paper stock for the manufacturing of paper, paperboard, cardboard and other similar products, is achieved and this thus modified stock is flocculated by the second component, the so-called primary retention and drainage agent.

[0066] The pumpable liquid chemical composition of the secondary retention and drainage agent VERSINQUI A-250 according to the invention allows to concentrate the smectite clay 6.5% by weight in the watery dispersion, situation not one single system in use in the world currently achieves.

[0067] The dosage controlled via a pump with variable caudal of the VERSINQUI A-250 lies preferable between 150 and 1.000 g/ton of final produced paper. The dispersing agent of the before mentioned formula is preferably a sodium polyacrylate. However, it is also possible to formulate the product VERSINQUI A-250 with other dispersing agents different from sodium polyacrylate:

- a) organic salts of alquil-aril-sulphonic acids;
- b) purified sulpholignine;
- c) extracts from seaweed;
- d) condensed proteins and fatty acids;
- e) sulphonate esters;
- f) high molecular weight alquil sulphate sodium salts;
- g) polycarboxilic compounds;
- h) phosphates: hexametaphosphates, pyrophosphates, tripolyphosphates, etc.;
- i) sodium salt of polyaspartic acid;
- j) alcohol;
- k) acetone
- l) glycerin.

[0068] B) The second stage of the method according to the invention comprises adding the liquid composition or chemical product, called primary retention and drainage agent or VERSINQUI, which can be a:

- linear, branched or cross-linked polyacrylamide;
- starch;
- polyethylene oxide;
- dry strength and wet strength resin;
- organic and inorganic coagulant and
- other polymer.

[0069] The adding points of the before mentioned primary retention agent can be between the positions 1a to 10c of the stream drawing of Figure 1. Adding the primary retention and drainage agent VERSINQUI is preferably done at the following points:

- a) before the fan pump (9);
- b) before the pressure screen (10a);
- c) inside the pressure screen (10b) y

a) after the pressure screen (10c).

[0070] The preparation and adding of the primary retention and drainage agent is preferably in the paper factory of the client. If the products are solid, then the dissolution is done in an automatic powder dissolution unit and if they are liquids, it is done by means of an on-line dilution dosing pump.

[0071] The dosage range of the primary retention and drainage agent lies between 50 and 10.000 g/ton final paper.

[0072] Contrarily to what is explained before, in the adding system described in the prior art, through the ORGANOPOL system of the company CIBA, the recommended adding points are the following:

- a) adding ORGANOSORB, bentonite dispersion, at the level box (3) and
- b) adding ORGANOPOL, linear polyacrylamide, after the pressure screen (10c).

[0073] Generally, in the process of the present invention, the sequence of adding the two chemical compositions or the chemical products can be done indistinctly; that is, first the secondary retention and drainage agent and then the primary, or vice versa, first the primary retention and drainage agent and then the secondary. Additionally, in some cases the secondary retention and drainage agent can be used without the primary retention and drainage agent.

[0074] Here below the adding points of the TOP DUAL retention and drainage system according to the invention are summed up, referring to Figure 1:

1)VERSINQUI A-250, secondary retention and drainage agent:

- a) at the suction of the stock tank pump (1 b);
- b) at the level box (3);
- c) at the suction of the stock pump feeding the stock depuration stage (4);
- d) at other paper stock depuration stages (5);
- e) to accepted of the first stage of stock depuration (6);
- f) at the dilution water before the entry of the depurated stock (8);
- g) before the fan pump (9);
- h) before the pressure screen (10a);
- i) inside the pressure screen (10b) and
- j) after the pressure screen (10c).

2)VERSINQUI, primary retention and drainage agent, between the stages of the process of manufacturing paper, paperboard, cardboard or other similar products from item 1 a to 10c of Figure 1, but preferably:

- a) before the fan pump (9);
- b) before the pressure screen (10a);
- c) inside the pressure screen (10b) y
- d) after the pressure screen (10c).

Claims

1. Process for the retention and drainage of the stock in the manufacturing of paper, paperboard, cardboard and other similar products (such as cellulose, fiber cement, etc.) **CHARACTERIZED** since it contemplates the adding, in a first stage, of a liquid chemical composition with properties of retaining fines, colloidal and semi-colloidal particles, of organic and inorganic compounds present in the stock, which can be added at ten different points, and then, in a second stage, the adding of a liquid composition or chemical product that can be a linear, branched, or cross-linked polyacrylamide, a starch, a polyethylene oxide, a wet or dry strength resin, an organic or inorganic coagulant and another polymer with properties to flocculate the stock and which can be added preferably before the fan pump and before, inside and after the pressure screen of the paper machine.
2. Process according to claim 1 **CHARACTERIZED**, since a liquid composition in its first stage is added at the suction of the stock pump (1b) of the refined or non-refined stock tank (1a) and is added in a continuous way.
3. Process according to claims 1 and 2 **CHARACTERIZED** since a liquid composition in its first stage is added at the level box (3) and is added in a continuous way.

4. Process according to claims 1 to 3 **CHARACTERIZED** since a liquid composition in its first stage is added at the suction of the stock pump (4) which feeds the depuration stage and is added in a continuous way.
5. Process according to claims 1 to 4 **CHARACTERIZED** since a liquid composition in its first stage is added at the other stock depuration stages (5) and is added in a continuous way.
6. Process according to claims 1 to 5 **CHARACTERIZED** since a liquid composition in its first stage is added at the accepted of the first stage of stock depuration (6) and is added in a continuous way.
7. Process according to claims 1 to 6 **CHARACTERIZED** since a liquid composition in its first stage is added at the piping of the dilution water (8) before the fall of the stock accepted in the first depuration stage (7) and is added in a continuous way.
8. Process according to claims 1 to 7 **CHARACTERIZED** since a liquid composition in its first stage is added at the suction of the fan pump (9) and is added in a continuous way.
9. Process according to claims 1 to 8 b since a liquid composition in its first stage is added before the pressure screen (10a) and is added in a continuous way.
10. Process according to claims 1 to 9 **CHARACTERIZED** since a liquid composition in its first stage is added inside the pressure screen (10b) and is added in a continuous way.
11. Process according to claims 1 to 10 **CHARACTERIZED** since a liquid composition in its first stage is added after the pressure screen (10c) and is added in a continuous way.
12. Process according to claims 1 to 11 **CHARACTERIZED** since the liquid composition in its first stage is added in a range between 40 and 2.000 g/ton produced paper.
13. Process according to claims 1 to 12 **CHARACTERIZED** since the liquid composition in its first stage is added in a preferable application range between 150 and 1.000 g/ton produced paper; this range corresponds to adding 40 to 250 grams of smectite per ton of paper.
14. Process according to claims 1 to 13 **CHARACTERIZED** since the liquid composition in its first stage can be added to the stock in an acid, neutral or alkaline environment.
15. Liquid chemical composition with retention and drainage properties for the manufacturing of paper, paperboard, cardboard and other similar products, according to claims 1 to 14 **CHARACTERIZED** since the chemical formula comprises the following ingredients:

Water (5 - 95° C)	0 - 92%, by weight;
Dispersing agent	1 - 80%, by weight and
Smectite (clay)	8 - 50% by weight.

16. Liquid chemical composition according to claims 1 and 15 **CHARACTERIZED** since the dispersing agent in the chemical formula is a sodium polyacrylate.
17. Liquid chemical composition according to claims 1, 15 and 16 **CHARACTERIZED** since the dispersing agent in the chemical formula is a purified sulpholignine.
18. Liquid chemical composition according to claims 1 and 15 to 17 **CHARACTERIZED** since the dispersing agent in the chemical formula is an extract of seaweed.
19. Liquid chemical composition according to claims 1 and 15 to 18 **CHARACTERIZED** since the dispersing agent in the chemical formula are proteins and condensed fatty acids.
20. Liquid chemical composition according to claims 1 and 15 to 19 **CHARACTERIZED** since the dispersing agent in the chemical formula is a sulphonate ester.

21. Liquid chemical composition according to claims 1 and 15 to 20 **CHARACTERIZED** since the dispersing agent in the chemical formula is a high molecular weight alquil sulphate sodium salt.

22. Liquid chemical composition according to claims 1 and 15 to 21 **CHARACTERIZED** since the dispersing agent in the chemical formula is a polycarboxilic compound.

23. Liquid chemical composition according to claims 1 and 15 to 22 **CHARACTERIZED** since the dispersing agent in the chemical formula is a phosphate: hexametaphosphate, pyrophosphate, tripolyphosphate, etc.

24. Liquid chemical composition according to claims 1 and 15 to 23 **CHARACTERIZED** since the dispersing agent in the chemical formula is a polyaspartic acid sodium salt.

25. Liquid chemical composition according to claims 1 and 15 to 24 **CHARACTERIZED** since the dispersing agent in the chemical formula is an alcohol.

26. Liquid chemical composition according to claims 1 and 15 to 25 **CHARACTERIZED** since the dispersing agent in the chemical formula is an acetone.

27. Liquid chemical composition according to claims 1 and 15 to 26 **CHARACTERIZED** since the dispersing agent in the chemical formula is glycerin.

28. Liquid chemical composition according to claims 1 and 15 to 27 **CHARACTERIZED** since the smectite (clay) is preferably a montmorillonite.

29. Liquid chemical composition with retention and drainage properties for the manufacturing of paper, paperboard, cardboard and other similar products according to the process described in the claims 1 to 15 **CHARACTERIZED** since the chemical application formula is as follows:

Warm water (40 - 60° C)	66.4%, by weight;
Dispersing agent	9.1%, by weight and
Smectite (clay)	24.5% by weight; (preferably montmorillonite).

30. Liquid chemical composition with retention and drainage properties for the manufacturing of paper, paperboard, cardboard and other similar products according to the process described in the claims 1 to 15 **CHARACTERIZED** since the chemical application formula is prepared in the factory and delivered as a liquid to the paper plant.

31. Liquid chemical composition with retention and drainage properties for the manufacturing of paper, paperboard, cardboard and other similar products according to the process described in the claims 1 to 15 and 29 **CHARACTERIZED** since the chemical application formula contains a smectite or a chemically modified version thereof, preferably a normal, activated or modified bentonite.

32. Process according to claim 1 **CHARACTERIZED** since the primary retention and drainage agent can be added in any stage of the process of manufacturing paper, paperboard, cardboard and other similar products, between the points (1a) and (10c).

33. Process according to claims 1 and 32 **CHARACTERIZED** since a liquid composition or chemical product in the second stage is added preferably before the fan pump (9) and is added in a continuous way.

34. Process according to claims 1, 32 and 33 **CHARACTERIZED** since a liquid composition or chemical product in the second stage is added preferably before the pressure screen (10a) and is added in a continuous way.

35. Process according to claims 1, 32 to 34 **CHARACTERIZED** since a liquid composition or chemical product in the second stage is added preferably inside the pressure screen (10b) and is added in a continuous way.

36. Process according to claims 1, 32 to 35 **CHARACTERIZED** since a liquid composition or chemical product in the second stage is added preferably after the pressure screen (10c) and is added in a continuous way.

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37. Process according to claims 1 and 32 to 36 **CHARACTERIZED** since the dosage range of the liquid composition or chemical product in the second phase lies between 50 and 10.000 g/ton produced paper.
- 5 38. Process according to claims 1 and 32 to 37 **CHARACTERIZED** since the liquid composition or chemical product has an application range between 100 and 6.000 g/ton of produced paper.
39. Liquid composition or chemical product with retention and drainage properties according to claim 1 **CHARACTERIZED** since the retention and drainage agent is a linear polyacrylamide.
- 10 40. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 **CHARACTERIZED** since the retention and drainage agent is a branched polyacrylamide.
41. Liquid composition or chemical product with retention and drainage properties according to claims 1 , 39 and 40 **CHARACTERIZED** since the retention and drainage agent is a cross-linked polyacrylamide.
- 15 42. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 to 41 **CHARACTERIZED** since the retention and drainage agent is a starch.
43. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 to 42 **CHARACTERIZED** since the retention and drainage agent is a dry strength resin.
- 20 44. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 to 43 **CHARACTERIZED** since the retention and drainage agent is a wet strength resin.
- 25 45. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 to 44 **CHARACTERIZED** since the retention and drainage agent is a organic coagulant.
46. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 to 45 **CHARACTERIZED** since the retention and drainage agent is an inorganic coagulant.
- 30 47. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 to 46 **CHARACTERIZED** since the retention and drainage agent is a polyethylene oxide.
48. Liquid composition or chemical product with retention and drainage properties according to claims 1 and 39 to 47 **CHARACTERIZED** since the retention and drainage agent can be another polymer.
- 35 49. Retention and drainage process according to claim 1 **CHARACTERIZED** since the adding sequence of the two retention and drainage agents can be indistinctive; first the secondary retention and drainage agent and then the primary retention and drainage agent or, vice versa, first the primary retention and drainage agent and then the secondary retention and drainage agent.
- 40 50. Retention and drainage process according to claims 1 and 49 **CHARACTERIZED** since the secondary retention and drainage agent can be used alone, without the primary retention and drainage agent.
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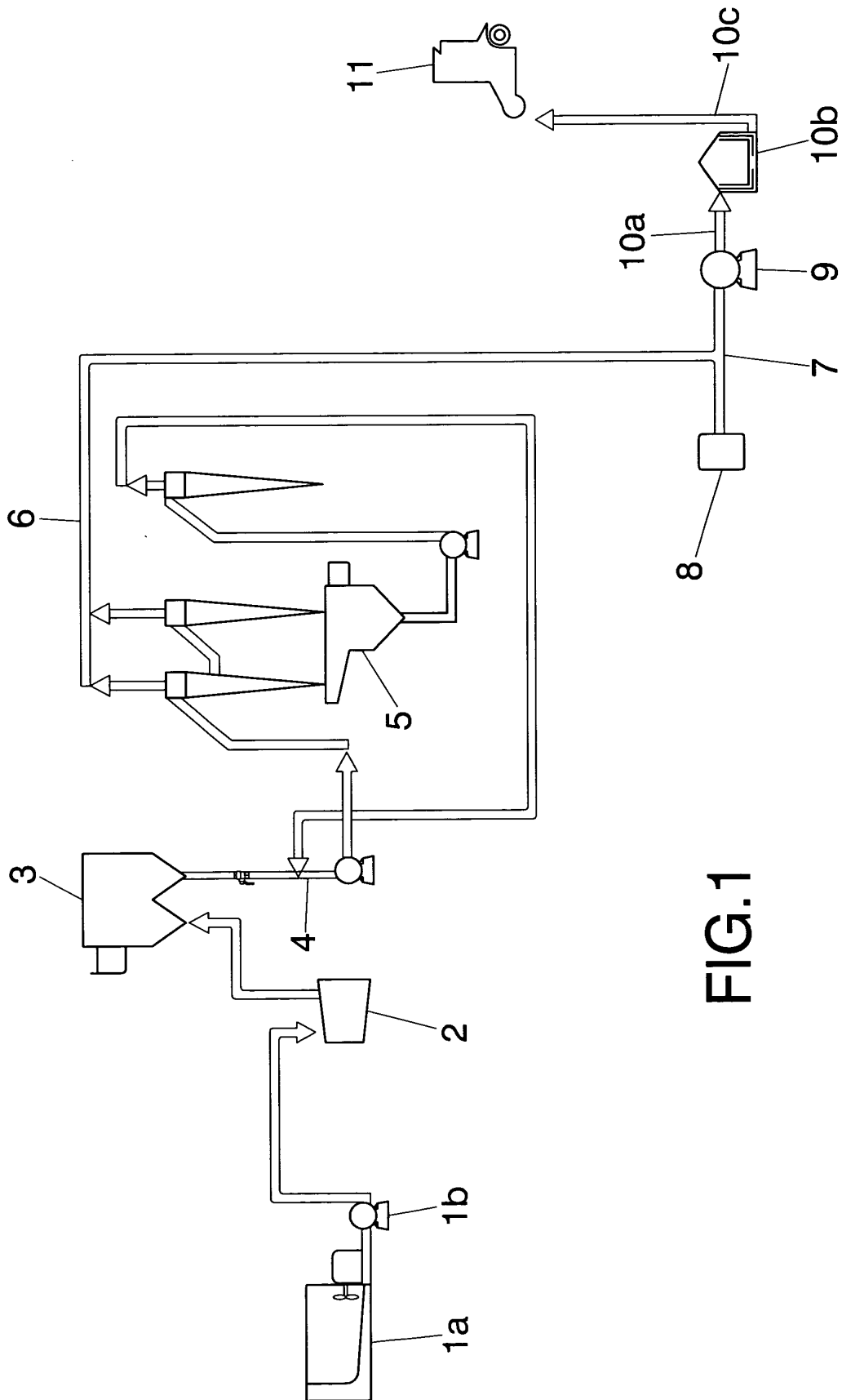


FIG.1

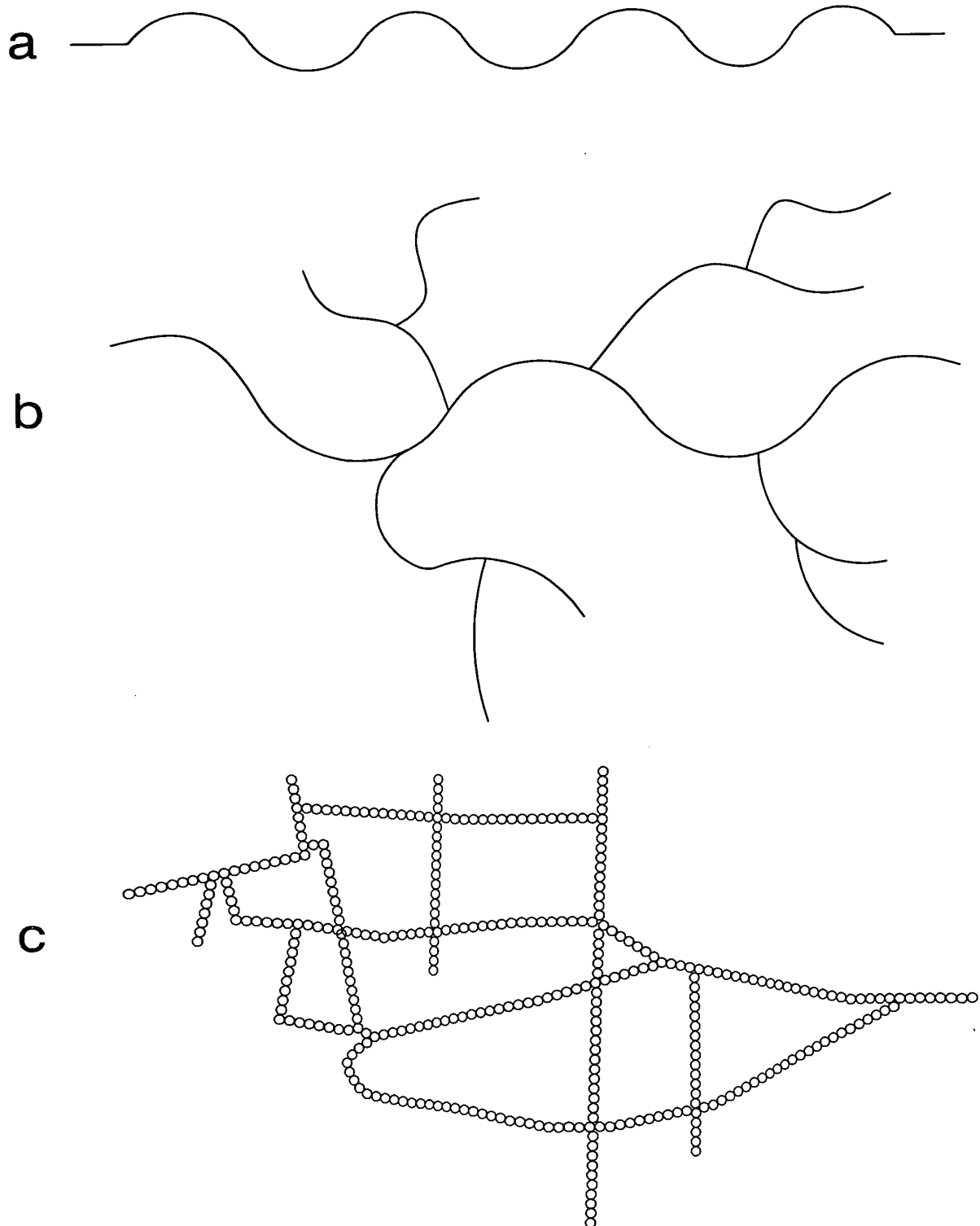


FIG.2



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