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(54) **Procedure and additive for preventing clogging of a handling process of dry cellulose-containing material.**

(57) A procedure for preventing clogging of a process handling dry cellulose-containing material, antistatic agent being added into the process.

An additive for use in connection with a dry cellulosic material handling process, said additive being an antistatic agent.

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# PROCEDURE AND ADDITIVE FOR PREVENTING CLOGGING OF A HANDLING PROCESS

The present invention concerns a procedure for preventing clogging in connection with a handling process, e.g. grinding, mainly of dry cellulose or equivalent, in particular in the manufacturing of paper or equivalent by the dry process or in connection with other further processing. Furthermore the invention concerns an additive for use mainly in connection with a handling process, e.g. grinding, of dry cellulose or equivalent to prevent clogging of the process.

In the dry process of paper or equivalent products, the structure of dry cellulose is disintegrated and the cellulose is ground, whereafter the dry fibre material is conducted through a screen and/or a drum to enter the paper forming process. Cellulose is usually supplied in the form of sheets, and these sheets are shredded or ground, for instance in a hammer mill. In connection with the shredding and grinding of sheets the cellulose particles tend to cause clogging of the process ; the cellulose particles which are formed, i.e., dry and flutty fibres and fibre bundles, present poor travelling characteristics. Moreover, fibres and fibre bundles tend to adhere to the process appparatus, e.g. to the hammer mill and to the walls of its hopper, to screens, etc.

The object of the present invention is to eliminate the above-mentioned drawback. It is a particular object of the invention to present a novel procedure, and additive, for preventing clogging of a dry cellulose handling process, e.g. grinding thereof.

Regarding the features which are characteristic of the invention, reference is made to the claims section.

The invention is based on the fact noticed in research that the travelling characteristics of dry and fluffy cellulose fibres and fibre bundles or equivalent can be substantially improved ny adding in conjuction with the respective process, that is e.g. to the cellulose sheets, fibres or fibre bundles, an antistatic agent.

Antistatic agent can be added e.g. by spraying it on the material to be treated, such as e.g. on cellulose sheets, fibres, fibre bundles, and/or on the process equipment, such as a grinding apparatus and/or other pieces of process equipment in conjuction with the grinding apparatus, such as the supply hopper, etc.

The antistatic agent is liquid or gaseous, and it contains advantageously, in addition to an antistatic chemical, as carrier substance e.e. water ; proportion of antistatic chemical e.g. 1 to 20%, suitable 4 to 16%. The antistatic agent may furthermore contain e.g. ethanol (possibily denatured) or another alcohol, e.g. 2 to 40%, advantageously 5 to 30%. Furthermore, the antistatic agent may contain e.g. glycol, such as propylene glycol e.g. 1 to 10%, advantageously 3 to 7%.

The antistatic agent may be anionic, cationic or non-ionic. The following may be mentioned as examples : polyamines, quaternary nitrogen compounds, alkyl dimethyl-benzylammonium halides, e.g. chlorides.

All percentages are expressed as % by weight.

Thanks to the invention, and by its aid, it has been possible to prevent most efficiently the clogging of the cellulose grinding process mainly in connection with the grinding of dry cellulose or equivalent. Obviously, the antistatic agent removes from the dry cellulose particles their static electricity, which appears to be the most significant cause of clogging. The additives, such as ethanol and glycol, improve the handling properties of the respective additive and/or its anticlogging properties.

The procedure and/or additive of the invention is applicable in connection with handling processes od dry cellulose and other dry fibre material containing cellulose, e.g. of wood fibres and lignocellulose fibres on the whole, for preventing clogging of the process and improving the handling characteristics and/or passage properties of the fibres.

Furthermore, the procedure and/or additive of the invention can be used in connection with any fibrous material handling process, such as grinding, transporting, screening or other separation, web-forming from dry fibres, handling and transport of a web formed of dry fibres, etc. The procedure is further applicable e.g. in connection with the dry process of paper or equivalent products, as gas been described in the foregoing, and or in connection with the wet process of paper and equivalent product, e.g. when grinding dry cellulose to be suspended to produce pulp sludge in conventional manner. A dry paper process in which the procedure and additive are particularly advantageous has for instance been described in the article Paper Without Water, Pirinen, M., News on Finnish Technology 2/90.

The invention is described in the following in detail with the aid of embodiment examples, without confining the invention to the embodiment example presented and/or to the antistatic agents mentioned.

Fig. 1 illustrates, by a schematic diagram, the use of the procedure and additive in a dry process for manufacturing paper products.

Example 1

In a cellulose mill, the hopper of the hammer mill tended to become clogged from time to time by effect of dry cellulose particles. Into the process, mainly into said hopper, was sprayed antistatic agent containing 8% polyamine condensate and 10% ethanol, the rest water. Through the influence of this antistatic agent clogging no longer occurred in the process.

Example 2

In Fig. 1 is depicted a plant process for paper manufacturing by the dry process. The cellulose raw material 1 is conducted into a hammer mill 2, where the cellulose material is disintegrated to fibres. The fibres are conducted onto a wire 3 with the aid of a drum forming means 4, to constitute a web 5. There may be several drum formers in succession, e.g. two of them 4,4², over the endless wire circulating supported by rolls 6. To the web thus formed is added bonding agent, e.g. latex, by spreading it with the aid of spray nozzles 7. Finally, the web that has been formed is carried to a drying section 8, where the latex bonds the web to become a paper-like product, such as paper or cardboard, to be conducted onto a reel 9.

The process depicted in Fig. 1 includes spray nozzles 10 and 11 for spraying antistatic agent into the hammer mill, and similarly into the drum former, in order to prevent clogging of the hammer mill and former and to improve the handling and passage properties of the fibres. When using the additives mentioned in Example 1, the earlier clogging of the hammer mill could be completely avoided in the process.

The process depicted in Fig. 1 may further comprise e.g. screen or other separating means, disposed e.g. between the hammer mill and the former. The fibre fraction passing through the separating means, meeting the desired specifications, is then conducted to the former, while the coarser fibre fraction may be returned to the hammer mill. The screen, indicated with interrupted lines, reference numeral 12, may equally be provided with spray nozzles 10 or with other means for adding antistatic agent to the process for preventing clogging of the fibrous material and for improving the passage properties of the fibres.

In the process of Fig. 1 one mag use, e.g. in the hammer mill 2, in the separating means 12, in the drum forming means 4 or in conjunction with the web 15 formed upon the wire 3, e.g. the antistatic agents described in Example 3 or farther below in Example 3, in order to prevent clogging of the process and/or to improve the handling properties of the fibrous material.

Example 3

Commercially available antistatic agents :

Alkaril chemicals Inc. GAF : Alkamuls SML (sorbitan monolaurate), Alkaphos B6-56A (phosphate ester), Alkaquat C (quaternary imidazole), Alkaquat DAPT (quaternary fatty acid), Alkaquat DMB-ST (stearyl-dimethylbenzylammonium chloride), Alkaquat O (quaternary diolein imidazole), Alkaquat T (quaternary imidazole) ;

Mazer Chemicals, Inc. : Alubrasoft SJ-Wax (polyamide), Alubrasol APL-5, Alubrasol FE (cationic polyamide salt mix), Alubrasol NSL, Alubrasol OS, Alubrasol WL-100, Alubraspin HS-100 (fat/alcohol alkoxylate), Alubraspin HS 100 (fat/alcohol alkoxylate), Alubraspin NF-8A Conc., Alubraspin PF, Alubraspin PNA, Alubraspin 100-PM ;

Hart Products Corp. : Antistat H (quaternary nitrogen compound) ;

Laurel Products Corp. : Antistat 680 (quaternary ammonium compound) ;

Hexcal Corp. : Antistatic Agent 273-E (bis-2-hydroxyethylstearylamine), Antistatic Agent 273-C (bis-2-hydroxyethylcocamine) ;

Akzo, Chemical Div. : Armostat 100V (quaternary ammonium salts), Armostat 310, 410 (tertiary ethoxylated amine), Armostat 375, 450, 475 (tertiary ethoxylated amine), Armostat 550 (tertairy ethoxylated amine) ;

Lyndal : Aston 01 (imidazoline) ;

North Chemical : Aston 123 (polyamine) ;

ICI Americas Inc. : Atmer 122, 125 (monoglyceride), Atmer 129 (monoglyceride), Atmer 163 (monoglycerides) ;

E.I. Du Pont De Namours & Co. : Avitex DN (quaternized hydrocarbon), Avitex E (quaternary ammonium salt), Avitex NA (higher alkylamine compound), Avitex R (higher alkylamine compound) ;

Capital City Products Co. : Capstat (quaternary alkylammoniumethylsulphate) ;

Union Carbide Corp. : Carbowax$^{R}$ PEG Series (polyethylene glycol) ;

Sandoz Chenicals Corp. : Ceranine HCA Granules (amide complex) :

Chemax Inc. : Chemstat 122/60DC, 182/67DC (bis(2-hydroxyethyl)alkylamine), Chemstat 122, 172 (bis(2-hydroxyethyl)alkylamine), Chemstat 182 (bis(2-hydroxyethyl)alkylamine), Chemstat 192 (bis(2-hydroxyethyl)alkylamine) ;

Finetex Inc. : Cordex DJ (amine derivative) ;

The C.P. Hall Co. : CPH-376N (polyoxyethylene laurate) ;

American Cyanamid Co. : Cyastat$^{R}$ LS ((3-lauramidopropyl)trimethylammonium methylsulphate), Cyastat$^{R}$SP (stearamidopropyldimethyl-β-hydroxye-thylammonium-dihydrogen nitrate), Cyastat$^{R}$ 609 Antistatic Agent (N-N-bis(2-hydroxyethyl)-N-(3'-dodecyloxy-2-hydroxypropyl) methylammonium methosulphate) ;

Henkel Corp. : Dacospin HS (arylphenol), Dacospin PE-146 (phosphatized aliphatic alcohol), Dacospin 092 (quaternary imidazole sulphate), Dehyquart E (hydroxyhexadecyldimethylhydroxyethylammonium chloride) ;

Eastern Color & Chemical Corp. : Eccostat ;

Wiltco Corp. : Emcol$^{R}$ CC-9 (polypropoxy-quaternary ammonium chloride), Emcol$^{R}$ CC-55 (polypropoxy-quaternary ammonium acetate), Emphos$^{TR}$ PS-220, PS-236, PS-400 (organic phosphate esters);

Akzo, Chemical Div. : Ethoquad C12, C25, R1315 (quaternary ammonium salts) ;

American Hoechst Corp.: Genamin KDM-F (alkyltrimethylammonium chloride) ;

The C.P. Hall Co. : Hallco Antistat C-1047 (laurate ester), Hallco$^{R}$ C.7065 (polyoxyethylene laurate);

Croda Inc. : Incromectant AQ (acetamidopropyltrimonium chloride), Incrosoft S-75 (imidazolinium methosulphate), Incrosoft S-90 (imidazolinium methosulphate), Incrosoft S-90M (imidazolinium methosulphate), Incrosoft T-75 (imidazolinium methosulphate), Incrosoft T-90 (imidazolinium methosulphate) ;

Cropmpton & Knowales Corp. : Intrasoft$^{R}$ OCN (cationic fatty acid condensation) ;

akzo, Chemical Div. : Ketjenblack E.C. (soot) ;

Laporte Inc. : Laponite$^{R}$ XLS (synthetic sodium-magnesium silicate) ;

Mazer Chemicals Inc.: Larostat 88 (soy dimethylethylammonium ethosulphate), Larostat 143 (oleyldimethylethylammonium ethosulphate), Larostat 264A, 264 (soy dimethylethylammonium ethosulphate), Larostat 264A Anhydrous (soy dimethylethylammonium ethosulphate), Larostat 300 (potassium alkylphosphate ester), Larostat 300A (alkylphosphate ester), Larostat 377 DPG (alkyldimethylethylammonium ethosulphate), Larostat 451 (stearyldimethylethylammonium ethosulphate) ;

Lipo Chemicals Inc. : Lipoquat C 25 (quaternized alkylamine ethoxylate), Lipoquat R (quaternized ricinoleinic acid) ;

Mazer Chemicals Inc. : Maphos$^{R}$ 66H (phosphate ester), Maphos$^{R}$ 76 NA (salt/phosphatic acid ester), Mazeen$^{R}$ C-2, C-5, C-15 (polyoxyethylene cocoamine), Mazeen$^{R}$ S-2, S-5 (polyoxyethylene-soy amine), Mazeen$^{R}$ T-2, T-5, T-15 (fat amines, Mazol$^{R}$ GMO K (glycerol monooleate), Mazoline$^{R}$ OA (fat imidazole), Mazon JMR-1 ;

M.Michel & Co, Inc.: Michel XO-24 (amine), Michel XO-85 (amine). Michel XO-108 (amine) ;

Miranol Inc. : Miranol Ester PO-LM4 (oligomeric polyester), Miranol$^{R}$ DM, DM Conc. 45% (monocarboxyl-stearine derivative, sodium salt), Mirapol$^{R}$ A-15 (polyquaternary ammonium chloride), Mirapol$^{R}$ AD-1 (polyquaternary ammonium chloride), Mirapol$^{R}$ 9 (polycationic copolymer), Mirapol$^{R}$ 95 (polycationic copolymer), Mirapol$^{R}$ 175 (polycationic copolymer) ;

Mona Industries Inc. : Monafax 785, 786 (phosphate ester), Monastat 1195 ;

Lyndal Inc. : Phosfac 1001 (organic phosphate ester), Phosfac 1044 FA, 1044, 1006, 1066, 1066FA (organic phosphate ester) ;

Henkel Canada Ltd. : Polyquart H (polyamine) ;

Akzo Chemicals Div. : RD-5078 ;

Sandoz Chemicals Corp. : Sandin EU (sulphonated hydrocarbon), Sandin VU (sulphonated hydrocarbon), Sandotex A amine) ;

Mazer Chemicals Inc.: S Maz$^{R}$ 20 (sorbitan monolaurate) ;

ACL Inc. : Staticide$^{R}$ ;

Hexcal Corp. : Sumquat$^{R}$ 5106/ Antistatic (bis(2-hydroxyethyl)octyl-methylammoniumparatoluene sulphonate), Agent 106G-90% ;

Tomah Products : Tomah Q-14-2 (quaternary amine), Tomah Q-18-3-50% quaternary amine) ;

Union Carbide Corp. : Union Carbide$^{R}$ Y 9567, T 9794 (organosiliconic compound) ;

Sherex Chemical Co. Inc : Varstat K22, T22 (bis-hydroxyethylalkylamine), Varstat 10 (ethoxylated alcohol), Varstat 55 (ethyl-bis-(polyhydroxyethyl)alkylammoniumethylsulphates) ;

E.I. Du Pont De Nemours & Co. : Zelec NE, NK (alcohol phosphates), Zelec TY (alcohol phosphates) ;

Taiwan Surfactant Corp. : Albumine 230 (N-alkyldimethylammonium chloride), Albumine 280 (stearyldimethylbenzylammonium chloride), Abluphat LP (sodium salt of phosphate ester), Abluphat LPF, LPI, LFX (free acid of phosphate ester) ;

Cyanamid B.V. : Aerosol C 61 (alkylamineguanide polyoxyethanol) ;

Toho Chemical Industry Co. Ltd. : Anstex AK-25 (phosphate) ;

ICI : Atmer 122, 123, 126, 128, 129 (glycerol ester), Atmer 151 (alkoylated alcohol), Atmer 1454 (alkoxylated fatty acid ester). Atmer 160 (quaternized amine ethoxylate), Atmer 163 (alkoxylated fat amine), Atmer 172, Atmer 190 (alkylsulphonate) ;

Stepan Europe : Catigene$^{R}$ CT 30/70 (alkylmethylammonium ethoxysulphate), Catigene$^{R}$ LT 45 (alkylmethylammonium ethoxysulphate), Catigene$^{R}$ ST 30/70 (alkyltrimethylammonium ethoxysulphate) ;

Sanyo Chemical Industries Ltd. : Chemistat 3500, 6120, 5300, 6300H (quaternary ammonium polymer) ;

Croda Surfactants Ltd. : Cithrol A (polyglycol oleate) ;

Pulcra Sa : Crafol AP-12 (oleate-5-phosphate), Crafol AP-31, AP -33, AP 34 (potassium salt of phosphate ester), Crafol AP-36 (DEA salt of phosphate ester), Crapol AU-31 (quaternary dialkylimidazole) ;

Croda Surfactnats Ltd. : Crillet (POE-sorbitan esters), Crodafos (alkylether phophates), Crodamet (POE amines), Croduret (POE-hydrogenated oil) ;

Henkel KG&A : Dehyquart LT (lauryltrimethylammonium chloride) ;

Kao Corp. : Elec AC, EA, QN, RC, TS2, TS-3, TS-5, TS-6, Elec-2 (ethoxylated fat amine), Electmaster HE-110, 210, Electmaster S-520, LL-10, PP-220, 320 ;

Takemoto Oil & Fat Co. Ltd. : Elecut S-117 ;

Witco SA : Emcol CC 55, CC 57 (polypropoxylated quaternary ammonium phosphate) ;

Yoshimura Oil Chemical Co. Ltd. : Ereak PS-909 (alkylamidepropyldimethyl-β-hydroxyethylammonium nitrate) ;

Akzo Chemicals BV: Ethoquad C/12, O/12

(ethoxylated quaternary ammonium compound) ;

Pulcra SA : Etilenox KM Series (polyoxyethylene alkylamine) ;

Henkel-NOPCO S.A. : Kerensim L 10 P (alkyl-polyethhoxy esters and ethers) ;

BASF AG : Kerostat$^{R}$ 5009 (salts of aminocarboxylic acids) ;

Harcros Chemicals UK Limited : Lankrostat Series ;

Lion Corp. : Lipomin LA (alanine derivates) ;

ICI Ltd. : Lubrol 17 A-17 (fat-alcohol ethoxylate oxide condensate) ;

Henkel-NOPCO S.A. : Lutostat MSQ 30. MSW 88 (alkylamine) ;

Pulcra SA : Niox KQ-20, KQ-22, KQ-52, KQ-53, KQ-54 (ethoxylated fat oxoalcohol), Niox KQ-55, KQ-56, KQ-70, KQ-80, KQ-81 (ethoxylated fat oxoalcohol) ;

Nippon oil & Fats Co. Ltd. : Nissan Cation SA (octadecylamine acetate), Nissan Elegan S-100, Nissan New Elegan A. ASK, Nissan Elegan S-100 ;

Pulcra SA : Noiox AK-43, AK-45 (polyethylene fatty acid ester) ;

Ceca SA : Noxamium S2/50 (ammoniumquaternary derivatives of ethoxylated amines) ;

Henkel KG&A : Polyquart H 81 (polyglycol-polyamine condensate resin) ;

Aquatec Quimica S/A : Proplast 058 (glycerol ester) ;

Hefti Ltd. Chemical Products : PGE-600 (polyethylene glycol), PGE-1000 (polyethylene glycol), PGE-1500 (polyethylene glycol) ;

Hacros Chemicals UK Limited : Quadrilan AT (quaternary ammonium salt) ;

Synfina-Oleofina S.A. : Radiamine 6140 (primary amine), Radiaquat (dialkyldimethyl-quaternary ammonium chlorides), Radiasurf (esters of fatty acids and poly-alcohols, and ethoxylated sorbitol esters) ;

Rewo Chemische Werke GmbH : Rewoquat CPEM (N-methyl-N-(pentathoxy)-N-cocoammonium methosulphate) ;

Sanyo Chemical Industries Ldt. : Sanstat 2012-A ;

Servo Chemische Fabriek : Serdox NSG 400 (sterylpolyglycerol ester), Servamine KAC 412 (N-gluco-N,N,N-trimethylammonium chloride), Servoxyl VPI 55 (phosphate ester) ;

Kao Corporation S.A. : Soluol OM (quaternary ammonium salt) ;

Zchimmer & Schwarz : Sulfostat KNT (amido-alkylamine acetate) ;

ICI PLC : Synprolam 35 DMBQC ($C_{12}$-$C_{15}$-alkyldimethylbenzylammonium chloride), Synprolam 35 MX 1, 35 MX 3, 35 MX 5 ($C_{13}$-$C_{15}$-alkylmethylpolyethoxylated amines), Synprolam 35 MX 10, 35 MX 15, ($C_{13}$-$C_{15}$-alkylmethylpolyethoxylated amines), Synprolam 35 MX 1QC ($C_{13}$-$C_{15}$-alkylmethylpolyethoxylated amines), Synprolam 35 N3X3, 35 N3X5, 35 N3X10 ($C_{13}$-$C_{15}$-alkylmethypolyethoxylated propanidamine), Synprolam 35 N3X15 ($C_{13}$-$C_{15}$-alkylmethypolyethoxylated propanidamine), Synprolam 35 TMQS ($C_{13}$-$C_{15}$-alkyltriemethylammonium methosulphate), 35X 2, 35X 5, 35X10, 35X15 ($C_{13}$-$C_{15}$-alkylmethylpolyethoxylated amines), Synprolam 35X 15 QS, 35X 20QS, 35X 2QS, 35 5QS, 35X 10QS ($C_{13}$-$C_{15}$-alkylmethylpolyethoxylated methylammonium methosulphate compounds) ;

Nippon Nyukazai So. Ltd. : Texnol IL (alkylimidazoline laurate), Texanol SPT.

The embodiment examples are only meant to illustrate the invention, without in any way restricting it.

## Claims

1. A procedure for preventing clogging of a process handling mainly dry cellulose-containing material and for improving the handling properties of the material, characterized in that antistatic agent is added to the cellulosic material.

2. Procedure according to claim 1, characterized in that antistatic agent is sprayed into a dry handling process, selected from the group : grinder feed means, grinder, conveyor, screen, and fibre web forming process.

3. Procedure according to claim 1 or 2, characterized in that antistatic agent is supplied onto the cellulose particles to be ground.

4. Procedure according to any one of claims 1-3, characterized in that the antistatic agent is liquid and contains water and antistatic chemical 1 to 29%, and additive selected from the groups : ethanol 2 to 40% and glycol 1 to 10%.

5. Additive for use in connection with a process handling mainly dry cellulosic material, in order to prevent clogging of the process and to in prove the handling properties of the material, characterized in that the additive is an antistatic agent.

6. Additive according to claim 5, characterized in that the additive contains water and antistatic chemical 1 to 20%.

7. Additive according to claim 5 or 6, characterized in that the additive contains ethanol 2 to 40%.

8. Additive according to any one of claims 5-7, characterized in that the additive contains glycol 1 to 10%.

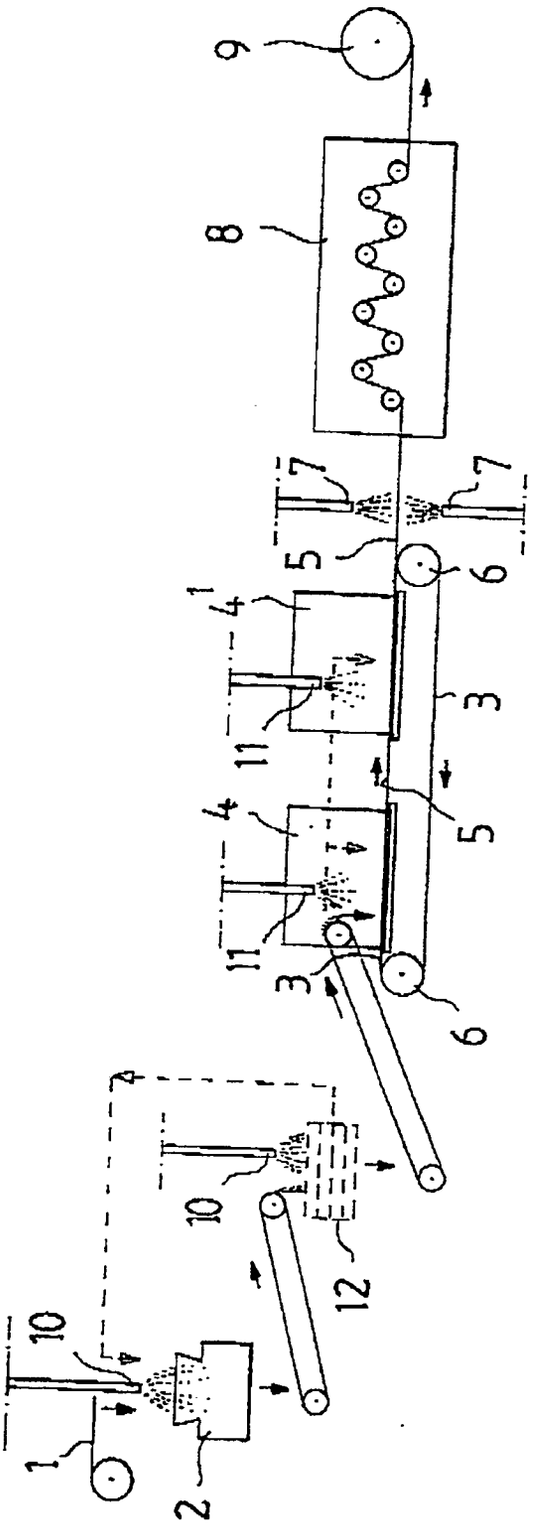


Fig.1

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number

EP 91 85 0007

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| X | US-A-4118832 (T.O.ADDY ET AL.)<br>* the whole document * | 1, 2, 5, 6 | D21H21/00 |
| Y | ABSTRACT BULLETIN OF THE INSTITUTE OF PAPER CHEMISTRY.<br>vol. 44, no. 4, October 1973, APPLETON US<br>page 372 A.E.GUSHCHIN:<br>"Generation of static electricity during sheet formation by the dry process."<br>* the whole document * | 1-8 | |
| Y | GB-A-769231 (PHILIPS ELECTRICAL INDUSTRIES LIMITED)<br>* examples 1-6 * | 1-8 | |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl.5) |
| | | | D21H |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 11 APRIL 1991 | SONGY O.M-L.A. |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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