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(54) Pulp and paper manufacturing cleaning composition

(57) Pulp and paper manufacturing cleaning composition characterized in that the pulp and paper manufacturing machinery cleaning composition has a viscosity in the range of 100 to 3000 mPa·s measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm at a temperature of 23 °C.

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Description

[0001] The present invention relates to a pulp and paper manufacturing machinery cleaning composition according to claim 1. The present invention further relates to a method for cleaning pulp and paper manufacturing machinery according to claim 11 and to the use of a pulp and paper manufacturing machinery cleaning composition according to claim 14.

[0002] It is often necessary in industrial processes to apply cleaning compositions to plant to remove unwanted contamination. Such industrial cleaning compositions are usually liquids that are supplied in drums or containers and will be applied by pumping or spraying onto the parts to be cleaned. As this procedure usually means that a process must be stopped to allow the cleaning operation to take place, the speed with which the cleaning effect takes place is of high importance.

[0003] In for instance a plant intended to manufacture paper known as a paper machine, the machine is designed to separate fibres etc from aqueous slurry to form a web of wet paper on a continuous synthetic sieve, known as the "wire" or "formation wire" (as in the past it was made of woven bronze wire), whereby the wet paper web is then pressed between felts in the press-section to remove more water and then subsequently dried over heated cylinders in the drying-section. To help guide the damp web over the heated cylinders a continuous, open weave fabric, known as the "drying wire", is usually used as a support as the drying paper web has limited strength. All these parts coming in contact with the fibre slurry (pulp), the wet paper web and the progressively drying paper will become contaminated with a variety of unwanted substances ranging from scale, bacterial slime, chemical deposits and perhaps residues from waste paper recycled raw materials known as "stickies". The active components of a cleaning composition must clearly cater for the type of contamination involved.

[0004] Further, the surfaces to be cleaned will take several forms. In the example of the paper machine, there will be metal parts which due to the construction may be in the horizontal or up to the vertical plane or even the underside of a roof location such as the top inside a closed vessel such as the so-called "head-box" through which the paper slurry flows onto the formation wire. Secondly it will almost certainly be necessary to clean the various open-weave sieves such as the formation wire where the paper components slurry is initially de-watered to form the wet paper web, or the drying-wire. The felts in the press-section also present themselves as a porous substrate where unwanted contamination can de deposited.

[0005] Conventionally, cleaners for such machines can be in the form of for instance, aqueous solutions of alkali and tenside or acid and tenside. The mixture may contain solvents whereby if the solvent is water soluble the mixture would be a solution but if the solvent were non-water soluble the mixture could be in the form of an oil-in-water emulsion. The cleaner could even be a water-free solution of tenside in organic solvent.

[0006] The physical form of these mixtures is normally that of a liquid. They will be applied by direct application, perhaps pre-diluted in water, perhaps as diluted or undiluted made up as foam in a special foam producing unit etc. There are several drawbacks in these methods. A high proportion of a conventional liquid cleaner will run off a vertical surface or run through an open weave sieve construction and be lost. A foamed product on the other hand is mostly air, the quantity of active cleaning chemicals in contact with the surface to be cleaned is low.

[0007] In patent DE 195 19 268 C1 it is disclosed that an oil-in-water emulsion containing organic solvents and tensides can be applied to machines and plant used to make pulp, paper and board to clean away or inhibit contamination consisting of synthetic adhesives and/or natural resins. In this patent it is described that the preparation of stable oil-in-water emulsions is well known inferring that it is a requirement that the emulsion be stable. Further, it is cited that the hydrophobic phase of the said emulsion represents in the main, the substance giving the active effect. That the product is an oil-in-water emulsion infers that more than half of the product is water.

[0008] Those with knowledge of oil-in-water emulsions will realise that a stable emulsion will become evenly distributed throughout any aqueous system into which it is added. Further, in de-watering machinery such as a paper machine, the formation wires, the press-felts and the drying wires are open-weave or porous structures which allow water and thus low viscosity liquids to easily pass through.

[0009] Thus when any cleaning composition consisting of a typical oil-in-water emulsion is applied to such substrates, the greater proportion of such compositions will pass through the wire or felt whereby what remains would anyway be at least half water. As the active substances are evenly distributed throughout the water phase of the emulsion, only a limited part of the emulsified active components will make contact with the de-watering plant surfaces intended to be cleaned or remain adhered to such surfaces.

[0010] Further, as many cleaning compositions are aggressive and potentially hazardous in use, it is not wanted that the product contaminates areas outside of the part directly being cleaned or for instance, escapes into the surrounding atmosphere as an aggressive aerosol.

[0011] Moreover, tensides that can maintain a hydrophobic solvent in a stable oil-in-water emulsified condition may also cause undesirable foaming effects. In papermaking for instance, quite large amounts of products known as defoamers are added specifically to reduce foam and the associated problems.

[0012] Hence, the object of the present invention is to overcome the disadvantages of the prior art.

[0013] Namely, it is an object of the present invention to minimise the loss of cleaning composition to areas outside of that to be cleaned. Further, it is an object of the present invention to minimise the contamination of personnel. Moreover, it is an object of the present invention to minimise the contamination of equipment not intended to be treated with the cleaning composition. A further object of the present invention is to shorten the cleaning time.

[0014] The present invention is based on the finding that a minimum of active ingredients is needed if a maximum amount of cleaning composition may be deposited and held on the machinery components to be treated.

[0015] The above mentioned objects of the present invention are solved by subject matter defined in the claims.

[0016] The present invention therefore relates to a pulp and paper manufacturing machinery cleaning composition which has a viscosity in the range of 100 to 3000 mPa·s measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm at a temperature of 23°C. The data refers to a measurement on a Brookfield LVT viscometer fitted with a Brookfield LV No. 2 Spindle and Brookfield LV Guardleg.

[0017] Preferably, the cleaning composition of the present invention has a viscosity in the range of 300 to 3000 mPa·s, and most preferably of a viscosity in the range of 500 to 3000 mPa·s measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm at a temperature of 23°C. As mentioned the data refers to a measurement on a Brookfield LVT viscometer fitted with a no. 2 spindle.

Most preferably, the pulp and paper manufacturing machinery cleaning composition has a viscosity in the range of 600 to 2500 mPa·s measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm on a Brookfield LVT viscometer fitted with a no. 2 spindle and at a temperature of 23°C

[0018] Viscosity measurement is thereby done under the following conditions:

- Brookfield model LVT viscometer as in Brookfield manual M85-150-P700 fitted with Brookfield LV number 2 spindle and standard Brookfield LV Guardleg

- 600 ml low-form glass beakers with 500 ml working volume for holding test sample - volume of test sample used is 500 ml but spindle placed in fluid to level mark on spindle shaft

- All equipment and samples held conditioned for at least one hour in a lab controlled to a temperature of 23°C at normal room pressure

- LVT viscometer rotational speed ranges of 6, 12, 30 and 60 rpm are used giving measurement of Newtonian and/or pseudo-plastic viscosity characteristics

- At speeds of 6 and 12 rpm, 5 rotations of spindle are allowed before reading value, at speeds of 30 and 60 rpm, between 5 and 10 rotations of spindle are allowed before reading value

- Time-dependant, meaning thixotropic, viscosity characteristics are judged by measuring viscosity after 5 seconds and 180 seconds rotation at a given spindle rotational speed of normally 30 rpm

[0019] The term Newtonian viscosity characteristic means that the measured viscosity remains constant at different shear rates.

[0020] The term pseudo-plastic viscosity characteristic means the measured viscosity decreases at increasing shear rates.

[0021] The term thixotropic viscosity characteristic means that the measured viscosity decreases with the increase in length of time that the liquid is subjected to shear forces.

[0022] The term "pulp and paper manufacturing machinery" thereby means plant, machinery and parts thereof used for the manufacture of papermaking fibre such as mechanical pulp, chemical pulp, chemo-mechanical pulp, re-cycle pulp, paper, board and tissue. These plant parts especially include pulp-dewatering machinery and paper, board and tissue production machines including all parts and sections comprising such machines such as tanks, pipe-work, circuits, head-boxes, formation sections and their corresponding fabrics known as "wires", fibre-recovery plant such as poly-discs, press-sections and their corresponding felts, drying-sections and their corresponding fabrics, rolls and cylinders. Further examples include such plant as paper-coating machines.

[0023] Surprisingly, it was found that by increasing the viscosity of the pulp and paper manufacturing machinery cleaning composition so that it stays essentially on the surface to be cleaned, a much higher cleaning efficiency can be obtained in that the cleaning effect is achieved in less time and with significantly less product. Further, as the pulp and paper manufacturing machinery cleaning composition does not run away from the parts being cleaned, there is less loss of product to the drain system and therefore less unwanted contamination of the surrounding environment and less chance of unwanted contact between the often aggressive cleaning chemicals and people working in the area.

[0024] It is further preferred that the pulp and paper manufacturing machinery cleaning composition comprises two or more of the components selected from the group consisting of water, alkali, acid, tenside, chelating agent, organic solvent and/or thickener.

[0025] Thereby, water may be added in the form of demineralised water, but also in mineralised form such as drinking or table water such as from a spring or surface water from rivers and lakes.

[0026] Further, an alkali is a specific type of base, formed as a carbonate, hydroxide or other ionic salt of an alkali metal or alkali earth metal element. Preferred are easily soluble, readily available alkalis such as sodium hydroxide, sodium carbonate, potassium hydroxide etc. whereby if low residual solids are required then ammonium hydroxide is suitable.

[0027] As acid, any substance may be used that, when dissolved in water, gives a solution with a pH of less than 7. It is preferred that the acid at the strength used is not detrimental to the surfaces to be cleaned whereby anti-corrosion additives such as but-2-yne-1,4-diol can be added. Preferred acids and acidic substances are hydrochloric acid, sulphuric acid, phosphoric acid, nitric acid, sulphamic acid, glycolic acid, acetic acid, formic acid, aluminium chloride and citric acid.

[0028] As tenside, also known as surfactant or wetting agent, substances are meant that are able to lower the surface tension of a liquid, allowing easier spreading, and the interfacial tension between two liquids. Surfactants are organic compounds that are amphipathic, meaning they contain both hydrophobic groups, also known as tail groups, and hydrophilic groups, also known as head groups.

Tensides play an important role in many applications and products such as detergents, emulsifiers, adhesives, for wetting, foaming and defoaming.

A tenside or surfactant can be classified by the presence of formally charged groups in its head. A non-ionic surfactant has no charge groups in its head. The head of an ionic surfactant carries a net charge. If the charge is negative, the tenside or surfactant is called anionic, if the charge is positive, it is called cationic. If a surfactant contains a head with two oppositely charged groups, it is termed amphoteric.

Some commonly encountered tensides or surfactants of each type include tensides based on sulphate anions, sulphonate anions or carboxylate anions, such as fatty acid salts, sodium 2-ethylhexyl sulphate, sodium dodecyl sulphate, sodium lauryl sulphate, ammonium lauryl sulphate, dodecyl benzene sulphonic acid and other alkyl sulphate salts as anionic tensides or surfactants. Cationic tensides or surfactants may be based on substituted ammonium derivatives such as quaternary ammonium cations. Examples are cetyl trimethylammonium bromide (CTAB) and other alkyltrimethylammonium salts. Further cationic tensides or surfactants are cetyl pyridinium chloride, polyethoxylated tallow amine (POEA), benzalkonium chloride. Examples for zwitterionic, i.e. amphoteric tensides or surfactants are dodecyl betaine, dodecyl dimethylamine oxide, cocamidopropyl betaine and coco ampho glycinate. Examples for non-ionic tensides or surfactants are alkyl poly(ethylene oxide), alkyl polyglucosides, ethoxylated C9 - C16 aliphatic alcohols, poyoxyethylene stearylamine, fatty alcohols as well as cocamide MEA, cocamide DEA and cocamide TEA.

Preferred tensides are alkyl aryl sulphonate alcohol amine salt, polyethyleneglycol alkyl ether, alkyl sulphonsuccinate sodium salt and/or aliphatic alcohol ethoxylate.

[0029] As chelating agent, a compound is meant that binds avidly to form a complex with certain metals. Thereby, the ligands are coordinated to the metal ion. For instance, EDTA, ethylenediamine tetra acetic acid, may be mentioned as a chelating agent. Preferred chelating agents are EDTA, DTPA, Ethylenetriamine pentamethylene phosphonic acid Na-salt, polyacrylates, tetra potassium pyrophosphate, polyamines, polyphosphates and phosphonates.

[0030] As organic solvent, any organic solvent may be used that is not detrimental to the personnel, the machinery or the environment.

Preferred organic solvents or mixtures thereof are selected from the group consisting of saturated or unsaturated open-chain or cyclic, normal or isomeric hydrocarbon having 5 to 30 carbon atoms; acyclic, monocyclic and/or bicyclic terpene hydrocarbons or terpene alcohols, fatty acid esters, rape-seed oil methylester.

Particularly preferred are hydrocarbons obtainable from de-aromatized white spirit or hydrogen treated petroleum distillates, whereby the hydrocarbons have a boiling range such that the initial boiling point is typically between 175°C and 200°C and final boiling point of typically 220°C with a boiling range average of approximately 198°C.

Further, derivatives of fatty acids are preferred organic solvents. Examples are fatty acid esters, rape-seed oil methylester or bio-diesel.

[0031] Moreover, citrus oils are preferred organic solvents. Examples are orange terpene pressed from the rind of sweet oranges whereby a high proportion of the resulting solvent is limonene.

[0032] It is also preferred that the combination of organic solvent and tenside comprises up to 20 wt% of citrus oils.

[0033] Thickeners are substances which, when added to a mixture, increase its viscosity without substantially modifying its other properties such as cleaning properties.

Thickeners may be divided into the following groups:

> As organic natural thickeners, agar-agar, carrageen, tragacanth, gum arabic, alginates, pectins, polyoses, guar flour, carob gum, starch, dextrines, gelatine, casein may be mentioned.

As organic modified thickeners, methyl cellulose, carboxymethylcellulose and other cellulose ethers, hydroxyethyl and - propyl cellulose, carob gum ether, guar derivatives, may be mentioned.

As organic synthetic thickeners, polyacrylates and polymethacrylates, vinyl polymers, polycarbonic acids, polyethers, polyimines, carbomers and polyamides may be mentioned.

As inorganic thickeners, polysilicic acids, clay minerals such as montmorillonite, zeolithes and silicic acids may be mentioned.

Preferred thickeners or thickening agents are selected from the group consisting of methyl cellulose, carboxymethyl cellulose, hydroxyethyl cellulose, xanthan gum, guar gum, colloidal silica, bentonite clay, polyacrylate, polyvinyl alcohol, polymethacrylate.

[0034] Preferably, the pulp and paper manufacturing machinery cleaning composition of the present invention is in the form of a solution, a suspension, a water-in-oil emulsion or a thixotropic liquid.

[0035] Further, preferably the pulp and paper manufacturing machinery cleaning composition according to the present invention may have a pseudo-plastic character meaning the viscosity reduces on being subjected to increasing shear and the pulp and paper manufacturing machinery cleaning composition may have a thixotropic character, i.e. it exhibits a progressively reduced viscosity the longer it is subjected to a given shear or when agitated.

[0036] The viscosity needed may be achieved in a variety of ways, depending on the components essential to the basic cleaning formulation. For an aqueous alkali / tenside cleaner, a small amount of a water-soluble thickener such as water soluble cellulose derivatives or xanthan gum may be added. For a solvent / tenside / water mixture, the tenside types used may be chosen to not only have a cleaning effect but also to create a stable water-in-oil emulsion of increased viscosity such as is achieved when oil and lemon juice is blended with egg yolk to give a mayonnaise with a much higher viscosity than the bulk of the starting ingredients. Such a water-in-oil emulsion can possess a useful pseudo-plastic character that flows easily under shear stress but thickens when the shear is reduced or removed. A mixture of solvent and tenside may be thickened with a hydrophobic colloidal silica powder.

[0037] Bentonite clays may be used to yield a pseudo-plastic and/or thixotropic properties of the pulp and paper manufacturing machinery cleaning composition.

[0038] Pseudo-plastic properties are highly desirable and yield excellent cleaning properties. Particularly a pulp and paper manufacturing machinery composition having a viscosity in the range of 100 to 500 mPa s measure at the shear rate produced at the rotational speed range of 60 rpm at a temperature of 23 °C (Brookfield LVT viscosimeter fitted with a no. 2 spindle) and a viscosity in the range of 600 to 3000 mPa s measure at the shear rate produced at the rotational speed range of 6 rpm at a temperature of 23 °C (Brookfield LVT viscosimeter fitted with a no. 2 spindle)is preferred. More preferably the ratio of the viscosities (viscosity (60 rpm)/viscosity(6 rpm)) measured at the above mentioned conditions should be within the range of 1:2 and 1:8, preferably 1:3 and 1:6 and most preferably 1:4 and 1:5.

[0039] It is also preferred that the pulp and paper manufacturing machinery cleaning compositions according to the present invention have thixotropic properties. Preferably the pulp and paper manufacturing machinery cleaning compositions according to the present invention has a viscosity in the range of 600 to 3000 MPa s measured after 5 seconds at the shear rate produced at the rotational speed range of 30 rpm on a Brookfield LVT viscosimeter fitted with a no. 2 spindle and at a temperature of 23 °C and a viscosity in the range of 100 to 500 mPa s measured after 180 seconds under the same conditions. More preferably the ration of the viscosities measured under said conditions (viscosity (180 seconds) / viscosity (5 seconds) should be in the range of 1:1 to 1:10 and even more preferably in the range of 1:2 to 1:8. Most preferably the viscosity ratio (viscosity (180 seconds)/viscosity (5 seconds) is in the range of 1:3 to 1:5.

[0040] All these techniques have one thing in common in that when the so formulated pulp and paper manufacturing machinery cleaning composition is applied to a surface to be cleaned, the concentration of active cleaning ingredients in contact with the surface remains at a maximum, undiluted with for instance extra dilution water or air from a foam generator or water as majority component of an oil-in-water emulsion. Further, due to the suitably high viscosity, it remains in place on or in the surface to be cleaned for the required contact time and does not run away unnecessarily.

[0041] Moreover, the present invention provides a method for making a pulp and paper manufacturing machinery cleaning composition for cleaning pulp and paper manufacturing machinery according to the present invention wherein the above mentioned components are mixed together.

[0042] Further, the present invention relates to a method for cleaning pulp and paper manufacturing machinery whereby the above-identified pulp and paper manufacturing machinery cleaning composition is applied to the machinery or parts thereof.
Cleaning procedures may include the following:

Where a paper machine is stopped for maintenance and cleaning session, known as a boil-out, many components need to be cleaned. For instance the head-box, which is a device where the pulp slurry is lead out through a wide mouthpiece onto the formation wire, is often cleaned inside at the boil-out. In the inside of the head-box it is often very difficult to reach all surfaces and a conventional low viscosity cleaner or a foamed, diluted or concentrated cleaner would be sprayed onto all surfaces repeatedly prior to washing off with a high-pressure jet washer.

[0043] The cross-flow manifold which distributes the flow of pulp slurry into the entry of the head-box is also often cleaned at a boil-out. This pipe-work with a progressively decreasing diameter is difficult to clean and often overlooked but careful owners clean this with liquid cleaners or foaming cleaners followed by high-pressure water-jet rinsing.

[0044] The formation sieve or "wire" is often cleaned. This wire is typically in the form of a continuous length of woven sieve running over a so-called "table" of supports and then returning over rollers which guide it and keep it in tension. The "wire table" area is often situated in the horizontal plane. The wire can become contaminated with deposits such as natural resins, synthetic polymers or so-called "stickies", with filler such as carbonates and with scale etc. A cleaning composition would be sprayed onto the weave of the wire and supports including the guide rolls whereby the wire would be slowly moving and the cleaning agents would be subsequently washed off.

[0045] The same applies to felts in the press-section and also to the open weave drying fabrics which support the wet paper through the drying section where the wet paper web is carried over heated cylinders to dry it.

[0046] It was seen that in the use of conventional cleaning compositions, especially in cleaning of open weaves, vertical surfaces and the underside of horizontal surfaces, that much of the product would run away and only a small percentage of the product would remain in contact with the surface to be treated.

[0047] It was also seen that foamed cleaners stayed in contact better with the surface to be cleaned. Many conventional foamed cleaners are first diluted with water and then foamed. It was apparent that the cleaning effect was not really any more efficient than non-foamed cleaners.

[0048] The present cleaning formulations maximise the concentration of active components in contact with the surfaces to be cleaned and further maximise the contact time after initial application.

[0049] It was found in one embodiment of the invention that by taking a conventional water-free cleaner based on solvents and tensides and possessing a characteristically low viscosity, with the addition of a small quantity of water and suitable mixing that a water-in-oil emulsion could be produced which had an increased viscosity in comparison to the mixture of solvent and tenside alone. This viscosity was such that on application to a surface, the product exhibited a thixotropic character in that its apparent viscosity increased on standing whereby the pulp and paper manufacturing machinery cleaning composition remained essentially in place on the surface to be cleaned without running away.

[0050] Thereby, the cleaning process afforded less pulp and paper manufacturing machinery cleaning composition, less time and less operator work input to achieve the desired cleaning effect.

[0051] Furthermore it was found that by adding water-soluble thickeners to low viscosity water-based solutions of active cleaning components such as tensides, acids or alkalis, a pulp and paper manufacturing machinery cleaning composition could be made whereby significantly less product was needed to achieve the desired cleaning effect within the cleaning process.

[0052] It is further preferred that in the inventive cleaning process, the pulp and paper manufacturing machinery cleaning composition is applied directly to the sieves, felts, fabrics, parts or units of the machinery being treated by a pressurized system using one or more nozzles to distribute the composition on the machinery.

[0053] In this spray application of cleaning compositions, the tendency to form aerosols and mists may be drastically reduced thus reducing the exposure of personnel in the area. This applies in particular for the higher viscosity versions of the pulp and paper manufacturing machinery cleaning compositions.

[0054] However, the viscosity of the pulp and paper manufacturing machinery cleaning composition should remain at a level to enable pumping and spraying of the composition and moreover, that the composition still behaves as a liquid on the surface to be cleaned so as to enable fluid movement throughout the deposited layer of the pulp and paper manufacturing machinery cleaning composition.

[0055] It is further preferred that in the inventive cleaning process, the pulp and paper manufacturing machinery cleaning composition is applied directly to the sieves, felts, fabrics or parts or units of the machinery being treated by a gravity-fed system using mechanical means to distribute the composition on the machinery. In one such preferred instance the pulp and paper manufacturing machinery cleaning composition is poured onto the horizontally slowly moving fabric and is evenly distributed by hand using a spreading device with a serrated edge made of a rubber material to avoid damage.

Description of the Figures:

[0056]

Figure 1: Viscosity of aqueous, alkaline cleaning composition - standard recipe plus higher viscosity formulation

according to example 1

Figure 2: Viscosity of aqueous, acidic cleaning compositions - standard recipe plus two higher viscosity formulations according to example 2 and 3

Figure 3: Viscosity of a neutral, water-in-oil cleaning composition with pseudo-plastic viscosity characteristics plus standard product

Figure 4: Schematic diagram of a formation section of a paper machine showing formation wire 5, position where cleaning composition is applied to the formation wire (position 1), and locations referred to in Figures 5 and 6. Further, the headbox 4 is schematically shown.

Examples

Example 1. Preparation of a water-based, alkaline pulp and paper manufacturing machinery cleaning composition with increased viscosity

[0057]

	Wt.-%
C9-C16 alcohols, ethoxylated	5
Hydroxyethyl cellulose	0.7
Ethylenetriamine pentamethylene phosphonic acid, Na-salt	2
Sodium hydroxide	5
2-ethylhexylsulphate, sodium salt	2
Sodium metasilicate-5-hydrate	0.5
Tetrapotassium pyrophosphate	2
Water	83

[0058] The standard formulation was the same recipe but without the hydroxyethyl cellulose component. The viscosity differences are seen in Figure 1.

Example 2. Preparation of a water-based, acidic pulp and paper manufacturing machinery cleaning composition with increased viscosity

[0059]

	Wt.-%
Ethoxylated C9-C 16 alcohols	0.5
Xanthan gum	0.5
Ethylenetriamine pentamethylene phosphonic acid, Na-salt	0.5
Fatty alcoholethylenglycol-polypropyleneglycolether	0.5
Polyoxyethylene-stearylamine	0.5
Hydrochloric acid	5
Water	92.5

[0060] The standard formulation was the same recipe but without the xanthan gum component. The viscosity differences are seen in Figure 2(together with an even higher viscosity recipe from example 3).

Example 3. Preparation of a water-based, acidic pulp and paper manufacturing machinery cleaning composition with increased viscosity

[0061]

	Wt.-%
C9-C16 alcohols, ethoxylated	0.5
Xanthan gum	0.8
Ethylenetriamine pentamethylene phosphonic acid Na-salt	0.5
Fatty alcohol-ethyleneglycol-polypropyleneglycolether	0.5
Polyoxyethylene - stearylamine	0.5
Hydrochloric acid	5
Water	92.2

[0062] The standard formulation was the same recipe but without the xanthan gum component. The viscosity differences are seen in Figure 2(together with a lower viscosity recipe from example 2).

Example 4. Preparation of a solvent/tenside-based, pulp and paper manufacturing machinery cleaning composition containing colloidal silica as thickening agent

[0063]

	Wt.-%
De-aromatised white spirit	95.8
Isopropanolamine dodecylbenzenesulfonate	0.7
Polyethyleneglycol monodecylether	0.6
Di(2-ethylhexyl) sulfosuccinic acid, Na-salt	0.5
C12 - C14 aliphatic alcohol ethoxylate	0.4
Colloidal silica	2

[0064] The standard formulation was the same recipe but without the colloidal silica component.

Example 5. Preparation of an solvent/tenside containing pulp and paper manufacturing machinery cleaning composition in the form of a water-in-oil emulsion.

[0065] The standard product of this type was a neutral cleaner consisting of essentially solvent and tenside with traces of water and was a low viscosity liquid. In the increased viscosity recipe of example 5, extra water is added whereby the tensides present cause the extra water added to form a water-in-oil emulsion which possesses a shear-thinning or pseudo-plastic character.

	Wt.-%
Mixture of n-, i- and cyclo-aliphatics, predominantly within range C11 - C12	70
Orange terpene, ex orange rind oil	10
Polyethyleneglycol-monodecylether	2
Oleyl-fatty acid-glycolester	1.5
Water	16.5

Example 6. Application of a thickened cleaning agent as in example 1 to a paper machine formation wire

[0066] After approximately 1 week of continuous paper production, the formation wire of a paper machine was usually contaminated with patches of deposits including a high proportion of natural resins from the paper pulp. It was usual to use one of two similar commercial pulp and paper manufacturing machinery cleaning compositions, , both consisting of an aqueous solution of approximately 5% concentration of caustic soda together with certain tensides to restore the wire to a clean condition. From experience, the amount normally used of the first commercial cleaner was 200 litres of product sprayed onto the slowly moving formation wire in several portions to ensure that the wire remained as far as possible uniformly wetted out with the product for the duration of cleaning. It was also known from experience that a contact time of about 45 minutes was essential to achieve a clean wire. This time of 45 minutes included that necessary for the several repeated applications of the pulp and paper manufacturing machinery cleaning composition. After this time the cleaner was rinsed off with water for 10 minutes with the wire still travelling at 15 m/min. thus the total time required for the cleaning operation was typically 55 minutes. The cleanliness of the wire was tested by microscopic analysis and by analysis of wire samples removed from for instance damaged wires, with such tests as water drop penetration time, solvent extraction of residual resins etc. The second commercial cleaner was also used as alternative using the same amount of that product and the same contact time.

[0067] A trial was conducted with an increased viscosity cleaning composition as in example 1 (this composition differed from the first commercial cleaner by the additional cellulose-derivative thickener component increasing viscosity. During the application of this product the parameters on the paper formation unit were set as follows:

Speed of formation wire:	15 m/min (metres/minute)
Rate of dosing of cleaner:	20 l/min (litres/minute)

[0068] The increased viscosity cleaner as in example 1 was dosed for 2 minutes through a spray-bar fitted with fan-nozzles to give an even coverage of the wire whereby a satisfactory coverage of the length of the formation wire and associated guide-rolls was achieved. The cleaner was allowed to work for a further 10 minutes whereby the cleaner was again dosed for a further 2 minutes. After this time the cleaner was allowed to work for a further 16 minutes giving 30 minutes in total. After this time the cleaner was rinsed off with water for 10 minutes with the wire still travelling at 15 m/min. Thus the total time required for the cleaning and rinsing operation was 40 minutes.

[0069] The total amount of cleaner needed to give coverage of the wire for the 30 minutes duration using two short spray applications was 75 litres. This gave a use of 0.73 kg/m2 product compared to the total surface area of the wire.

[0070] At 200 litres use for the conventional cleaner, this represented a use of 1.95 kg/m2.

[0071] Thus with the high viscosity formulated cleaner nearly 63% less product was needed than with the conventional cleaner formulation.

[0072] Further, using the high-viscosity pulp and paper manufacturing machinery cleaning composition gave a saving in the time needed for the wire-cleaning operation of 15 minutes on 55 minutes otherwise expressed as a 27% time saving.

Example 7. Application of a thickened cleaning agent as in example 2 to a vertical metal surface

[0073] 1ml of a standard aqueous acidic pulp and paper manufacturing machinery cleaning composition (formulated as in example 2 but without the xanthan-gum thickener) was applied to a vertical plate 40 cm long. The low viscosity composition ran down the plate almost immediately. The liquid that had run off during the first 10 seconds was collected in a dish and weighed to calculate the percentage left on the surface of the plate. The length of the treated area was 37 cm and the mid width was 0.55 cm.

[0074] In a second experiment an increased-viscosity pulp and paper manufacturing machinery cleaning composition BR-S-0-5, HVS-1 as in example 2, plus an even higher viscosity composition BR-S-0-5, HVS-2 from example 3, were applied to a horizontal metal plate. An amount of 1 ml was used in each case.

[0075] The plate was immediately stood in the vertical plane and a timer started. Figure 7 shows the degree as to how far the two increased-viscosity compositions had run down the plate after 30 seconds and again after 5 minutes.

[0076] After 1 minute the cleaner BR-S-0-5, HVS-2 as in example 3 had run 7.5 cm and BR-S-0-5, HVS-1 as in example 2 had run 13 cm. After 5 minutes the cleaner HVS-2 had run 11.5 cm and HVS-1 had run 21 cm.

[0077] After 5 minutes, the following procedure was used to measure the area of plate treated in each case.

[0078] The test plate was digitally photographed, the images scaled to true size, printed out onto plastic foil, the image area on the foil carefully cut out and weighed. Knowing the weight per unit area of the plastic foil, the area of the treated plate was calculated from the weight of the foil cut-outs.

Table 1

Specific coverage of a standard plus 2 increased viscosity pulp and paper manufacturing machinery cleaning compositions. 1 g applied to a vertical metal plate

	Standard	HVS-1	HVS-2
Weight of composition remaining on plate (g)	0.08	1.02	1.02
Weight remaining on plate as percentage (%)	8	100	100
Area covered (treated) (cm2)	20.3	13.7	8.1

(continued)

Specific coverage of a standard plus 2 increased viscosity pulp and paper manufacturing machinery cleaning compositions. 1 g applied to a vertical metal plate			
	Standard	HVS-1	HVS-2
Specific coverage (kg/m2)	0.039	0.75	1.26

[0079] The composition HVS-1 gave a higher coverage area than HVS-2 but with no run-off loss of composition. 92% of the standard composition was lost in the first few seconds.

Example 8. Application of a thickened pulp and paper manufacturing machinery cleaning composition as in example 2 and 3 to a formation wire of a paper machine

[0080] Three pieces were cut out of a paper machine formation wire which had been in use for approximately 2 months. The so called wire was typically contaminated to the degree that a cleaning operation to remove bedded-in carbonate contamination would normally have been done had the wire remained in the machine. Three pulp and paper manufacturing machinery cleaning compositions were compared. A standard low-viscosity composition (formulated as in example 2 but without the xanthan-gum thickener) and two thickened acidic compositions as in example 2 and example 3 were compared.

[0081] 1 ml of the compositions was placed on a piece of wire that was placed over a pre-weighted glass beaker. After 1, 3, 5 and 7 minutes, any composition that had run through the wire and collected in the beaker was weighed back and the loss reported as percentage loss.

Table 2

Loss through wire over time for various pulp and paper manufacturing machinery cleaning compositions (expressed as percent from original weight placed on wire)			
Time (minutes)	Standard composition (% wt. loss)	BR-S-0-5,HVS-1 (% wt. loss)	BR-S-0-5,HVS-2 (% wt. loss)
1	81 (after 10 sec)	0	0
3	86	15	0
5	-	44	0
7	-	52	17

[0082] As can be seen in the table, over 80% of the conventional low-viscosity composition ran immediately through the wire and in a paper machine, this proportion would have been effectively lost. The composition with the highest viscosity BR-S-0-5,HVS-2 appears to be the best in that this composition has the highest amount remaining on the wire. However, the composition BR-S-0-5, HVS-2 actually remained predominantly on top of the wire whereas the composition BR-S-0-5, HVS-1 penetrates into the weave of the wire thus giving a more uniform contact. In practice as in example 6, the continuous wire would be slowly moving around over the guide rolls in the paper machine and would be inverted on each return run thus compensating for the progressive flow through the wire.

Example 9. Preparation of a thixotropic, water-based, alkaline pulp and paper manufacturing machinery cleaning composition with increased viscosity

[0083]

	Wt.-%
C9-C 16 alcohols, ethoxylated	5
Ethylenetriamine pentamethylene phosphonic acid, Na-salt	2
Sodium hydroxide	5
2-ethylhexylsulphate, sodium salt	2
Sodium metasilicate-5-hydrate	2

(continued)

	Wt.-%
Tetrapotassium pyrophosphate	2
Modified bentonite (Smectite) clay	4
Water	78

[0084] The standard formulation was the same recipe but without the bentonite clay component. The viscosity differences are seen in Table 3.

Table 3.

Cleaning composition	Viscosity at 30 rpm, spindle 2 mPa.s		Viscosity ratio 180 sec:5 sec
	After 180 sec	After 5 sec	
Composition with no bentonite thickener	4.5	5.2	1:1.16
Composition with bentonite thickener	314	1170	1:3.73

Claims

1. Pulp and paper manufacturing cleaning composition **characterized in that** the pulp and paper manufacturing machinery cleaning composition has a viscosity in the range of 100 to 3000 mPa·s measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm at a temperature of 23°C.

2. Pulp and paper manufacturing cleaning composition according to claim 1 having a viscosity in the range of 300 to 3000 mPa·s.

3. Pulp and paper manufacturing cleaning composition according to claim 1 or 2, **characterized in that** it comprises two or more of the components selected from the group consisting of water, alkali, acid, tenside, chelating agent, organic solvent and/or thickener.

4. Pulp and paper manufacturing cleaning composition according to claim 3, **characterized in that** the organic solvent comprises at least one of the following substances:

   a) a saturated or unsaturated open-chain or cyclic, normal or isomeric hydrocarbon having 5 to 30 carbon atoms
   b) an acyclic, monocyclic and/or bicyclic terpene hydrocarbon or terpene alcohol, preferably citrus oils
   c) an ester derivate of a fatty acid

5. Pulp and paper manufacturing cleaning composition according to claim 3 or 4, **characterized in that** it comprises up to 20 wt% of citrus oils.

6. Pulp and paper manufacturing cleaning composition according to any of claims 3 to 5, **characterized in that** the tenside is selected from the group consisting of alkyl aryl sulphonate alcohol amine salt, alkyl sulphate sodium salt, polyethylene glycolalkyl ether, alkyl sulphonsuccinate sodium salt, alkylamine ethoxylate and/or aliphatic alcohol ethoxylate

7. Pulp and paper manufacturing cleaning composition according to any of claims 3 to 6, **characterized in that** the chelating agent is selected from the group consisting of ethylene diamine tetraacetic acid (ED-TA), Diethylene triamine pentaacetic acid (DTPA), Hydroxyethyl-ethylenediaminetriacetic acid (HEDTA), Ethylenetriamine pentamethylene phosphonic acid Na-salt, polyacrylate, polyamine, polyphosphate and phosphonate

8. Pulp and paper manufacturing cleaning composition according to any of claims 3 to 7, **characterized in that** the thickening agent is selected from the group consisting of methyl cellulose carboxymethyl cellulose, hydroxyethyl cellulose, xanthan gum, guar gum, colloidal silica, bentonite clay, polyacrylate, polyvinyl alcohol, polymethacrylate, carbomer.

9. Pulp and paper manufacturing cleaning composition according to any of claims 1 to 8, **characterized in that** it has a pseudo-plastic character.

10. Pulp and paper manufacturing cleaning composition according to any of claims 1 to 9, **characterized in that** it has a thixotropic character.

11. Method for cleaning pulp and paper manufacturing machinery, **characterized in that** a pulp and paper manufacturing cleaning composition according to any of claims 1 to 10 is used.

12. Method according to claim 11, **characterized in that** the pulp and paper manufacturing cleaning composition is applied directly to the sieves, felts, fabrics or parts of the machinery being treated by a pressurized system using one or more nozzles to distribute the composition on the machinery.

13. Method according to claim 11, **characterized in that** the pulp and paper manufacturing cleaning composition is applied directly to the sieves, felts, fabrics or parts of the machinery being treated by a gravity-fed system using mechanical means to distribute the composition on the machinery.

14. Use of a pulp and paper manufacturing cleaning composition according to any of claims 1 to 10 for treating the machinery or parts thereof.

Amended claims in accordance with Rule 137(2) EPC.

1st Auxiliary Request

1. Method for cleaning pulp and paper manufacturing machinery, **characterized in that** a pulp and paper manufacturing cleaning composition is applied directly to the sieves, felts and fabrics of the machinery being treated by a pressurized system using one or more nozzles to distribute the composition on the machinery
or
by a gravity-fed system using mechanical means to distribute the composition on the machinery,
whereby the pulp and paper manufacturing cleaning composition has a viscosity in the range of 100 to 3000 mPas measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm at a temperature of 23°C.
2. Method for cleaning pulp and paper manufacturing machinery according to claim 1, whereby the pulp and paper manufacturing cleaning composition has a viscosity in the range of 300 to 3000 mPa·s.
3. Method for cleaning pulp and paper manufacturing machinery according to claim 1 or 2, whereby the pulp and paper manufacturing cleaning composition comprises two or more of the components selected from the group consisting of water, alkali, acid, tenside, chelating agent, organic solvent and/or thickener.
4. Method for cleaning pulp and paper manufacturing machinery according to claim 3, whereby the organic solvent in the pulp and paper manufacturing cleaning composition comprises at least one of the following substances:

a) a saturated or unsaturated open-chain or cyclic, normal or isomeric hydrocarbon having 5 to 30 carbon atoms
b) an acyclic, monocyclic and/or bicyclic terpene hydrocarbon or terpene alcohol, preferably citrus oils
c) an ester derivate of a fatty acid

5. Method for cleaning pulp and paper manufacturing machinery according to claim 3 or 4, whereby the pulp and paper manufacturing cleaning composition comprises up to 20 wt% of citrus oils.
6. Method for cleaning pulp and paper manufacturing machinery according to any of claims 3 to 5, **characterized in that** the tenside is selected from the group consisting of alkyl aryl sulphonate alcohol amine salt, alkyl sulphate sodium salt, polyethylene glycolalkyl ether, alkyl sulphonsuccinate sodium salt, alkylamine ethoxylate and/or aliphatic alcohol ethoxylate
7. Method for cleaning pulp and paper manufacturing machinery according to any of claims 3 to 6, **characterized in that** the chelating agent is selected from the group consisting of ethylene diamine tetraacetic acid (EDTA), Diethylene triamine pentaacetic acid (DTPA), Hydroxyethyl-ethylenediaminetriacetic acid (HEDTA), Ethylene-triamine pentamethylene phosphonic acid Na-salt, polyacrylate, polyamine, polyphosphate and phosphonate
8. Method for cleaning pulp and paper manufacturing machinery according to any of claims 3 to 7, **characterized**

in that the thickening agent is selected from the group consisting of methyl cellulose carboxymethyl cellulose, hydroxyethyl cellulose, xanthan gum, guar gum, colloidal silica, bentonite clay, polyacrylate, polyvinyl alcohol, polymethacrylate, carbomer.

9. Method for cleaning pulp and paper manufacturing machinery according to any of claims 1 to 8, **characterized in that** the pulp and paper manufacturing cleaning composition has a pseudo-plastic character.

10. Method for cleaning pulp and paper manufacturing machinery according to any of claims 1 to 9, **characterized in that** the pulp and paper manufacturing cleaning composition has a thixotropic character.

11. Use of a pulp and paper manufacturing cleaning composition as defined in any of claims 1 to 10 for treating open weaves and the underside of horizontal surface of the machinery or parts thereof.

12. Pulp and paper manufacturing cleaning composition **characterized in that** the pulp and paper manufacturing machinery cleaning composition has a viscosity in the range of 100 to 3000 mPas measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm at a temperature of 23°C and has a pH of less than 7.

13. Pulp and paper manufacturing cleaning composition according to claim 12, **characterized in that** it comprises two or more of the components selected from the group consisting of water, alkali, acid, tenside, chelating agent, organic solvent and/or thickener.

14. Pulp and paper manufacturing cleaning composition according to claim 13, **characterized in that** the organic solvent comprises at least one of the following substances:

d) a saturated or unsaturated open-chain or cyclic, normal or isomeric hydrocarbon having 5 to 30 carbon atoms
e) an acyclic, monocyclic and/or bicyclic terpene hydrocarbon or terpene alcohol, preferably citrus oils
f) an ester derivate of a fatty acid

15. Pulp and paper manufacturing cleaning composition according to claim 13 or 14, **characterized in that** it comprises up to 20 wt% of citrus oils.

16. Pulp and paper manufacturing cleaning composition according to any of claims 13 to 15, **characterized in that** the tenside is selected from the group consisting of alkyl aryl sulphonate alcohol amine salt, alkyl sulphate sodium salt, polyethylene glycolalkyl ether, alkyl sulphonsuccinate sodium salt, alkylamine ethoxylate and/or aliphatic alcohol ethoxylate.

17. Pulp and paper manufacturing cleaning composition according to any of claims 13 to 16, **characterized in that** the chelating agent is selected from the group consisting of ethylene diamine tetraacetic acid (EDTA), Diethylene triamine pentaacetic acid (DTPA), Hydroxyethyl-ethylenediaminetriacetic acid (HEDTA), Ethylene-triamine pentamethylene phosphonic acid Na-salt, polyacrylate, polyamine, polyphosphate and phosphonate.

18. Pulp and paper manufacturing cleaning composition according to any of claims 13 to 17, **characterized in that** the thickening agent is selected from the group consisting of methyl cellulose carboxymethyl cellulose, hydroxyethyl cellulose, xanthan gum, guar gum, colloidal silica, bentonite clay, polyacrylate, polyvinyl alcohol, polymethacrylate, carbomer.

19. Pulp and paper manufacturing cleaning composition according to any of claims 12 to 18, **characterized in that** it has a pseudo-plastic character.

20. Pulp and paper manufacturing cleaning composition according to any of claims 12 to 19, **characterized in that** it has a thixotropic character.

Amended claims in accordance with Rule 137(2) EPC.

2nd Auxiliary Request

1. Method for cleaning pulp and paper manufacturing machinery, **characterized in that** a pulp and paper manufacturing cleaning composition is applied directly to the sieves, felts and fabrics of the machinery being treated by a pressurized system using one or more nozzles to distribute the composition on the machinery
or
by a gravity-fed system using mechanical means to distribute the composition on the machinery,
whereby the pulp and paper manufacturing cleaning composition has a viscosity in the range of 100 to 3000 mPa·s measured at shear rates produced within the rotational speed range of 6 rpm up to 60 rpm at a temperature of 23°C.

2. Method for cleaning pulp and paper manufacturing machinery according to claim 1, whereby the pulp and paper manufacturing cleaning composition has a viscosity in the range of 300 to 3000 mPa·s.

3. Method for cleaning pulp and paper manufacturing machinery according to claim 1 or 2, whereby the pulp and paper manufacturing cleaning composition comprises two or more of the components selected from the group consisting of water, alkali, acid, tenside, chelating agent, organic solvent and/or thickener.

4. Method for cleaning pulp and paper manufacturing machinery according to claim 3, whereby the organic solvent in the pulp and paper manufacturing cleaning composition comprises at least one of the following substances:

a) a saturated or unsaturated open-chain or cyclic, normal or isomeric hydrocarbon having 5 to 30 carbon atoms
b) an acyclic, monocyclic and/or bicyclic terpene hydrocarbon or terpene alcohol, preferably citrus oils
c) an ester derivate of a fatty acid

5. Method for cleaning pulp and paper manufacturing machinery according to claim 3 or 4, whereby the pulp and paper manufacturing cleaning composition comprises up to 20 wt% of citrus oils.

6. Method for cleaning pulp and paper manufacturing machinery according to any of claims 3 to 5, **characterized in that** the tenside is selected from the group consisting of alkyl aryl sulphonate alcohol amine salt, alkyl sulphate sodium salt, polyethylene glycolalkyl ether, alkyl sulphonsuccinate sodium salt, alkylamine ethoxylate and/or aliphatic alcohol ethoxylate

7. Method for cleaning pulp and paper manufacturing machinery according to any of claims 3 to 6, **characterized in that** the chelating agent is selected from the group consisting of ethylene diamine tetraacetic acid (EDTA), Diethylene triamine pentaacetic acid (DTPA), Hydroxyethyl-ethylenediaminetriacetic acid (HEDTA), Ethylenetriamine pentamethylene phosphonic acid Na-salt, polyacrylate, polyamine, polyphosphate and phosphonate

8. Method for cleaning pulp and paper manufacturing machinery according to any of claims 3 to 7, **characterized in that** the thickening agent is selected from the group consisting of methyl cellulose carboxymethyl cellulose, hydroxyethyl cellulose, xanthan gum, guar gum, colloidal silica, bentonite clay, polyacrylate, polyvinyl alcohol, polymethacrylate, carbomer.

9. Method for cleaning pulp and paper manufacturing machinery according to any of claims 1 to 8, **characterized in that** the pulp and paper manufacturing cleaning composition has a pseudo-plastic character.

10. Method for cleaning pulp and paper manufacturing machinery according to any of claims 1 to 9, **characterized in that** the pulp and paper manufacturing cleaning composition has a thixotropic character.

11. Use of a pulp and paper manufacturing cleaning composition as defined in any of claims 1 to 10 for treating open weaves and the underside of horizontal surface of the machinery or parts thereof.

Figure 1

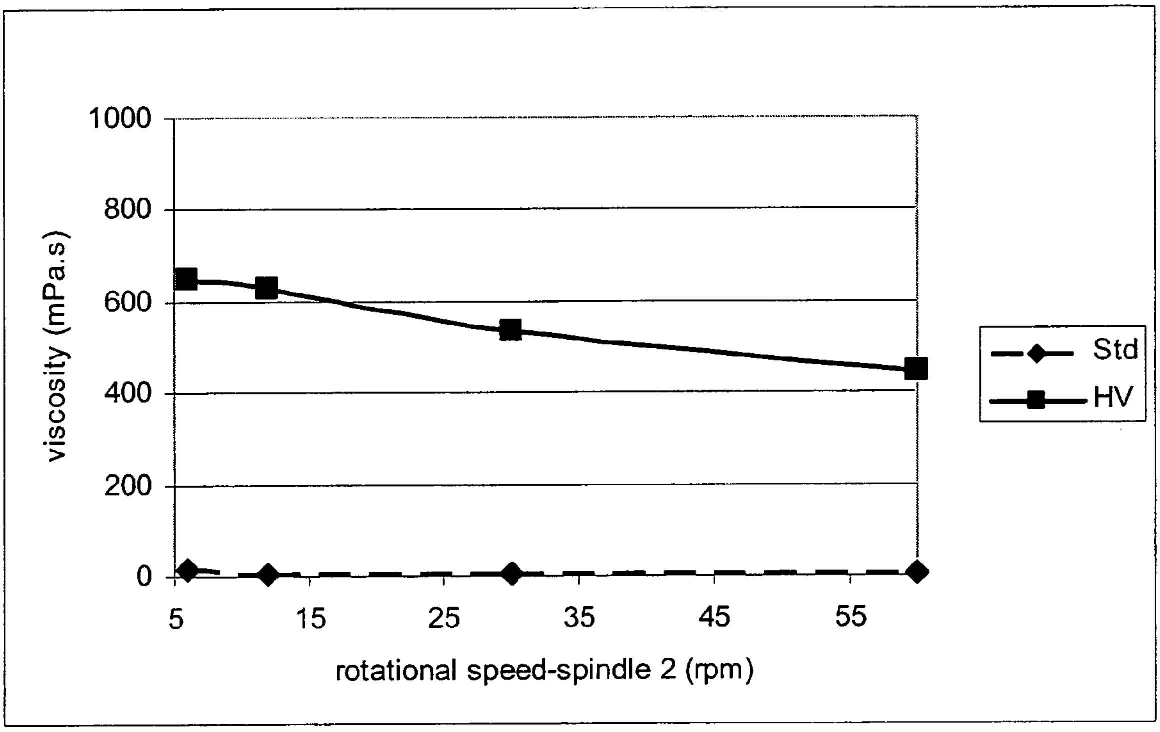


Figure 2

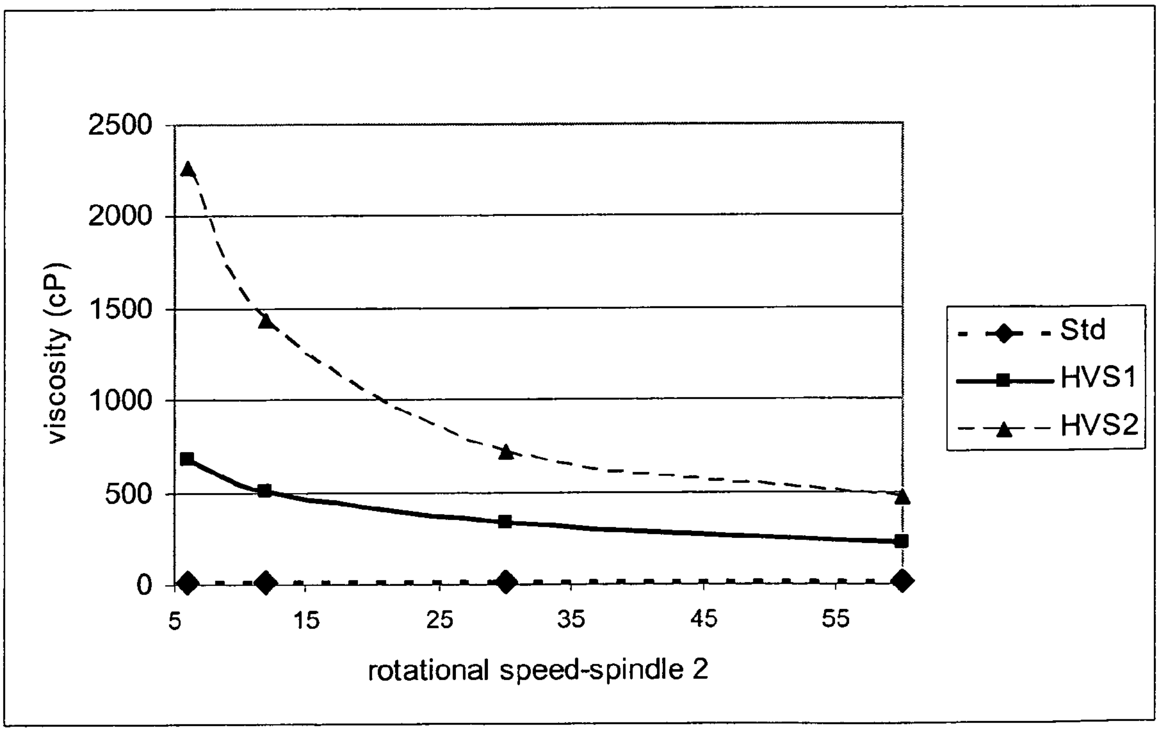


Figure 3

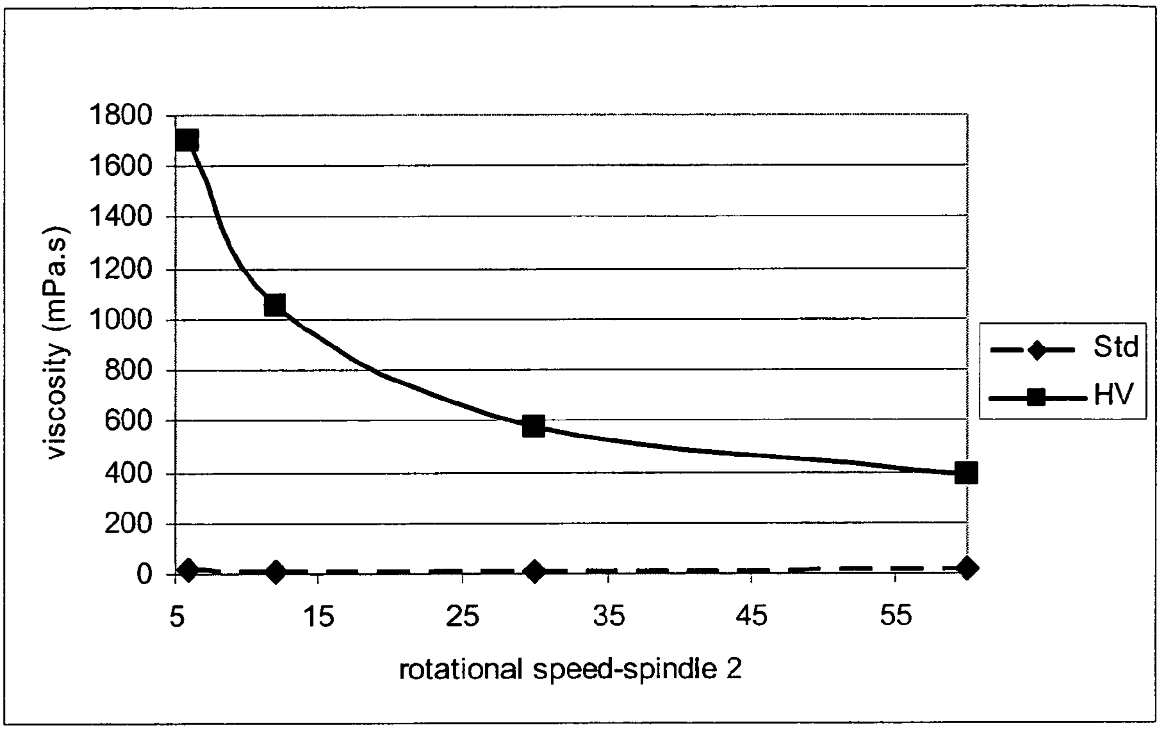
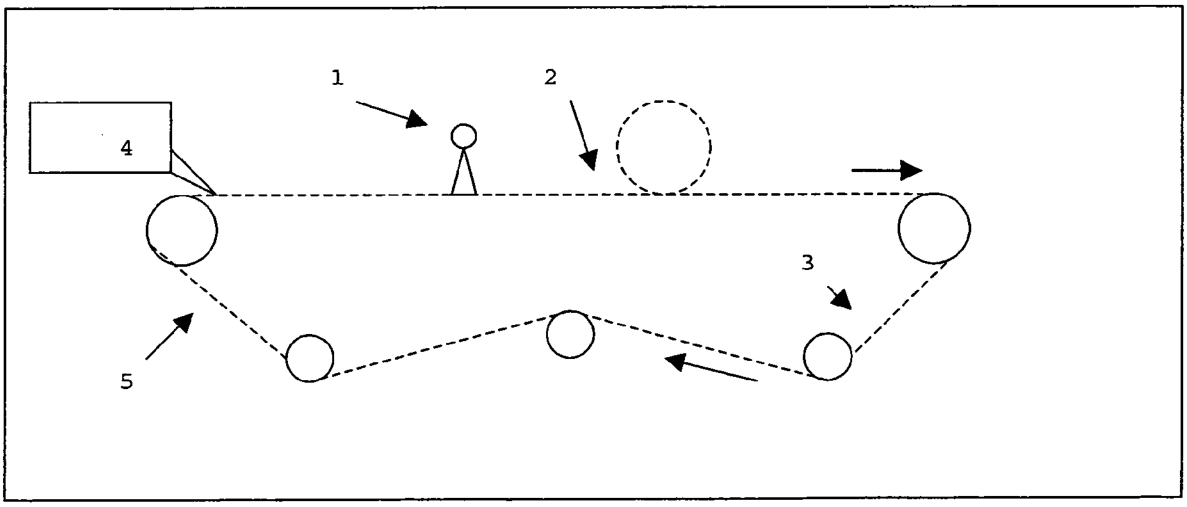


Figure 4



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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 June 2007	Hillebrecht, Dieter

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X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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