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(54) **Method and Installation for making a paper coating composition and an inline mixing unit therefore**

(57) The invention relates to:
1) a method of preparing a paper coating composition in a single pass manner, comprising the steps of:
i) providing a pre-composition comprising pigment(s) and ingredients mixed into an aqueous phase;
ii) mixing the pre-composition with cold water soluble

powder binder; and
iii) subjecting the mixture of step ii) to high shear mixing thereby forming the paper coating composition, and

2) to an installation and to an inline mixing unit for such method.

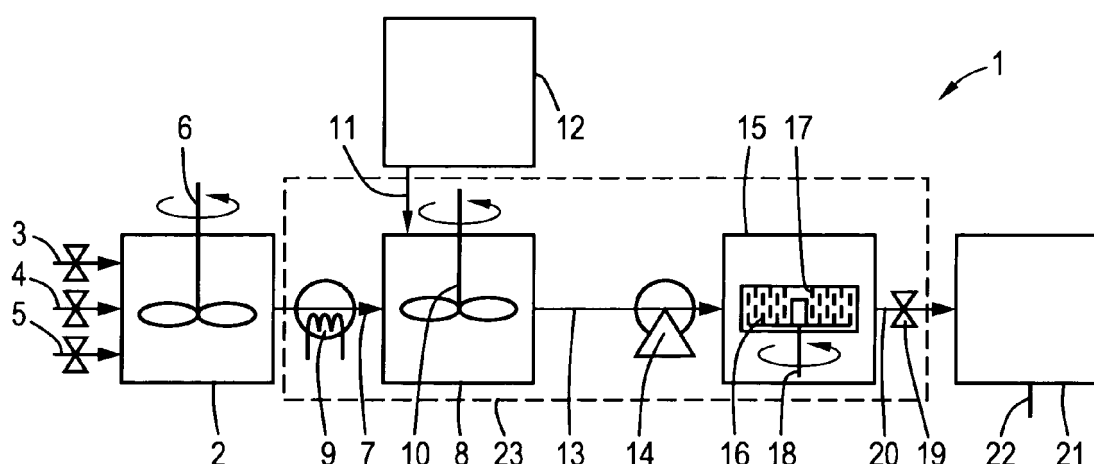


Fig.1

Description

[0001] The present invention relates to a method and installation for preparing a paper coating composition and to an inline mixing unit according to the invention which can be added to an existing continuous coating colour preparation system.

[0002] Paper coating compositions are used to protect and enhance the feeling and appearance of the paper surface. The paper coating composition may also impart or improve characteristics such as printability, water resistance, reflectivity and strength of paper. Typically a paper coating composition comprises pigment(s) and other ingredients, such as binders, thickeners, surfactants, hardeners, dispersing agents, rheology aids, lubricants, antifoaming agents and the like. Such ingredients may be added to the paper coating composition in an amount expressed relative to the pigment content, which is as parts per 100 parts pigment(s). The binder may be present in an amount of 5-50 parts binder, and the other ingredients in an amount of 0-10 parts per 100 parts pigment(s).

[0003] The paper coating compositions may be prepared using standard methods such as adding the various ingredients to the pigment and subsequently dispersing the ingredients into water. The pigment(s) and other ingredients may also be separately added to an aqueous phase in a continuous manner.

[0004] The paper coating composition may be applied to the surface of the paper in the paper machine by traditional application or coating procedures, such as using an air knife coating, rod coating, bar coating, spray coating, brush coating, cast coating, blade coating, curtain coating and the like. Thereafter, the coated paper has to be dried and optionally calendered in order to improve the surface smoothness and gloss. Particularly for these subsequent operations it is recommendable to use a paper coating composition with relatively high dry solids. The dry solids should preferably be higher than 70% by weight and more preferably even higher than 75%.

[0005] The drying step is expensive in terms of time and energy. Accordingly, it is beneficial to use a cold water soluble powder binder in the paper coating composition, which can also be used at high concentrations and has no negative effect on the properties of the paper coated therewith. Suitable binders include polyvinyl alcohol (PVOH), carboxymethyl cellulose (CMC), protein, and starch. An example of a suitable cold water soluble starch is described in W02008/104574 (Cargill, Incorporated).

[0006] However, such cold water soluble powder binder cannot be added directly to the pigment and other ingredients in an aqueous state. Such direct addition results in an unmanageable or uncontrollable viscosity due to local increase of the viscosity because of an improper homogenisation of cold water soluble powder binder throughout the mixture. Such uncontrolled viscosity and inhomogeneous dispersion of the cold water soluble

powder would require a (partial) recirculation of the mixture for additional or more intense mixing in order to provide a desired paper coating composition with the desired properties. Partial recirculation is not recommendable because this implies that part of the paper coating composition that will not be recirculated will still comprise inhomogeneously distributed or partially solubilised granular starch material. The presence of such material will negatively affect the properties of the paper coated with such paper coating composition.

[0007] In addition, there is a trend towards continuous preparation and supply of the paper coating composition to the coating machine for coating paper. In this respect, it is considered that the cold water soluble powder binder cannot be added downstream to the (partially) prepared paper coating composition because of a high risk for air entrapment in the system which would also negatively affect the properties of the paper coating composition and of the paper coated therewith.

[0008] Accordingly, there is a need for a method and installation for preparing in a continuous manner, a paper coating composition which can make use of the preferred cold water soluble powder binder in order to meet the objectives of low costs and high dry substance content of the paper coating composition.

[0009] The invention is based on the insight that the cold water soluble powder binder can be added as single or partial replacement of another binder for making the paper coating composition by adding the pigment (s), the other ingredients and the cold water soluble powder in a particular order and by using particular types of mixing in a given claimed order. In this manner, it is possible to prepare the paper coating composition in a single pass manner, which means that there is no requirement for whole or partial recirculation of the prepared mixture comprising pigment (s), other ingredients and the cold water soluble powder binder in order to improve its properties and in particular improve the homogeneous distribution of the pigment (s), the other ingredients and the binder. Accordingly, it is possible by the method according to the invention to continuously prepare and produce the paper coating composition and supply it as is directly (or after intermediate storage) to a paper coating machine.

[0010] Accordingly, the invention provides a method of preparing a paper coating composition in a single pass manner, and comprising the steps of:

- i) providing a pre-composition comprising pigment (s) and ingredients mixed into an aqueous phase;
- ii) mixing the pre-composition with cold water soluble powder binder; and
- iii) subjecting the mixture of step ii) to high shear mixing, thereby forming the paper coating composition.

[0011] The method according to the invention prepares the paper coating composition in a single pass manner.

That is, the paper coating composition is prepared without partial or full recirculation of the composition or any intermediate product or precursor to the start or an earlier step of the process. In the first step of the method according to the invention, is provided a pre-composition comprising pigment (s) and ingredients mixed into an aqueous phase. This pre-composition can be made by mixing the pigment (s) and ingredients (other than the cold water soluble powder binder) into an aqueous phase forming a solution or dispersion of the pigment (s) and ingredients. Accordingly, a so called pre-composition for the paper coating composition is formed. In the initial step of the method according to the invention, the pre-composition is mixed with the cold water soluble powder binder. This mixing step results in the distribution of the cold water soluble powder binder throughout the aqueous phase already comprising pigment (s) and other ingredients. This homogeneous distribution of the cold water soluble powder co-binder is essential to the invention, because it provides the cold water soluble powder co-binder with sufficient surrounding liquid which will penetrate the cold water soluble powder binder resulting in swelling of the powder binder. Accordingly, formation of agglomerates of the binder is substantially reduced. In a second step of the method according to the invention, the mixture of the pigment (s), other ingredients and homogeneously distributed powder binder is subjected to high shear mixing. This high shear mixing results in a further dispersing and solubilisation of the wetted binder throughout the aqueous phase. By using the two steps of the method according to the invention, a paper coating composition in which the pigments, other ingredients and binder are uniformly distributed and solubilised, is prepared in a single pass manner.

[0012] The properties of the powder binder as described above are such that other traditional binders, such as latex and cooked starches, may be present in lower amounts, or may even be absent. The same applies for the addition of traditional thickeners and other additives so required.

[0013] Suitable cold water soluble powder binders are for instance carbohydrate based binders including starch-based binders (such as oxidised or esterified starch) and cellulose binders (such as CMC and hydroxyethyl cellulose), protein binders (such as casein, gelatine, soy protein and animal glues) and synthetic binders, polyvinyl alcohol together with mixtures of two or more thereof. A preferred binder is a granular starchy material (a powder) having a number average molecular weight of 3500 to 20.000 Daltons (C*Coat®, Cargill) as described in WO2008/104574.

[0014] The cold water soluble powder binder has a low moisture content of ca. 2-10% by weight, the exact figure being strongly influenced by Atex (explosion prevention) regulations.

[0015] Accordingly, by using such a suitable cold water soluble powder binder according to the invention, the dry substance content of the final coating composition may

be increased preferably to above 65% dry substance by weight, more preferably above 70%, most preferably above 75% dry substance by weight.

[0016] Dependent on the amount of pigments and other ingredients, the paper coating composition may comprise 1-20 parts powder binder per 100 parts pigments. Preferably the suitable powder binder is present in 5-10 parts per 100 parts pigments.

[0017] Examples of suitable pigments include: clays such as kaolin but also structured and calcined clays, hydrated aluminum silicates, bentonite, natural and synthetic calcium carbonate, calcium sulphate (gypsum), silicas, precipitated silicas, titanium dioxide, alumina, aluminium trihydrate, plastic (polystyrene) pigments, satin white, talc, barium sulphate, zinc oxide and mixtures of two or more thereof. The appropriate pigment will easily be selected by a skilled person depending on the type of coating composition to be obtained.

[0018] Where a further binder is required, it can be selected - by way of example only - from carbohydrate-based binders including starch-based binders (such as oxidised or esterified starch) and cellulose binders (such as CMC and hydroxyethyl cellulose), protein binders (such as casein, gelatine, soy protein and animal glues) and synthetic binders, especially latex binders (such as styrene butadiene, styrene acrylate, vinyl polymer based latexes and polyvinyl alcohol) together with mixtures of two or more thereof.

[0019] Additional thickeners are also optional. Again, they can be replaced, in whole or in part, by the powder binder of the present invention. If further thickeners are used, they should not account for more than 50% of total thickener content on a dry weight basis. Examples of suitable thickeners include cellulose ethers (such as CMC, hydroxyethyl cellulose, hydroxypropyl cellulose, ethylhydroxyethyl cellulose and methyl cellulose), alginates (such as sodium alginate), xanthan, carrageenans, galactomannans (such as guar), native or modified starches (such as roll-dried starch), synthetic polymers (such as polyacrylates) and mixtures of two or more thereof.

[0020] Examples of possible other ingredients, if used, include: surfactants (e.g. cationic surfactants, anionic surfactants, non-ionic surfactants, amphoteric surfactants and fluorinated surfactants), hardeners (e.g. active halogen compounds, vinylsulfone compounds, epoxy compounds, etc.), dispersing agents (e.g. polyacrylates, polyphosphates, polycarboxylates, etc.), flowability improvers, lubricants (e.g. calcium, ammonium and zinc stearate, wax or wax emulsions, alkyl ketene dimer, glycols, etc.), antifoamers (e.g. octyl alcohol, silicone-based antifoamers, etc.), releasing agents, foaming agents, penetrants, optical brighteners (e.g. fluorescent whiteners), preservatives (e.g. benzisothiazolone and isothiazolone compounds), biocides (e.g. metaborate, thiocyanate, sodium benzonate, etc.), yellowing inhibitors (e.g. sodium hydroxymethyl sulfonate, sodium p-toluenesulfonate, etc.), ultraviolet absorbers (e.g. benzot-

riazole compounds having a hydroxy-dialkylphenyl group at the 2 position), antioxidants (e.g. sterically hindered phenol compounds), insolubilisers, antistatic agents, pH regulators (e.g. sodium hydroxide, sulfuric acid, hydrochloric acid, etc.), water-resisting agents (e.g. ketone resin, anionic latex, glyoxal, etc.), wet and/or dry strengthening agents (e.g. glyoxal based resins, oxidised poly ethylenes, melamine resins, urea formaldehyde, etc.), cross-linking agents, gloss-ink holdout additives, grease and oil resistance additives, leveling and evening aids (e.g. polyethylene emulsions, alcohol/ethylene oxide, etc.), and mixtures of two or more thereof.

[0021] Another aspect of the invention relates to an installation for preparing a paper coating composition in a single pass manner, comprising:

- i) an inline premixing unit for mixing a cold water soluble powder binder into a composition; and
- ii) an inline high shear mixing unit connected to the inline mixing unit for dispersing the powder binder thereby preparing the paper coating composition.

[0022] With reference to the description of the invention in more detail given above, it will be appreciated that the installation comprises an inline premixing unit that is fed continuously with the pre-composition or connected to a mixing unit for mixing pigment and ingredients thereby forming a pre-composition. In the inline premixing unit the cold water soluble powder binder is mixed into and distributed as wetted particles within the liquid premixing composition. The inline mixing unit may comprise a blender or mixer working in a continuous manner. The pre-composition comprising the homogeneously distributed wetted powder co-binder is then fed directly into an inline high shear mixing unit. In the high shear mixing unit the distributed wetted powder binder is dispersed and solubilised. The high shear mixing unit may comprise a high shear mixer. Such a high shear mixer may comprise a stator and a rotor forming a mixing unit. The rotor may comprise holes or slots and is rotating at a high rotational speed such as 10-20 meters per second, preferably 20 or more meters per second.

[0023] According to another alternative, the mixture originating from the inline premixing unit is added into a mixing chamber comprising stationary stator blades and a rotor having blades and openings or slots rotating at high speed (10 meters per second or more) in between the stator blades. The rotational speed is higher at the radial outer parts of the rotor. Accordingly, feeding the material at different rotational speed sections of the rotor will result in a difference in intense high shear mixing of the powder binder in the composition.

[0024] Operating in this manner, air entrapment is substantially avoided, and thus no negative effects on the prepared paper coating composition arise.

[0025] The objective of the present invention is to improve installations for preparing the paper coating composition without additional costs for rebuilding. There-

fore, according to a preferred embodiment, the inline premixing unit and the inline high shear mixing unit form an inline mixing unit interposed in between an existing pigment mixing unit and an existing storage tank for the paper coating composition.

[0026] Accordingly, it is obvious to those skilled in the art that the outlet of the tank in which the paper coating composition is originally prepared is now being connected to the inlet of the inline premixing unit. Moreover it is preferred that the addition of the binder, in particular the cold water soluble powder binder, should not take place in the continuous mixing unit preparing the pre-composition or further upstream in the process, but is relocated to the inline premixing unit. This might reduce the supply of other binder (s) or even avoid the addition of other binders to the tank in which originally the paper coating composition is made. It will be understood by the skilled person that the paper coating composition with the desired properties and composition will then be made available for direct supply to either the storage tank or to the paper coating machine after release from the inline mixing unit, beside other components always consisting of the inline premixing unit followed by the inline high shear unit.

[0027] Dependent on the composition of the paper coating composition it may be advantageous to reduce the viscosity of the premixing composition or of the paper coating composition before or after mixing and/or high shear mixing. Thereto, it may be beneficial that the installation is provided with heat exchange means for increasing the temperatures to a temperature which is desired in view of a desired viscosity, dispersing rate and/or solubilisation rate. Such temperatures are generally within the range of 35-50°C.

[0028] Under circumstances, such as dependent on the composition of the paper coating composition to be made, it may be advantageous to supply the pre-composition to the high shear mixing unit at a higher pressure than the atmospheric pressure. Under such circumstances this prefers that pump means are interposed between the inline premixing unit and the high shear mixing unit.

[0029] The aforementioned and other features and advantages of the method and installation of the present invention will become apparent from a description of embodiments of the present invention, which will be provided for information purposes and are not intended to limit the invention in any aspect. In the description of the embodiments reference will be made to the drawings, in which:

Figures 1 and 2 are schematic flow charts of methods and installations of the present invention.

[0030] Figure 1 shows an installation 1 according to the invention. The installation 1 comprises a mixing unit 2, such as a blender. The mixing unit 2 is provided with inlets for pigment (s), for ingredients, such as binder, thickener, dispersing agent, water retention agent and

the like and for supplying water. The content of the mixing unit 2 is continuously stirred with a stirring means 6. The mixing unit 2 is connected via a connection line 7 to an inline free mixing unit 8.

[0031] The stirring in the mixing unit 2 is such that the connection line 7 delivers a homogeneous suspension of pigments and other ingredients in water into the inline premixing unit 8. Optionally by using the heat exchanger 9 the pre-composition formed in the mixing unit 2 may be heated to a desired temperature above room temperature.

[0032] The inline premixing unit 8 may be a wet blender provided with stirring means 10. The inline premixing unit 8 is fed with a cold water soluble powder binder (such as C*iCoat 07520®, Cargill), that is metered from a hopper 12 with screw feeder means 11, volumetric or gravimetric (loss in weight feeding) in the desired ratio relative to the flow rate of the pre-composition in the connection line 7.

[0033] The stirring means 10 are operated such that the powder starchy material is homogeneously distributed into the pre-composition supplied via the connection line 7. The homogeneous dispersion is released from the inline premixing unit 8 via an outlet 13 and supplied via a pump 14 into an inline high shear mixing unit 15. In the high shear mixing unit 15 the homogeneous dispersion supplied via the outlet 13 and the pump 14 is subjected to an high shear mixing action, such that a paper coating composition is formed which is well blended homogenized, solubilised or very finely distributed in the aqueous phase with the starchy material.

[0034] Thereto the high shear mixing unit 15 comprises a rotor 16 which cooperates with one or more stators 17 so that due to the difference in radial speed in between the rotating rotor 16 and stationary stators 17 the particulate and granulate material is subjected to high shear. The particle size is thereby reduced and the result is a fine dispersion and/or solution of the original granular starchy material. To that extent the rotor 16 on axe 18 is driven at a speed of about 10 meters per second, but preferably 20 meters per second or more. The continuously formed paper coating composition is released from the high shear mixing unit 15 via the line 20 provided with a valve 19. The product is stored in a storage tank 21 equipped with stirring means (similar to stirring means 6) from which it may be released via the outlet 22 towards a not shown paper coating machine.

[0035] As shown in figure 1 by the interrupted line 23, the inline premixing unit 8 and the high shear mixing unit 15, inclusive optionally the heat exchanger 9 and the pump 14, and possibly the hopper 12 for the granular starchy material, may form an integral inline mixing unit which may be interposed in between an existing mixing unit 2 for all ingredients of the paper coating composition, and the storage tank 21 or the paper coating machine. Accordingly, existing installations may be supplemented with the inline mixing unit 23 such that a cold water soluble powder binder may be used as a supplemental or exclusive binder for the paper coating composition.

[0036] Figure 2 shows another installation 24 according to the invention comprising as in the installation according to figure 1, a mixing unit 2, an inline premixing unit 8 for mixing in the a cold water soluble powder binder from the hopper 12, and a high shear mixing unit 5 for homogenizing and solubilising the a cold water soluble powder binder that was uniformly distributed in the pre-composition comprising pigment(s) and other ingredients.

[0037] The installation 24 comprises further downstream of the inline premixing unit 8 a heat exchanger 25, such that the mixture originating from the inline premixing unit 8 may be heated to a desired temperature, such as in view of the viscosity or the solubilisation rate of the granular starchy material. Thereafter, the heated stream is pressurized using the pump 14 and then supplied to the high shear mixing unit 15. The high shear mixing unit 15 is provided with inlets 26, 27 and 28, for feeding the mixture into the rotor/stator mixing unit at different radial positions so that the stream fed into the high shear mixing unit 15 is subjected initially to different shear forces. Accordingly, the operator has a possibility of selecting a particular shear force in view of the composition degree of dispersion, viscosity and the like.

[0038] As an example of the method according to the invention, a mixture of calcium carbonate and kaolin (100 parts) was mixed with whitening agent (0.05 parts), polyvinyl alcohol (0.3 parts) and water in the mixing unit 2. The mixture was heated in the heat exchanger 9 to a temperature of 35°C. The heated mixture is supplied to the inline premixing unit 8 in which granular starchy material was added (7 parts). The product stream from the inline premixing unit 8 comprising finely distributed starchy material was supplied via the pump 14 to the high shear mixing unit 15 in which the cold water soluble powder binder was homogenized and solubilised in the aqueous phase, due to the high shear forces applied in the high shear mixing unit 15. The product was the product being the paper coating composition produced by the single pass method, was stored in the tank 21 and thereafter supplied to a standard paper machine via the line 20. The paper coating composition produced in the single pass manner was applied to paper and the paper calendered. The ready product (paper coating composition) was analyzed using standard testing methods and showed good results, although the paper coating composition had a dry solids content of about 72%.

Claims

1. Method of preparing a paper coating composition in a single pass manner, comprising the steps of:
 - i) providing a pre-composition comprising pigment(s) and ingredients mixed into an aqueous phase;
 - ii) mixing the pre-composition with a cold water

- soluble powder binder; and
 iii) subjecting the mixture of step ii) to high shear mixing thereby forming the paper coating composition.
2. Method as claimed in claim 1, wherein the cold water soluble powder binder is selected from polyvinyl alcohol, carboxymethyl cellulose, protein, and starch, and is preferably starchy material having a number average molecular weight of 3500 to 20.000 Daltons 10
 3. Method as claimed in claim 1 or 2, wherein the ingredients do not comprise a latex binder.
 4. Method according to claim 1-3, wherein the pre-composition contains more than 65% dry substance by weight, preferably more than 70%, more preferably more than 75% dry substance by weight. 15
 5. Method according to any of the claims 1-4, wherein the paper coating composition contains 1-20 parts starchy material per 100 parts pigments, preferably 5-10 parts starchy material per 100 parts pigments. 20
 6. Installation for continuously making a paper coating composition in a single pass manner, comprising: 25
 - i) an inline premixing unit for mixing a cold water soluble powder binder into a composition; and
 - ii) an inline high shear mixing unit connected to the inline mixing unit for dispersing the powder binder thereby preparing the paper coating composition. 30
 7. Installation according to claim 6, comprising: 35
 - i) a unit for a pre-composition;
 - ii) an inline premixing unit connected to the pre-composition unit for mixing a cold water soluble powder binder, into the pre-composition; and 40
 - iii) an inline high shear mixing unit connected to the inline mixing unit for dispersing the powder binder thereby preparing the paper coating composition. 45
 8. Installation according to claim 6 or 7, wherein the inline pre-mixing unit and the inline high shear mixing unit form an inline mixing unit interposed in between the pigment mixing unit and a storage tank for the paper coating composition. 50
 9. Installation according to claim 7 or 8, wherein the pre-composition unit comprises means for mixing the pigments and ingredients thereby forming the pre-composition. 55
 10. Installation according to claim 6-9, comprising heat exchange means.
 11. Installation according to any of the claims 6-10, comprising pump means interposed between the inline premixing unit and the inline high shear mixing unit.
 12. Inline mixing unit, comprising an inline mixing unit and an inline high shear mixing unit as defined in claim 6.

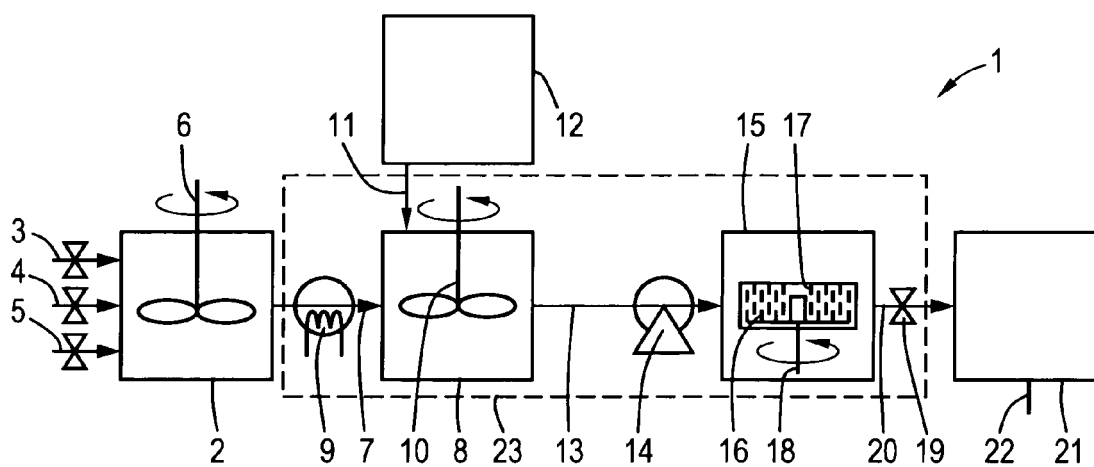


Fig.1

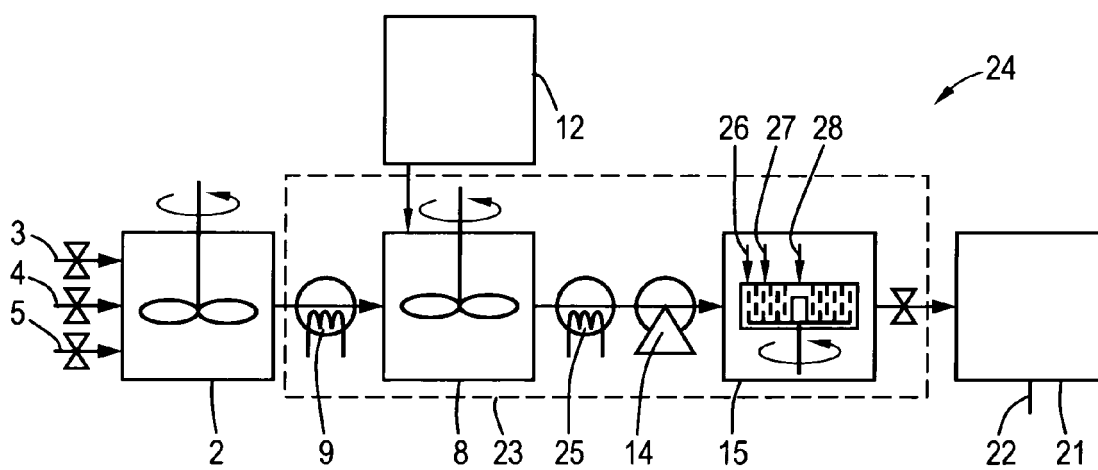


Fig.2



EUROPEAN SEARCH REPORT

Application Number
EP 12 00 1949

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 298 987 A (COLGAN GEORGE P ET AL) 17 January 1967 (1967-01-17) * claims *	1,2,4	INV. D21H19/00
Y	----- WO 2008/104574 A1 (CARGILL INC [US]; BERCKMANS MARC CHARLES FLORENT [BE]; GLITTENBERG DET) 4 September 2008 (2008-09-04) * the whole document *	1-5	D21H19/44 D21H19/50 D21H19/52 D21H19/54 D21H19/60 D21H23/00 D21H23/02 D21H23/20
X	----- US 5 795 948 A (HEIDINGSFELD HERBERT [DE] ET AL) 18 August 1998 (1998-08-18) * claims *	6-12	D21H21/18 D21H23/22 B01F13/10
			TECHNICAL FIELDS SEARCHED (IPC)
			D21H B01F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 August 2012	Examiner Koegler-Hoffmann, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure 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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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 00 1949

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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10-08-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3298987 A	17-01-1967	DE 1264944 B GB 1027330 A US 3298987 A	28-03-1968 27-04-1966 17-01-1967
-----	-----	-----	-----
WO 2008104574 A1	04-09-2008	CA 2679073 A1 CN 101255667 A EP 1964969 A1 JP 2010519429 A US 2008206571 A1 WO 2008104574 A1	04-09-2008 03-09-2008 03-09-2008 03-06-2010 28-08-2008 04-09-2008
-----	-----	-----	-----
US 5795948 A	18-08-1998	NONE	
-----	-----	-----	-----

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2008104574 A [0005] [0013]