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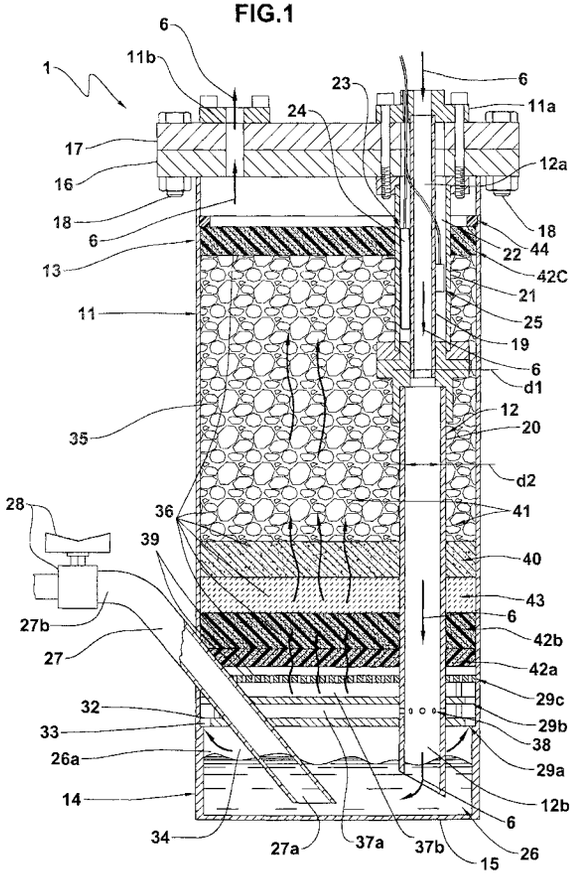
(54) Method and apparatus for neutralizing electrostatic charges from an electrostatically charged element

(57) A gaseous fluid (6) is treated by bubbling in a treatment composition (26) containing magnesium chloride, sugars and surface-active agents in an aqueous solution. The composition (26) is held in a vessel (11) within which the gaseous fluid is also submitted to a dehumidification step by filtering through an expanded-clay bed (41), preceded by an active-carbon filter bed. The fluid thus treated is brought into contact with atomized paint or other electrostatically charged element, to neutralize the effects of the electrostatic charge.

FIG.1



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Description

[0001] The present invention relates to a method of neutralizing electrostatic charges from an electrostatically-charged element, comprising the features set out in the preamble of claim 1, and to an apparatus to be used for putting said method into practice.

[0002] In more detail, the invention as described is particularly conceived for utilization within a spray-painting process.

[0003] The invention also proposes a composition to be used in the method and apparatus referred to above.

[0004] It is known that in different industrial processes, in the manufacture of ribbons or laminates of plastic material for example, there is a need for removing electrostatic charges from the workpieces. A method presently used for the purpose involves directing a jet of compressed air against the surfaces of the workpiece, which air has been previously submitted to ionization by passage through a series of devices for dispersion of electrostatic charges powered by high-voltage alternating current, in the order of 7 kV for example. The charge-dispersing devices cyclically generate in the air passing close thereto, positive and negative ions each of which neutralizes a charge opposite in sign possibly present in the workpiece. The opposite-in-sign ions that are in excess in the air neutralize each other, whereas the remaining excess ions of same sign are dispersed in the air stream, a certain distance away from the workpiece.

[0005] It is an aim of the present invention to propose a new method of neutralizing electrostatic charges which proves to be better than known methods, in terms of efficiency, safety, simplicity and reduced costs.

[0006] It is also a particular aim of the invention to propose a method susceptible of being put into practice in the field of spray painting; referring to spray painting the Applicant has actually perceived that elimination of electrostatic charges from paint can give surprising advantages in terms of painting yield and quality.

[0007] Apparatus presently used for spray painting with liquid paints in an atomized form generally comprise a housing holding the liquid paint which is provided with an admission valve, usually of the Venturi effect type, associated with a compressed-air gun for paint delivery. The forced passage of the air flow through the admission valve, regulated to a given flow rate, causes suction of the liquid paint, in a controlled flow rate, and formation of an air-paint mixture. The air-paint mixture is ejected from the delivery nozzle of the gun, atomized in the form of very fine liquid droplets dispersed in the gaseous fluid that will adhere to the workpiece surface.

[0008] It has been found however, that at the present state of the art an important percentage of the paint delivered in an atomized form, that just as an indication can be estimated between 10 and 30%, is dispersed in the surrounding atmosphere in the workplace instead of laying down on the workpiece.

[0009] Therefore, the working environment where painting is carried out is usually enclosed in appropriate spray booths, with which suitable suction and filtering systems are associated. In addition, the whole painting plant is to be periodically stopped for some hours, in order to carry out cleaning of the inner walls of the booths, to avoid too many paint amounts accumulating on said walls and the consequent risk that paint dripping may fall down on the workpiece, which will impair the painting result.

[0010] In accordance with the present invention the Applicant has perceived that all drawbacks present in the known art can be mostly ascribed to formation of electrostatic charges in the atomized paint particles. In fact it was found that it is surprising possible to overcome the above described drawbacks by submitting the air stream to be sent to the supply duct of the gun to a treatment adapted to neutralize the electrostatic charges generated in the atomized paint particles.

[0011] In more detail, it is an aim of the invention to provide a method of neutralizing electrostatic charges in a paint or other electrostatically-charged element, comprising the features set out in the characterizing portion of claim 1.

[0012] The above mentioned method can be put into practice with the aid of an apparatus for treatment of a gaseous fluid as defined in claim 12.

[0013] It is a further aim of the invention to provide a composition for treatment of a gaseous fluid in a process for neutralizing electrostatic charges in an electrostatically-charged element, as defined in claim 19.

[0014] In a further aspect of the invention, a method carrying out spray-painting on a workpiece as defined in claim 28 is proposed.

[0015] Further features and advantages will become more apparent from the following detailed description of a preferred but not exclusive embodiment of a method and an apparatus for neutralizing electrostatic charges from an electrostatically-charged element, and a treatment composition for carrying out said method. This description will be set out hereinafter with reference to the accompanying drawings, in which:

- Fig. 1 diagrammatically shows, in diametrical section, an apparatus for treatment of a gaseous fluid in accordance with the present invention;
- Fig. 2 is a fragmentary diagrammatic view of the apparatus in Fig. 1 associated with a spray-painting plant.

[0016] With reference to the drawings, generally denoted at 1 is an apparatus for treatment of a gaseous fluid in a method of neutralizing electrostatic charges from an electrostatically-charged element in accordance with the present invention.

[0017] In the embodiment shown in Fig. 2, apparatus 1 is associated with a spray-painting plant 2, of the type comprising at least one spray gun 3 connected via a supply duct 4 to a source 5 of a gaseous fluid under pres-

sure 6, typically air.

[0018] The spray gun 3, substantially of known type, defines a channel 7 for passage of the gaseous fluid under pressure 6 between an inlet 7a connected to the supply duct 4, and an atomizing outlet nozzle 7b, through a Venturi-effect valve element 8.

[0019] The spray gun 3 is further provided with a holding tank 9 for the paint in the liquid state 10 which is connected to a narrow portion 8a of the valve element 8. Due to the negative pressure of the air in the narrow portion 8a of the valve element 8, a measured admission of paint 10 into the air flow 6 is caused as well as subsequent ejection of the paint itself from nozzle 7b, in the form of an atomized jet.

[0020] Apparatus 1 is operatively interposed between a first length 4a of the supply duct 4, terminating at the source of air under pressure 5, and a second length 4b or end length, of the supply duct itself connecting apparatus 1 with gun 3.

[0021] Apparatus 1 comprises a closed vessel 11 mainly extending along a vertical-extension direction X and preferably having a cylindrical conformation of circular crosssection.

[0022] Vessel 11 is provided with an inlet valve union 11a communicating with the first length 4a of the supply duct 4, and an outlet valve union 11b communicating with the end length 4b of duct 4.

[0023] More specifically, the inlet valve union 11a is connected to an upper or first end 12a of an admission pipe 12 extending within the vessel itself, between an upper portion 13 and a lower portion 14 of the latter. The opposite or second end 12b of the admission pipe 12 is open at the bottom 15 of vessel 11.

[0024] In the embodiment shown in the drawings, vessel 11 is provided at the upper portion 13 thereof, with a holed flange 16 with which a closing lid 17 is associated which is secured thereto by conventional fastening means 18 such as screws and bolts. The inlet valve union 11a and outlet valve union 11b are disposed on lid 17 and the admission pipe 12 extends from lid 17 to bottom 15.

[0025] The admission pipe 12 has, from top to bottom, a first portion 19 of smaller inner diameter d1, and a second portion 20 of greater inner diameter d2.

[0026] At the first portion 19, a tubular wall 21 coaxial with, and external to, the first portion 19 itself is associated with pipe 12, to form a hollow space of annular cross section 22 in which heating means 23 is disposed. Advantageously, the heating means 23 consists of a resistor 24 connected to a thermostat 25 capable of keeping the temperature of the duct walls within a predetermined range.

[0027] Vessel 11 further holds a treatment composition 26 preferably in a liquid state, which is the object of the present invention too. The level of the treatment composition 26 is as low as to take up only a small portion of vessel 11, sufficient to ensure that the lower end 12b of the admission pipe 12 is plunged in the composition itself.

[0028] During its flowing from source 5 to the delivery nozzle 7b of gun 3, the flow of compressed air 6 enters the admission pipe 12 through the inlet valve union 12a and passes close to the hollow space 22 where, if required, is heated to an optimal temperature for use of the treatment composition 26, corresponding to at least 20°C. More particularly, calibration of thermostat 25 is capable of heating air to a temperature preferably included between 30°C and 40°C. Subsequently, the air flow 6 comes out of the opening of the second end 12b of pipe 12 and bubbles through the treatment composition 26.

[0029] The admission pipe 12 therefore embodies a mixing means adapted to bring the air introduced through the inlet valve union 11a, into contact with the treatment composition 26.

[0030] To facilitate replacement, topping up or merely control of the treatment composition 26, device 1 further comprises an auxiliary tube 27 dipping from the bottom 15 of vessel 11 itself. In the embodiment shown, the auxiliary tube 27 has a first end 27a plunged in the treatment composition 26 and a second end 27b emerging in cantilevered fashion from a side wall of vessel 11, on which wall a tap 28 is further arranged.

[0031] Placed on the free surface 26a of the treatment composition 26 is a first separation diaphragm 29a of metal material, preferably aluminium, diametrically extending in vessel 11 which is passed through by the admission pipe 12 and auxiliary tube 27. The peripheral edges 32 of the first separation diaphragm 29a are spaced apart from the inner wall of vessel 11 to define passage ports 33 for the bubbled air flow 6.

[0032] The first diaphragm 29a in vessel 11 delimits a lower treatment region 34 occupied by the treatment composition 26 and a dehumidification region 35 vertically extending over the first diaphragm and containing appropriate dehumidificating means preferably comprising a filtering unit 36 described in more detail below.

[0033] Advantageously, the presence of further separation diaphragms 29b, 29c may be also provided to prevent the treatment composition 26 from sprinkling and directly reaching the dehumidification region 35.

[0034] In particular, as clearly shown in Fig. 2, apparatus 1 in accordance with a preferred embodiment also comprises a second 29b and third 29c diaphragms disposed above the first diaphragm 29a along the vertical extension X of vessel 11. The three diaphragms 29a, 29b, 29c are mutually spaced apart along the vertical extension X to define a first gap 37a and a second gap 37b. The first gap 37a is in fluid communication with the duct of the admission pipe 12 through a plurality of openings 38 formed in the admission pipe portion 12 crossing the gap itself.

[0035] The third diaphragm 29c further has a plurality of through holes 39 to facilitate passage of the air flow 6 to the dehumidification region 35.

[0036] Placed on top of the last diaphragm 29c in the

dehumidification region 35, an active-carbon filter bed 40 is installed which is operatively associated with a filter bed made of expanded clay. In particular, the active-carbon filter bed 40 takes the form of a layer of reduced thickness that can be directly lain down on the third diaphragm 29c even if the presence of at least one rigid synthetic filter 42a is preferably provided which is fastened on top of the third diaphragm 29c to supply a further mechanical support.

[0037] The embodiment illustrated in Fig. 1 further shows a second synthetic filter 42b and a filter of ceramic material 43 that are disposed between the rigid synthetic filter 42a and the active-carbon filter bed 40.

[0038] The filtering function is mainly performed by the expanded-clay filter bed 41 which extends vertically over the active-carbon filter bed 40, on a height included just as an indication between 400 and 800 mm and preferably corresponding to about half the overall vertical extension of the treatment region 34 and the dehumidification region 35.

[0039] Finally, a further upper synthetic filter 42c is provided to close the filter pack 40, 41, 42a, 42b, 43, said filter being maintained pack-wise against the top of the clay filter bed 41 by a locking ring 44 made of PVC.

[0040] The air flow 6, after bubbling in the composition 26, rises, pressure-pushed, to the upper portion 13 of vessel 11 passing first through the peripheral passage ports 33 of the first 29a and second 29b diaphragms and subsequently also through holes 39 present in the third diaphragm 29c. The dampened air flow 6 subsequently passes through the gaps of the filter pack 40, 41, 42a, 42b, 42c, 43 that will absorb most of the humidity typical of the atmospheric compressed air and the humidity gathered during passage in composition 26.

[0041] Filtering carried out in the described manner therefore enables the bubbled air to dry thereby conveniently reducing the aqueous component thereof. In fact, if filtering should not be appropriately carried out, the outgoing air would have an aqueous component with a high salt content, in the presence of which there would be a risk of impairing a correct painting of the workpiece.

[0042] The active-carbon filter 40 is adapted to quickly absorb big humidity amounts but, used alone, could have an unsatisfactory result because it would tend to absorb humidity to saturation, consequently losing its efficiency.

[0043] The expanded clay 41 on the contrary does not become saturated and keeps its efficiency in time.

[0044] The clay filter bed 41 therefore lends itself to "stabilize" the properties of the outgoing air, i.e. to ensure that the outgoing air has a controlled and constant residual humidity value independently of possible oscillations in the humidity value of the incoming flow.

[0045] Once the air flow 6 has passed through the filter pack 40, 41, 42a, 42b, 42c, 43, it comes out through the outlet valve union 11b and is conveyed to gun 3.

[0046] The forced air passage in gun 3 causes suction of the liquid paint and formation of the air-paint mixture, in an adjustable flow rate, in the delivery nozzle 7b. The liquid paint therefore comes out through the delivery nozzle 7b in an atomized state in the form of very fine droplets dispersed in the gaseous fluid, to be thus sprayed against the workpiece. By a possible baking, polymerization (cross-linking) of the liquid paint layer applied and steady adhesion of same to the workpiece will be achieved.

[0047] Preferably, the treatment composition 26 is a solution comprising distilled water as the solvent and a solute comprising at least one salt of a divalent cation.

[0048] Preferably said salt is present in a percentage by weight included between 20 and 60% relative to the water weight; more preferably in a percentage included between 30 and 50%. Advantageously, this percentage may be in the range of 38 to 42% relative to the water weight.

[0049] Preferably, salt is selected from the group consisting of magnesium chloride, magnesium sulphate, manganese chloride and manganese sulphate. Advantageously, salt is magnesium chloride or mixtures of soluble salts containing magnesium salts.

[0050] The treatment composition may further comprise at least one carbohydrate compound preferably in a percentage by weight included between 10 and 50% relative to the salt weight. When composition 26 is in the form of a solution, the carbohydrate compound is present just as an indication in a percentage by weight included between 2 and 30% relative to the water weight, preferably included between 2.5 and 15%. Advantageously, the percentage by weight of the carbohydrate compound may be in the range of 3 to 10% relative to the water weight.

[0051] Preferably, the carbohydrate compound includes a monosaccharide sugar selected from the group comprising glucose and fructose and/or a disaccharide sugar selected from the group comprising sucrose and lactose sugar.

[0052] Advantageously, the carbohydrate compound is in the form of a mixture comprising monosaccharide and disaccharide sugars, in varying proportions with respect to each other.

[0053] In particular, advantageous results are obtained when the carbohydrate compound is a mixture comprising sucrose and glucose. In the context of the present invention sucrose sugar (common sugar) is a sugar extracted from sugar beet or sugarcanes which is usually employed as a food. The above specified sugar is formed of glucose and fructose.

[0054] The proportion by weight between glucose and sucrose may be included between 1:5 and 5:1, and is preferably included between 1:3 and 3:1.

[0055] Preferably the solute being part of the treatment composition 26 further comprises at least one surface-active compound. Generally, a surface-active compound consists of a lipophilic part and a hydrophilic part. A surface-active compound in the form of a salt has the hydrophilic part salified with a metal cation such as so-

dium, potassium, calcium and magnesium for example. In the case of an anionic surface-active compound which is preferred to the aims of the invention, the hydrophilic part may be represented by a carboxyl group, a sulphate group or a sulphonic group. The difference consists in that the sulphate and sulphonic groups give the anion (hydrophilic head) higher hydrophilic properties than the carboxyl group. In addition, sulphates and sulphonates form soluble salts with calcium and magnesium ions.

[0056] Advantageously, the surface-active compound is selected from alkyl sulphates, alkyl sulphonates, alkylaryl sulphates and alkylaryl sulphonates. In more detail, the surface-active compound is selected from sodium and/or potassium alkylaryl sulphonate soaps. The surface-active compound is advantageously present in a percentage by weight included between 0.005 and 0.5%, relative to the water weight; preferably in a percentage included between 0.008 and 0.4% and more specifically in the range of 0.01 to 0.3%, relative to the water weight.

[0057] It is also preferably provided that in the treatment composition 26 the solute and solvent should form a saturated solution at the preset use temperature that, as previously stated, can be conveniently selected in the range of 20 to 40°C.

[0058] The treatment composition 26 can be advantageously prepared by a method involving mixing of at least one carbohydrate compound and at least one surface-active compound in a given distilled water amount at room temperature. The aqueous composition is maintained under stirring over a period of time included between 10 and 30 minutes for the purpose of completely solubilizing all components. Subsequently, magnesium chloride or other water-soluble salt of a divalent cation is gradually added to the thus obtained composition under continuous stirring. At the end of the salt addition, the composition is maintained under stirring for a period of time included between 10 and 30 minutes in order to obtain a clear composition without traces of precipitates.

[0059] A preferential example of preparing the treatment composition provides for 100 g of distilled water at room temperature to be disposed in a proper container equipped with a magnetic stirrer. 30 g of glucose, 50 g of sucrose and 2 g of sodium alkylaryl sulphonate are then added to the aqueous composition under stirring. The composition is maintained under stirring for 20 minutes to complete solubilization of the added compounds and avoid formation of insoluble precipitates. 400 g of magnesium chloride are added to the treatment composition thus obtained and the same is maintained under stirring for 20 minutes until a clear composition is obtained.

[0060] The treatment composition thus prepared is ready to be introduced into vessel 11 through the auxiliary tube 27 to carry out treatment of air or other gaseous fluid as above described.

[0061] The present invention achieves important advantages.

[0062] The air or other gaseous fluid treated as above described in fact acquire the property of neutralizing the electrostatic charges possibly present in any element with which the fluid is brought into contact. Referring particularly to spray painting, the air treated in accordance with the invention enables the electrostatic charges that are created on the finely divided particles of the liquid paint coming out of the gun nozzle to be neutralized, due to said particles rubbing against each other and against the surfaces of the nozzle itself, as well as the charges created on the possible particles impinging on and rebounding against the workpiece without adhering thereto.

[0063] In the absence of a treatment carried out in accordance with the present invention, the electrostatically charged paint particles with a residual charge of same sign would repel each other and would consequently tend to spread in the environment surrounding the workpiece. Consequently, many paint particles would not reach the workpiece and/or would tend to rebound thereon, also because they are electrostatically repelled by the particles already adhered thereto, and would therefore float in the environment until they meet the closest surface on which they can lay down and discharge the acquired electrostatic charge.

[0064] Painting carried out in accordance with the present invention has proved to be very advantageous because, by neutralizing the effect of the electrostatic charge induced on the atomized-paint particles, it greatly inhibits tendency of said particles to spread in the environment surrounding the work region and to remain suspended in the air migrating towards grounded surfaces or surfaces electrostatically charged with an opposite sign with respect to the particles themselves.

[0065] In addition, the absence of an electrostatic charge in the particles avoids the latter being repelled by the paint already laid down on the workpiece, thereby improving the painting yield, paint waste being greatly reduced.

[0066] Actually, the invention makes a greater amount of atomized paint to adhere to the workpiece and causes the reduced paint percentage not adhering to the workpiece to immediately fall to the ground, without spreading in the surrounding atmosphere.

[0067] Obviously, while the invention is described referring particularly to painting, it is advantageously usable in any other circumstance in which the electrostatic charges present in an element are wished to be neutralized; for instance, air or other gaseous fluid treated in accordance with the invention can be employed to neutralize the static electricity present on articles of manufacture in making sheets or ribbons of plastic or paper material and in weaving processes, as well as for carrying out dusting processes on the surfaces of these articles of manufacture or articles of manufacture of other types.

Claims

1. A method of neutralizing electrostatic charges from an electrostatically-charged element, comprising the step of bringing a gaseous fluid (6) previously submitted to a treatment, into contact with said electrostatically-charged element to neutralize the electrostatic charges from said at least one element, **characterized in that** said treatment comprises the step of bringing at least part of the gaseous fluid (6) into contact with a treatment composition (26) including at least one salt of a divalent cation.

2. A method as claimed in claim 1, wherein the treatment composition comprises a solvent and a solute including said salt dissolved in the solvent, preferably in a percentage by weight included between 20 and 60%, relative to the solvent weight.

3. A method as claimed in claim 1 or 2, wherein the treatment composition further comprises at least one carbohydrate compound, preferably in a percentage by weight included between 10% and 50% relative to the salt weight.

4. A method as claimed in claim 1, wherein the salt is selected from the group consisting of magnesium chloride, magnesium sulphate, manganese chloride and manganese sulphate.

5. A method as claimed in claim 3, wherein the carbohydrate compound comprises at least one sugar selected from the group consisting of glucose, fructose, lactose and sucrose.

6. A method as claimed in claim 2 or 3, wherein the solvent and solute form a saturated solution to a predetermined use temperature in the range of 20 to 40°C.

7. A method as claimed in claim 2, wherein the gaseous fluid is brought into contact with the treatment composition (26) by bubbling of the latter.

8. A method as claimed in claim 1, further comprising a step of dehumidifying the treated gaseous fluid, preferably by filtering through at least one filter bed of expanded clay (41).

9. A method as claimed in claim 1, further comprising a step of filtering the treated gaseous fluid.

10. A method as claimed in claim 1, wherein before the treatment step, a step of heating the gaseous fluid is carried out to bring said fluid to a temperature of use of the treatment composition, which is higher than 20°C and preferably included between 30°C and 40°C.

11. A method as claimed in claim 1, wherein said electrostatically-charged element comprises an atomized paint in a spray painting process comprising the further steps of:

- conveying the treated gaseous fluid (6) to a delivery nozzle (7b);
- atomizing a liquid paint (10) constituting said electrostatically-charged element in the gaseous fluid (6) ;
- projecting the atomized paint against a workpiece, concurrently with delivery of the treated gaseous fluid (6) through the delivery nozzle (7b).

12. An apparatus for treatment of a gaseous fluid in a method of neutralizing electrostatic charges in an electrostatically-charged element, **characterized in that** it comprises:

- at least one vessel (11) containing a composition (26) for treatment of the gaseous fluid;
- an inlet valve union (11a) to be connected to a first length (4a) of a duct (4) for supply of said gaseous fluid;
- an outlet valve union (11b) to be connected to a second length (4b) of the supply duct (4) to bring the gaseous fluid into contact with the electrostatically-charged element;
- mixing means (12) terminating at the inlet valve union (11a) and operating within the vessel (11) to bring the gaseous fluid admitted through the inlet valve union (11a) into contact with the treatment composition (26).

13. An apparatus as claimed in claim 12, wherein said mixing means comprises an admission pipe (12) having a first end (12a) connected to the inlet valve union (11a) and a second end (12b) plunged in the treatment composition (26), said treatment composition (26) being liquid, so that the gaseous fluid from the supply duct (4) is submitted to bubbling in the composition itself.

14. An apparatus as claimed in claim 12, further comprising dehumidification means (36) for the treated gaseous fluid, operating in said vessel (11).

15. An apparatus as claimed in claim 12, further comprising a filtering unit (36) for the treated gaseous fluid, operating in said vessel (11).

16. An apparatus as claimed in claim 15, wherein said filtering unit (36) comprises a filter bed (41) of expanded clay.

17. An apparatus as claimed in claim 15, wherein said filtering unit (36) further comprises at least one filter

bed of active carbon (40) disposed upstream of the filter bed of expanded clay (41).

18. An apparatus as claimed in claim 12, further comprising heating means (23) for the gaseous fluid (6) operating at the inlet valve union (11a) to heat the fluid admitted to the vessel to a temperature at least as high as 20°C.

19. A composition for the treatment of a gaseous fluid in a process for neutralizing electrostatic charges in an electrostatically-charged element, **characterized in that** it comprises:

- at least one salt of a divalent cation soluble in said solvent;
- at least one carbohydrate compound, preferably in a percentage by weight included between 10% and 50% relative to the salt weight.

20. A composition as claimed in claim 19, wherein the salt and the carbohydrate compound form a solute dissolved in a solvent, preferably water.

21. A composition as claimed in claim 20, wherein the salt is present in a percentage by weight included between 20% and 60% relative to the solvent weight, and the carbohydrate compound is present in a percentage by weight included between 2% and 30% relative to the solvent weight.

22. A composition as claimed in claim 20, wherein the solute further comprises at least one surface-active compound, preferably in a percentage by weight in the range of 0.005% to 0.5% relative to the solvent weight.

23. A composition as claimed in claim 19, wherein the salt is selected from the group consisting of magnesium chloride, magnesium sulphate, manganese chloride and manganese sulphate.

24. A composition as claimed in claim 19, wherein the carbohydrate compound comprises at least one sugar selected from the group consisting of glucose, fructose, lactose and sucrose.

25. A composition as claimed in claim 19, wherein the carbohydrate compound is a mixture comprising glucose and sucrose sugar.

26. A composition as claimed in claim 22, wherein the surface-active compound is of the anionic type, preferably selected from the group consisting of alkyl sulphates, alkyl sulphonates, alkylaryl sulphates and alkylaryl sulphonates.

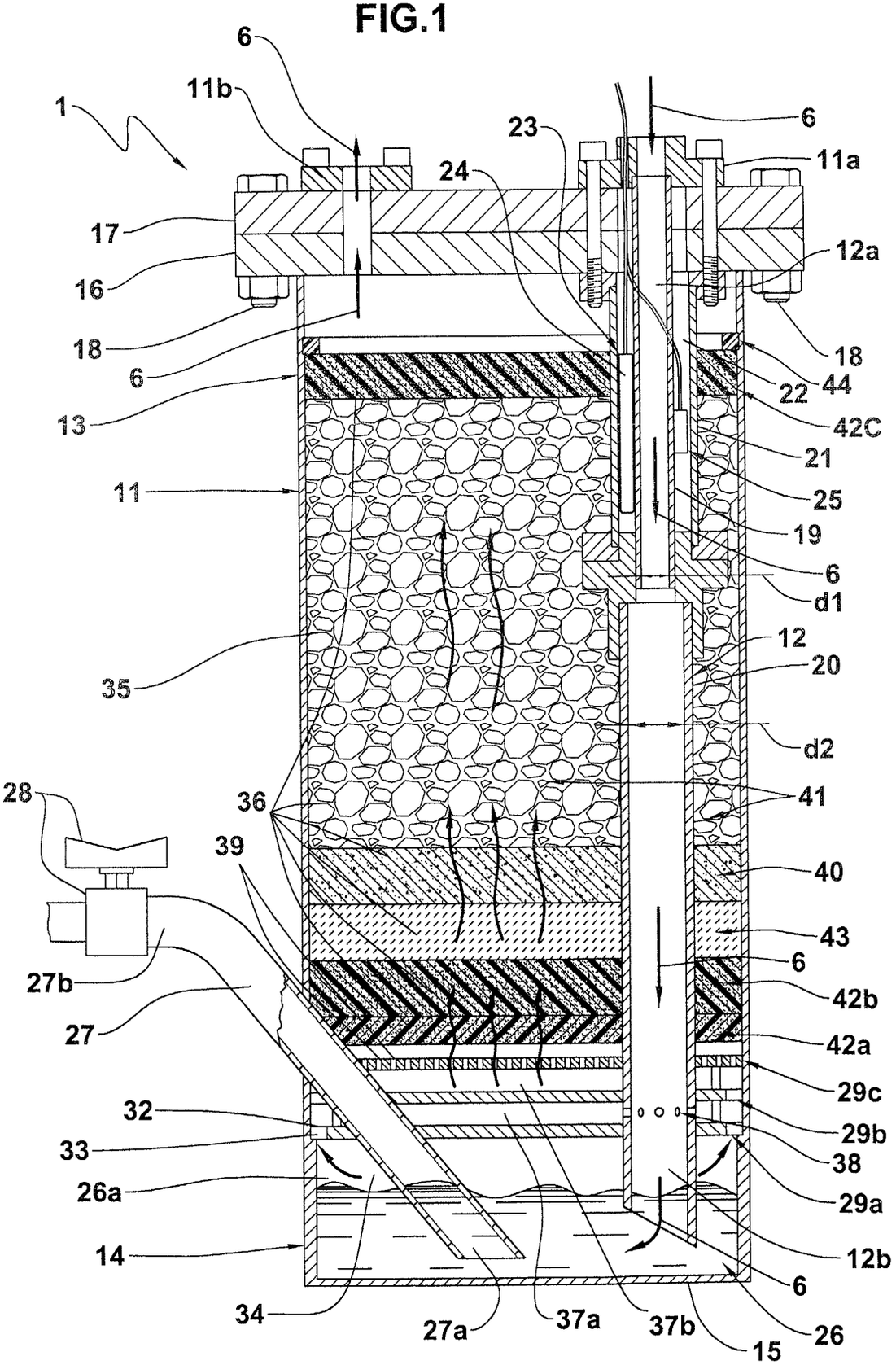
27. A composition as claimed in claim 20, wherein the solute and solvent form a saturated solution to a use temperature included between 20°C and 40°C.

28. A method of spray-painting a workpiece, comprising the following steps:

- conveying an air flow (6) towards a delivery nozzle (7b);
- atomizing a liquid paint (10) in the air flow (6);
- projecting the atomized paint against a workpiece, concurrently with delivery of the air flow (6) through the delivery nozzle (7b),

characterized in that at least part of the air flow (6) conveyed to the delivery nozzle (7b) is submitted to a treatment for neutralizing electrostatic charges in the atomized paint, preferably as claimed in one or more of claims 1 to 10.

FIG.1


6
11b
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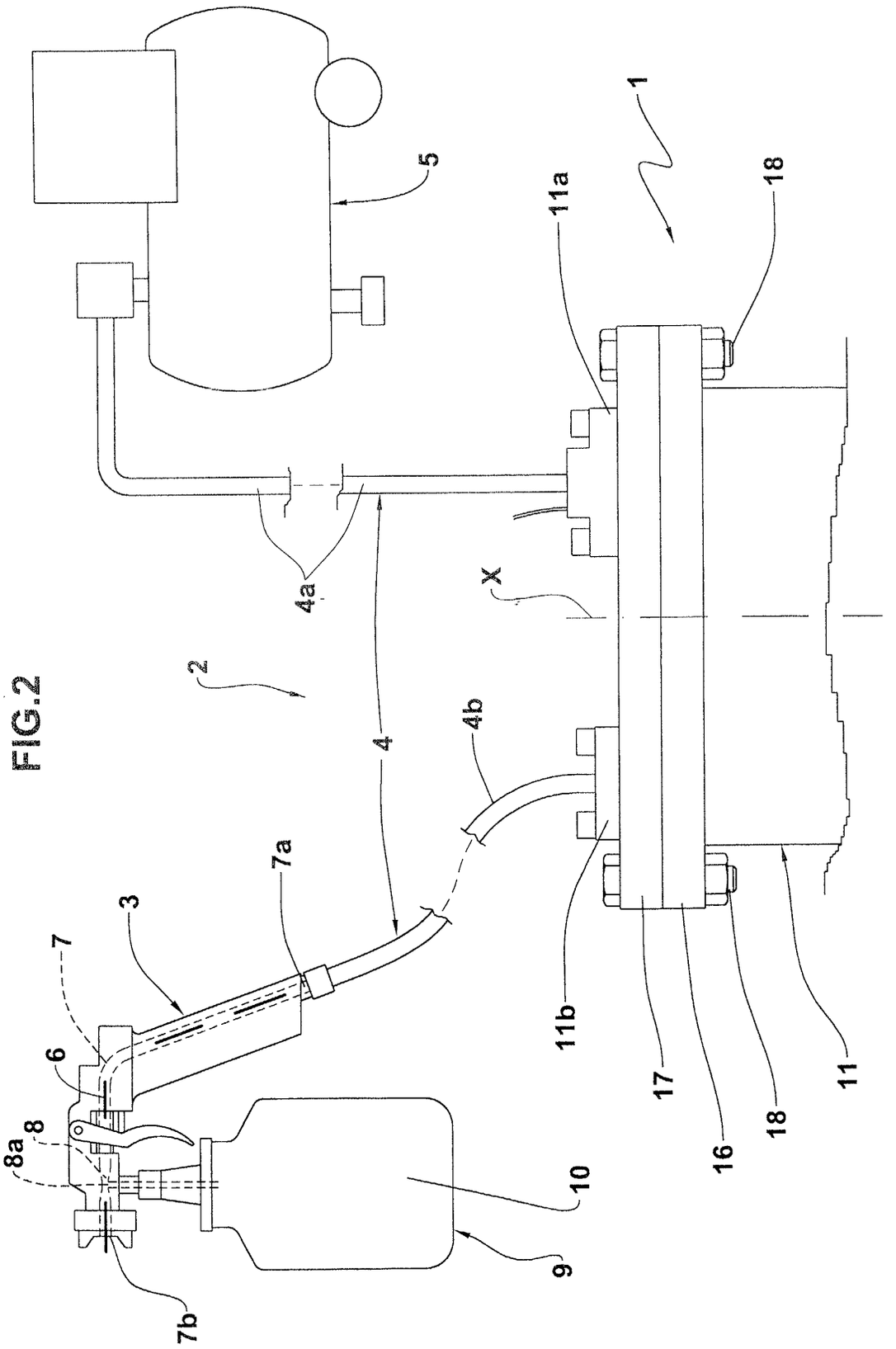

FIG.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 83 0755

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.7)
X A	FR 683 906 A (PAILLET JULES-LOUIS-VICTOR) 19 June 1930 (1930-06-19) * page 1, line 47 - page 2, line 20; figure 4 *	12,13 1,28	H05F1/00 B05B7/24
X A	US 4 314 308 A (FAULKNER JAMES D) 2 February 1982 (1982-02-02) * column 8, line 12 - column 9, line 31; claims; figures *	12 1,19,28	
A	US 3 123 640 A (WITCO CHEMICAL COMPANY INC.) 3 March 1964 (1964-03-03) * column 1, line 11 - line 25 *	1,19	
A	US 4 169 279 A (FRIEDMAN JR LESTER A ET AL) 25 September 1979 (1979-09-25) * column 1, line 38 - column 2, line 8 * * column 3, line 45 - column 6, line 10 *	1,12,19, 28	
X	EP 1 084 761 A (HIMU ELECTRO CO LTD ;TAKEDA KOICHI (JP)) 21 March 2001 (2001-03-21) * column 1, line 32 - column 2, line 35; figure 1 *	28	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B05B H05F
A	GB 311 978 A (FREDERICK JOHNS;BENJAMIN MESNARD) 23 May 1929 (1929-05-23)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 June 2002	Brévier, F

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 83 0755

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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04-06-2002

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