

(19)



(11)

**EP 3 210 784 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**08.04.2020 Bulletin 2020/15**

(51) Int Cl.:  
**B41J 2/165** <sup>(2006.01)</sup> **C11D 7/50** <sup>(2006.01)</sup>  
**C11D 11/00** <sup>(2006.01)</sup>

(21) Application number: **17156288.7**

(22) Date of filing: **15.02.2017**

**(54) MAINTENANCE LIQUID FOR PRINTERS**

WARTUNGSFLÜSSIGKEIT FÜR DRUCKER

LIQUIDE D'ENTRETIEN POUR IMPRIMANTES

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO  
PL PT RO RS SE SI SK SM TR**

(30) Priority: **23.02.2016 EP 16156981**

(43) Date of publication of application:  
**30.08.2017 Bulletin 2017/35**

(73) Proprietor: **Canon Production Printing Holding  
B.V.  
5914 CA Venlo (NL)**

(72) Inventor: **PELZERS, Ronald J.H.M.C.  
5914 CA Venlo (NL)**

(74) Representative: **Canon Production Printing IP  
Department  
St. Urbanusweg 43  
5914 CA Venlo (NL)**

(56) References cited:  
**EP-A1- 1 550 556 EP-A1- 2 796 516  
WO-A1-2013/083413 WO-A2-2005/091771  
GB-A- 2 462 410 JP-A- H06 220 489  
JP-B2- 2 951 216 JP-B2- 3 962 116  
US-A1- 2013 141 501**

**EP 3 210 784 B1**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

**Description**

## FIELD OF THE INVENTION

5 **[0001]** The present invention relates to a maintenance liquid in particular for cleaning (inkjet) printers, the maintenance liquid comprising an aromatic ester compound. The present invention further relates to the use of an aromatic ester compound in a maintenance liquid in particular for cleaning printers.

## BACKGROUND ART

10 **[0002]** Maintenance liquids for cleaning print heads are known in the art.  
US 2007/0132807 discloses a maintenance liquid for ink jet recording containing water, a resin solvent and a moisturizing agent. US 2007/0132807 further discloses that the resin solvent comprises at least one selected from the group consisting of alcohols, ethers, ketones, esters, nitrogen-containing compounds, and sulfur-containing compounds and that the  
15 amount is preferably less than 10 wt% because otherwise cleaning properties are deteriorated by reduction in fluidity caused by increase in viscosity of the maintenance liquid and because of reactivity with ink flow passage members that may get damaged during cleaning.

EP 2 796 516 discloses a maintenance liquid of inkjet printers including at least 50 wt% of at least one ether solvent.  
US 2007/0225185 discloses an ink washing liquid for a photo curable ink including at least one type of ether compound  
20 **[0003]** It is however a disadvantage of such maintenance liquids that the resin solvent used may form peroxides, which renders the cleaning liquid unsuitable for use in printers wherein radiation curable inks are used.

**[0004]** It is another disadvantage that many resin solvents are not HS&E friendly compounds.

**[0005]** It is yet another disadvantage that many resin solvents are aggressive towards materials used in printers, in particular in ink handling systems of printers including print heads, such that high concentrations of the resin solvent  
25 must be avoided in order to prevent damage to the printers, which adversely affects the efficiency of the maintenance liquid and hence requires long maintenance actions.

It is therefore an object of the present invention to provide a maintenance liquid that overcomes or at least mitigates said disadvantages and provides efficient cleaning and which is mild to commonly used materials in printers.

## SUMMARY OF THE INVENTION

**[0006]** This object can be partly achieved by providing a maintenance liquid comprising a low molar weight aromatic ester compound. The molar weight is below 200 g/mol, preferably below 175 g/mol, more preferably below 150 g/mol.

**[0007]** Therefore, in a first aspect the present invention relates to the use of an aromatic ester compound in a maintenance liquid for use in an ink jet printer, wherein the aromatic ester compound has a molar weight of below 200 g/mol.  
35 **[0008]** According to the claimed invention, the maintenance liquid comprises at least one aromatic ester compound selected from the group consisting of methyl salicylate, methyl phenylacetate, methyl anthranilate and benzyl formate. Due to its cleaning efficiency, benzyl formate is most preferred.

**[0009]** Inventors have surprisingly found that the maintenance liquid according to the present invention are able to  
40 efficiently remove cured or semi-cured radiation (e.g. UV) curing ink residues from printer parts, in particular from printer parts that are difficult to access (such as the interior of print heads and clogged nozzles). Because of efficient removal of (semi) cured ink residues, low residence times of the maintenance liquid in the printer parts are required, such that damaging the printer parts due to contact with aggressive resin solvents present in the maintenance liquid. The required low residence time also improves the down-time of the printer for maintenance actions and therefore improves the overall  
45 productivity of the printer. The aromatic ester compounds present in the maintenance liquids are non peroxide forming, therefore initiating of further polymerization reactions of the radiation curable inks is prevented. The aromatic ester compounds selected in this invention are also HS&E friendly.

**[0010]** In an embodiment the resin solvent compound has a flash point that is higher than 40 °C, preferably higher than 70°C. Such resin solvent compounds will not easily self-ignite when used under normal environmental conditions.

50 **[0011]** In an embodiment, the maintenance liquid is substantially free of water

**[0012]** In an embodiment, the aromatic compound is present in an amount of more than 50 wt%, preferably more than 75%, more preferably more than 90%

**[0013]** Typically benzyl formate is used as maintenance liquid in its pure form (100 wt%, disregarding impurities of the components as such), or a mixture of x wt% methyl benzoate and y wt% benzyl formate wherein x+y = 100 wt%.

55 **[0014]** In an embodiment, the maintenance liquid comprises organic solvents that are inert towards materials used in a printer and are miscible with the aromatic ester resin solvent.

In a second aspect the present invention relates to a method for maintaining an inkjet printer comprising the step of applying a maintenance liquid using an aromatic ester compound and having a molar weight of below 200 g/mol, in

accordance with any embodiment of the first aspect of the present invention.

A method for maintaining a printer may be a method for cleaning the printer or parts thereof. The printer may be configured to eject droplets of an ink composition, in particular a radiation curable ink composition use of a low molar weight aromatic esters compound as described above in all aspects in a maintenance liquid, in particular a maintenance liquid for cleaning printers, more particular printers for printing radiation curable inks.

## DETAILED DESCRIPTION

**[0015]** In a printer wherein radiation curable inkjet ink is jetted to form an image onto a recording substrate, the formed ink image needs to be radiated in order to initiate a polymerization reaction between reactive monomers present in the ink, such that the ink image is cured. Radiation sources, e.g. UV-lamps or UV-LEDs are used to radiate a freshly printed image. Due to e.g. scattering of the radiation, the radiation curable ink may be partly and accidentally cured in the printer, for example in the ink tubes that supply and transport ink to and in the printer; the print head; the nozzle plate. Such cured or semi-cured ink residues are difficult to remove from printer parts.

**[0016]** Curing (polymerization) of ink inside the printer may cause all kinds of print problems:

- malfunctioning of the print heads: e.g. non-jetting (clogged) or misdirecting (partly clogged) nozzles;
- clogging of: filters, ink tubes, etc.

**[0017]** Cured or semi-cured ink residues may be successfully removed with a maintenance (cleaning) liquid comprising a resin solvent which dissolves and/or causes the (semi) cured ink residues to swell.

**[0018]** In order to be able to work safely with organic solvents the flash point of the used solvents should be above the operating temperature of the printer, or at least above the maintenance temperature of the printer.

The Flash Point of a volatile chemical is the lowest temperature at which it can ignite in either liquid or vapor form. In general, chemicals which have a flash point that is higher than the environment (e.g. room temperature) will be at low risk of catching fire.

For example a solvent with a flash point of 2 degrees Celsius is prone to ignition in almost any normal workplace. In contrast a product with a flashpoint above 40 degrees Celsius would only be an ignition risk under quite extreme conditions.

## UV-curable ink compositions

**[0019]** UV-curable ink compositions comprise:

- an ink vehicle comprising one or more radiation curable compounds (monomers), for example acrylates;
- a colorant, for example a dye, a pigment, or a mixture of dyes and/or pigments;
- an initiator, which is a compound that can easily form a reactive species when radiated. The reactive species starts a polymerization reaction (curing) of the reactive monomers;
- additives such as: inhibitors (preventing spontaneous reaction of the reactive monomers and/or reaction under influence of e.g. oxygen); viscosity modifiers; gelling agents; etc.

**[0020]** Examples of such compounds and examples of radiation curable inks are well known in the art.

## Maintenance liquid

**[0021]** The maintenance liquid according to the present invention comprises an aromatic ester compound as a resin solvent.

**[0022]** The aromatic ester compounds are: methyl salicylate, methyl phenylacetate, methyl anthranilate and benzyl formate.

**[0023]** The maintenance liquid may further comprise additives such as surfactants, dispersants, inhibitors etc, which are known in the art. Specific additives are not limited to any kind, as long as the effect of the present invention is maintained.

## Maintenance (e.g. cleaning) method

**[0024]** Ink residues in and on printer parts may be removed with a maintenance liquid according to the present invention, which maintenance liquid may be applied in various ways, also depending on the location of the contamination with ink residues. Examples are: spraying, application with a cloth (wiping), (off-line) soaking, flushing via liquid (ink) handling system of the printer, etc. The methods may be performed manually or (semi) automatically.

## EXAMPLES

Comparative example A

**[0025]** Prints were made comprising full cover areas of each color from a UV-curable CMYK ink set comprising standard curable ink vehicles (i.e. an acrylate monomer composition comprising acrylates commonly known in the art of UV-curable inkjet inks). The used print medium was IJM608 which is a polyester fiber reinforced paper obtained from Canon. The prints were made on a printer set-up comprising an Océ printhead adapted for being used in combination with UV-curable inks and cured with a UV-LED curing device. The ink layers are cured such, that just non-tacky ink layers are obtained.

**[0026]** Then a drop of benzyl alcohol as maintenance liquid was placed on the print and left to soak for 1 min and for 3 min. When the maintenance liquid is effective the ink layer will wrinkle and swell. After set time we remove in one rub as much as swelled ink layer from the medium with a AlphaWipe TX1004 tissue. When the liquid is effective all swelled ink is removed from the medium (0% ink layer remaining), when not effective no ink is removed from the media (100% ink layer remaining). This was repeated for all colored inks in the set.

**[0027]** For the black inks two printing modes were used, a production mode (printed with 4 passes of the printhead) and a presentation mode (printed with 8 passes of the printhead), which are printer settings. The difference between said modes is that in a presentation mode a print with a higher quality (denser ink layer) is obtained. It is expected that due to a denser ink layer, penetration of the solvent into said layer is more difficult.

**[0028]** For the cyan, magenta and yellow inks, prints are only made in the presentation mode and only 3 min soaking tests are.

**[0029]** The results for the black ink in the production and presentation mode are shown in Table 1. The results for the complete CMYK ink set made in the presentation mode and tested at 3 min soaking are shown in Table 2 (n.d. = not determined).

Examples 1- 4 and Comparative Examples B-C

**[0030]** Comparative Example A was repeated for all solvents shown in Tables 1 and 2.

**[0031]** Any subject matter of the following examples that falls outside the scope of independent claims 1 and 7 as granted is to be considered as comparative to the claimed invention.

*Table 1 : results black ink in production and presentation mode at 1 and 3 min soaking*

|    |                       | production mode |        | presentation mode |        |
|----|-----------------------|-----------------|--------|-------------------|--------|
|    |                       | 1               | 3      | 1                 | 3      |
| Ex | Solvent               |                 |        |                   |        |
| A  | Benzyl alcohol        | >80%            | >80%   | 60-80%            | >80%   |
| 1  | Benzyl formate        | >80%            | >80%   | 40-60%            | 60-80% |
| B  | Methyl benzoate       | 60-80%          | >80%   | 20-40%            | 40-60% |
| C  | Ethyl benzoate        | 40-60%          | 60-80% | <20%              | n.d.   |
| 2  | Methyl salicylate     | 40-60%          | >80%   | n.d.              | n.d.   |
| 3  | methyl phenyl acetate | 40-60%          | 60-80% | n.d.              | n.d.   |
| 4  | methyl anthranilate   | 40-60%          | 60-80% | 20-40%            | n.d.   |

*Table 2 : results CMYK ink set in presentation mode and at 3 min soaking*

|    |                 | Cyan | Magenta | Yellow | Black  |
|----|-----------------|------|---------|--------|--------|
| Ex | Solvent         |      |         |        |        |
| A  | Benzyl alcohol  | >80% | n.d.    | n.d.   | >80%   |
| 1  | Benzyl formate  | >80% | >80%    | >80%   | 60-80% |
| B  | Methyl benzoate | >80% | >80%    | >80%   | 40-60% |

(continued)

|    |                       | Cyan   | Magenta | Yellow | Black |
|----|-----------------------|--------|---------|--------|-------|
| Ex | Solvent               |        |         |        |       |
| C  | Ethyl benzoate        | 40-60% | 40-60%  | >80%   | n.d.  |
| 2  | Methyl salicylate     | <20%   | n.d.    | n.d.   | n.d.  |
| 3  | methyl phenyl acetate | 20-40% | n.d.    | n.d.   | n.d.  |
| 4  | methyl anthranilate   | >80%   | >80%    | >80%   | n.d.  |

[0032] From Table 1 it can be concluded that:

- all selected solvents are able to remove black ink from prints made in production mode (in particular at longer soaking);
- the selected solvents are less effective on prints made in presentation mode;
- benzyl formate is the most efficient (non peroxide forming) alternative for benzyl alcohol.

[0033] From Table 2 it can be concluded that:

- the tested solvents are more efficient on colored ink layers than on black ink layers;
- for colored inks (CMYK), benzyl formate, methyl benzoate and methyl anthranilate are efficient alternatives for benzyl alcohol;
- considering the entire ink set (CMYK), benzyl formate is the most efficient alternative for benzyl alcohol.

#### Example 7

[0034] A print head nozzle plate is on purpose exposed with UV-light which results in a clogged (i.e. non-jetting) print head. After soaking the nozzle plate in Benzyl formate for 12 minutes the print head showed complete recovery for all nozzles. No damage to the print head was found.

[0035] The terms "a" or "an", as used herein, are defined as one or more than one.

[0036] It will, for example, be obvious to the skilled person that the maintenance liquid disclosed herein may also, outside the scope of the claimed invention, be suitable for use in printers using other ink types that may suffer from accumulation of resinous compounds and/or pigments in printer parts. For example aqueous latex ink or pigmented ink compositions.

#### Claims

1. Use of an aromatic compound having a carbonyl group in a maintenance liquid for use in an ink jet printer, wherein the aromatic compound has a molar weight of below 200 g/mol, **characterized in that** the maintenance liquid comprises at least one aromatic ester compound selected from the group consisting of methyl salicylate, methyl phenylacetate, methyl anthranilate and benzyl formate.
2. The use according claim 1, wherein maintenance liquid comprises benzyl formate.
3. The use according to any one of the preceding claims, wherein the aromatic compound has a flash point that is higher than 40 °C.
4. The use according to any one of the preceding claims, wherein the maintenance liquid is substantially free of water.
5. The use according to claim 1, wherein the maintenance liquid further comprises at least one of methyl benzoate and ethyl benzoate.
6. The use according to any one of the preceding claims, wherein the aromatic ester compound is present in an amount of more than 50 wt%, relative to the total maintenance liquid composition.
7. A method for maintaining an inkjet printer comprising the step of applying a maintenance liquid comprising an

aromatic compound having a carbonyl group and having a molar weight of below 200 g/mol, **characterized in that** the maintenance liquid comprises at least one aromatic ester compound selected from the group consisting of methyl salicylate, methyl phenylacetate, methyl anthranilate and benzyl formate.

- 5     **8.** Method according to claim 7, wherein the maintenance liquid comprises benzyl formate.

## Patentansprüche

- 10     **1.** Verwendung einer aromatischen Verbindung, die eine Carbonylgruppe hat, in einer Wartungsflüssigkeit zum Gebrauch in einem Tintenstrahldrucker, wobei die aromatische Verbindung ein molares Gewicht von unter 200 g/mol hat, **dadurch gekennzeichnet, dass** die Wartungsflüssigkeit wenigstens eine aromatische Esterverbindung enthält, die ausgewählt ist aus der Gruppe bestehend aus Methylsalicylat, Methylphenylacetat, Methylantranilat und Benzylformiat.
- 15     **2.** Verwendung nach Anspruch 1, bei der die Wartungsflüssigkeit Benzylformiat enthält.
- 3.** Verwendung nach einem der vorstehenden Ansprüche, bei der die aromatische Verbindung einen Flammpunkt hat, der höher ist als 40°C.
- 20     **4.** Verwendung nach einem der vorstehenden Ansprüche, bei der die Wartungsflüssigkeit im wesentlichen frei von Wasser ist.
- 5.** Verwendung nach Anspruch 1, bei der die Wartungsflüssigkeit weiterhin Methylbenzoat und/oder Ethylbenzoat enthält.
- 25     **6.** Verwendung nach einem der vorstehenden Ansprüche, bei der die aromatische Esterverbindung in einer Menge von mehr als 50 Gew.% vorhanden ist, bezogen auf die gesamte Wartungsflüssigkeitszusammensetzung.
- 30     **7.** Verfahren zur Wartung eines Tintenstrahldruckers mit dem Schritt der Anwendung einer Wartungsflüssigkeit, die eine aromatische Verbindung enthält, die eine Carbonylgruppe aufweist und ein molares Gewicht von unter 200 g/mol hat, **dadurch gekennzeichnet, dass** die Wartungsflüssigkeit wenigstens eine aromatische Esterverbindung enthält, die ausgewählt ist aus der Gruppe bestehend aus Methylsalicylat, Methylphenylacetat, Methylantranilat und Benzylformiat.
- 35     **8.** Verfahren nach Anspruch 7, bei der die Wartungsflüssigkeit Benzylformiat enthält.

## Revendications

- 40     **1.** Utilisation d'un composé aromatique présentant un groupe carbonyle dans un liquide de maintenance pour une utilisation dans une imprimante à jet d'encre, dans laquelle le composé aromatique présente un poids molaire inférieur à 200 g/mole, **caractérisée en ce que** le liquide de maintenance comprend au moins un composé d'ester aromatique sélectionné dans le groupe constitué de salicylate de méthyle, phénylacétate de méthyle, anthranilate de méthyle et formiate de benzyle.
- 45     **2.** Utilisation selon la revendication 1, dans laquelle un liquide de maintenance comprend du formiate de benzyle.
- 3.** Utilisation selon l'une quelconque des revendications précédentes, dans laquelle le composé aromatique présente un point d'éclair qui est supérieur à 40 °C.
- 50     **4.** Utilisation selon l'une quelconque des revendications précédentes, dans laquelle le liquide de maintenance est sensiblement exempt d'eau.
- 5.** Utilisation selon la revendication 1, dans laquelle le liquide de maintenance comprend en outre au moins un parmi le benzoate de méthyle et le benzoate d'éthyle.
- 55     **6.** Utilisation selon l'une quelconque des revendications précédentes, dans laquelle le composé d'ester aromatique

## EP 3 210 784 B1

est présent dans une quantité supérieure à 50% en poids, par rapport à la composition de liquide de maintenance totale.

- 5      7. Procédé de maintien d'une imprimante à jet d'encre comprenant l'étape d'application d'un liquide de maintenance comprenant un composé aromatique présentant un groupe carbonyle et présentant un poids molaire inférieur à 200 g/mole, **caractérisé en ce que** le liquide de maintenance comprend au moins un composé d'ester aromatique sélectionné dans le groupe composé de salicylate de méthyle, phénylacétate de méthyle, anthranilate de méthyle et formiate de benzyle.
- 10      8. Procédé selon la revendication 7, dans laquelle le liquide de maintenance comprend du formiate de benzyle.

15

20

25

30

35

40

45

50

55

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- US 20070132807 A [0002]
- EP 2796516 A [0002]
- US 20070225185 A [0002]