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54 **ADDITIVE FOR DAMPENING SOLUTION FOR LITHOGRAPHIC PLATE AND STOCK DAMPENING SOLUTION.**

57 An additive for dampening solution, comprising a readily water-soluble glycol monoalkyl ether and a minute amount of a fluoroalkylated nonionic surfactant. Dampening solution can be prepared by using this additive without the necessity for using isopropyl alcohol at a dampening solution supply efficiency (FSE) equal to the one attained by using isopropyl alcohol.

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1. Technical Field

The present invention relates to an additive to be added to damping water or damping water concentrate and also relates to a damping water concentrate containing such an additive, said damping water being used for lithographic printing (usually offset printing). More particularly, the present invention relates to an additive for damping water and also to a damping water concentrate containing such an additive, said additive being capable of superseding isopropyl alcohol (IPA) which has conventionally been in use as an additive for damping water.

The term "damping water concentrate" as used in this specification is defined as a liquid which is diluted twice or more with water to prepare damping water (to be fed to the printing plate) . In the following description, the amount for formulation is expressed by weight unless otherwise indicated.

2. Background Art

Lithographic printing is a system of printing which is based on the principle that water and oil are substantially immiscible with each other. It utilizes a printing plate which is made of an image area (or a lipophilic part (or an ink receptive part) which repels water but accepts oily ink) and a non-image area (or a hydrophilic part (or a water receptive part) which accepts water but repels oily ink).

In lithographic printing, the printing plate is supplied with water which is customarily called damping water. It is necessary that damping water be fed to the printing plate in adequate proportion to ink so that it is uniformly distributed to the water receptive part and ink receptive part.

An excess supply of damping water brings about the emulsification of ink. Conversely, a short supply of damping water causes the non-image area to attract ink, resulting in scumming, because of its insufficient hydrophilicity. Either cases are damaging to printing quality.

Damping water serves to prevent the scumming which would otherwise occur during printing. The damping water concentrate which has been in common use is an aqueous solution containing chromate and phosphoric acid (or phosphate) and having an adequate viscosity adjusted with gum arabic or methyl cellulose.

Continued improvement is being made on the damping water supply unit in order to meet the recent requirements for higher printing quality and speed and better workability. However, the improvement has not yet reached the stage at which no skill is required to feed damping water to the printing plate in adequate proportion to ink. Therefore, it is common practice to prepare damping water by incorporating a damping water concentrate with 20-25% of IPA. The thus prepared damping water readily wets the non-image area and facilitates the balanced supplies of ink and damping water. In addition, it reduces the emulsification of ink into damping water. This leads to the improvement of printing quality, printing speed, and workability.

The damping water containing IPA has a disadvantage that its use is restricted according to the Industrial Safety and Health Law (regulation for the prevention of poisoning by organic solvents) and the Fire Service Law (handling of hazardous substances). The Industrial Safety and Health Law is applicable to damping water containing more than 5% of IPA. With an IPA content less than 5%, damping water is hardly effective in the improvement of printing quality. The Fire Service Law is applicable to the storage and handling of IPA (which is designated as the fourth class petroleum and alcohol). Another disadvantage of IPA is its high volatility, which makes it necessary to provide the damping water supply unit with an evaporation preventing means. In addition, IPA is expensive and bad-smelling.

Attempts have been made to produce the desired effect without adding IPA to the damping water concentrate. They include the use of a surface active agent to reduce the surface tension of water and the use of a paste or water-soluble resin to increase the viscosity of water. (See Japanese Patent Publication No. 25075/1980 and Japanese Patent Laid-open Nos. 176280/1983 and 134293/1988.)

Unfortunately, the damping water poses the following problems if it is prepared from a damping water concentrate containing no IPA.

- (1) Fill-in of dots in the image area.
- (2) Scumming of the non-image area.
- (3) Excessive emulsification of ink by the surface active agent.
- (4) Foaming by the surface active agent.

The improvement of workability by the addition of 20-25% of IPA to water was investigated by R. Bssemir of Sun Chemicals, Inc. He reported that IPA reduces the surface tension of water as well as increases the viscosity of water. He also proposed the fountain solution efficiency (FSE) as the function required of damping water. FSE is defined by the equation below, assuming that the surface tension of

water is 73 (dyn·cm⁻¹) and the viscosity of water is 1.0 (cP).

$$FSE = 73 - F_t/F_v$$

5 (where F_t denotes the surface tension of damping water and F_v denotes the viscosity of damping water.)
The value of FSE should be greater than 40.

3. Disclosure of the Invention

10 An object of the present invention is to provide an additive for damping water and a damping water concentrate containing said additive. The additive supersedes IPA and imparts the necessary performance to damping water as IPA does.

The first aspect of the present invention resides in an additive for damping water for lithographic printing, said additive comprising a water-soluble glycol monoalkyl ether selected from the group consisting of di- or tri-ethylene glycol monoalkyl ethers and di- or tri-propylene glycol monoalkyl ethers, and a nonionic surface active agent having a fluoroalkyl group.

The second aspect of the present invention resides in a damping water concentrate for damping water which contains said additive in an amount equal to 40-80 wt%.

20 The third aspect of the present invention resides in a process for preparing damping water for lithographic printing which comprises adding said additive to a commercial damping water concentrate.

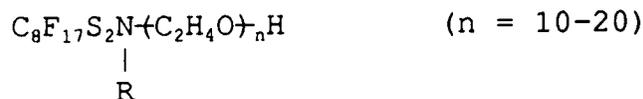
The present invention produces the effect of obviating the necessity of IPA without posing problems in lithographic printing associated with the fill-in of dots in the image area, the scumming of non-image area, the excessive emulsification of ink by the surface active agent, and the foaming by the surface active agent.

25 4. Best Mode for Carrying Out the Invention

(1) There are no specific restrictions on the water-soluble monoalkyl ether that can be used in the present invention, so long as it meets the requirements set forth in the claim. The typical examples include the following.

- 30 • Diethylene glycol monoethyl, butyl, isobutyl, propyl, or isopropyl ether.
- Triethylene glycol monomethyl, ethyl, butyl, or isobutyl ether.
- Propylene glycol monoethyl, butyl, isobutyl, propyl, or isopropyl ether.
- Dipropylene glycol monomethyl, ethyl, butyl, or isobutyl ether.

35 There are no specific restrictions on the nonionic surface active agent that can be used in the present invention. Those which are represented by the formula below are preferable.



(where R denotes hydrogen or a C₁₋₄ alkyl group.)

45 Examples of the nonionic surface active agent include "Surflon S-145" made by Asahi Glass Co., Ltd. and "Florad FC-170" made by Sumitomo 3M Co., Ltd.

The nonionic surface active agent having a fluoroalkyl group lowers the surface tension of damping water even with a very small amount, without causing the emulsification of ink. It should be used in an amount of 0.1-1.0 part for 100 parts of glycol monoalkyl ester. With an amount less than 0.1 part, it does not lower sufficiently the surface tension of damping water. With an amount in excess of 1.0 part, it is liable to cause the emulsification of ink.

50 The additive for damping water, which is composed of the above-mentioned glycol monoalkyl ether and specific nonionic surface active agent, is added to a commercial damping water concentrate which is diluted afterward to prepare damping water. The amount of the additive should be 1.5-2.0% or more, which is enough for the FSE value to be not less than 40. Although there are no upper limits, an amount of 4.0-5.0% will be enough. An excess amount produces no additional effect but poses problems associated with anomalous emulsification. It was confirmed by the present inventors that the additive for damping water is as effective as IPA (in terms of FSE) with one-fourth to one-tenth the amount of IPA.

The additive for damping water can also be used as one component of damping water. In this case, it

should be used in an amount of 40-80%, preferably 45-60%. With an amount less than 40%, it does not yield an FSE value not less than 40. With an amount in excess of 80%, it dose not yield an FSE value not less than 40 because it decreases the solubility of the desensitizing component. Table 3 shows an example of the damping water concentrate pertaining to the present invention.

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Examples

To evaluate the effect of the additives pertaining to the present invention, they were added to pure water and the resulting solutions were tested for surface tension and viscosity and the FSE values were calculated from them. The results are shown in Table 1. It is noted from Table 1 that an amount of 1.5-2.0% is enough to yield FSE values greater than 40.

To evaluate the effect of the damping water concentrates formulated as shown in Table 2, it was added to pure water and the resulting solutions were tested for surface tension and viscosity and the FSE values were calculated from them. The results are shown in Table 3. It is noted that it is possible to relatively reduce the amount of the additive for damping water (glycol monoalkyl ether incorporated with a nonionic surface active agent) by making a proper selection of other agents for the damping water concentrate. In other words, an amount of 0.5% in terms of glycol monoalkyl ether (or an amount of 1% in terms of loads) for pure water is enough to yield FSE values greater than 40.

The abbreviations used in the tables stand for the following compounds.

- 20 PG-MPE : propylene glycol monopropyl ether
- DEG-MBE : diethylene glycol monobutyl ether
- DEG-MIBE : diethylene glycol monoisobutyl ether
- TEG-MBE : triethylene glycol monobutyl ether

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Table 1

	Amount added (%)	Surface tension (dyn/cm)	Viscosity (cP)	FSE	
5	Pure water	0.0	73.00	1.000	0.00
	PG-MBE (*)	1.0	45.09	1.158	34.06
		2.0	37.41	1.178	41.24
10		3.0	34.65	1.188	43.83
		4.0	31.51	1.317	49.07
		5.0	27.91	1.366	52.57
	DEG-MBE (*)	1.0	41.41	1.048	33.49
15		1.6	34.57	1.076	40.87
		3.0	29.76	1.171	47.59
		4.0	26.86	1.200	50.62
20		5.0	25.71	1.286	53.01
	DEG-MIBE (*)	1.0	41.51	1.072	34.28
		1.6	34.35	1.135	42.74
25		3.0	29.49	1.189	48.20
		4.0	26.81	1.243	51.43
		5.0	25.67	1.297	53.21
	TEG-MBE (*)	1.0	40.29	1.086	35.20
30		2.0	35.64	1.105	40.75
		3.0	31.70	1.175	46.02
		4.0	29.73	1.232	48.87
35		5.0	26.51	1.254	51.86

* used in addition with 0.5% of "Surflon S-145".

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Table 2

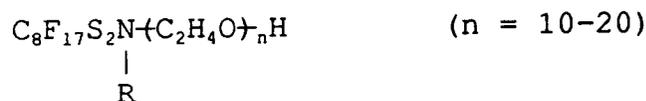
DEG-MBE	500 parts
Tributyl phosphate	3.0
"Surflon S-145"	2.0
Ethylene oxide-propylene oxide copolymer	15.0
PEG 400	30.0
Phytic acid	16.0
Citric acid	16.0
Ammonium nitrate	24.0
Monoethanolamine	15.0
Antiseptic	10.0
Acetylated starch	6.0
Water	363.0
Total	1000.0

Table 3

Amount added (%)	Surface tension (dyn/cm)	Viscosity (cP)	FSE
0.6	37.36	1.10	39.04
1.2	36.24	1.13	40.93
2.0	30.82	1.17	46.66
3.0	27.83	1.22	50.19
4.0	25.22	1.26	52.98
5.0	23.16	1.32	55.45

Claims

1. An additive for damping water for lithographic printing, said additive comprising a water-soluble glycol monoalkyl ether selected from the group consisting of di- or tri-ethylene glycol monoalkyl ether and di- or tri-propylene glycol monoalkyl ether, and a nonionic surface active agent having a fluoroalkyl group.
2. An additive for damping water for lithographic printing as set forth in Claim 1, wherein the nonionic surface active agent is one which is represented by the formula below.



(where R denotes hydrogen or a C₁₋₄ alkyl group.)

3. An additive for damping water for lithographic printing defined in Claim 1, wherein the nonionic surface active agent is used in an amount of 0.1-10 parts by weight for 100 parts by weight of the glycol

monoalkyl ether.

4. A damping water concentrate for lithographic printing which contains the additive defined in Claim 1 in an amount of 40-80 wt%.

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5. A process for preparing damping water for lithographic printing which comprises adding the additive defined in Claim 1 to a commercial damping water concentrate.

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INTERNATIONAL SEARCH REPORT

International Application No PCT/JP91/01693

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. ⁵ B41N3/08		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC	B41N3/08, C09D11/02	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	JP, A, 62-234992 (Fuji Photo Film Co., Ltd.), October 15, 1987 (15. 10. 87), (Family: none)	1-5
A	JP, A, 52-4301 (The Dow Chemical Co.), January 13, 1977 (13. 01. 77) & BE-A-842801 & NL-A-7606078 & DE-A1-2625604 & SE-A-7606693 & FR-A1-2314248 & GB-A-1509329 & CA-A-1058342	1-5
A	JP, A, 49-12908 (Toyo Ink Mfg. Co., Ltd.), February 4, 1974 (04. 02. 74), (Family: none)	1-5
A	JP, A, 58-176280 (Union Carbide Corp.), October 15, 1983 (15. 10. 83) & GB-A-2137817 & FR-A1-2543805 & DE-A1-3411915 & US-A-4527311	1-5
A	JP, A, 63-134293 (Fuji Photo Film Co., Ltd.),	1-5
<p>[*] Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
February 18, 1992 (18. 02. 92)	March 10, 1992 (10. 03. 92)	
International Searching Authority	Signature of Authorized Officer	
Japanese Patent Office		

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

June 6, 1988 (06. 06. 88),
(Family: none)

V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers _____, because they relate to subject matter not required to be searched by this Authority, namely:
2. Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. Claim numbers _____, because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ²

This International Searching Authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- The additional search fees were accompanied by applicant's protest.
- No protest accompanied the payment of additional search fees.