Patents Act 1977 **Opinion Number** **24/24**

OPINION UNDER SECTION 74A

Patent	EP 2563869 B1
Proprietor(s)	Hapa AG
Exclusive Licensee	
Requester	Appleyard Lees
Observer(s)	Kilburn & Strode LLP (on behalf of the Proprietor)
Date Opinion issued	08 January 2025

The Request

1. The Comptroller has been requested by Appleyard Lees ("the Requester") to issue an opinion as to whether EP 2563869 B1 ("the Patent") is invalid on the grounds of a lack of novelty and/or inventive step. The request was filed on 18 October 2024 and was accompanied by a statement explaining the request.

2. The supplied evidence includes three patent documents, D2: WO 2008/093071 A1, D3: US 7581829 B2 and D7: US 7569623 B2. D2 and D3 are considered by the Requester to demonstrate a lack of novelty or a lack of inventive step. D7 was provided to exemplify common general knowledge in support of the arguments made in relation to documents D2 and D3.

3. Further supporting evidence was provided in the form of eleven technical data sheets, D4: Sartomer® SR601E, D5: Sartomer® SR339C, D6: Sartomer® SR484, D8: Phthalo Blue, Royal Blue 15:3, D9: Phthalo Green, bluish, D10: Omnirad® 2959, D11: Omnirad® 819, D12: Omnirad® 369, D14: Sartomer® SR306, D15: Sartomer® SR454 and D16: Sartomer® SR455, and a brochure, D13: Kowa®, Company Profile & Product Overview.

4. A copy of an English language equivalent of the Patent, D1: US 2013/0116358 A1, was also supplied.

Observations and observations in reply

5. Observations and observations in reply were received on 18 November 2024 and 2 December 2024 respectively.

The Patent

6. The Patent is titled “UV-curable acrylate based ink, a process and an ink base for its production”. It was filed on 29 April 2011, with an earliest priority date of 30 April 2010, and was granted on 5 August 2015. The Proprietor requested limitation at the European Patent Office on 9 September 2024. The request was deemed admissible and was published on 16 October 2024. The Patent remains in force.

7. As the Patent was published in German, the Requester used the description of the English language equivalent, D1, when preparing their submission. It would seem reasonable to assume that the description of D1 is the same as the description of the Patent, and I will also use the description of D1.

8. The patent relates to a UV-curable acrylate-based ink for inkjet printing. The specification describes a prior art inkjet ink comprising radiation-curable monomers, such as polyfunctional alkoxylated and/or polyfunctional polyalkoxylated acrylate monomers, and at least one radical photoinitiator. Another described prior art ink contains radiation-curable oligomers in the form of low-viscosity unsaturated acrylate resins, a radiation-curable acrylate monomer selected from amongst polyfunctional alkoxylated or polyalkoxylated acrylic monomers comprising one or more diacrylkates or triacrylates, at least one radical photoinitiator, and at least one surface-active agent.

9. The Patent explains how the prior art inks typically require relatively high amounts of UV energy for drying and/or exhibit low smear resistance with respect to various solvents. The aim of the invention is to produce inks which dry using minimal energy and are smear resistant. A further aim is to keep the fraction of expensive photoinitiators in the ink as low as possible.

10. To achieve these aims, the ink of the invention contains at least two radical photoinitiators of the Norrish Type I that exhibit different absorption maxima. A photoinitiator having a UV absorption maximum in a low wavelength range of the UV spectrum is especially effective during curing of the inkjet printout in its surface region, whilst a photoinitiator having a higher UV absorption maximum is effective for curing in the interior of the printout.

11. I will consider the claims in their form incorporating the requested limitation. Claim 1 reads as follows:

> *A UV-curable acrylate-based ink, particularly a UV-curable inkjet ink, containing pigments(s), radical photoinitiators, dispersant(s) and optionally further additives, characterised in that it contains at least two radical photoinitiators of Norrish Type I and at least one radically curable monomer in the form of a polyfunctional, alkoxylated and/or polyalkoxylated acrylate monomer, which includes one or more di- and/or tri-acrylates, wherein the molar ratio of all acrylates to all initiators is 7:1 to 19:1, particularly 7:1 to 15:1, and it has a viscosity (measured with the Bohlin apparatus at 45^{o}C) of 5 to 15 mPa.s and wherein at least one of the radical photoinitiators of Norrish Type I is a bifunctional initiator, which includes two potential cleavage sites, and wherein the polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer is present in the form of tripropylene glycol diacrylate,*

dipentaerythritol hexaacrylate, propoxylated neopentyl glycol diacrylate, dipropylene glycol diacrylate, ethoxylated trimethylolpropane triacrylate, trimethylolpropane triacylate, and/or ethylene glycol phenyl ether acrylate.

12. The Patent also includes dependent claims 2 - 17, which read as follows:

> *2. A UV-curable ink as claimed in Claim 1, characterised in that the at least two radical photoinitiators (A) and (B) differ in their absorption maxima wherein, in particular, the distance between the absorption maxima of the at least two radical photoinitiators (A) and (B) is at least about 20 nm, in particular at least about 35 nm.*
>
> *3. A UV-curable ink as claimed in Claim 1 or 2, characterised in that the absorption maximum of the radical photoinitiator (A) lies below 290 nm and that of the radical photoinitiator (B) lies above 290 nm.*
>
> *4. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that the molar ratio of the radical photoinitiator (A) to the radical photoinitiator (B) lies between about 0.7:1 and 1:0.7 and is, in particular, about 1:1.*
>
> *5. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that at least one of the photoinitiators of Norrish Type I is selected from 2-hydroxy-1-{4-[4-(2-hydroxy-2-methyl-propionyl)-benzyl]-phenyl}-2-methyl-propane-1-one (Irgacure 127), 1-hydroxycyclohexyl-phenyl-ketone (Irgacure 184), phenyl-bis-2,4,6-trimethylbenzoyl-phosphine-oxide (Irgacure 819), 2-benzyl-2-dimethylamino-1-(4-morpholino-phenyl)-bu-tanone-1 (Irgacure 369), 2,4,6-trimethylben-zoyl-diphenyl-phosphine oxide (Doublecure TPO), 2-dimethylamino-2-(4-methyl-benzyl)-1-(4-morpholine-4-yl-phenyl)-butane-1-one (Irgacure 379).*
>
> *6. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that a combination is selected from: 1. 2-hydroxy-1-{4-[4-(2-hydroxy-2-methyl-propionyl)-benzyl]-phenyl}-2-methyl-propane-1-one (Irgacure 127)/ 2-dimethylamino-2-(4-methyl-benzyl)-1-(4-morpho-line-4-yl-phenyl)-butane-1-one (Irgacure 379), 2. 2-hydroxy-1-[4-[4-(2-hydroxy-2-methyl-propionyl)-benzyl]-phenyl}-2-methyl-propane-1-one (Irgacure 127)/ phenyl bis 2,4,6-trimethylbenzoyl-phosphine oxide (Irgacure 819), 3. 2-hydroxy-1-{4-[4-(2-hydroxy-2-methyl-propionyl)-benzyl]-phe-nyl}-2-methyl-propane-1-one (Irgacure 127)/ 2-benzyl-2-dimethylamino-1-(4-morpholino-phenyl)-butanone-1 (Irgacure 369).*
>
> *7. A UV-curable ink as claimed in at least one of the preceding claims, characterised that in addition to the polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer, at least one monofunctional alkoxylated and/or polyalkoxylated acrylate monomer and/or a non-alkoxylated and non-polyalkoxylated acrylate monomer is present.*
>
> *8. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that in addition to the radically curable monomer, a radically curable oligomer of low viscosity, particularly in the form of a polyester- or*

polyether-acrylate, is present.

9. A UV-curable ink as claimed in Claim 8, characterised in that about 10 to 100 parts by weight acrylate monomer, particularly about 30 to 50 parts by weight, are allotted to one part by weight radically curable oligomer.

10. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that the pigment is present in the form of carbon black, a quinacridone, a benzimidazolone, an isoindolinone and/or a phthalocyanine.

11. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that the dispersant is present in the form of Solsperse® 24000, Solsperse® 39000, Solsperse® 35000, Solsperse® 32000 and/or Solsperse® 76400 (Lubrizol company).

12. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that it includes a synergist in the form of Solsperse® 5000, Solsperse® 12000 and/or Solsperse® 22000 (Lubrizol company).

13. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that it has a viscosity (measured with the Bohlin apparatus at 45°C) of 7 to 12 mPa.s, particularly 10 to 11 mPa.s.

14. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that the surface tension (ring) lies between about 20 and 35 mN/mm, particularly between 20 and 26 mN.

15. A UV-curable ink as claimed in at least one of the preceding claims, characterised in that it contains dissolved oxygen, wherein the oxygen content is maintained by the oxygen partial pressure of a superimposed atmosphere.

16. A method of producing a UV-curable ink, particularly an inkjet ink, as claimed in at least one of the preceding Claims 1 to 15, characterised in that

> *1. a ground material or an ink base is produced by one or more radically curable monomers in the form of a polyfunctional alkoxylated and/or polyalkoxylated acryl monomer, which include one or more di- and/or triacrylates, being ground with one or more pigments and dispersants, particularly optionally additionally with synergists, stabilisers and further additives, in a high speed grinder, particularly in a bead grinder, until a constant viscosity and/or constant particle size has been reached,*
>
> *2. the ground material obtained is mixed with further acrylate monomers and the radical photoinitiators in the form of Norrish Type I corresponding to the definitions in the preceding Claims 1 to 15 and optionally further additives in accordance with the information in at least one of the preceding Claims 1 to 15.*

17. A method as claimed in Claim 16, characterised in that the ratio of dispersant to synergist is set so that up to about 30 parts by weight, particularly about 5 to 10 parts by weight, dispersant are allotted to one part

by weight synergist.

Claim Construction

13. Before considering novelty and inventive step, I need to construe the claims of the patent – that is to say, I must interpret them in the light of the description and drawings as instructed by Section 125(1) of the Patents Act 1977 ("the Act"):

> *For the purposes of this Act an invention for a patent for which an application has been made or for which a patent has been granted shall, unless the context otherwise requires, be taken to be that specified in a claim of the specification of the application or patent, as the case may be, as interpreted by the description and any drawings contained in that specification, and the extent of the protection conferred by a patent or application for a patent shall be determined accordingly.*

14. I must interpret the claims in context through the eyes of the person skilled in the art. Ultimately the question is what the person skilled in the art would have understood the patentee to be using the language of the claims to mean. This approach has been confirmed in the recent decisions of the High Court in *Mylan v Yeda*[1] and the Court of Appeal in *Actavis v ICOS*[2].

15. The Requester provided their interpretation of claim 1, helpfully dividing the claim into separate sections, which are reproduced below:

> *(a) A UV-curable acrylate-based ink,*
>
> *(b) particularly a UV-curable inkjet ink,*
>
> *(c) containing pigment(s),*
>
> *(d) radical photoinitiators,*
>
> *(e) dispersant(s)*
>
> *(f) and optionally further additives,*
>
> *(g) characterised in that it contains at least two radical photoinitiators of Norrish Type I*
>
> *(h) and at least one radically curable monomer in the form of a polyfunctional, alkoxylated and/or polyalkoxylated acrylate monomer, which includes one or more di- and/or tri-acrylates,*
>
> *(i) wherein the molar ratio of all acrylates to all initiators is 7:1 to 19:1,*
>
> *(j) particularly 7:1 to 15:1,*

---

[1] *Generics UK Ltd (t/a Mylan) v Yeda Research and Development Co. Ltd & Anor* [2017] EWHC 2629 (Pat)

[2] *Actavis Group & Ors v ICOS Corp & Eli Lilly & Co.* [2017] EWCA Civ 1671

(k) and it has a viscosity (measured with the Bohlin apparatus at 45°C) of 5 to 15 mPa.s

(l) wherein at least one of the radical photoinitiators of Norrish Type I is a bifunctional initiator, which includes two potential cleavage sites,

(m) and wherein the polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer is present in the form of tripropylene glycol diacrylate, dipentaerythritol hexaacrylate, propoxylated neopentyl glycol diacrylate, dipropylene glycol diacrylate, ethoxylated trimethylolpropane triacrylate, trimethylolpropane triacylate, and/or ethylene glycol phenyl ether acrylate.

16. Firstly, I note that claim 1 refers to "*a polyfunctional, alkoxylated and/or polyalkoxylated acrylate monomer"*. It appears to me that the comma included in this phrase was introduced during translation of the claims from the original German. The original version of the claims of the Patent and of the claims of the equivalent application D1 refer to "*a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer"*, which I interpret as "*a polyfunctional alkoxylated acrylate monomer and/or a polyfunctional polyalkoxylated acrylate monomer"*.

17. Turning to the Requester's construal of claim 1, I agree with their assertion that features (b), (f) and (j) do not limit the scope of the claim due to being optional features. I also agree that features (c) and (e) may be present in either the singular or plural.

18. I cannot agree, however, with the Requester's assertion that it is not clear which claim feature the word "it" refers to in (g) and (k). To my mind, it is completely clear that (g) and (k) respectively restrict the UV-curable acrylate-based ink to containing at least two radical photoinitiators of Norrish Type I and to having a viscosity (measured with the Bohlin® apparatus at 45°C) of 5 to 15 mPa.s.

19. The Requester states that:

> *"Feature h) requires at least one radically curable monomer which in turn should be a polyfunctional, alkoxylated and/or polyalkoxylated acrylate monomer and then still further must include one or more di-and or tri-acrylates and this limitation is defined further in feature m). It is of note that the functional language used in claim 1 of "polyfunctional alkoxylated and/or polyalkoxylated" in relation to the acrylate monomers is unclear given the list of monomers present in claim 1 which include monomers labelled as both non alkoxylated (dipentaerythritol hexaacrylate) and monofunctional (ethylene glycol phenyl ether acrylate) in the description of the Patent."*

20. It is stated in paragraph [0027] of the Patent that:

> *"It has proven to be expedient if such radically curable acrylic monomers are used, in which a plurality of acrylate groups are bound to a base molecule. In specialist use, acrylate monomers of this type are also called polyfunctional acrylates. Simple examples of such polyfunctional acrylate monomers are inter alia trimethylol propane triacrylate or dipentaerythritol hexaacrylate. The*

acrylate monomers also especially preferably have alkylene glycol sub-units or polyalkylene glycol sub-units, by means of which the acrylate radicals are connected to the base molecule. Such acrylate monomers are also called alkoxylated or polyalkoxylated acrylate monomers. Examples of polyfunctional alkoxylated or polyalkoxylated acrylate monomers are ethoxylated trimethylol propane triacrylate (Miramer 3130, Rahn AG), dipropylene glycol diacrylate (Miramer 222, Rahn AG) or bisphenol A 30 Mol ethoxylated dimethacrylate (Miramer 2301, Rahn AG).”

21. It seems to me that dipentaerythritol hexaacrylate is provided as an example of a polyfunctional acrylate monomer, but not as an example of a polyfunctional alkoxylated or polyalkoxylated acrylate monomer.

22. It is stated in paragraph [0028] that:

> *“Apart from the polyfunctional acrylates, monofunctional acrylates can moreover be used, which can also be alkoxylated and/or polyalkoxylated…Examples of an alkoxylated or polyalkoxylated acrylate monomer are ethylene glycol phenyl ether acrylate (Miramer 140, Rahn AG)...”*

23. It is my understanding from paragraph [0028] that monofunctional acrylates can be included in the ink composition in addition to the required polyfunctional acrylates, and that these monofunctional acrylates may or may not be alkoxylated.

24. I agree, therefore, with the Requester’s assertion that the list in claim 1 of allegedly polyfunctional alkoxylated and/or polyalkoxylated acrylate monomers including one or more di- and/or tri-acrylates features examples that do not fall within this definition.

25. The Requester goes on to assert that, as the list of monomers from which the polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer is to be selected “*is a limitation made to claim 1 as granted, it should be interpreted that the functional requirements are considered fulfilled by each of the listed monomers*”. I disagree. As the teaching of the description corresponds with what, in my view, the skilled person would understand to be the definition of a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer including one or more di- and/or tri-acrylates, there appears to be a clarity issue in claim 1. I consider that the skilled person would understand claim 1 to require the inclusion of a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer including one or more di- and/or tri-acrylates, and that they would further understand that dipentaerythritol hexaacrylate and ethylene glycol phenyl ether acrylate are not suitable for fulfilling this requirement.

26. I construe claim 1 as follows:

> *A UV-curable acrylate-based ink containing pigment(s), dispersant(s), at least two radical photoinitiators of Norrish Type I, and at least one radically curable monomer in the form of a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer which includes one or more di- and/or tri-acrylates, wherein the molar ratio of all acrylates to all initiators is 7:1 to 19:1, the ink has a viscosity (measured with the Bohlin apparatus at 45^{o}C) of 5 to 15 mPa.s, at*

least one of the radical photoinitiators of Norrish Type I is a bifunctional initiator which includes two potential cleavage sites, and the polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer is present in the form of tripropylene glycol diacrylate, propoxylated neopentyl glycol diacrylate, dipropylene glycol diacrylate, ethoxylated trimethylolpropane triacrylate and/or trimethylolpropane triacylate.

27. The dependent claims do not present any difficulties of construction.

Prior Art - D2

28. D2 relates to printing inks for use in ink-jet printers that are cured using actinic radiation and was published before the priority date of the patent. The general teaching of D2 describes an ink comprising at least two monofunctional (meth)acrylate monomers, a monofunctional monomer selected from an N-vinyl amide, an N-acryloyl amine or a mixture thereof, a polymerisable (meth)acrylate oligomer, a radical photoinitiator, and a colouring agent. The ink has a viscosity of less than 100 mPas at 25°C and is substantially free of multifunctional monomers. D2 states that "*The oligomer is multifunctional meaning that it contains more than one reactive functional group per molecule. The degree of functionality is preferably from 2 to 6.*"

29. A preferred embodiment ("Ink 1") has the following composition:

Example 1

An ink (ink 1) was prepared having the following composition:

Component	Wt%	Function
N Vinyl caprolactam	25.8	Vinyl amide monomer
2 Phenoxy ethylacrylate	38.77	Cyclic monofunctional monomer
Octyl decyl acrylate	5.0	Acyclic-hydrocarbon monofunctional monomer
Cyan pigment dispersion	4.53	
UV stabiliser	0.8	
Irgacure 2959	2.0	Photoinitiator
Irgacure 819	4.0	Photoinitiator
Irgacure 369	1.0	Photoinitiator
BYK 307	0.1	Surfactant
Sartomer SR601E	18.0	Difunctional acrylate oligomer
Total	100.0	

Prior Art - D3

30. D3 concerns ink compositions for ink-jet printing and was published before the priority date of the Patent. D3 describes how, when a one-component ink composition is cured using ultraviolet radiation, often only the surface of the ink film is cured and the interior remains uncured and in liquid form, due to the radiation only being absorbed by the surface of the film. Conversely, if the polymerisation rate is low, only the interior is cured, which would seem to be due to inhibition of

polymerisation due to permeation of oxygen from the surface. D3 further describes how this problem is sometimes overcome by the use of two photo-polymerisation initiators in combination in the one-component ink composition, one having a high initiator efficiency, which is suitable for surface curing, and the second being suitable for interior curing. However, the problem can still arise that ultraviolet radiation is absorbed, reflected or scattered by a colorant, resulting in insufficient curing in the interior of the ink film.

31. D3 proposes to solve this problem by the use of two ultraviolet ray-curable ink compositions in combination. A first ink composition (A), which may be referred to as a colour ink composition, comprises four separate component inks, each comprising a different pigment, and a greater proportion of a photoinitiator suitable for interior curing. A second ink composition (B), for application on top of composition A prior to curing, is transparent and contains a greater proportion of a photoinitiator suitable for surface curing.

32. Examples 9 and 10 are ink compositions comprising four component inks, Y1 ("Ink Y1"), M1, C1 and Bk1. Ink Y1 contains Pigment Yellow 155 and its composition is detailed below:

2-1) Color Ink Composition 1 (Y1)

C.I. Pigment Yellow 155 (pigment)	3.0% by weight
Polyoxyalkylene-added polyalkyleneamine (dispersant, Discol N-518, produced by Dai-ichi Kogyo Seiyaku Co., Ltd.)	1.0% by weight
BYK-UV3570 (polyester-modified silicone surfactant, produced by BYK Chemie Japan Co., Ltd.)	0.5% by weight
NVF (produced by Arakawa Chemical Industries, Ltd.)	20.0% by weight
Allyl glycol (produced by Nippon Nyukazai Co., Ltd.)	35.3% by weight
Tripropylene glycol diacrylate (Aronix M-220, produced by Toagosei Co., Ltd.)	20.0% by weight
Trimethylolpropane EO-modified triacrylate (Viscoat #360, produced by Osaka Organic Chemical Industry, Ltd.)	15.0% by weight
Irgacure 819 (produced by Ciba Specialty Chemicals, Inc.)	4.0% by weight
Irgacure 369 (produced by Ciba Specialty Chemicals, Inc.)	1.0% by weight
Irgastab UV-10 (produced by Ciba Specialty Chemicals, Inc.)	0.2% by weight

Prior Art - D7

33. Document D7 relates to ultraviolet-curable ink compositions and was published before the priority date of the application. D7 describes how monomers used in

conventional ultraviolet curing inks are generally high in the primary irritation index (PII) if they have high curability (polymerisation) and low in the PII if they have low curability. As a higher rate of polymerisation is desirable, materials having a PII value of 5 or more are often used, requiring attention during handling and the use of a local exhaust system. Furthermore, higher molecular weight monomers tend to have a lower PII, but their inclusion in the ink composition undesirably raises the viscosity. D7 aims to provide an ink composition which has a high rate of curing and is low in viscosity and toxicity.

The Law - Novelty

34. Section 1(1)(a) of the Act reads:

> *A patent may be granted only for an invention in respect of which the following conditions are satisfied, that is to say –*
>
> *(a) the invention is new;*

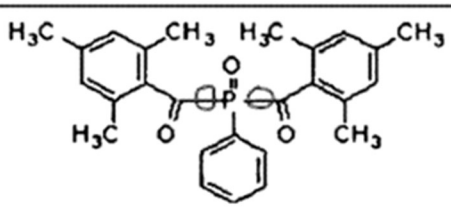
35. Sections 2(1) and 2(2) of the Act read:

> *2(1) An invention shall be taken to be new if it does not form part of the state of the art.*
>
> *2(2) The state of the art in the case of an invention shall be taken to comprise all matter (whether a product, a process, information about either, or anything else) which has at any time before the priority date of that invention been made available to the public (whether in the United Kingdom or elsewhere) by written or oral description, by use or in any other way.*

Whether claim 1 is novel in light of D2

36. D2 discloses UV-curable acrylate-based inks comprising a colouring agent that is preferably a dispersible pigment. The Requester asserts that the inclusion in Ink 1 of the cyan pigment dispersion means that it is "*implicit that a dispersant must be present*". I note that D2 discloses that dispersants may be present in the ink and agree that the inclusion of a dispersant is disclosed.

37. Ink 1 includes the photoinitiators Irgacure® 819 and Irgacure® 369, which the Patent teaches are Norrish Type I radical photoinitiators. The Requester asserts that Irgacure® 819 is a bifunctional initiator that includes two potential cleavage sites and indicates the suggested cleavage sites using circles drawn onto the structure of Irgacure® 819 (taken from the Patent), as reproduced below:



Irgacure 819 : Phosphineoxid, phenylbis 2,4,6-trimethylbenzoyl) (418,5 g.mol^{-1}). *Main component of* Irgacure 2022, 360, 2022

38. I am in agreement with the Requester's assertion that Irgacure® 819 is a bifunctional initiator including two potential cleavage sites.

39. The Requester points out that Ink 1 comprises 2-phenoxyethyl acrylate, which is a synonym for ethylene glycol phenyl ether acrylate, asserting that a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer taken from the list of claim 1 is therefore included. As I have construed claim 1 to exclude ethylene glycol phenyl ether acrylate, due to it not being a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer, it is my opinion that D2 does not disclose an ink comprising a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer.

40. As D2 does not disclose an ink composition comprising the required polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer, I do not consider assessment of whether the ratio of all acrylates to all initiators meets the requirements of claim 1 to be necessary.

41. The Requester points to the statement on page 1 lines 9 - 15 of D2 that:

> *"For high-speed printing, the inks must flow rapidly from the printing heads, and, to ensure that this happens, they must have in use a low viscosity, typically below 100 mPas at 25°C although in most applications the viscosity should be below 50 mPas, and often below 25 mPas…preferably 5 - 15 mPas and ideally 10.5 mPas at the jetting temperature which is often elevated to about 40°C…"*

42. Also, as noted by the Requester, D2 discloses in the table provided at the top of page 13 that Ink 1 has a viscosity of 20.6 mPas. It would appear that the viscosity measurements were made at 25°C using a Brookfield RV6 running at 5 rpm. For the purposes of comparing the disclosure of D2 with the requirements of the Patent, I am prepared to assume that the viscosity values are independent of the measurement apparatus used.

43. The Requester asserts that:

> *"Given that viscosity typically decreases with temperature, and D2 acknowledges simultaneously that ink viscosity at 25°C should be below 25mPa.s, and that for jetting temperatures of around 40°C ink viscosity should be 5-15mPa.s, D2 implicitly discloses that Ink 1 will have a viscosity*

of 5-15 mPa.s at around 40°C and therefore at 45°C and therefore fulfils the requirement of [having a viscosity (measured with the Bohlin apparatus at 45°C) of 5 to 15 mPa.s".

44. The Observer submits that:

> *"with regard to implicit disclosure, according to the EPO established case law, a prior art document anticipates the novelty of claimed subject-matter if the latter is directly and unambiguously derivable from that document, including any features implicit to a person skilled in the art. However, an alleged disclosure can only be considered "implicit" if it is immediately apparent to the skilled person that nothing other than the alleged implicit feature forms part of the subject-matter disclosed. In other words, a prior art disclosure is novelty-destroying if the subject-matter claimed can be inferred directly and unequivocally from that disclosure, including features which for the skilled person are implicit in what is explicitly disclosed."*

45. The Observer asserts that "*even if increasing the temperature, the viscosity of the ink decreases, the assumption that it would fall exactly in the range disclosed in EP'869 cannot be derived clearly and unambiguously from the teaching of D2. Thus, this feature cannot be considered implicitly disclosed in D2*".

46. In response, the Requester asserts that the person skilled in the art "*would expect the viscosity of a typical UV-curable inkjet ink to decrease by about 40% if its temperature were to increase from 25°C to 45°C, [as] demonstrated by the long-established Lewis and Squires chart used by chemical engineers*".

47. I agree that the Lewis and Squires chart can provide an approximation of the viscosity at a specific temperature from a provided viscosity measurement at a lower temperature. Whilst I am unclear on the origins of the stated 40%, it seems to me that using the Lewis and Squires chart and the measured viscosity value of 20.6 mPas at 25°C gives an approximate viscosity value at 45°C falling within the range of 5 - 15 mPas required by claim 1. When considering, in addition, the disclosure of D2 that an ideal value at the jetting temperature of 40°C is 10.5 mPas, it is my view that the viscosity of Ink 1 could only take a value falling within the range required by claim 1 and so D2 implicitly discloses this feature.

48. It is my opinion that claim 1 of the Patent is novel in light of D2, due to D2 not disclosing the inclusion of a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer. Due to their dependency on claim 1, claims 2 - 17 are also novel in light of D2.

Whether claim 1 is novel in light of D3

49. As noted by the Requester, Ink Y1 is a UV-curable acrylate-based ink containing the acrylates tripropylene glycol diacrylate and trimethylolpropane EO-modified triacrylate (Viscoat #360). D13 states that Viscoat #360 is ethoxylated trimethylolpropane EO3.5 mol triacrylate. Both tripropylene glycol diacrylate and ethoxylated trimethylolpropane triacrylate are included in the list in claim 1 from which the polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer is to

be selected.

50. As further noted by the Requester, Ink Y1 contains C.I. Pigment Yellow 155, the dispersant Discol N-518, and the photoinitiators Irgacure® 819 and Irgacure® 369, which are Norrish Type I radical photoinitiators. As discussed previously in relation to D2, I am in agreement with the Requester's assertion that Irgacure® 819 is a bifunctional initiator including two potential cleavage sites.

51. The Requester provides a calculation of the ratio of all acrylates (tripropylene glycol diacrylate and ethoxylated trimethylolpropane EO3.5 mol triacrylate) to all initiators (Irgacure® 819 and Irgacure® 369) for Ink Y1.

52. From D14, tripropylene glycol diacrylate has a molecular weight of 300 g/mol. From D15 and D16, ethoxylated trimethylolpropane EO3 triacrylate and ethoxylated trimethylolpropane EO4 triacrylate have molecular weights of 428 g/mol and 472 g/mol respectively. The Requester asserts that ethoxylated trimethylolpropane EO3.5 mol triacrylate therefore has a molecular weight of 450 g/mol. I consider this assertion to be reasonable. As calculated by the Requester, in 100 g of Ink Y1, the molar quantities of tripropylene glycol diacrylate and ethoxylated trimethylolpropane EO3.5 mol triacrylate would be 0.0067 and 0.0033 respectively, giving a total molar quantity of acrylates of 0.1.

53. From the Patent, the molecular weights of Irgacure® 819 and Irgacure® 369 are 418.5 g/mol and 366.5 g/mol respectively. As calculated by the Requester, in 100 g of Ink Y1, the molar quantities of Irgacure® 819 and Irgacure® 369 would be 0.0096 and 0.0027 respectively, giving a total molar quantity of initiators of 0.012. The molar ratio of all acrylates to all initiators is, therefore, 8.1:1, thus meeting the requirement of claim 1.

54. With regard to the viscosity of Ink Y1, the Requester refers to column 25 line 65 - column 26 line 16 of D3, which describes the curing test performed by charging the four inks forming ink composition A in separate nozzle rows of an inkjet printer, specifically a PM-G900 inkjet printer produced by Seiko Epson Corp., and transparent ink composition B in a further nozzle row. The Requester considers that, as the ink composition is suitable for use in an inkjet printer, it must have the same viscosity as the inks described in D2. I do not agree that simply being intended for use in an inkjet printer clearly and unambiguously leads to an ink having the same viscosity as another ink also suitable for use in an inkjet printer.

55. The Requester further notes that D7 "*which is in the same technical field as D3*" discloses that as "*the ultraviolet curing ink composition is preferably ejected while its viscosity is decreased by heating*" and that D7 teaches using a PM-G900 inkjet printer to print "*at ordinary temperatures and ordinary pressures*" using four example inks having viscosities of 11.5, 12.0, 11.0 and 11.7 mPas. They argue that as "*the ink compositions of D3, which include Ink Y1, are also suitable for jetting using a PM-G900 printer, it is implicit that Ink Y1 has a viscosity of 11 to 12 mPas and therefore a viscosity of 5 to 15 mPas at 45°C*".

56. In response, the Observer points out that "*the inks of D3 have a different chemical composition compared to the inks of D7*" and so "*it cannot be inferred that the viscosity of the inks of these documents are comparable based only on the printer*

used". I agree with this assertion.

57. It is my view that D3 does not implicitly disclose that Ink Y1 meets the viscosity requirement of claim 1 and, consequently, I consider that claim 1 is novel in light of D3. It follows that the dependent claims 2 - 17 are also novel in light of of D3.

The Law – Inventive Step

58. Section 1(1)(b) of the Act reads:

> *1(1) A patent may be granted only for an invention in respect of which the following conditions are satisfied, that is to say –*
> *(a) the invention is new;*
> *(b) it involves an inventive step;*

59. The provisions in relation to inventive step are found in section 3 which states:

> *3. An invention shall be taken to involve an inventive step if it is not obvious to a person skilled in the art, having regard to any matter which forms part of the state of the art by virtue only of section 2(2) above (and disregarding section 2(3) above).*

60. The Court of Appeal in *Windsurfing*[3] formulated a four-step approach for assessing whether an invention is obvious to a person skilled in the art. This approach was restated and elaborated upon by the Court of Appeal in *Pozzoli*[4]. Here, Jacob LJ reformulated the Windsurfing approach as follows:

> *(1)(a) Identify the notional "person skilled in the art" ;*
> *(1)(b) Identify the relevant common general knowledge of that person;*
> *(2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;*
> *(3) Identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed;*
> *(4) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?*

(1)(a) Identify the person skilled in the art and (1)(b) their common general knowledge

61. I consider the person skilled in the art to be a developer of printing inks. They would be familiar with the properties required of inks for various printer types, including inkjet printers. They would be aware of the viscosity and curing requirements of printing inks and how these are typically achieved.

---

[3] *Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd*, [1985] RPC 59
[4] *Pozzoli SPA v BDMO SA* [2007] EWCA Civ 588

(2) Identify the inventive concept of claim 1

62. The stated aim of the invention is to produce an ink suitable for use in an inkjet printer that dries using minimal energy, whilst keeping the fraction of expensive photoinitiators in the ink as low as possible. This aim is achieved by including in the ink at least one radically curable monomer in the form of a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer, which comprises one or more diacrylates and/or triacrylates, selected from tripropylene glycol diacrylate, propoxylated neopentyl glycol diacrylate, dipropylene glycol diacrylate, ethoxylated trimethylolpropane triacrylate and trimethylolpropane triacylate, and at least two radical photoinitiators of the Norrish Type I for targeted internal and surface curing, wherein the molar ratio of all the acrylates to all the initiators is specifically in the range of approximately 5:1 to 19:1, and by ensuring that the viscosity of the ink is 5 to 15 mPa.s at 45ºC.

Whether claim 1 is inventive in light of D2

(3) Identify what differences exist between D2 and the inventive concept of claim 1

63. D2 does not disclose a UV-curable acrylate-based ink comprising a polyfunctional alkoxylated and/or polyalkoxylated acrylate monomer selected from tripropylene glycol diacrylate, propoxylated neopentyl glycol diacrylate, dipropylene glycol diacrylate, ethoxylated trimethylolpropane triacrylate and trimethylolpropane triacylate.

(4) Does this difference constitute a step which would have been obvious to the person skilled in the art or do they require any degree of invention?

64. D2 states that:

> *"It has now been found that combinations of certain monofunctional (meth)acrylate monomers, N- vinyl amide and/or N-acryloyl amine monomers and a polymerizable (meth)acrylate oligomer provide an excellent balance of cure speed and viscosity for the ink together with hardness and flexibility for the cured film."*

65. The ink composition of the embodiment of D2 comprises N-vinyl caprolactam, 2 phenoxy ethylacrylate, octyl decyl acrylate and bisphenol A ethoxylated diacrylate. I do not believe that the skilled person would be motivated to include, by addition or replacement, tripropylene glycol diacrylate, propoxylated neopentyl glycol diacrylate, dipropylene glycol diacrylate, ethoxylated trimethylolpropane triacrylate or trimethylolpropane triacylate.

66. It is my view that claim 1 is inventive in light of D2. The dependent claims 2 - 17 are, therefore, also inventive.

Whether claim 1 is inventive in light of D3

(3) Identify what differences exist between D3 and the inventive concept of claim 1

67. D3 does not disclose that the UV-curable acrylate-based ink has a viscosity at 45°C of 5 to 15 mPa.s.

(4) Does this difference constitute a step which would have been obvious to the person skilled in the art or do they require any degree of invention?

68. The Requester considers that claim 1 lacks an inventive step over D3 in view of the common general knowledge of the skilled person, which they assert is evidenced in D2, where it is stated that:

> *"For high-speed printing, the inks must flow rapidly from the printing heads, and, to ensure that this happens, they must have in use a low viscosity, typically below 100 mPas at 25°C although in most applications the viscosity should be below 50 mPas, and often below 25 mPas. Typically, when ejected through the nozzles, the ink has a viscosity of less than 25 mPas, preferably 5 - 15 mPas and ideally 10.5 mPas at the jetting temperature which is often elevated to about 40° (the ink might have a much higher viscosity at ambient temperature)."*

69. The Requester considers that:

> *"Should Ink Y1 not have a viscosity in the range required by limitation (k), to adjust the viscosity of Ink Y1 marginally to a viscosity of 5-15 mPas at 45°C would be obvious and facile to the person skilled in the art."*

70. It is my view that the design of inkjet nozzles and their intended jetting temperature will vary between different printer models. Whilst the generalised statement made in D2 may be true for a large number of printer models, I cannot confidently accept that it forms common general knowledge applicable to all inkjet printers.

71. The Observer states that:

> *"The ink of claim 1 differs from the prior art for the claimed specific range of viscosity which is responsible for the very low drying energy of the ink, as shown in the examples."*
>
> *"The person skilled in the art, faced with the objective technical problem of reducing the drying energy of the ink, would not have adjusted the viscosity, since no indication of a correlation between viscosity and drying energy is present in any of the prior art documents nor is part of the common general knowledge."*
>
> *"The claimed viscosity range of the ink of claim 1 results, surprisingly, in very low drying energy, thus solving the objective technical problem in a non-obvious way."*

72. The Requester responds by pointing out that:

> *"the viscosities of the formulations in the Patent have not been evidenced nor any evidence provided that a low drying energy requirement is associated with the claimed viscosity. As such, any difference between the inks of D2 and D3 and the claimed inks would not provide any technical contribution and would be a mere alternative which would be obvious for the skilled person to try for the reasons set out above."*

73. The Patent provides measurements of the viscosity of a ground product (ink base) suitable for forming the ink of the invention and teaches that the viscosity of the ink itself falls within the specific range stated in claim 1, which I consider to be sufficient evidence of the viscosity. Although I agree with the Requester that the Patent does not explicitly teach that the claimed specific range of viscosity is responsible for the very low drying energy of the ink, I cannot agree with their conclusion that this leads to any difference between the inks of D3 and those of the Patent being a mere alternative that would be obvious for the skilled person to try.

74. D3 does not provide any information on the intended jetting temperature of the ink or on its required jetting viscosity. I therefore cannot see any motivating factors which would lead the skilled person to produce the ink of D3 having a viscosity falling within the range required by claim 1 of the Patent.

75. It is my view that claim 1 is inventive in light of D3. The dependent claims 2 - 17 are, therefore, also inventive.

Opinion

76. It is my opinion that the claims of the Patent are novel and inventive over the teaching of D2 and D3.

Karen Payne
Examiner

NOTE

This opinion is not based on the outcome of fully litigated proceedings. Rather, it is based on whatever material the persons requesting the opinion and filing observations have chosen to put before the Office.