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- (71) Applicant: **SUPERBULBS, INC.** [US/US]; 824
Sovereign Way, Redwood City, CA 94065 (US).
- (71) Applicants and
- (72) Inventors: **LENK, Ronald J** [US/US]; 824 Sovereign
Way, Redwood City, CA 94065 (US). **LENK, Carol**
[US/US]; 824 Sovereign Way, Redwood City, CA 94065
(US). **CHANDLER, Daniel** [US/US]; 1043 Greenwood
Drive, Menlo Park, CA 94025 (US). **GALLA, Matthew P**
[US/US]; 645 Barbara Avenue, Mountain View, CA 94040
(US).
- (74) Agent: **NUZUM, Kirk M.**; Buchanan Ingersoll & Rooney
LLP, P.O. Box 1404, Alexandria, Virginia 22313-1404
(US).
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AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH,
CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES,
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FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL,

[Continued on next page]

(54) Title: HEAT REMOVAL DESIGN FOR LED BULBS

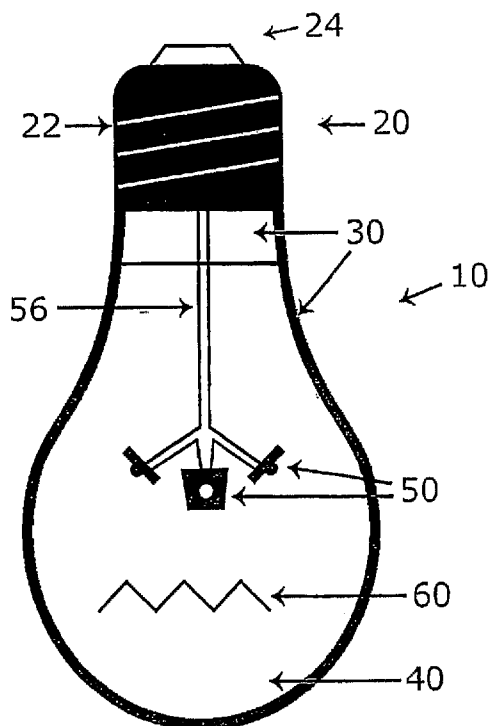


Fig. 3

(57) Abstract: A LED light bulb having a plastic bulb-shaped shell (30) and having thermally conductive water, mineral oil or gel material (40) disposed in the shell (30). The LED light bulb includes a screw base (20) that could be used in a standard lamp socket. The LED elements (52) can be in direct contact with the water, mineral oil or gel material (40) or can be separated from the water, mineral oil or gel material (40) via a layer (70).

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC: **F21S 6/00(2006.01);F21V 9/12(2006.01)**
 F21S 6/00(2006.01);F21V 9/12(2006.01)

 USPC: **362/257,267,294,311,318,363,800**
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 U.S. : 362/257, 267, 294, 311, 318, 363, 800

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,726,535 A (Yan) 10 March 1998 (10.03.1998), See Figure 1, column 2, lines 37-49.	1-140
A	US 7,086,756 B2 (Maxik) 08 August 2006 (08.08.2006), Figure 6B	1-140
A	US 2004/0233661 A1 (Taylor) 25 November 2004 (25.11.2004), Figure 2, paragraph [0017]	1-140
A	US 2006/0034077 A1 (Chang) 16 February 2006 (16.02.2006)Figure 2	1-140
A	US 2002/0176246 A1 (Chen) 28 November 2002 (28.11.2002), Figure 7	1-140
A	US 2006/0061985 (Elkins) 23 March 2006 (23.03.2006), Figure 5	1-140
A	US 2006/0250802 A1 (Herold) 09 November 2006 (09.11.2006), Figure 2, paragraph [0048]	1-140

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:			
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 30 July 2008 (30.07.2008)	Date of mailing of the international search report 29 SEP 2008.
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Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer <i>Michael B. Shingleton</i> Michael B. Shingleton Telephone No. 703-308-0956
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International application No.

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

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

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
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. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
 2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of any additional fees.
 3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

 4. 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 claims Nos.:
- Remark on Protest**
- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - No protest accompanied the payment of additional search fees.

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In order for more than one species to be examined, the appropriate additional examination fees must be paid. The species are as follows:

Species 1. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT THE FLUID, THE SHELL IS COLORED AS WITH DYE BUT NOT THE FLUID. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 19, 83, 9, 15, 48, 73, 79, 118, 119, 132, 133, 11, 17, 50, 75, 81, 118, 120, 132.

Species 2. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT THE FLUID, THE SHELL IS NOT COLORED AND NEITHER IS THE FLUID. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 19, 83, 9, 15, 48, 73, 79, 118, 119, 132, 133.

Species 3. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS DISPERSION MATERIAL LIKE BUBBLES IN THE FLUID BUT NOT IN THE SHELL, THE FLUID IS COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1, 7, 13, 37, 38, 41, 47,

65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 19, 83, 10, 14, 44, 45, 74, 78, 114, 115, 128, 129, 84, 86, 20, 22, 12, 16, 44, 46, 76, 80, 114, 116, 128, 130, 134, 21, 23, 85, 87.

Species 4. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS DISPERSION MATERIAL LIKE BUBBLES IN THE FLUID BUT NOT IN THE SHELL, THE FLUID IS NOT COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 19, 83, 10, 14, 44, 45, 74, 78, 114, 115, 128, 129, 84, 86, 20, 22.

Species 5. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL, THE SHELL IS COLORED AS WITH DYE BUT NOT THE FLUID. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 19, 83, 11, 17, 50, 75, 81, 118, 120, 132.

Species 6. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL, THE SHELL IS NOT COLORED AND NEITHER IS THE FLUID. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 19, 83.

Species 7. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL, THE FLUID IS COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 19, 83, 12, 16, 44, 46, 76, 80, 114, 116, 128, 130, 134, 21, 23, 85, 87.

Species 8. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE WATER, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID , THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL , THE FLUID IS NOT COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1-50 and 87.

Species 9. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE MINERAL OIL, THERE IS DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT THE FLUID , THE SHELL IS COLORED AS WITH DYE BUT NOT THE FLUID. Claims 51-100 and 132.

Species 10. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE MINERAL OIL, THERE IS DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT THE FLUID , THE SHELL IS NOT COLORED AND NEITHER IS THE FLUID. Claims 101-140.

Species 11. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE MINERAL OIL, THERE IS DISPERSION MATERIAL LIKE BUBBLES IN THE FLUID BUT NOT IN THE SHELL , THE FLUID IS COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 8, 24, 42, 72, 88, 106, 126, 10, 14, 44, 45, 74, 78, 114, 115, 128, 129, 25, 27, 89, 91, 12, 16, 44, 46, 76, 80, 114, 116, 128, 130, 134, 26, 28, 90, 92.

Species 12. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE MINERAL OIL, THERE IS DISPERSION MATERIAL LIKE BUBBLES IN THE FLUID BUT NOT IN THE SHELL , THE FLUID IS NOT COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1, 7, 13, 37,

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38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 8, 24, 42, 72, 88, 106, 126, 10, 14, 44, 45, 74, 78, 114, 115, 128, 129, 25, 27, 89, 91.

Species 13 TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE MINERAL OIL, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL, THE SHELL IS COLORED AS WITH DYE BUT NOT THE FLUID. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 8, 24, 42, 72, 88, 106, 126, 11, 17, 50, 75, 81, 118, 120, 132.

Species 14. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE MINERAL OIL, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL, THE SHELL IS NOT COLORED AND NEITHER IS THE FLUID. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 8, 24, 42, 72, 88, 106, 126.

Species 15. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS IN DIRECT CONTACT WITH THE FLUID AND NO THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A BATTERY, THE FLUID MATERIAL IS ELECTRICALLY CONDUCTIVE MINERAL OIL, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL, THE FLUID IS COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 3, 67, 5, 39, 69, 103, 123, 8, 24, 42, 72, 88, 106, 126, 12, 16, 44, 46, 76, 80, 114, 116, 128, 130, 134, 26, 28, 90, 92.

Species 16. TO AN LED LAMP WITH A PLASTIC BULB-SHAPED SHELL WITH FLUID IN THE SHELL, THE LED IS NOT IN DIRECT CONTACT WITH THE FLUID AND A THIN SHELL SEPARATES THE LED AND FLUID, THE POWER SOURCE IS NOT HOUSED WITHIN THE LAMP STRUCTURE, LIKE FOR EXAMPLE VIA A LAMP SOCKET, THE FLUID MATERIAL IS A MATERIAL THAT IS SO CALLED "STATIONARY" OR "STATIC" WHICH IS NOT A GEL AND MAY NOT BE AN ACTUAL FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ONLY IN THE SHELL AND NOT IN THE FLUID, THERE IS NO DISPERSION MATERIAL LIKE BUBBLES ARE NOT IN THE FLUID AND THEY ARE NOT IN THE SHELL AS WELL, THE FLUID IS NOT COLORED AS WITH DYE AND THE SHELL IS NOT COLORED. Claims 1, 7, 13, 37, 38, 41, 47, 65, 71, 77, 101, 102, 105, 117, 121, 122, 125, 131, 2, 18, 51, 52, 55, 61, 66, 82.

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The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: There are numerous mutually exclusive combinations such as the various fluids, the various dispersions, the various dyes and the various power supply arrangements all of which do not form a single inventive concept.