



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>5</sup> :</b> <b>A61K 7/047, C09D 9/00</b> <b>C11D 7/32, 7/50</b>	<b>A1</b>	<b>(11) International Publication Number:           WO 93/18734</b> <b>(43) International Publication Date:     30 September 1993 (30.09.93)</b>
<b>(21) International Application Number:</b> PCT/US93/02204 <b>(22) International Filing Date:</b> 11 March 1993 (11.03.93)  <b>(30) Priority data:</b> 07/851,738                   16 March 1992 (16.03.92)     US 07/866,793                   8 April 1992 (08.04.92)     US  <b>(71) Applicant:</b> DOTOLO ENTERPRISES, INC. [US/US]; 12555 Enterprise Boulevard, Largo, FL 34643 (US).  <b>(72) Inventors:</b> DOTOLO, Vincent, A. ; 2674 Heron Lane South, Clearwater, FL 34622 (US). SCHWARTZ, John, R. ; 12555 Enterprise Drive, Largo, FL 34643 (US). KRAUS-MARCHAK, Jaye ; 1841 Barbara Lane, Du- nedin, FL 34615 (US).	<b>(74) Agent:</b> HEBERLING, Richard, D.; Marshall & Melhorn, Four SeaGate, Eighth Floor, Toledo, OH 43604 (US).  <b>(81) Designated States:</b> CA, JP, NO, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>	
<b>(54) Title:</b> NAIL POLISH REMOVER COMPOSITION  <b>(57) Abstract</b>  <p>A liquid, non-aqueous cleaner composition that is well suited for removing finger nail polish, the composition comprising d-limonene, N-methyl pyrrolidone, cetyl acetate and, optionally, dibasic ester.</p>		

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Still another object of the present invention to provide a non-aqueous liquid cleaning composition especially adapted for removing finger nail polish, the composition comprising the following ingredients in approximate percent by weight:

<u>Ingredients</u>	<u>% by weight</u>
1. d-limonene	5-75
2. N-methyl pyrrolidone	5-95
3. cetyl acetate	1-15

10

It is a further object of the present invention to provide a very effective, non-toxic, non-methylene chloride, acetone, ethyl acetate or alcohol containing nail polish remover comprising d-limonene, N-methyl-2 pyrrolidone and cetyl acetate, and dibasic esters such as dimethyl adipate and products sold by duPont including dibasic ester DBE, dibasic ester DBE2 or dibasic ester DBE5.

15

Still another object of the present invention to provide a non-aqueous liquid cleaning composition especially adapted for removing finger nail polish, the composition comprising the following ingredients in approximate percent by weight:

20

25

	<u>Ingredients</u>	<u>% by weight</u>
	1. d-limonene	5-75
	2. N-methyl pyrrolidone	5-95
5	3. cetyl acetate	1-15
	4. dibasic ester (DBE)	5-95
	(dialkyl esters of aliphatic dicarboxylic acids)	

10           These and other objects will be apparent from the  
specification and claims that follow.

#### SUMMARY OF THE INVENTION

The present invention provides a non-aqueous  
15 composition comprising the following ingredients:

1. d-limonene;
2. N-methyl-2 pyrrolidone; and
3. cetyl acetate.

The present invention also provides an effective,  
20 non-toxic, non-aqueous liquid finger nail cleaner  
composition comprising the following ingredients in the  
general and preferred ranges set forth in approximate  
percent by weight:

25

	<u>Ingredients</u>	<u>% by weight</u>	
		<u>General</u>	<u>Preferred</u>
5	1. d-limonene	5-75	40-70
	2. N-methyl pyrrolidone	5-95	25-45
	3. cetyl acetate	1-15	3-10

The present invention also provides a non-aqueous  
 10 composition comprising the following ingredients:

1. d-limonene;
2. N-methyl-2 pyrrolidone;
3. cetyl acetate; and
- 15 4. dibasic ester DEB, (including dialkyl esters of dicarboxylic aliphatic acids having 4 to 12 carbon atoms such as dibasic ester DBE2, dibasic ester DBE5).

The present invention also provides an effective,  
 20 non-toxic, non-aqueous liquid finger nail cleaner, spray gun cleaner, hard surface cleaner, nail brush cleaner, etc. composition comprising the following ingredients in the general and preferred ranges set forth in approximate percent by weight:

	<u>Ingredients</u>	<u>% by weight</u>	
		<u>General</u>	<u>Preferred</u>
25	1. d-limonene	5-75	40-70
	2. N-methyl pyrrolidone	5-95	25-45
30	3. cetyl acetate	1-15	3-10
	4. dibasic ester	5-95	15-45

DETAILS OF THE INVENTION

The compositions of the present invention, while  
5 preferably used as a nail polish remover, can be used for  
an artificial nail tip remover, on silk line, and  
fiberglass wraps. The compositions are useful as all-  
purpose cleaners and, in particular, hard surface  
cleaners, blanket washes for us in the printing industry,  
10 cleaners for brake linings, silk screens, copier belts,  
all kinds of metering devices including coin collecting  
machines, and the cleaning of all types of spraying  
equipment when used for painting, applying glues, inks,  
greases, oils, etc.

15 The easy to use, easy to make cleaning composition is  
made by mixing the three liquid ingredients (d-limonene,  
N-methyl pyrrolidone and cetyl acetate) to form a  
homogenized stable cleaning mixture having enhanced  
detergent and stripping powers. When generally about one-  
20 half to 15% by weight and preferably 8 to 12% by weight of  
the d-limonene is replaced by ethyl lactate, the speed of  
the cleaning action increases. This combination is  
necessary for the removal of some of the new hard finishes

of certain nail polishes, especially when the polishes are on wrapped nails.

The d-limonene component is a solvent or diluent that assists in penetrating and stripping or removing of the coating (such as finger nail polish) to be removed.

In another embodiment, easy to use, easy to make cleaning composition is made by mixing the four liquid ingredients - d-limonene, N-methyl pyrrolidone, cetyl acetate or a mixture of cetyl acetate and acetylated lanolin oil and dibasic ester - to form a homogenized stable cleaning mixture having enhanced detergent and stripping powers. To further clarify the use of dibasic ester DBE or dibasic ester DBE2 or dibasic ester DBE5, it should be recognized these three components can be either blended together or incorporated separately with the same weight proportions as the basic formulation. It should also be recognized that d-limonene can be blended with either of the three - dibasic ester DBE, dibasic ester DBE2 or dibasic ester DBE5. They can be in the following ratios of d-limonene to dibasic ester:



7

50/50

40/60

60/40

30/70

5 70/30

80/20

20/80

When generally about one-half to 15% by weight and  
10 preferably 8 to 12% by weight of the d-limonene is  
replaced by dibasic ester, the speed of the cleaning  
action increases. This combination is necessary for the  
removal of some of the new hard finishes of certain nail  
15 polishes, especially when the polishes are on wrapped  
nails.

The d-limonene helps to loosen or dissolve grease,  
fat or organic materials, and is described as an  
ingredient in a cleaner in U.S. Patent Nos. 4,790,951 and  
20 5,031,648.

The N-methyl pyrrolidone is a solvent that is  
compatible with d-limonene and cetyl acetate and the  
ingredient, preferably N-methyl 2-pyrrolidone (NMP), is  
listed as a component in compositions in U.S. Patent Nos.  
25 4,120,810 and 4,732,695. U.S. Patent No. 4,605,670  
discloses a percutaneous (drug) absorption composition

including NMP and other ingredients such as alcohols or esters including cetyl acetate. U.S. Patent No. 5,011,621 is directed to a paint stripper composition and discloses the use of NMP, an oil, and a plurality of cosolvents including terpenes.

The cetyl acetate is a desensitizer that enhances the compatibility, efficiency, miscibility, and stability of the liquid non-aqueous d-limonene/NMP combination.

Acetulan™, a mixture of cetyl acetate and acetylated lanolin oil can be used as a substitute in whole or part for cetyl acetate. As indicated, cetyl acetate should be at least about 1/2 percent by weight of the composition with the best results being obtained with about 4 to 6 percent by weight. In some cases, a small amount of the cetyl acetate, say about 1/2 to 30 weight percent and preferably about 5 to 10% can be replaced by acetylated lanolin alcohol.

As indicated, small amounts of ethyl lactate can be used as well as small amounts, about 1/2 to 10% by weight, of an anti-fungicidal agent, myristalkonium chloride and Quaternium 14 (quaternary ammonium salt derivative) to enhance the cleaner composition and make it more

acceptable to the hands. Ethyl lactate is a solvent that is compatible with d-limonene, cetyl acetate, and N-methyl pyrrolidone. Ethyl lactate enhances the compatibility, efficiency, miscibility, and the stability of the liquid, non-aqueous d'limonene/NMP combination and enhances the removal time for the more difficult hard nail polish surfaces. Best results are obtained with about 10% by weight and reducing d-limonene by 10% weight ethyl lactate. As indicated, the total amount of d-limonene in the composition is preferably at least 45 percent by weight and more preferably at least about 50 or 55 percent by weight. In some cases, methyl lactate can be used with the ethyl lactate, the methyl lactate being generally about 3 to 5 weight percent up to 50 to 55 weight percent of the combination of ethyl lactate and methyl lactate.

The cleaner composition has an outstanding balance of properties including easy removal of coatings (finger nail polish) on hard surfaces, being non-irritating, having a pleasant order, being quick drying, having miscible ingredients, and leaving the cleaned surfaces free of surface fiber.

In the embodiment that optionally contains the DBE,

the dibasic ester is a dialkyl ester of an aliphatic dicarboxylic acid, the alkyl group having 1 to 5 carbon atoms and the aliphatic portion of the acid having generally 3 or 4 carbon atoms up to as many as 10 or 12 carbon atoms. Suitable dibasic esters are dimethoxy adipate, dipropoxy adipate, diethoxy adipate, dibutoxy adipate as well as corresponding dialkyl esters of succinic acid and glutaric acid. Other suitable dialkyl esters have the acid portion derived from oxalic, malonic, primalic and azelaic acids. The dibasic esters are described in duPont U.S. Patent Nos. 4,467,800, 5,096,501 and 5,002,078, incorporated herein by reference.

As indicated, preferably small amounts (15 to 30% by weight) of dibasic ester can be used as well as small amounts, about 10 to 30% by weight, of an anti-fungicidal agent, ethyl or methyl lactate, myristalkonium chloride and Quaternium 14 (quaternary ammonium salt derivative) to enhance the cleaner composition and make it more acceptable to the hands. Dibasic ester DBE, a preferred solvent, is a solvent that is compatible with d-limonene, cetyl acetate, and N-methyl pyrrolidone. Dibasic ester DBE or ethyl lactate enhances the compatibility,

efficiency, miscibility, and the stability of the liquid, non-aqueous d'limonene/NMP combination and enhances the removal time for the more difficult hard nail polish surfaces. Best results are obtained with about 20% to 30% by weight of dibasic ester and/or ethyl lactate and reducing d-limonene by 20 to 30% by weight. As indicated, the total amount of d-limonene in the composition is preferably at least 45 percent by weight and more preferably at least about 50 or 55 percent by weight. In some cases, when dibasic ester DBE is used, methyl lactate can be used with the ethyl lactate, the methyl lactate being generally about 3 to 5 weight percent up to 50 to 55 weight percent of the combination of ethyl lactate and methyl lactate.

The cleaner composition has an outstanding balance of properties including easy removal of coatings (finger nail polish) on hard surfaces, being non-irritating, having a pleasant order, being quick drying, having miscible ingredients, and leaving the cleaned surfaces free of surface fiber.

The composition can be used as an activator for a finger nail coating, it activating an acrylic compound by

mixing with an acrylic powder. The dry powder and liquid composition creates a round ball of material that is brushed on the fingernail. When hardened (by drying with a dryer, for instance) nail polish is applied over the

5 hardened acrylic powder/composition coating.

## WHAT IS CLAIMED IS:

1. A non-aqueous, liquid composition comprising the following ingredients:

- 5
- a) d-limonene
  - b) N-methyl-2 pyrrolidone
  - c) cetyl acetate

2. A fingernail polish remover and a finger artificial nail tip remover non-aqueous composition comprising the following ingredients:

- 10
- a) d-limonene
  - b) N-methyl-2 pyrrolidone
  - c) cetyl acetate,

15 the d-limonene being at least 50% by weight of the composition.

3. A non-aqueous cleaning composition comprising the following ingredients in approximate percent by weight:

20

<u>Ingredients</u>	<u>% by weight</u>
1. d-limonene	5-75
2. N-methyl pyrrolidone	5-95
3. cetyl acetate	1-15

4. A composition as defined in claim 3 in which the following ingredients are present in approximate percent by weight:

5	<u>Ingredients</u>	<u>% by weight</u>
	1. d-limonene	40-70
	2. N-methyl pyrrolidone	25-45
	3. cetyl acetate	3-10

10

5. A composition as defined in claim 3 in which the following ingredients are present in approximate percent by weight:

15	<u>Ingredients</u>	<u>% by weight</u>
	1. d-limonene	55-65
	2. N-methyl pyrrolidone	30-40
	3. cetyl acetate	4-6

20

6. A composition as defined in claim 3 containing about 60 weight percent d-limonene, 35 weight percent N-methyl pyrrolidone, and 5 weight percent cetyl acetate.



7. A composition as defined in claim 3 in which a part of the d-limonene is substituted for by about 1/2 to 10 percent by weight of ethyl lactate.

5 8. A composition as defined in claim 3 that is effective as a fingernail polish remover and as artificial fingernail tip remover.

9. A composition as defined in claim 3 in which the  
10 d-limonene is the major component in the composition.

10. A composition as defined in claim 1 in which a portion of the d-limonene is substituted for by ethyl lactate.

15

11. A composition as defined in claim 1 comprising about 50% by weight of d-limonene, about 25% by weight of N-methyl pyrrolidone, about 5% by weight of cetyl acetate and acetylated lanolin, about 10% by weight of ethyl  
20 lactate, and about 10% by weight of methyl lactate.

12. A liquid non-aqueous cleaner composition as defined in claim 1, the composition being adapted to remove finger nail polish, nail wraps and tips, the  
5 composition comprising d-limonene, N-methyl pyrrolidone, cetyl acetate, acetylated lanolin alcohol, ethyl lactate and methyl lactate.

13. A method of removing a coating from a fingernail  
10 comprising:

a) applying a cleaning composition comprising d-limonene, NMP, a mixture of cetyl acetate and acetylated lanolin oil, and optionally, a dibasic ester to the coating on the nail;

15 b) allowing the coated nail and composition to remain in contact for a time sufficient to loosen the coating from the nail, and

c) separating the coating and the composition from the nail.

20

14. A composition as defined in claim 1 containing dibasic ester.

15. A non-aqueous, liquid composition comprising the following ingredients:

- 5
- a) d-limonene
  - b) N-methyl-2 pyrrolidone
  - c) cetyl acetate
  - d) dibasic ester

16. A non-aqueous cleaning composition comprising the following ingredients in approximate percent by weight:

	<u>Ingredients</u>	<u>% by weight</u>
	1. d-limonene	5-75
	2. N-methyl pyrrolidone	5-95
15	3. cetyl acetate	1-15
	4. dibasic ester	5-95

17. A composition as defined in claim 3 in which the following ingredients are present in approximate percent by weight:

	<u>Ingredients</u>	<u>% by weight</u>
	1. d-limonene	40-70
	2. N-methyl pyrrolidone	25-45
25	3. cetyl acetate	3-10
	4. dibasic ester	15-40

18. A composition as defined in claim 3 in which the following ingredients are present in approximate percent by weight:

	<u>Ingredients</u>	<u>% by weight</u>
5	1. d-limonene	55-65
	2. N-methyl pyrrolidone	30-40
	3. cetyl acetate	4-6
	4. dibasic ester	10-30

10 19. A composition as defined in claim 1 comprising about 50% by weight of d-limonene, about 25% by weight of N-methyl pyrrolidone, about 5% by weight of cetyl acetate and acetylated lanolin, and about 20% by weight of dibasic ester.

15

20 20. A liquid non-aqueous cleaner composition as defined in claim 1, the composition being adapted to remove finger nail polish, nail wraps and tips, the composition comprising d-limonene, N-methyl pyrrolidone, cetyl acetate, acetylated lanolin alcohol, and dibasic ester.

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/US93/02204

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) :A61K 7/047; C09D 9/00; C11D 7/32,7/50  
US CL :252/153,162,170,171,364,542, DIG. 8; 134/38; 424/61,401  
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. :

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US, A, 5,098,591 (STEVENS) 24 March 1992, See abstract and col. 6, lines 30-35.	1-20
Y	US, A, 5,082,660 (OUNANIAN ET AL.) 21 January 1992, See column 5, lines 7-21 and the example.	1-20
Y	US, A, 5,063,057 (SPELLMAN ET AL.) 05 November 1991, See col. 4, lines 40-58 and example 2.	1-20
Y	US, A, 4,620,937 (DELLUTRI) 04 November 1986, See abstract.	1-20

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

* Special categories of cited documents:	*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
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Date of the actual completion of the international search 13 APRIL 1993	Date of mailing of the international search report <b>15 JUN 1993</b>
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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US93/02204

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US, A, 5,139,170 (CASTROGIOVANNI ET AL.) 18 August 1992, See abstract and col. 2, lines 29-39.	1-20
Y,P	US, A, 5,145,671 (CASTROGIOVANNI ET AL.) 08 September 1992, See abstract and col. 5, lines 32-41.	1-20
Y	US, A, 4,780,235 (JACKSON) 25 October 1988, See abstract, col. 1, lines 17-21, and col. 2, lines 5-32.	14-20
A,P	US, A, 5,188,675 (DORMON-BRAILSFORD) 23 February 1993.	1-20
A,P	US, A, 5,110,584 (MEDRI ET AL.) 05 May 1992.	1-20
A	US, A, 4,533,487 (JONES) 06 August 1985.	1-20
A	US, A, 3,686,701 (CHARLE ET AL.) 29 August 1972.	1-20