

UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	Attorney Docket No.	821920-1030
	First Inventor	Ponder
	Title	ENVIRONMENTALLY SAFER REPLACEMENT REFRIGERANT WITH NAPHTHENIC OIL
	Express Mail Label No.	EV5476895021US

APPLICATION ELEMENTS <i>See MPEP Chapter 600 concerning utility patent application contents</i>		ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450	
1. ☒ Fee Transmittal Form (e.g., PTO/SB/17) <i>(Submit an original, and a duplicate for fee processing)</i>	7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)		
2. ☒ Applicant claims small entity status. See CFR 1.27	8. Nucleotide and/or Amino Acid Sequence Submission <i>(if applicable, all necessary)</i>		
3. ☒ Specification <i>(preferred arrangement set forth below)</i> [Total Pages 23]	a. ☐ Computer Readable Copy (CRF)		
- Descriptive title of the invention - Cross Reference to Related Applications - Statement Regarding Fed. Sponsored R&D - Reference to sequence listing, a table, or a computer program listing appendix - Background of the Invention - Brief Summary of the Invention - Brief Description of the Drawings <i>(if filed)</i> - Detailed Description - Claim(s) - Abstract of the Disclosure	b. Specification Sequence Listing on:		
4. ☒ Drawing(s) (35 USC 113) [Total Sheets 12]	i. ☐ CD-ROM or CD-R (2 copies); or		
5. Oath or Declaration [Total Pages 3]	ii. ☐ Paper		
a. ☒ Unexecuted	c. ☐ Statements verifying identity of above copies		
b. ☐ Copy from a prior application (37 CFR §1.63(d)) <i>(for continuation/divisional with Box 18 completed)</i>			
i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).	ACCOMPANYING APPLICATION PARTS		
6. ☐ Application Data Sheet. See 37 CFR 1.76	9. ☐ Assignment Papers (cover sheet & Documents(s))		
	10. ☐ 37 CFR 3.73(b) Statement ☐ Power of Attorney <i>(when there is an assignee)</i>		
	11. ☐ English Translation Document <i>(if applicable)</i>		
	12. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations		
	13. ☐ Preliminary Amendment		
	14. ☒ Return Receipt Postcard (MPEP 503) <i>(Should be specifically itemized)</i>		
	15. ☐ Certified Copy of Priority Document(s) <i>(if foreign priority is claimed)</i>		
	16. ☐ Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.		
	17. ☐ Other:		

18. If a **CONTINUING APPLICATION**, check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: /
 Prior application information: **Examiner** Group / Art Unit:

For CONTINUATION OR DIVISIONAL APPS only: the entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. This incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

19. CORRESPONDENCE ADDRESS					
☒ Customer Number: 24504		OR ☐ Correspondence address below:			
NAME	Todd Deveau Thomas, Kayden, Horstemeyer & Risley, L.L.P.				
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Name (Print/Type)	Todd Deveau	Registration No. (Attorney/Agent)	29,526
Signature	<i>Todd Deveau</i>	Date	9/8/2004

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 1.22 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PTO/SB/17 (10-03)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revisions.

☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT

(\$)

Complete If Known

Application Number

Filing Date

First Named Inventor

Ponder

Examiner Name

Group / Art Unit

Attorney Docket No.

821920-1030

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account

Deposit Account Number

20-0778

Deposit Account Name

Thomas, Kayden, Horstemeyer Risley, L.L.P.

The Commissioner is authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Credit any overpayments
☐ Charge any additional fee(s) during the pendency of this application
☐ Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee (\$)	Small Entity Fee Code	Small Entity Fee (\$)	Fee Description	Fee Paid
1001	770	2001	385	Utility Filing Fee	
1002	340	2002	170	Design Filing Fee	
1003	530	2003	265	Plant Filing Fee	
1004	770	2004	385	Reissue Filing Fee	
1005	160	2005	80	Provisional Filing Fee	
SUBTOTAL (1)					(\$)

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

	Extra Claims	Fee From Below	Fee Paid
Total Claims	- 20**=	X 9.00	=
Independent Claims	- 3**=	X 43.00	=
Multiple Dependent		145.00	=

Large Entity		Small Entity		Fee Description
Fee Code	Fee (\$)	Fee Code	Fee (\$)	
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	**Reissue independent claims over original patent
1205	18	2205	9	**Reissue claims in excess of 20 and over original patent
SUBTOTAL (2)				(\$)

**or number previously paid, if greater; For Reissues, see above

FEES CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee (\$)	Small Entity Fee Code	Small Entity Fee (\$)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge-late filing fee or oath	
1052	50	2052	25	Surcharge-late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for ex parte reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive-unavoidable	
1453	1,330	2453	655	Petition to revive-unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee for provisional application	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	770	2810	385	For each add. invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited exam. of a design application	
Other fee (specify)					
SUBTOTAL (3)					(\$)

*Reduced by Basic Filing Fee Paid

SUBMITTED BY

Typed or Printed Name
Signature

Todd Deveau

Registration No. 29,526

Complete (if applicable)

Telephone Number

770-933-9500

Date

05/20/2004

9/8/2004

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This collection of information is required by 37 CFR 1.17 and 1.27. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 37 USC 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Dynatemp EX1007

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R03415

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: **Ponder**For: **Environmentally Safer Replacement Refrigerant with Napthenic Oil for Refrigerant R22-Based Refrigeration Systems****CERTIFICATE OF EXPRESS MAIL**

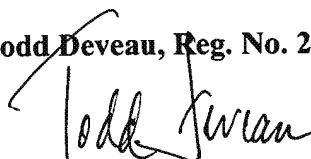
Mail Stop
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

Enclosed for filing in the above case are the following documents:

Return Postcard
Utility Patent Application Transmittal Page
Fee Transmittal Page
Utility Patent Application Consisting Of:
16 Pages of Specification
6 Pages of Claims (Claims 1-29)
1 Page of Abstract
1 Pages of Formal Drawings (Fig(s). 1-2)
Declaration (Unexecuted)

Respectfully submitted,

Todd Deveau, Reg. No. 29,526**THOMAS, KAYDEN, HORSTEMEYER
& RISLEY, L.L.P.**

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Our Docket No: **821920-1030**

I hereby certify that all correspondence listed above are being deposited for delivery to the above addressee, with the United States Postal Service **"EXPRESS MAIL POST OFFICE TO ADDRESSEE"** service under 37 CFR §1.10 on the date indicated below:

The envelope has been given U.S. Postal Service "Express Mail Post Office To Addressee" Package # **EV547689502US**.

Date:

7/8/04
Laurie Delesandro

ENVIRONMENTALLY SAFER REPLACEMENT REFRIGERANT WITH NAPHTHENIC OIL FOR REFRIGERANT R22-BASED REFRIGERATION SYSTEMS

RELATED APPLICATION

5

This application claims priority to and the benefit of provisional application, Serial No. 60/501,049 filed September 8, 2003.

BACKGROUND OF THE INVENTION

1. Field Of The Invention

10 The present invention relates to the replacement of Refrigerant R-22 (chlorodifluoromethane) refrigerant with a blend refrigerant that is less damaging to the ozone layer in systems designed to use Refrigerant R-22 (chlorodifluoromethane). More particularly the present invention relates to an improved refrigerant composition, method and apparatus for refrigeration wherein two non-Refrigerant R-22 refrigerants are mixed
15 in a defined ratio such that the temperature-pressure relationship of the mix approximates that of Refrigerant R-22 (chlorodifluoromethane). The mixture is compatible with Refrigerant R-22 (chlorodifluoromethane) so that it can be added to supplement and replace Refrigerant R-22 (chlorodifluoromethane). A further particularity of the instant invention relates to an improved method and apparatus for refrigeration wherein
20 refrigerant mixture is mixed with a soluble lubricating oil to provide lubrication to the apparatus. The lubricant is soluble in both the mixture of the invention and Refrigerant R-22 (chlorodifluoromethane) refrigerant.

2. General Background

25 Until recently, R-22 refrigerant chlorodifluoromethane (hereinafter sometimes called "Refrigerant R-22 (chlorodifluoromethane)") was the major, if not sole refrigerant, used in residential air-conditioners, refrigerators, freezers and window air-conditioning units. Refrigerant R-22 (chlorodifluoromethane) is a trademark of E. I. du Pont de Nemours & Co. Inc. for chlorodifluoromethane. Hereinafter, "Refrigerant R-22

(chlorodifluoromethane)” is used in this specification to denote chlorodifluoromethane, regardless of the source.

Recently, however, Refrigerant R-22 (chlorodifluoromethane) has come under attack both nationally and internationally as an ozone layer-damaging chemical. In recent years, both the national and international scientific communities have linked Refrigerant R-22 (chlorodifluoromethane) with damage to the earth’s protective ozone layer. Air-conditioners, refrigerator/freezers and window air-conditioning units containing R-22 are believed to be a global source of ozone-damaging material.

In response to scientific concern and a national and global outcry over the use of Refrigerant R-22 (chlorodifluoromethane) in air-conditioning, the United States Congress has acted to first reduce and then ban the use of Refrigerant R-22 (chlorodifluoromethane) in air-conditioning units.

As a first step toward phasing out the use of Refrigerant R-22 (chlorodifluoromethane) in air-conditioning units, Congress is phasing out the use of Refrigerant R-22 (chlorodifluoromethane) in new equipment effective 01/01/2015 and has banned the sale of Refrigerant R-22 (chlorodifluoromethane) in any size container as of 01/01/2020. One of the first areas in which the use of Refrigerant R-22 (chlorodifluoromethane) is to be phased out is in the Bakery industry under the Bakery Partnership Program. Another step in phasing out the use of R-22 is the import restrictions that begin in 2003, limiting the amount of R-22 that can be imported into the United States.

At the time of this application, the vast majority of residential, window units and freezers in use in the United States contain Refrigerant R-22 (chlorodifluoromethane).

Prior to banning the sale of quantities of Refrigerant R-22 (chlorodifluoromethane), owners of equipment with Refrigerant R-22 (chlorodifluoromethane)-based air-conditioning units are able to purchase the level of refrigerant in their equipment with only the need of a refrigerants license as required by

the Clean Air Act. Millions of units containing refrigerant R-22 (chlorodifluoromethane) were sold in the United States prior to the start of mandatory phase out set forth by Congress and the international community.

Refrigerant R-22 (chlorodifluoromethane) recharging typically involves 30 lb. cans or cylinders typically used in the HVAC/R industry. The cylinders are fitted with a dispensing outlet compatible with a commercially available refrigeration manifold. In order to recharge an air-conditioning system, a customer need to only fit the can or cylinder to the manifold and discharge, or "add to" the refrigerant charge directly into the air conditioning system.

Following Congress's ban on the sale of Refrigerant R-22 (chlorodifluoromethane) millions of equipment owners with Refrigerant R-22 (chlorodifluoromethane)-based air-conditioning units will be left with no choice other than to seek replacement refrigerants to service these units. Intentionally mixing of refrigerants is currently illegal by standards set forth by the Clean Air Act. An example would be for this application is that current R-22 units could not be mixed with this invention intentionally.

In response to Congress's ban on the use of Refrigerant R-22 (chlorodifluoromethane) in air-conditioning, service dealers have begun to retrofit existing Refrigerant R-22 (chlorodifluoromethane)-based air-conditioning units with new, non-R-22 refrigerants, such as R410A (a 50/50 mixture of difluoromethane and pentafluoroethane), R417 (a 46/50/4 mixture of pentafluoroethane, 1,1,1,2-tetrafluoroethane, and butane) or R407C (a 23/25/52 mixture of difluoromethane, pentafluoroethane, and 1,1,1,2-tetrafluoroethane). None of these replacements contain a lubricant when produced.

The refrigerants that will be authorized by the Environmental Protection Agency (EPA) to replace Refrigerant R-22 (chlorodifluoromethane) in air conditioners is currently under review and will evolve to require a environmentally safe refrigerant, with

a 0 odp factor like the one of the present invention described herein. Unfortunately, most replacements for R-22 have a markedly different temperature-pressure relationship at most operating temperatures than Refrigerant R-22 (chlorodifluoromethane).

Because of this difference in the temperature-pressure relationship of Refrigerant
5 R-22 (chlorodifluoromethane) and current replacement refrigerants, existing Refrigerant R-22 (chlorodifluoromethane)-based systems cannot typically be interchanged. Hence, non-retrofitted, Refrigerant R-22 (chlorodifluoromethane)-based units have a need for a refrigerant that will fulfill the requirements of the system design while also meeting the requirements of the EPA and the international community.

10 Simply mixing refrigerants with existing Refrigerant R-22 (chlorodifluoromethane) in order to replenish, or “topping off” the level is against the law and not feasible. When other refrigerants are mixed with Refrigerant R-22 (chlorodifluoromethane), the mixture can take on the pressure characteristics of a substance that could be harmful to either the equipment or the operator. The
15 temperature-pressure relationship becomes markedly different from that of Refrigerant R-22 (chlorodifluoromethane) at temperatures within the normal refrigerant operating temperature range and typical use of R-22.

Hence, in the absence of Refrigerant R-22 (chlorodifluoromethane) owners of equipment with Refrigerant R-22 (chlorodifluoromethane)-based air conditioners face but
20 one choice when the level of their air-conditioning coolant is low: professional service—at a significant cost—to remove the existing Refrigerant R-22 (chlorodifluoromethane), and retrofit the system compatible with some kind of refrigerant gas.

R-22 refrigerants were developed to replace the prior, now banned R-12 refrigerant, or dichlorodifluoromethane. R-12 is sometimes referred to as FREON 12®,
25 which is a trademark of E.I. du Pont de Nemours & Co. for dichlorodifluoromethane.

Thomas et al. (U.S. Pat. No. 5,254,280) discloses a lubricant developed for use with a refrigerant known as R134a (1,1,1,2 – tetrafluoroethane) and the combination of

that lubricant with a refrigerant, which is a replacement for R-12. The lubricant contains polyoxyalkylene glycol, which is hydrophilic and could damage the system as discussed below.

Wilczek (U.S. Pat. No. 5,384,057), Gorski (U.S. Pat. No. 4,971,712), and Anton
5 of DuPont (U.S. Pat. No. 5,145,594) disclose other R-12 replacements in the form of a blend of certain synthetic lubricants in various R134a and R134a/R125 refrigerant systems. The DuPont patents discuss a gas known as R125 (pentafluoroethane). R125 is five fluorine atoms bonded to an ethane molecule. This is a very large molecule for a refrigerant. It is currently being produced for refrigeration only. Anton discloses the use
10 of a lubricant comprising at least one cyanocarbon compound. Wilczek discloses a fluorosiloxane as a lubricant. Gorski discloses a polyalkylene glycol as a lubricant.

Systems that contain R-22, or R-12 replacements, are still being produced today. These older systems have common components: R-22, R-22 mineral oil lubricant, and water that is sequestered into the dryer. If R134a (1,1,1,2-tetrafluoroethane) were added to
15 the system, it would damage the system as follows: (1) if no lubricant is added to the R134a (as in U.S. Pat. No. 4,953,312 to Tamura et al.), then the R-22 system would be starved for lubricant, since the R134a gas is not miscible with the mineral oil lubricant; (2) if a synthetic lubricant is added to the R134a (as in Thomas et al.), then there is a different problem—that of moisture. Older systems can have water trapped in their
20 dryers. The synthetic lubricants (such as polyglycol- or polysiloxane-based lubricants) are hydrophilic. Thus, they are not only miscible with R-22 and R134a; they are also partially or completely miscible with water. Thus, if they are introduced into an R-22 system, they will pull this water out of the dryer into the refrigerant flow, initiating corrosion and damage to pressure switches and the TX valve and possible other system
25 components. This is why Elf Atochem and DuPont, to name a few publish elaborate flushing procedures and high efficiency dryer change-outs to prevent damage to the cooling system.

Weber (U.S. Patent No. 5,942,149) discloses yet another R-12 replacement consisting of a blend of chlorodifluoroethane, tetrafluoroethane and a napthenic lubricating oil.

SUMMARY OF THE PRESENT DISCLOSURE

5 The present disclosure is of a method and apparatus that are environmentally sound alternatives to the use of Refrigerant R-22 (chlorodifluoromethane) as a refrigerant. More particularly, the invention provides a mixture of at least two refrigerants that are miscible with each other, and compatible with Refrigerant R-22 (chlorodifluoromethane) while at the same time possessing a temperature-pressure profile
10 that approximates that of Refrigerant R-22 (chlorodifluoromethane) over the operating range of ambient temperatures usually encountered by air conditioning units or other apparatus utilizing Refrigerant R-22 (chlorodifluoromethane) as a refrigerant. The invention also provides a lubricant, that is compatible with both the environmentally sound refrigerant of the invention and with Refrigerant R-22 (chlorodifluoromethane), so
15 that mixtures of the refrigerant according to the invention and Refrigerant R-22 (chlorodifluoromethane) may be utilized with this lubricant in the refrigeration systems without deleterious effect upon moving parts of the refrigerating apparatus that require lubrication from the refrigerant.

More particularly, the refrigerant and method disclosed herein involves a mixture
20 of pentafluoroethane and tetrafluoroethane in specific proportions that provide a temperature-pressure relationship that approximates that of Refrigerant R-22 (chlorodifluoromethane) over the range of ambient temperature operating conditions in which Refrigerant R-22 (chlorodifluoromethane) is a useful refrigerant. The pentafluoroethane/tetrafluoroethane refrigerant blend disclosed herein is compatible with
25 both synthetic and mineral oils. The tetrafluoroethane can be either 1,1,1,2-tetrafluoroethane or 1,1,2,2-tetrafluoroethane. In an exemplary embodiment, the refrigerant according to the invention comprises a ratio of from about 40 to about 45 weight percent pentafluoroethane to about 55 to about 60 percent 1,1,1,2-

tetrafluoroethane, based upon the total weight of pentafluoroethane and 1,1,1,2-tetrafluoroethane. In a further exemplary embodiment, the refrigerant includes the ratio of about 42 weight percent pentafluoroethane to about 58 weight percent 1,1,1,2-tetrafluoroethane.

5 In addition, the refrigerant according to the invention also includes from about 0 to about 20 weight percent (based on the combined weight of pentafluoroethane and 1,1,1,2-tetrafluoroethane) of a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane, and 1,1,1,2-tetrafluoroethane. In a preferred embodiment the lubricating oil is present in the range of from about 0.5 to about 2% by weight of the
10 refrigerant mixture.

 In an exemplary embodiment, the lubricating oil is a napthenic or paraffinic based lubricating oil. In a further exemplary embodiment, the lubricant is selected from those lubricants sold by Anderol, Inc., East Hanover, N.J., an affiliate of Royal Lubricants Company, under the trademark ROYCO® 2302. ROYCO® 2302 is a napthenic oil
15 lubricant having the following composition:

65-85% hydrotreated light napthenic distillate,
10-20% solvent refined light napthenic distillate petroleum,
<0.5% butylated triphenyl phosphate, and
<2% minor additive.

20 In another exemplary embodiment, the lubricating oil can be a synthetic lubricating oil, or a mixture of oils, that is soluble in the mixture of the chlorodifluoroethane and tetrafluoroethane. A suitable synthetic lubricant is a man-made, synthetic alkyl aromatic lubricant. Suitable synthetic lubricants include alkylated benzene lubricants.

25 The lubricant can be either a synthetic alkyl aromatic lubricant, such as alkylbenzene, alone, or a mixture of a synthetic alkyl aromatic lubricant and mineral oil

or a mixture of a synthetic alkyl aromatic lubricant and polyol ester (POE). When so mixed, it is preferred, but not required, that a minor portion of the mixture be mineral oil or POE. By minor portion, we mean less than 50% by weight of the blended refrigerants. Alternatively, either mineral oil or polyol ester (POE) can be used alone.

5 While it is intended that the substitute refrigerant according to the invention may be utilized to replace Refrigerant R-22 (chlorodifluoromethane) that has escaped from apparatus, the substitute refrigerant of the invention may also be utilized to completely refill apparatus that have been designed for use with Refrigerant R-22 (chlorodifluoromethane), since the refrigerant has a temperature-pressure profile that
10 closely approximates that of Refrigerant R-22 (chlorodifluoromethane). Thus, when the refrigerant is used as a complete replacement for Refrigerant R-22 (chlorodifluoromethane), it is no longer necessary that the lubricant be compatible with chlorodifluoromethane but only that it should be compatible with 1,1,1,2-tetrafluoroethane and pentafluoroethane.

15 Further, whereas the substitute refrigerant of the invention is less damaging to the ozone layer than Refrigerant R-22 (chlorodifluoromethane) and is useful in air conditioning units, and in particular residential type air-conditioning units, it is not so limited in its use. Indeed, the refrigerant may be utilized as a substitute or replacement for Refrigerant R-22 (chlorodifluoromethane) in virtually any application, thereby
20 eliminating the use of ozone layer-damaging Refrigerant R-22 (chlorodifluoromethane).

 In further specifics, the invention provides a canister containing a mixture of tetrafluoroethane and pentafluoroethane with a napthenic oil that may be fitted with an outlet manifold that is compatible with a Refrigerant R-22 (chlorodifluoromethane) recharging manifold that is typically used to recharge an apparatus with the latter
25 refrigerant. Refrigerant may then be allowed to flow from the container through the manifold and into the apparatus to replace Refrigerant R-22 (chlorodifluoromethane) refrigerant that has been lost from the refrigeration system.

When mixing the components of the refrigerant blend of the present invention, one should first mix the lubricant with the tetrafluoroethane, then mix that mixture with the pentafluoroethane in the proportions afore mentioned. Otherwise, the product does not mix properly.

5 In an exemplary form, the lubricant has a viscosity of 5 to 500 centistokes, more preferably 5 to 100 centistokes, even more preferably 5 to 50 centistokes, and most preferably 5 to 10 centistokes. The lubricant having a viscosity of 5 to 10 centistokes is preferred.

10 In an exemplary embodiment, the percentage by weight of lubricant in the refrigerant blend is 0-20%, preferably 0.5-2%, more preferably 1-2%, even more preferably 1.25-2%, and most preferably 1.5-1.75%. The percentage by weight of lubricant in the refrigerant blend is, for example, 1.75. $\pm$ 0.05%.

15 A suitable lubricant is severely hydro treated naphthenic/paraffinic lubricant, such as the aforementioned ROYCO® 2302. Other suitable lubricants include Sunpar R2280 (a paraffinic based lubricant), Lubrizol 403, Sunthene 200 (a naphthenic based lubricant) and L30 or L35 from Shrieve Chemical Company, The Woodlands, Texas, or Zerol 150 from Nu-Calgon Wholesale, Inc., St. Louis, Missouri, or AB150 from Virginia KMP Corporation, Dallas, Texas (alkylbenzene synthetic lubricants). Mobil One 5-weight synthetic oil (it is hydrophobic) could also work as a lubricant, but it is relatively
20 expensive.

 In order for the parts of the refrigerant system to function best, 0.5-20% of total weight of refrigerant should be lubricant. When adding the refrigerant blend to a refrigerant system, one should leave the lubricant in the system if one for some reason takes out the Refrigerant R-22.

25 The lubricating of the present system is miscible with the pentafluoroethane and tetrafluorethane blend and with R-22 refrigerant. This allows for mixing of residual R-22 refrigerant and the refrigerant of the present invention, without the release of significant

amounts of residual water in the dryer and subsequent system damage (as will happen if the synthetic lubricants disclosed in Thomas et al. and the DuPont patents are used). While alkylbenzene alone is considered not miscible with tetrafluoroethane (in particular R134a), it is sufficiently soluble in the present tetrafluoroethane/chlorodifluoroethane mixture. This solubility allows the replacement refrigerant blend to lubricate the system, preventing damage to the compressor and component parts of the system.

Various optional additives can be included in the lubricant. A corrosion inhibitor can be included. (otherwise corrosion will probably occur within 6 months). An exemplary corrosion inhibitor is one for anhydrous systems (such corrosion inhibitors comprise calcium, or phosphate salts). The corrosion inhibitor can be bonded to the lubricant. Additionally, a surfactant and/or a foaming agent can be included.

The present refrigerant blend is designed to be utilized as a R-22 replacement in refrigeration systems. It is designed as a replacement, in which little or no modifications including parts are used to adapt the system for the refrigerant of the present invention.

The present refrigerant blend can be used as a replacement for R-22 refrigerant, typically deminimus without retrofitting the air conditioning system or flushing it out. It is recommended that a full vacuum be obtained before adding the refrigerant to the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the disclosure can be better understood with reference to the following drawings.

FIG. 1 illustrates pressure versus temperature profiles for various blends of the present disclosure in comparison to R-22.

FIG. 2 compares the temperature versus enthalpy profile of an exemplary embodiment of the present disclosure to R-22.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present disclosure provides a mixture of non-Refrigerant 22 refrigerants that are less damaging to the Earth's ozone layer and that are approved by the U.S. Environmental Protection Agency for use in air-conditioners. The invention mixture is compatible with Refrigerant R-22 (chlorodifluoromethane) and can be used to replace existing Refrigerant R-22 (chlorodifluoromethane)-in R-22 based refrigeration systems. It is expected that the present invention will gradually replace Refrigerant R-22 (chlorodifluoromethane) in Refrigerant R-22 (chlorodifluoromethane)-based air-cooling systems, without the need to retrofit existing Refrigerant R-22 (chlorodifluoromethane)-based systems for non-Refrigerant 22 replacement refrigerants.

Specifically, the present refrigerant blend includes a mixture of pentafluoroethane and tetrafluoroethane packaged with a compatible lubricating oil, provided under pressure in a can or cylinder equipped with an outlet compatible with existing Refrigerant R-22 (chlorodifluoromethane) recharging kit manifolds, so that the refrigerant and lubricant mixture can be added to existing Refrigerant R-22 (chlorodifluoromethane) based coolant systems. Also, the invention provides the possibility of using new refrigerant systems, originally designed for "Refrigerant R-22 (chlorodifluoromethane)," by supplying an EPA-approved refrigerant so that retrofitting to new equipment use is not required.

In an exemplary embodiment, the invention provides an cylinder can like the standard 25 or 30 lb. can formerly used for containing "Refrigerant R-22 (chlorodifluoromethane)," but containing about 58% by weight 1,1,1,2-tetrafluoroethane and about 42% by weight pentafluoroethane. The can also contains the preferred lubricant, ROYCO® 2302 in solution with the coolant mixture at a percent by weight of between 0.5% and 2%.

Existing Refrigerant R-22 (chlorodifluoromethane)-based air-conditioning systems use an amount of a vegetable or hydrocarbon mineral oil to lubricate the compressor. This oil has a very low vapor pressure, and is not soluble with pure

tetrafluoroethane, particularly 1,1,1,2-tetrafluoroethane. Hence, adding tetrafluoroethane to replace Refrigerant R-22 (chlorodifluoromethane) in existing Refrigerant R-22 (chlorodifluoromethane)-based air-conditioning systems leads to compressor breakdown from lack of sufficient lubrication. The invention provides lubricants that are compatible
 5 with the invention mixture of tetrafluoroethane and pentafluoroethane, and with "Refrigerant R-22 (chlorodifluoromethane)," and that are suitable for lubricating refrigerant compressors and other air-conditioner component parts. The lubricants disclosed herein, on the other hand, are soluble in a tetrafluoroethane/ pentafluoroethane mixture. This solubility allows the replacement refrigerant blend to lubricate the air-
 10 conditioning system, preventing damage to the compressor and component parts of the system.

EXAMPLE 1

Table 1 summarizes the results of solubility tests of a 2% by weight solution of ROYCO® 2302 oil lubricant in an 58/42% by weight mixture of 1,1,1,2-
 15 tetrafluoroethane and pentafluoroethane refrigerants. ROYCO® 2302 oil (available from ANDEROL®, Inc., an affiliate of Royal Lubricants Co.), was added to a clear Fisher-Porter pressure burette and a mixture of 1,1,1,2-tetrafluoroethane/pentafluoroethane in an 58/42 ratio by weight was introduced under pressure to maintain the liquid state.

TABLE 1

20	Full Burette	clear no separation
	2/3 Full Burette	clear no separation
	1/2 Full Burette	clear no separation
	1/3 Full Burette	clear no separation
25	Almost Empty Burette	clear no separation

Note: The color of the fluid remained the same as the burette was emptied. The expelled gas deposited the oil onto a test panel.

EXAMPLE 2

1,1,1,2-tetrafluoroethane and pentafluoroethane are mixed with the napthenic oil lubricant at set ratios such that the temperature-pressure profile of the mixture is similar to that of Refrigerant R-22 (chlorodifluoromethane), over the normal operating range of air-conditioners. Table 2 summarizes the results of tests of the temperature-pressure profiles of various mixes of 1,1,1,2-tetrafluoroethane and pentafluoroethane over the range of normal air-conditioner working temperatures, from -60 degree. F. to 160. degree. F.

For Table 2, different percentages of 1,1,1,2-tetrafluoroethane and pentafluoroethane --by weight--were mixed with the lubricant to show the pressure temperature relationships of the various invention combinations.

Fig. 1 shows Pressure (liquid) vs. Temperature profiles for R-22 and blends of 60/40, 55/45 and 58/42 of tetrafluoroethane and pentafluoroethane, respectively.

Fig. 2 shows Temperature vs. Enthalpy profiles comparing a blend of 60/40 tetrafluoroethane and pentafluoroethane to R-22.

The blend of refrigerants tetrafluoroethane and pentafluoroethane of the present disclosure shows the following properties of interest:

Dew Point @ -32F

Bubble Point @ -41.5F

Glide @ 9.5 F

An exemplary blend of refrigerants is about 42% by weight pentafluoroethane and about 58% by weight 1,1,1,2-tetrafluoroethane. This is the ratio of pentafluoroethane to 1,1,1,2-tetrafluoroethane with the lubricant where the mixture of the invention shows the greatest similarity to "Refrigerant R-22 (chlorodifluoromethane)", over most operating temperatures.

The apparatus and method of the preferred embodiment encompass the use of a mixture of 1,1,1,2-tetrafluoroethane and pentafluoroethane at the ranges, as discussed above, with a lubricating oil at ranges, as discussed above of about 0.5% to about 2% by weight in the operation of an air-conditioning system, wherein the coolant-oil mixture
5 replaces Refrigerant R-22 (chlorodifluoromethane) in a Refrigerant R-22 (chlorodifluoromethane)-based refrigeration system.

The method and apparatus in the preferred embodiment further details providing the above described mix of pentafluoroethane/1,1,1,2-tetrafluoroethane and lubricating oil in 30 lb. cylinders, where the cylinders are pressure sealed and fitted with an outlet
10 compatible for existing Refrigerant 22-type refrigeration manifolds typically 1/4 inch male flare.

Further, it was noted that the systems tested ran more smoothly and the compressor showed less vibration during the test period, as the mixture of the invention was added. It is theorized that the lubricating oil, being soluble in the refrigerant gasses, was better able to lubricate the compressor and reciprocating parts than the existing
15 Refrigerant R-22 (chlorodifluoromethane) lubricant used by itself. In some applications a reduction in power consumption maybe also noted.

The refrigerant of the present invention can also be used as a replacement refrigerant for the new R-22 air-conditioning systems, such as the systems used in today's
20 HFC-free units

The ROYCO® 2302 napthenic oil lubricant of the present disclosure has a flash point of more than 150 degrees F. Pure refrigerant 1,1,1,2-tetrafluoroethane is not miscible with a napthenic lubricant like mineral oil or mineral seal oil (both of which could be used as the lubricants of the present invention). Pentafluoroethane is miscible
25 with most napthenic lubricants, including mineral oils. The presence of the pentafluoroethane allows the use of mineral oils in the refrigerant blend and system of the present invention (a translucent, partially miscible blend is formed). The lubricant can

advantageously be partially polymerized into longer chain molecules to allow it to function at very low percentage levels. The lubricant can be hydrotreated or polymerized for stability and wear resistance.

5 Phosphated additives add corrosion resistance in the presence of acids and salts and increase wear resistance. Calcium additives help the lubricant resist rust and the effects of corrosion; calcium salts reduce the corrosive effects of hydrochloric acid that is formed in the presence of water and the chlorinated gases present in the refrigerant systems of the present invention.

10 The ROYCO® lubricants mentioned above contain the corrosion inhibitors mentioned above and can also contain acrylic polymer. It is believed that the function of the acrylic polymer is to increase wear resistance under severe conditions. Acrylics can help film formation, and the ability of the lubricant to coat metal and soft parts and stay in place.

15 The lubricant of the present invention is miscible with R-22, the R-22 lubricant, and the blend of the refrigerant gases of the present invention.

It should be understood that variations and modifications may be made of the invention herein taught, and that those are within the scope and spirit of the invention as taught above and claimed here below.

Table 2

Temp (F)	P (60-40)	P (58-42)	P (55-45)	P (R-22)
-60	8.982	8.81	8.552	8.836
-55	10.36	10.16	9.87	10.19
-50	11.9	11.68	11.35	11.7
-45	13.62	13.37	12.99	13.39
-40	15.52	15.24	14.82	15.26
-35	17.63	17.32	16.84	17.34
-30	19.96	19.61	19.08	19.62
-25	22.52	22.13	21.54	22.14
-20	25.33	24.9	24.25	24.91
-15	28.41	27.93	27.21	27.93
-10	31.76	31.23	30.44	31.23
-5	35.42	34.83	33.96	34.82
0	39.39	38.74	37.79	38.73
5	43.69	42.98	41.94	42.96
10	48.34	47.57	46.43	47.54
15	53.36	52.52	51.27	52.48
20	58.76	57.85	56.5	57.79
25	64.57	63.58	62.11	63.51
30	70.8	69.73	68.14	69.65
35	77.48	76.33	74.61	76.22
40	84.62	83.38	81.52	83.26
45	92.25	90.9	88.91	90.76
50	100.4	98.93	96.79	98.76
55	109	107.5	105.2	107.3
60	118.2	116.6	114.1	116.3
65	128	126.2	123.6	125.9
70	138.4	136.5	133.6	136.1
75	149.3	147.3	144.3	146.9
80	160.9	158.8	155.6	158.3
85	173.2	170.9	167.5	170.4
90	186.1	183.7	180.1	183.1
95	199.8	197.2	193.3	196.5
100	214.2	211.4	207.3	210.6
105	229.3	226.4	222.1	225.5
110	245.3	242.2	237.6	241.1
115	262	258.7	253.9	257.5
120	279.6	276.1	271	274.7
125	298.1	294.4	289	292.7
130	317.5	313.6	307.8	311.6
135	337.8	333.7	327.6	331.4
140	359.1	354.8	348.3	352.1
145	381.4	376.8	370.1	373.7
150	404.8	400	392.8	396.4
155	429.3	424.2	416.7	420
160	454.9	449.5	441.6	444.7

Claims

What is claimed as the invention is:

5 1. In an apparatus for refrigerating that is designed for use with ozone layer-damaging chlorodifluoromethane refrigerant known as R-22, the improvement comprising substituting the chlorodifluoromethane with a substitute blend refrigerant containing a lubricant less damaging to the Earth's ozone layer than chlorodifluoromethane,

10 said substitute refrigerant consisting of:

 about 40% to about 45% by weight pentafluoroethane;

15 about 55% to about 60% by weight tetrafluoroethane; and

 packaged with about 0% to about 20% by weight of the refrigerant with a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and
20 tetrafluoroethane.

 2. The invention according to Claim 1, the lubricating oil having the following components:

25 65-88% hydrotreated light napthenic distillate, and

 10-20% solvent refined light napthenic distillate petroleum.

30 3. The invention according to claim 1 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

4. The invention according to claim 1 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 42% by weight to said tetrafluoroethane present in an amount of about 58% by weight.

5 5. The invention according to claim 1 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight.

6. A method for refilling an apparatus for refrigeration that is designed for
10 use with ozone layer-damaging chlorodifluoromethane refrigerant, the method comprising:

(1) supplying a substitute refrigerant under pressure, in a cylinder can fitted with an outlet compatible with a chlorodifluoromethane recharging manifold of the apparatus; and
15

(2) adding to said apparatus via the manifold a substitute refrigerant for chlorodifluoromethane, wherein said substitute refrigerant consists of:

20 about 40% to about 45% by weight pentafluoroethane ;

about 55% to about 60% by weight tetrafluoroethane; and

25 about 0% to about 20% by weight of the refrigerant of a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and tetrafluoroethane.

7. The invention according to claim 6, the lubricating oil having the following components:

30 65-85% hydrotreated light napthenic distillate, and

10-20% solvent refined light napthenic distillate petroleum.

8. The invention according to claim 6 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

5 9. The invention according to claim 6 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 42% by weight to said tetrafluoroethane present in an amount of about 58% by weight.

10 10. The invention according to claim 6 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight.

11. In an apparatus for air-conditioning designed for use with ozone layer-damaging chlorodifluoromethane refrigerant the improvement comprising substituting
15 the chlorodifluoromethane with a refrigerant less damaging to the Earth's ozone layer than chlorodifluoromethane, the substitute refrigerant consisting of:

about 40% to about 45% by weight pentafluoroethane;

20 about 55% to about 60% by weight tetrafluoroethane; and

about 0% to about 20% by weight of the refrigerant of a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and tetrafluoroethane.
25

12. The invention according to claim 11, the lubricating oil having the following components:

30 65-85% hydrotreated light napthenic distillate, and

10-20% solvent refined light napthenic distillate petroleum.

13. The invention according to claim 11 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 42% by weight to said tetrafluoroethane present in an amount of about 58% by weight.

5 14. The invention according to claim 11 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight.

10 15. The invention according to claim 11 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

15 16. A method for refilling an apparatus for air-conditioning that is designed for use with ozone layer-damaging chlorodifluoromethane refrigerant, the method comprising:

(1) supplying a substitute refrigerant under pressure in a cylinder can fitted with an outlet compatible with a chlorodifluoromethane recharging manifold of the apparatus; and

20

(2) adding to said apparatus via the manifold the substitute refrigerant for chlorodifluoromethane, wherein said substitute refrigerant consists of:

25

about 40% to about 45% by weight pentafluoroethane ;

about 55% to about 60% by weight tetrafluoroethane; and

30

about 0% to about 20% by weight of the refrigerant of a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and tetrafluoroethane.

17. The invention according to claim 16, the lubricating oil having the following components:

65-85% hydrotreated light napthenic distillate, and

10-20% solvent refined light napthenic distillate petroleum.

18. The invention according to claim 16 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 42% by weight to said tetrafluoroethane present in an amount of about 58% by weight.

19. The invention according to claim 16 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight.

20. The invention according to claim 16 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

21. A refrigerant consisting of:

about 40% to about 45% by weight pentafluoroethane;

about 55% to about 60% by weight tetrafluoroethane; and

about 0% to about 20% by weight of the refrigerant of a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and tetrafluoroethane.

22. The invention according to claim 21, the lubricating oil having the following components:

65-85% hydrotreated light napthenic distillate, and

10-20% solvent refined light napthenic distillate petroleum.

23. A refrigerant according to claim 21 wherein said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

5 24. A refrigerant according to claim 21 wherein said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight with a napthenic lubricant.

10 25. A refrigerant according to claim 21 wherein said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight with a napthenic lubricant.

15 26. The invention according to any one of claims 1, 6, 11, 16, and 21, wherein the tetrafluoroethane is 1,1,1,2-tetrafluoroethane.

20 27. The invention according to any one of claims 2, 7, 12, 17, and 22, wherein the lubricating oil further includes an acrylic polymer or a corrosion inhibitor or both.

25 28. The invention according to any one of claims 6, 11, 16, and 21, wherein the lubricating oil is selected from the group consisting of napthenic based lubricants, paraffinic based lubricants and mixtures thereof, synthetic alkyl aromatic lubricants, synthetic alkyl aromatic lubricants mixed with mineral oil, synthetic alkyl aromatic lubricants mixed with polyol ester, mineral oil, and polyol ester.

29. The invention according to claim 28, wherein the synthetic alkyl aromatic lubricant includes an alkylbenzene.

ABSTRACT

An apparatus and method wherein potential ozone layer-damaging chlorodifluoromethane (Refrigerant R-22) is substituted with a mix of less environmentally damaging refrigerants pentafluoroethane and tetrafluoroethane in chlorodifluoromethane-based air-cooling systems mainly in residential cooling. While less environmentally damaging than chlorodifluoromethane, the substitute refrigerant has a temperature-pressure relationship similar to that of chlorodifluoromethane, making the substitute refrigerant suitable for use with chlorodifluoromethane-based air-cooling systems. In this event, it is mixed with a relatively small percentage of a lubricating oil which is compatible with both the unit refrigerant and typical R-22 system design.

FIG. 1

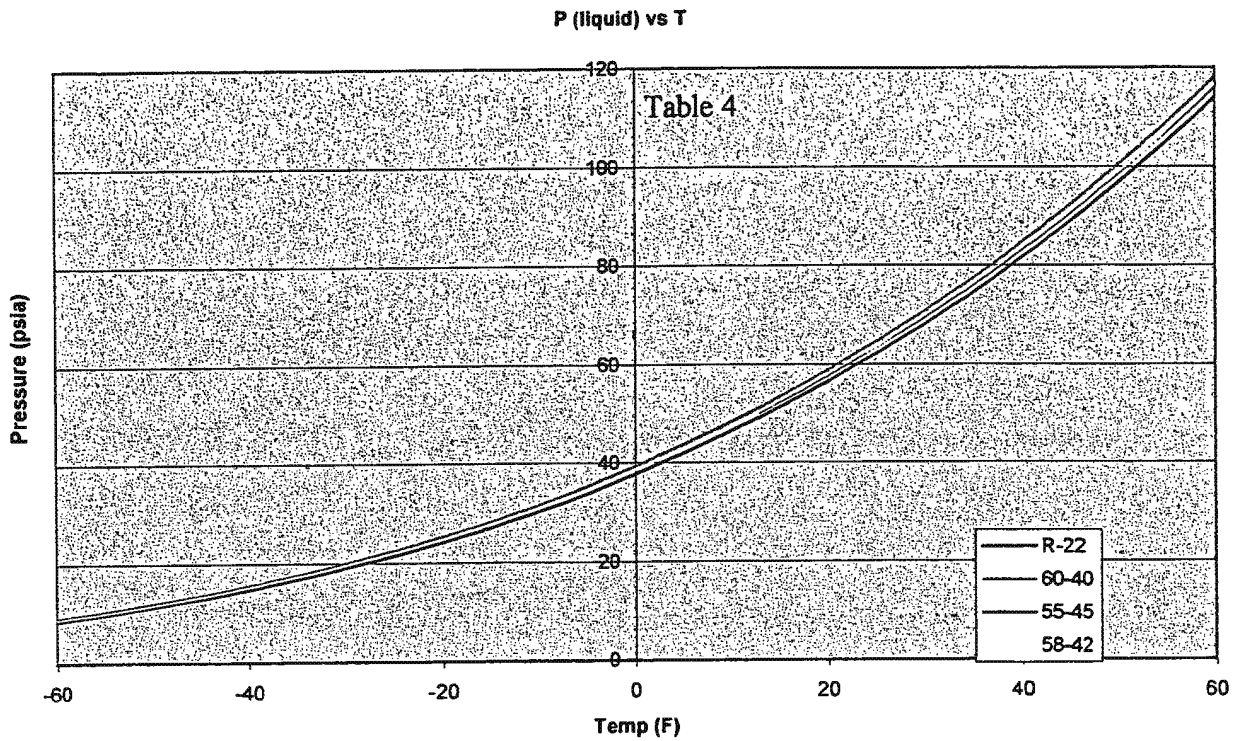
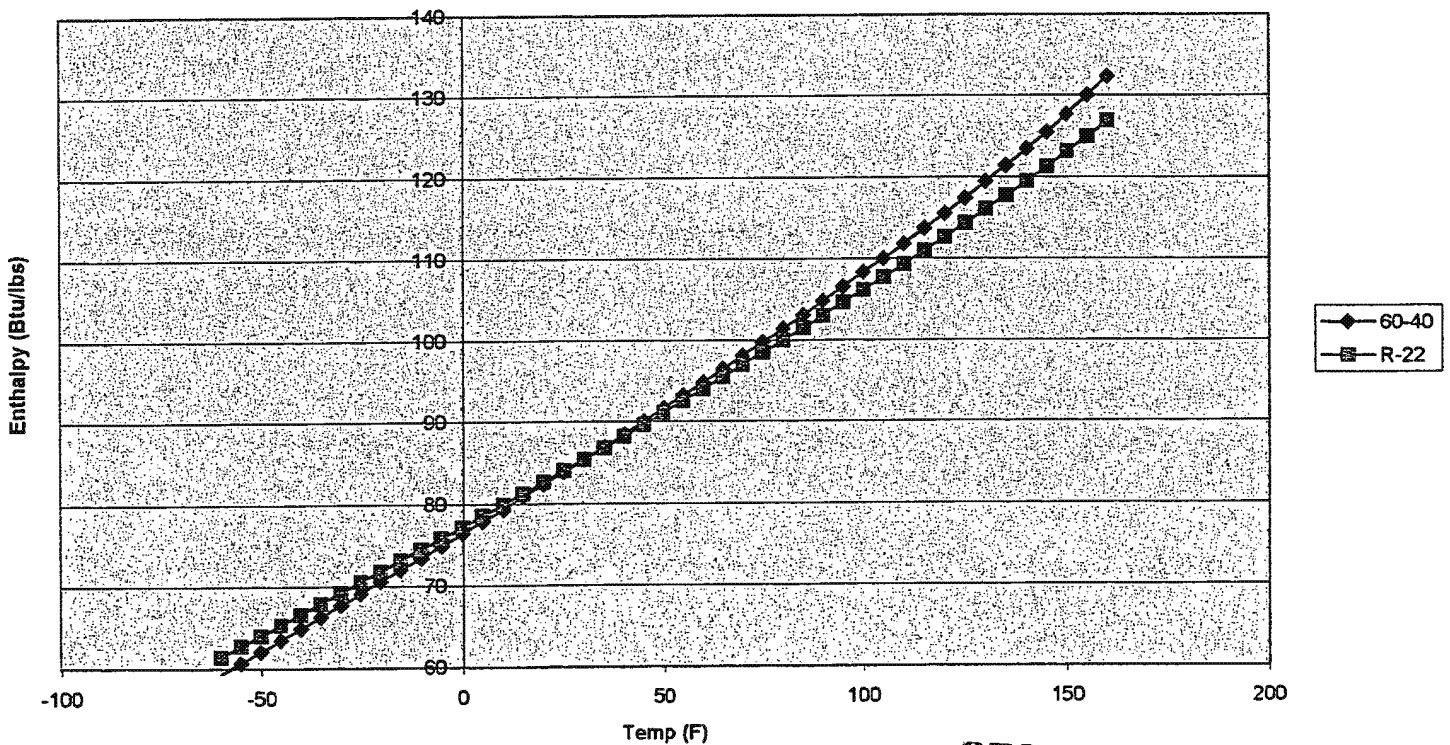


FIG. 2
Temp vs Enthalpy



BEST AVAILABLE COPY

Dynatemp EX1007

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R03440

DECLARATION FOR PATENT APPLICATION

Attorney Docket No: **821920-1030**

As the below named inventor(s), I/we hereby declare that:

Our residences, post office addresses and citizenships are as stated below next to our names.

We believe we are the original, first, and joint inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled _____, the specification of which:

- ☒ is attached hereto.
☐ was filed on _____ as Application Serial No. _____.
☐ was filed on _____ under U.S. Express Mail No. _____.
☐ is set forth in PCT International Application No. _____;
filed on _____ and as amended Under PCT Article 19 on _____ (if any).

I/we hereby state that I/we have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I/we acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I/we hereby claim foreign priority benefits under Title 35, United States Code, 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America listed below and have also identified below any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed: **NOT APPLICABLE.**

I/we hereby appoint all attorneys and agents of Thomas, Kayden, Horstemeyer & Risley, LLP, who are listed under the USPTO Customer Number shown below as my/our attorneys and agents to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, recognizing that the specific attorneys and agents listed under that Customer Number may be changed from time to time at the sole discretion of Thomas, Kayden, Horstemeyer & Risley, LLP, and request that all correspondence be addressed to the address filed under the same USTPO Customer Number.

24504

Please address all telephone calls, in the first instance, to **Todd Deveau** at telephone number: (770) 933-9500.

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Atlanta, Georgia 30339-5948**

I/we hereby declare that all statements made herein of my/our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statement and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of First Inventor: **Kenneth M. Ponder**
Residence: _____ Citizenship: **US**
Post Office Address: _____

Inventor's Signature: _____ Date: _____

Full Name of Second Inventor: Steffan Thomas, Jr.
Residence: _____ Citizenship: US
Post Office Address: _____

Inventor's Signature: _____ Date: _____

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 2004

Application or Docket Number

109 37736

CLAIMS AS FILED - PART I

(Column 1) (Column 2)

TOTAL CLAIMS	29	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	43 minus 20 =	* 23
INDEPENDENT CLAIMS	5 minus 3 =	* 2
MULTIPLE DEPENDENT CLAIM PRESENT ☐		

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

(Column 1) (Column 2) (Column 3)

AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total	*	Minus	**	=
	Independent	*	Minus	***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

6, 11, 16, 21

(Column 1) (Column 2) (Column 3)

AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total	*	Minus	**	=
	Independent	*	Minus	***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

(Column 1) (Column 2) (Column 3)

AMENDMENT C		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total	*	Minus	**	=
	Independent	*	Minus	***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

SMALL ENTITY TYPE ☐

OR OTHER THAN SMALL ENTITY

RATE	FEE
BASIC FEE	395.00
X\$ 9=	207
X44=	88
+150=	150
TOTAL	840

RATE	FEE
BASIC FEE	790.00
X\$18=	
X88=	
+300=	
TOTAL	

SMALL ENTITY OR

OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE
X\$ 9=	
X44=	
+150=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X88=	
+300=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$ 9=	
X44=	
+150=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X88=	
+300=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$ 9=	
X44=	
+150=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X88=	
+300=	
TOTAL ADDIT. FEE	



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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/937,736	09/08/2004	Kenneth M. Ponder	821920-1030

CONFIRMATION NO. 1006

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FORMALITIES LETTER



OC000000014246960

Date Mailed: 11/01/2004

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

*Filing Date Granted*Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
Applicant must submit \$ 395 to complete the basic filing fee for a small entity.
- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of \$65 for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this letter.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of **\$445** as a small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **\$905** for a Small Entity

- **\$395** Statutory basic filing fee.
- **\$65** Late oath or declaration Surcharge.
- Total additional claim fee(s) for this application is **\$445**

- \$88 for 2 independent claims over 3.
- \$207 for 23 total claims over 20.
- \$150 for multiple dependent claim surcharge.

Items Required To Avoid Processing Delays:

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A new oath or declaration, identifying this application number is required. The oath or declaration does not comply with 37 CFR 1.63 in that it:
- does not identify the residence (e.g., city and either state or foreign country) of each inventor.
- does not identify the complete mailing or post office address of each inventor.

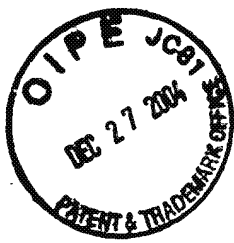
Replies should be mailed to: Mail Stop Missing Parts
 Commissioner for Patents
 P.O. Box 1450
 Alexandria VA 22313-1450

*A copy of this notice **MUST** be returned with the reply.*



Customer Service Center
Initial Patent Examination Division (703) 308-1202

PART 3 - OFFICE COPY



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of: Ponder, K.

Serial No.: 10/960,181

Confirmation No.: 1006

Docket No. 821920-1030

Filed: September 8, 2004

For: REFRIGERANT WITH LUBRICATING OIL FOR
REPLACEMENT OF R-22 REFRIGERANT

**RESPONSE TO NOTICE TO FILE MISSING PARTS
OF NONPROVISIONAL APPLICATION, FILING DATE GRANTED
AND SUBMISSION OF PRELIMINARY AMENDMENT**

Mail Stop: Missing Parts
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Notice to File Missing Parts of Nonprovisional Application, dated
November 1, 2004, please find enclosed:

1. Combined Declaration and Power of Attorney;
2. a copy of the Notice to File Missing Parts of Provisional Application; and
3. a check in the amount of \$650.00 for the statutory filing fee and additional claims
fee.
4. a check in the amount of \$65.00 additional surcharges under 37 CFR 1.16(e).

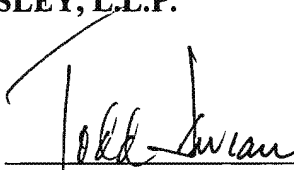
In addition, Applicant encloses a Preliminary Amendment.

The Commissioner is authorized to charge Deposit Account 20-0778 for any deficiencies
or credit any over payments.

Respectfully Submitted,

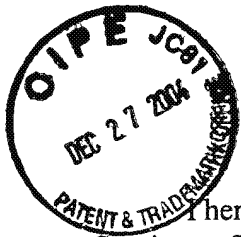
**THOMAS, KAYDEN, HORSTEMEYER
& RISLEY, L.L.P.**

By:



Todd Deveau, Reg. No. 29,526

100 Galleria Parkway, Suite 1750
Atlanta, Georgia 30339-5948
(770) 933-9500



CERTIFICATE OF MAILING

I hereby certify that the below listed items are being deposited with the U.S. Postal Service as first class mail in an envelope addressed to:

**Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450**

on 12/23/04

Laurie Delesandro
Laurie Delesandro

In Re Application of:

Ponder, K.

Serial No.: 10/937,376

Filed: September 8, 2004

Confirmation No.: 1006

Group Art Unit: Unknown

Examiner: Unknown

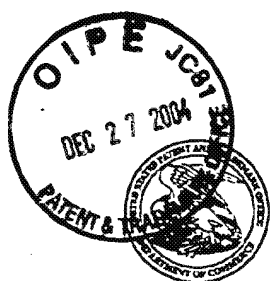
Docket No.: 821920-1030

For: Refrigerant with Lubricating Oil for Replacement of R-22 Refrigerant

The following is a list of documents enclosed:

Return Postcard
Response to Missing Parts
Declaration
Preliminary Amendment
Check for \$650.00 filing fee
Check for \$65.00 Surcharge

Further, the Commissioner is authorized to charge Deposit Account No. 20-0778 for any additional fees required. The Commissioner is requested to credit any excess fee paid to Deposit Account No. 20-0778.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/937,736	09/08/2004	Kenneth M. Ponder	821920-1030

24504
THOMAS, KAYDEN, HORSTEMEYER & RISLEY, LLP
100 GALLERIA PARKWAY, NW
STE 1750
ATLANTA, GA 30339-5948

CONFIRMATION NO. 1006

FORMALITIES LETTER



OC000000014246960

Date Mailed: 11/01/2004

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

12/28/2004 SDENBDB1 00000048 10937736

FILED UNDER 37 CFR 1.53(b)

01 FC:2001 395.00 OP
02 FC:2202 150.00 OP
03 FC:2051 65.00 OP

*Filing Date Granted*Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
Applicant must submit \$ 395 to complete the basic filing fee for a small entity.
- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of \$65 for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this letter.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of \$445 as a small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **\$905** for a Small Entity

- \$395 Statutory basic filing fee.
- \$65 Late oath or declaration Surcharge.
- Total additional claim fee(s) for this application is **\$445**

Repln. Ref: 12/28/2004 SDENBDB1 0010332500
CEN: 200776 Name/Number: 10937736
FC: 9204 \$40.00 CR

Repln. Ref: 12/28/2004 SDENBDB1 0010332500
CEN: 200776 Name/Number: 10937736
FC: 9204 \$65.00 CR

- \$88 for 2 independent claims over 3.
- \$207 for 23 total claims over 20.
- \$150 for multiple dependent claim surcharge.

Items Required To Avoid Processing Delays:

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A new oath or declaration, identifying this application number is required. The oath or declaration does not comply with 37 CFR 1.63 in that it:
- does not identify the residence (e.g., city and either state or foreign country) of each inventor.
- does not identify the complete mailing or post office address of each inventor.

Replies should be mailed to: Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

*A copy of this notice **MUST** be returned with the reply.*



Customer Service Center

Initial Patent Examination Division (703) 308-1202

PART 2 - COPY TO BE RETURNED WITH RESPONSE



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Docket No.: 821920-1030

PONDER, K..

Serial No.: 10/937,736

Confirmation No. 1006

Filing Date: September 8, 2004-12-23

For: **Refrigerant with Lubricating Oil for Replacement of R-22 Refrigerant**

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

In regard to the above-referenced application, the Applicant submits the following preliminary amendments and remarks to be respectively entered and considered prior to examination.

IN THE SPECIFICATION

Amend the title as follows:

~~ENVIRONMENTALLY SAFER REPLACEMENT REFRIGERANT WITH
NAPHTHENIC LUBRICATING OIL FOR REFRIGERANT REPLACEMENT OF R22-BASED
REFRIGERATION SYSTEMS REFRIGERANT~~

IN THE CLAIMS

Please amend the claims to read as follows wherein changes in a claim are shown by strikethrough for deleted matter and underlining for added matter:

1. (Currently Amended) In an apparatus ~~for refrigerating that is designed for use with ozone layer damaging chlorodifluoromethane refrigerant known as R-22~~, the improvement comprising substituting the chlorodifluoromethane with a substitute blend refrigerant containing a lubricant ~~less damaging to the Earth's ozone layer than chlorodifluoromethane~~,

said substitute refrigerant consisting of:

about 40% to about 45% by weight pentafluoroethane;

about 55% to about 60% by weight tetrafluoroethane; and

said substitute refrigerant packaged with about 0% to about 20% by weight of the refrigerant with a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and tetrafluoroethane.

2. (Original) The invention according to Claim 1, the lubricating oil having the following components:

65-88% hydrotreated light napthenic distillate, and

10-20% solvent refined light napthenic distillate petroleum.

3. (Original) The invention according to claim 1 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

4. (Original) The invention according to claim 1 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 42% by weight to said tetrafluoroethane present in an amount of about 58% by weight.

5. (Original) The invention according to claim 1 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight.

6. (Currently Amended) A method for refilling an apparatus ~~for refrigeration that is~~ designed for use with ~~ozone-layer-damaging~~ chlorodifluoromethane refrigerant, the method comprising:

(1) supplying a substitute refrigerant under pressure, in a cylinder can fitted with an outlet compatible with a chlorodifluoromethane recharging manifold of the apparatus; and

(2) adding to said apparatus via the manifold a substitute refrigerant for chlorodifluoromethane, ~~wherein~~ said substitute refrigerant ~~consists~~ consisting of:

about 40% to about 45% by weight pentafluoroethane ;

about 55% to about 60% by weight tetrafluoroethane; and

said substitute refrigerant packaged with about 0% to about 20% by weight of the refrigerant of a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and tetrafluoroethane.

7. (Currently Amended) The ~~invention~~ method according to claim 6, the lubricating oil having the following components:

65-85% hydrotreated light napthenic distillate, and

10-20% solvent refined light napthenic distillate petroleum.

8. (Currently Amended) The ~~invention~~ method according to claim 6 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

9. (Currently Amended) The ~~invention~~ method according to claim 6 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 42% by weight to said tetrafluoroethane present in an amount of about 58% by weight.

10. (Currently Amended) The ~~invention~~ method according to claim 6 wherein in the substitute refrigerant said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight.

11. – 20. (Cancelled)

21. (Currently Amended) A refrigerant consisting of:

about 40% to about 45% by weight pentafluoroethane;

about 55% to about 60% by weight tetrafluoroethane; ~~and~~

said refrigerant packaged with about 0% to about 20% by weight of the refrigerant of a lubricating oil that is soluble in chlorodifluoromethane, pentafluoroethane and tetrafluoroethane.

22. (Original) The invention according to claim 21, the lubricating oil having the following components:

65-85% hydrotreated light napthenic distillate, and
10-20% solvent refined light napthenic distillate petroleum.

23. (Original) A refrigerant according to claim 21 wherein said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight.

24. (Original) A refrigerant according to claim 21 wherein said pentafluoroethane is present in the ratio of about 45% by weight to said tetrafluoroethane present in an amount of about 55% by weight with a napthenic lubricant.

25. (Original) A refrigerant according to claim 21 wherein said pentafluoroethane is present in the ratio of about 40% by weight to said tetrafluoroethane present in an amount of about 60% by weight with a napthenic lubricant.

26. (Cancelled)

27. (Currently Amended) The ~~invention~~ refrigerant according to ~~any one of claims 2, 7, 12, 17, and 22~~ claim 21, wherein the lubricating oil further includes an acrylic polymer or a corrosion inhibitor or both.

28. (Currently Amended) The ~~invention~~ refrigerant according to ~~any one of claims 2, 6, 11, 16, and Claim~~ Claim 21, wherein the lubricating oil is selected from the group consisting of naphthenic based lubricants, paraffinic based lubricants and mixtures thereof, synthetic alkyl aromatic lubricants, synthetic alkyl aromatic lubricants mixed with mineral oil, synthetic alkyl aromatic lubricants mixed with polyol ester, mineral oil, and polyol ester.

29. (Currently Amended) The ~~invention~~ refrigerant according to claim ~~28~~ 21, wherein the ~~synthetic alkyl aromatic lubricant includes~~ lubricating oil is an alkylbenzene-based lubricating oil.

30. (New) The invention according to claim 1, wherein the apparatus is selected from the group consisting of refrigeration equipment, air-conditioning equipment, and HVAC equipment.

31. (New) The invention according to claim 1, wherein the lubricating oil includes an additive selected from the group consisting of acrylic polymer, a corrosion inhibitor and mixtures thereof.

32. (New) The invention according to claim 1, wherein the lubricating oil is selected from the group consisting of naphthenic based lubricants, paraffinic based lubricants and mixtures thereof, synthetic alkyl aromatic lubricants, synthetic alkyl aromatic lubricants mixed with mineral oil, synthetic alkyl aromatic lubricants mixed with polyol ester, mineral oil, and polyol ester.

33. (New) The invention according to claim 1, wherein the lubricating oil is an alkylbenzene-based lubricating oil.

34. (New) The method according to claim 6, wherein the apparatus is selected from the group consisting of refrigeration equipment, air-conditioning equipment, and HVAC equipment.

35. (New) The method according to claim 6, wherein the lubricating oil includes an additive selected from the group consisting of acrylic polymer, a corrosion inhibitor and mixtures thereof.

36. (New) The method according to claim 6, wherein the lubricating oil is selected from the group consisting of naphthenic based lubricants, paraffinic based lubricants and mixtures thereof, synthetic alkyl aromatic lubricants, synthetic alkyl aromatic lubricants mixed with mineral oil, synthetic alkyl aromatic lubricants mixed with polyol ester, mineral oil, and polyol ester.

37. (New) The method according to claim 6, wherein the lubricating oil is an alkylbenzene-based lubricating oil.

REMARKS

Applicant submits this Preliminary Amendment to amend the title and claims.

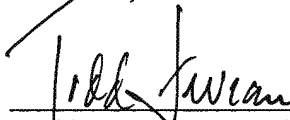
It is believed that the foregoing amendments and additions add no new matter to the present application.

Favorable action in regard to the application is earnestly solicited.

Respectfully submitted,

**THOMAS, KAYDEN, HORSTEMEYER &
RISLEY, L.L.P.**

By:


Todd Deveau, Reg. 29,526

100 Galleria Parkway
Suite 1750
Atlanta, Georgia 30339-5948
(770) 933-9500

Docket No. 821920-1030



RX TIME 12/22/04 14:40

LOCATION: 7707770599

DECLARATION FOR PATENT APPLICATION

Attorney Docket No: 821920-1030

As the below named inventor(s), I/we hereby declare that:

Our residences, post office addresses and citizenships are as stated below next to our names.
We believe we are the original, first, and joint inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled **Environmentally Safer Replacement Refrigerant with Napthenic Oil for Refrigerant R22-Based Refrigeration Systems**, the specification of which:

☐ is attached hereto.
☒ was filed on September 8, 2004 as Application Serial No. 10/937,736.
☐ was filed on _____ under U.S. Express Mail No. _____;
☐ is set forth in PCT International Application No. _____;
filed on _____ and as amended Under PCT Article 19 on _____ (if any).

I/we hereby state that I/we have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I/we acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I/we hereby claim foreign priority benefits under Title 35, United States Code, 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America listed below and have also identified below any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed: **NOT APPLICABLE**.

I/we hereby appoint all attorneys and agents of Thomas, Kayden, Horstemeyer & Risley, LLP, who are listed under the USPTO Customer Number shown below as my/our attorneys and agents to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, recognizing that the specific attorneys and agents listed under that Customer Number may be changed from time to time at the sole discretion of Thomas, Kayden, Horstemeyer & Risley, LLP, and request that all correspondence be addressed to the address filed under the same USPTO Customer Number.

24504

Please address all telephone calls, in the first instance, to **Todd Deveau**
(770) 933-9500.

at telephone number:

Address all correspondence to:

Todd Deveau
THOMAS, KAYDEN, HORSTEMEYER
& RISLEY, L.L.P.
100 Galleria Parkway, N.W., Suite 1750
Atlanta, Georgia 30339-5948

Page 1 of 3

Docket No. 821920-1030

I/we hereby declare that all statements made herein of my/our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statement and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of First Inventor: Kenneth M PonderResidence: 105 Highland View Drive, Cumming, Georgia 30040 US Citizenship: USPost Office Address: 105 Highland View Drive, Cumming, Georgia 30040 USInventor's Signature: Date: 12/22/04

Page 2 of 3