PTO-1390 (05-13)
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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

Attorney Docket No.	
JMG001	
U.S. Application No. (if known, see 37 CFR 1.5)	

International Application No.	International Filing Date	Priority Date Claimed
PCT/US13/75126	13 December 2013	14 December 2012

Title of Invention
Appliance Immersion Cooling Sytem

First Named Inventor
Christopher L. Boyd

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☑ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). NOTE: The express request under 35 U.S.C. 371(f) will not be effective unless the requirements under 35 U.S.C. 371(c)(1), (2), and (4) for payment of the basic national fee, copy of the International Application and English translation thereof (if required), and the oath or declaration of the inventor(s) have been received.
2. ☐ A copy of the International Application (35 U.S.C. 371(c)(2)) is attached hereto (not required if the International Application was previously communicated by the International Bureau or was filed in the United States Receiving Office (RO/US)).
3. An English language translation of the International Application (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
4. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))
   a. ☐ is attached.
   b. ☐ was previously filed in the international phase under PCT Rule 4.17(iv).

Items 5 to 8 below concern amendments made in the international phase.

PCT Article 19 and 34 amendments

5. ☐ Amendments to the claims under PCT Article 19 are attached (not required if communicated by the International Bureau) (35 U.S.C. 371(c)(3)).
6. ☐ English translation of the PCT Article 19 amendment is attached (35 U.S.C. 371(c)(3)).
7. ☐ English translation of annexes (Article 19 and/or 34 amendments only) of the International Preliminary Examination Report is attached (35 U.S.C. 371(c)(5)).

Cancellation of amendments made in the international phase

8a. ☐ Do not enter the amendment made in the international phase under PCT Article 19.

8b. ☐ Do not enter the amendment made in the international phase under PCT Article 34.

NOTE: A proper amendment made in English under Article 19 or 34 will be entered in the U.S. national phase application absent a clear instruction from applicant not to enter the amendment(s).

The following items 9 to 17 concern a document(s) or information included.

9. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
10. ☐ A preliminary amendment.
11. ☐ An Application Data Sheet under 37 CFR 1.76.
12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b).
13. ☐ A power of attorney and/or change of address letter.
14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821-1.825.
15. ☐ Assignment papers *(cover sheet and document(s))*. Name of Assignee: _____
16. ☐ 37 CFR 3.73(c) Statement *(when there is an Assignee)*.

This collection of information is required by 37 CFR 1.414 and 1.491-1.492. 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. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 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, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

U.S. APPLN. No. (if known – see 37 CFR 1.5)	INTERNATIONAL APPLICATION No.	ATTORNEY DOCKET No.
	PCT/US13/75126	JMG001

17. ☐ Other items or information:

The following fees have been submitted.	CALCULATIONS	PTO USE ONLY
18. ☑ Basic national fee (37 CFR 1.492(a)) **$280**	$ 280	
19. ☐ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0** All other situations **$720**	$ 0	
20. ☐ Search fee (37 CFR 1.492(b)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority ..... **$120** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB ..... **$480** All other situations **$600**	$ 0	
TOTAL OF 18, 19, and 20 =	$ 280	
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). Fee for each additional 50 sheets of paper or fraction thereof **$400**		

Total Sheets	Extra Sheets	Number of each addition 50 or fraction thereof (round **up** to a whole number)	RATE	
- 100 =	/ 50 =		x **$400**	$

Surcharge of **$140.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		x **$80**	$	
Independent claims	- 3 =		x **$420**	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			**+ $780**	$	
Processing fee of **$140.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). **+**				$	
TOTAL OF ABOVE CALCULATIONS =				$ 280	
☑ **Applicant asserts small entity status.** See 37 CFR 1.27. Fees above are reduced by ½.					
☐ **Applicant certifies micro entity status.** See 37 CFR 1.29. Fees above are reduced by ¾. Applicant must attach form PTO/SB/15A or B or equivalent.					
TOTAL NATIONAL FEE =				$ 140	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property. **+**				$	
TOTAL FEES ENCLOSED =				$ 140	
				Amount to be refunded:	$
				Amount to be charged:	$

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees.

c. ☐ The Director is hereby authorized to charge additional fees which may be required, or credit any overpayment, to Deposit Account No. _____ as follows:

i. ☐ any required fee.

ii. ☐ any required fee except for excess claims fees required under 37 CFR 1.492(d) and (e) and multiple dependent claim fee required under 37 CFR 1.492(f).

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended to pay fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

Correspondence Address

☑ The address associated with Customer Number: 44070 **OR** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone			
Email					

Signature	/Jeffrey Van Myers/	Date	30 April 2014
Name (Print/Type)	Jeffrey Van Myers	Registration No. (Attorney/Agent)	27,362

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Appliance Immersion Cooling System
First Named Inventor/Applicant Name:	Christopher L. Boyd
Filer:	Jeffrey Van Myers
Attorney Docket Number:	JMG001

Filed as Small Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Basic National Stage Fee	2631	1	140	140
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**140**

Electronic Acknowledgement Receipt

EFS ID:	18910689
Application Number:	14355533
International Application Number:	PCT/US13/75126
Confirmation Number:	3995
Title of Invention:	Appliance Immersion Cooling System
First Named Inventor/Applicant Name:	Christopher L. Boyd
Customer Number:	44070
Filer:	Jeffrey Van Myers
Filer Authorized By:	
Attorney Docket Number:	JMG001
Receipt Date:	30-APR-2014
Filing Date:	
Time Stamp:	18:29:28
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	$140
RAM confirmation Number	6082
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Application Data Sheet	JMG001_ADS_131214.pdf	1105043 f4b3870dc71f2e7c0d372ab6677946ea75455174	no	6
Warnings:					
Information:					
2	Documents submitted with 371 Applications	JMG001_National_140430.pdf	214118 7c99a800e10ed0b1453b69438cb3b1ab8bbae053	no	4
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	29264 6d17ae8ceb2415b6b1b5d5c37391b13740872c9a	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1348425	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/14 (11-08)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	JMG001-01
	Application Number	
Title of Invention	Appliance Immersion Cooling System	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Christopher	L.	Boyd	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Austin	State/Province	TX	Country of Residence i	US

Citizenship under 37 CFR 1.41(b) i: US

Mailing Address of Applicant:

Address 1	1309 Bonham Terrace		
Address 2			
City	Austin	State/Province	TX
Postal Code	78704	Country i	US

Applicant 2 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	James	P.	Koen	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Round Rock	State/Province	TX	Country of Residence i	US

Citizenship under 37 CFR 1.41(b) i: US

Mailing Address of Applicant:

Address 1	2302 Falcon Drive		
Address 2			
City	Round Rock	State/Province	TX
Postal Code	78681	Country i	US

Applicant 3 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	David	Christopher	Laguna	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Austin	State/Province	TX	Country of Residence i	US

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	JMG001-01
	Application Number	
Title of Invention	Appliance Immersion Cooling System	

Citizenship under 37 CFR 1.41(b) i	US				
Mailing Address of Applicant:					
Address 1	2011 E. 6th Street				
Address 2					
City	Austin	**State/Province**	TX		
Postal Code	78702	**Country**i	US		

Applicant 4 Remove

Applicant Authority ◉ Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Thomas	R.	Turner	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Georgetown	**State/Province**	TX	**Country of Residence** i	US
Citizenship under 37 CFR 1.41(b) i	US				
Mailing Address of Applicant:					
Address 1	4210 Malaga Dr.				
Address 2					
City	Georgetown	**State/Province**	TX		
Postal Code	78628	**Country**i	US		

Applicant 5 Remove

Applicant Authority ◉ Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Kenneth	D.	Swinden	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Hutto	**State/Province**	TX	**Country of Residence** i	US
Citizenship under 37 CFR 1.41(b) i	US				
Mailing Address of Applicant:					
Address 1	132 Mustang Creek North Loop				
Address 2					
City	Hutto	**State/Province**	TX		
Postal Code	78634	**Country**i	US		

Applicant 6 Remove

Applicant Authority ◉ Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Mario	Conti	Garcia	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Austin	**State/Province**	TX	**Country of Residence** i	US
Citizenship under 37 CFR 1.41(b) i	US				

Petitioner Green Revolution Cooling, Inc., Ex-1002
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PTO/SB/14 (11-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	JMG001-01
	Application Number	
Title of Invention	Appliance Immersion Cooling System	

Mailing Address of Applicant:					
Address 1	9624 Woody Ridge View				
Address 2					
City	Austin		**State/Province**	TX	
Postal Code	78730	**Country**[i]	US		

Applicant 7 Remove

Applicant Authority (•) Inventor ( ) Legal Representative under 35 U.S.C. 117 ( ) Party of Interest under 35 U.S.C. 118

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	John	Charles	Tribou	

Residence Information (Select One) (•) US Residency ( ) Non US Residency ( ) Active US Military Service

City	Austin	**State/Province**	TX	**Country of Residence**[i]	US

Citizenship under 37 CFR 1.41(b)[i] US

Mailing Address of Applicant:					
Address 1	9109 Middlebe Dr.				
Address 2					
City	Austin		**State/Province**	TX	
Postal Code	78750	**Country**[i]	US		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	44070		
Email Address	jvm@jvmyers.com	Add Email	Remove Email

Application Information:

Title of the Invention	Appliance Immersion Cooling System		
Attorney Docket Number	JMG001-01	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	7	**Suggested Figure for Publication (if any)**	1

PTO/SB/14 (11-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	JMG001-01
	Application Number	
Title of Invention	Appliance Immersion Cooling System	

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	44070		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	a 371 of international	PCT/US13/75126	2013-12-13
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/US13/75126	non provisional of	61/737200	2012-12-14
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/US13/75126	non provisional of	61/832211	2013-06-07

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country [i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			◉ Yes ○ No

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	JMG001-01
	Application Number	
Title of Invention	Appliance Immersion Cooling System	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1 Remove

If the Assignee is an Organization check here. ☒

Organization Name	Midas Green Technology, LLC		
Mailing Address Information:			
Address 1	8500 Shoal Creek		
Address 2	Building 2, Suite K		
City	Austin	**State/Province**	TX
Country [i]	US	Postal Code	78757
Phone Number	512.420.8099	Fax Number	
Email Address	jim@midasgreentech.com		

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey Van Myers/			Date (YYYY-MM-DD)	2013-12-14
First Name	Jeffrey Van	Last Name	Myers	Registration Number	27362

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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 July 2014 (17.07.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/109869 A1

(51) International Patent Classification:
G06F 1/20 (2006.01)

(21) International Application Number:
PCT/US2013/075126

(22) International Filing Date:
13 December 2013 (13.12.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/737,200 14 December 2012 (14.12.2012) US
61/832,211 7 June 2013 (07.06.2013) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,

[Continued on next page]

(54) Title: APPLIANCE IMMERSION COOLING SYSTEM

(57) Abstract: A appliance immersion tank system comprising: a generally rectangular tank adapted to immerse in a dielectric fluid a plurality of appliances, each in a respective appliance slot distributed vertically along, and extending transverse to, the long axis of the tank; a primary circulation facility adapted to circulate the dielectric fluid through the tank; a secondary fluid circulation facility adapted to extract heat from the dielectric fluid circulating in the primary circulation facility, and to dissipate to the environment the heat so extracted; and a control facility adapted to coordinate the operation of the primary and secondary fluid circulation facilities as a function of the temperature of the dielectric fluid in the tank.

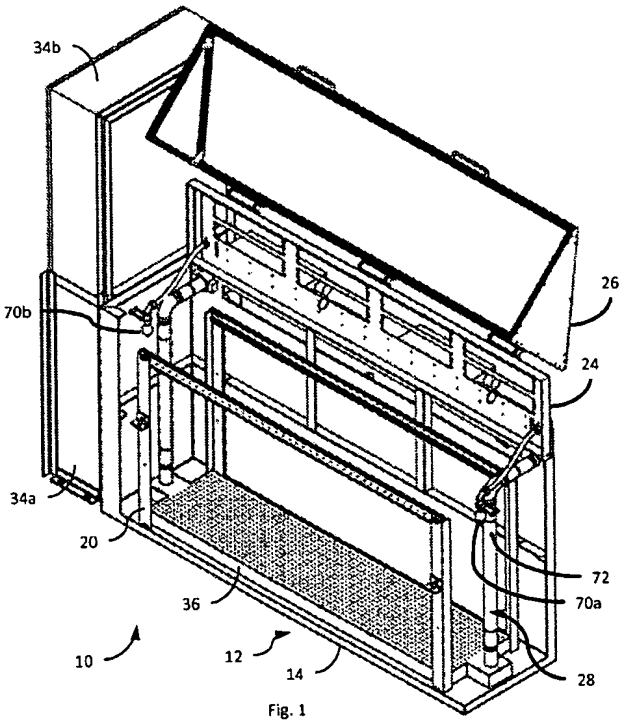


Fig. 1

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TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

APPLIANCE IMMERSION COOLING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is related to the following Provisional Applications:

1. Serial Number 61/737,200, filed 14 December 2012 ("*First Parent Provisional*"); and

2. Serial Number 61/832,211, filed 7 June 2013 ("*Second Parent Provisional*");

and hereby claims benefit of the filing dates thereof pursuant to 37 CFR §1.78(a)(4). (Collectively, "*Parent Provisionals*"). The subject matter of the Parent Provisionals, each in its entirety, is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention.

[0002] The present invention relates generally to electrical appliance cooling systems, and, in particular, to an improved appliance immersion cooling system and method of operation.

2. Description of the Related Art.

[0003] In general, in the descriptions that follow, we will *italicize* the first occurrence of each special term of art which should be familiar to those skilled in the art of *immersion cooling* systems. In addition, when we first introduce a term that we believe to be new or that we will use in a context that we believe to be new, we will **bold** the term and provide the definition that we intend to apply to that term.

[0004] US 4,590,538, "Immersion Cooled High Density Electronic Assembly", Cray (filed 18 November 1981 and issued 20 May 1986) ("Cray"), is an early example of an immersion system for cooling electronic components during normal operation. On information and belief, the machine disclosed therein was the Cray-2 super-computer ("Cray-2") manufactured by Cray Research, Inc. ("Cray Research"), of Chippewa Falls, Wisconsin. Of particular interest to the present application is the description of the significant advantages resulting from

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using an *electrically non-conductive* or *dielectric fluid* to extract heat from electronic circuit assemblies during normal operation (see, *e.g.*, col. 1, line 66 - col. 2, line 29).

[0005] On information and belief, Cray Research released, in 1985, a marketing brochure entitled "The CRAY-2 Computer System" (a copy of which is submitted herewith) describing the Cray-2. Of particular interest in this brochure is the description therein of the significant advantages resulting from using a dielectric fluid to extract heat from electronic circuit assemblies during normal operation (see, pages 10 and 13).

[0006] US 5,167,511, "High Density Interconnect Apparatus", Krajewski, *et al.* (issued 27 November 1992) ("Krajewski"), discloses another example of an immersion system for cooling electronic components during normal operation (see, *e.g.*, col. 2, lines 43-51). On information and belief, a machine implementing the Krajewski system was also marketed by Cray Research as a follow-on super-computer to the Cray-2.

[0007] One particular problem in the vertical-stack-type systems disclosed in the above references is the necessity of draining the cooling fluid whenever physical access to the electronic modules was required. In general, such an operation, besides being time consuming, requires the entire system to be switched off, especially if the component requiring attention is an essential element in the system architecture, such as the central processing unit ("CPU"). One possible solution to this problem is to immerse circuit assemblies vertically into a tank containing the cooling fluid such that each of the various assemblies can be withdrawn independently from the tank for servicing, replacement, upgrade, *etc.* One interesting example of such a system is disclosed in a web-presentation entitled "Puget Custom Computer's mineral-oil-cooled PC", by Nilay Patel ("Puget") (posted 12 May 2007 at 11:57AM; a copy of which is submitted herewith). As noted by the author, the lack of supplemental apparatus in the Puget system to extract waste heat from the oil inherently limited its operating capabilities.

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[0008] Another problem with the Cray Research systems in particular is the nature and cost of the chosen cooling fluid: *fluorocarbon* liquids. As is known, other dielectric fluids, such as *mineral oil*, have better heat transfer characteristics; of course, being an oil, the use thereof does represent a greater residue problem on modules that may be repairable. Notwithstanding, the Puget system implemented precisely this design choice.

[0009] US Patent Application Publication 2011/0132579, "Liquid Submerged, Horizontal Computer Appliance Rack and Systems and Method of Cooling such a Appliance Rack", Best, *et al.* ("Best"), discloses a appliance immersion tank system, include support apparatus for extracting waste heat from the tank cooling fluid and dissipating to the environment the heat so extracted. Although an improvement in several respects over the prior art discussed above, this system exhibits, *inter alia*, the following problems: generally non-uniform flow patterns through the several appliance slots within the tank, potentially resulting in uneven cooling across all slots; constricted dielectric fluid supply and return ports resulting in unnecessarily high fluid flow velocities at the respective points of connection to the tank; poor *scalability*; and inadequate attention to *fail-soft operation*.

[0010] The subject matter of all of the prior art references discussed above, each in its entirety, is expressly incorporated herein by reference.

[0011] We submit that what is needed is an improved appliance tank immersion system and method of operation. In particular, we submit that such a system should provide performance generally comparable to the best prior art techniques but more efficiently and effectively than known implementations of such prior art techniques.

BRIEF SUMMARY OF THE INVENTION

[0012] In accordance with a preferred embodiment of our invention, ...

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0013] Our invention may be more fully understood by a description of certain preferred embodiments in conjunction with the attached drawings in which:

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[0014] Fig. 1 illustrates, in partial cut-away form, a front perspective of a tank module of an appliance immersion cooling system constructed in accordance with our invention;

[0015] Fig. 2 illustrates a rear perspective of the tank module shown in Fig. 1;

[0016] Fig. 3 illustrates a close-up perspective of a detail A of Fig. 2;

[0017] Fig. 4 illustrates a close-up perspective of a detail B of Fig. 2;

[0018] Fig. 5 illustrates, in perspective view, several details of the tank shown in Fig. 1, with special emphasis on the dielectric fluid recovery weir integrated into the long rear wall of the tank;

[0019] Fig. 6 illustrates, in cross-section view, the section C-C in Fig. 5;

[0020] Fig. 7 illustrates, in perspective view, the plenum facility shown in Fig. 1;

[0021] Fig. 8 illustrates, in top plan view, the orifice plate portion of the plenum facility shown in Fig. 7;

[0022] Fig. 9 illustrates, in perspective view, the chamber portion of the plenum facility shown in Fig. 7;

[0023] Fig. 10 illustrates, in top plan view, a plurality of appliance slots distributed vertically along, and extending transverse to, a long axis of the tank of Fig. 1;

[0024] Fig. 11 illustrates, in longitudinal cross-sectional view, the plurality of appliance slots distributed vertically along, and extending transverse to, the long axis of the tank of Fig. 1;

[0025] Fig. 12 illustrates, in flow schematic form, one instantiation of a flow arrangement suitable for implementing our invention; and

[0026] Fig. 13 illustrates, in control schematic form, one instantiation of a flow control facility suitable for implementing our invention.

[0027] In the drawings, similar elements will be similarly numbered whenever possible. However, this practice is simply for convenience of reference and to avoid unnecessary proliferation of numbers, and is not intended to imply or

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suggest that our invention requires identity in either function or structure in the several embodiments.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Shown in Fig. 1 (front view) and Fig. 2 (rear view) is a tank module 10 adapted for use in an appliance immersion cooling system constructed in accordance with a preferred embodiment of our invention. For convenience of reference, we have illustrated in Fig. 1 the tank facility 12 of the immersion module 10 in partial cut-away to emphasize several important internal facilities; we have shown the tank facility 12 in isolation in Fig. 5. In general, the tank facility 12 comprises: a tank 14 adapted to immerse in a dielectric fluid a plurality of electrical appliances 16, *e.g.*, contemporary computer *servers* (see, *e.g.*, Fig. 11), each in a respective appliance slot 18a distributed vertically along, and extending transverse to, a long axis of the tank 14 (see, generally, Fig. 10); an appliance rack facility 20 of convention design adapted to suspend the appliances 16 (see, *e.g.*, Fig. 11) in respective appliance slots 18 (see, Fig. 10); a weir 22 (best seen in isolation in Fig. 5 and Fig. 6), integrated horizontally into one long wall of the tank 14 adjacent all appliance slots 18, and adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each of the appliance slots 18; an interconnect panel facility 24 attached to the upper rear edge of the tank 14 and adapted to mount various appliance *power distribution* equipment, cable interconnection panels and the like (none shown); and a cover 26 adapted to be opened and closed from the front of the tank 14 (and which may include a translucent portion to allow viewing of the interior of the tank 14 when in the closed position). In addition to the tank facility 12, the immersion module 10 comprises: a primary circulation facility 28 (portions of which are shown in both Fig. 1 and Fig. 2); a secondary fluid circulation facility 30 (of which only redundant heat exchangers 32a and 32b are shown in Fig. 2); and control equipment cabinets 34a and 34b, each adapted to accommodate the module status and control equipment associated with a respective one of the primary circulation facilities 28a and 28b (see, Fig. 13).

[0029] As can be best seen in Fig. 2, the primary circulation facility 28 (comprising redundant sub-facilities 28a and 28b) comprises both passive

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(*conduits, couplers, etc.*) and active (*valves, pumps, sensors, etc.*) components; a subset of the passive components are shared, whereas, in general, the active components are duplicated and adapted to cooperate in operation as separate, redundant sub-facilities. Excluding the tank 14, the primary shared component is the plenum facility 36 (see, Fig. 1 and Fig. 7) comprising an orifice plate 36a (see, Fig. 8) and a plenum chamber 36b (see, Fig. 9). As can be seen in Fig. 1, cooled dielectric fluid is pumped into both ends of the plenum facility 36 via a shared distribution header 38 (see, Fig. 2 and Fig. 3). In general, the plenum plate 36a comprises at least one row of orifices vertically aligned with each appliance slot 18a, with the dimensions and flow rates of each set being adapted to provide substantially equal flow of the dielectric fluid upwardly into each appliance slot 18a. Preferably, each appliance slot 18a is supplied via several rows of orifices, thus generally tending to reduce the volume of the dielectric fluid exiting each orifice and to make the flow of dielectric fluid more uniform upwardly through the appliance slots 18. One further shared component is the dielectric fluid recovery facility 40 (Fig. 2) comprising a dielectric fluid recovery reservoir 42 (see, Fig. 3, Fig. 4 and Fig. 13) positioned vertically beneath the overflow lip of the weir 22 and adapted smoothly to receive the dielectric fluid as it flows over the weir 22; the dielectric fluid recovery reservoir 42 is further adapted to allow the recovered fluid to be removed from the reservoir 42 via redundant recovery ports 44a and 44b (only port 44a can be seen in Fig. 2 as the port 44b is obscured by the heat exchanger 32a; but see Fig. 12). As can be seen in both Fig. 3 and Fig. 4, we consider it desirable to provide a *vortex breaker* at the input of each of the recovery ports 44. Also, we provide a removable recovery reservoir cover 46 adapted to also cover a major portion of the distribution header 38; note that, in both Fig. 2 and Fig. 3, we have illustrated the reservoir cover 46 in a partially raised orientation so as to better depict details that would otherwise be obscured. Note that we have constructed the reservoir 42 such that the average height of dielectric fluid above the recovery ports 44 develops sufficient *hydrostatic head* to meet the requirements of the pumps 48, while also tending to minimize the likelihood of breaking suction during normal operation.

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[0030] At this point in the primary circulation facility 28, we provide fully redundant sub-facilities 28a and 28b, each comprising a primary circulation pump (48a and 48b) and associated passive and active components which, collectively, provide the motive power for circulating the dielectric fluid through the shared components and tank 14. As can be generally seen, each of these sub-facilities 28a and 28b is adapted to recover the dielectric fluid exiting the tank 14 via the weir 22, re-pressurize the recovered fluid, pass the re-pressurized fluid through a respective one of the heat exchangers 32a and 32b, and then back to the plenum facility 36 via the header 38.

[0031] Shown in Fig. 12 is one flow arrangement suitable for integrating our tank module 10 into a fully redundant, appliance immersion cooling system, comprising the primary circulation facility 28 and the secondary fluid circulation facility 30. In general, the secondary fluid circulation facility 30 comprises redundant secondary circulation sub-facilities 30a and 30b, each of which is adapted to circulate a cooling fluid, *e.g.*, treated water, through the respective heat exchanger 32a and 32b to extract heat from dielectric fluid counter-circulating therethrough and to dissipate to the environment the heat so extracted. In the illustrated embodiment, each of the secondary fluid sub-facilities 30a and 30b comprise conventional cooling towers 50a (including fan facility 52a) and 50b (including fan facility 52b), and secondary circulation pumps 54a and 54b. To facilitate flexible operation in installations including multiple immersion modules 10 in combination with a plurality of secondary circulation sub-facilities 30, a common header arrangement can be implemented as illustrated in the secondary fluid circulation loop, with flow control valves located at key flow control points as is known.

[0032] Shown in Fig. 13 is a control facility 56 adapted to monitor and control the operation of both the immersion module 10 (including all active components of the primary circulation facility 28), and the secondary fluid circulation facility 30. As will be evident to those skilled in this art, efficient operation of our immersion module 10 requires continuous monitoring and control of several essential operating parameters, including fluidic temperatures, pressures, conductivity and *pH* at several points in the primary and secondary circulation loops.

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Although the several sensory and control functions can be implemented using traditional dedicated hardware components, we prefer to employ at least one *programmable logic controller* ("*PLC*"), commercially available from any of a number of respected vendors, *e.g.*, the *Allen-Bradley* brand of PLCs from Rockwell Automation, Inc. In the instantiation illustrated in Fig. 13, we have depicted: a primary controller 58a adapted to monitor and control the operation of the primary circulation sub-facility 28a as a function of the temperature of the dielectric fluid in the tank 14; a secondary controller 60a adapted to monitor and control the operation of the secondary fluid circulation sub-facility 30a as a function of the temperature of the dielectric fluid flowing through the heat exchanger 32a; and a master controller 62 adapted to coordinate the activities of the primary controller 58a and secondary controller 60a. As can be seen, we have incorporated into the primary circulation sub-facility 28a: supply and return *sensors*, including a *temperature probe*, T, inserted into a *thermowell* (not shown) installed in the bottom of the reservoir 42 adjacent a respective return port 44a (note that, in Fig. 4, only one of the holes that receive the thermowells is illustrated, but both holes are illustrated in Fig. 12); a pair of sensor facilities, S, which may sense temperature, pressure and conductivity, as deemed desirable); and return (and, if desired, supply) *flow control valves* and controls for the primary circulation pump 48a; of course, a redundant set of these components exists for the primary circulation sub-facility 28b. In general, the goal is to maintain the temperature of the dielectric fluid in the tank 14 between a predetermined minimum temperature and a predetermined maximum temperature.

[0033] As noted above, we have provided separate control equipment cabinets 34a and 34b, each adapted to accommodate the several components comprising a respective one of the primary controllers 58a and 58b. For convenience of access, we prefer to co-locate with each of the cooling towers 50 a protective housing (not shown) for the respective secondary controller 60. Of course, the control facility 56 can be instantiated as a single, multi-module PLC facility, with similar or other combinations of monitoring devices as deemed most appropriate for a particular installation. Alternatively, one or more, and perhaps all, of the

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functions performed by the controllers 58, 60 and 62 may be implemented in the form of dedicated *application-specific software* executing on a conventional computer platform having the appropriate resources; indeed, it would be entirely feasible to implement the entire control facility 56 on a server 16 installed in a tank 14.

[0034] One desirable enhancement that we recommend is a remote control facility, implemented, *e.g.*, via the master controller 62 (or by way of a direct, per-controller *interface*), adapted to facilitate remote monitoring of system status (*e.g.*, temperatures, pressures, *etc.*) and control over system control parameters (*e.g.*, temperature and pressure limits, *etc.*) to the primary controllers 58 and secondary controllers 60. For example, using a conventional data communication hardware module 64, *e.g.*, an *ethernet* card implementing the *TCP/IP* protocol, a modern *web browser* can be adapted to provide a *graphical user interface* ("*GUI*") with sufficient functionality to facilitate monitoring and control of an entire installation from a remote location. Such a GUI may be implemented using any of a number of programming paradigms, *e.g.*, *PHP*, *.NET* and the like.

[0035] Operational control of redundant, continuous process flow systems is generally well known. Preferable, each of the several redundant sub-facilities are routinely activated to assure current functionality, and to allow the inactive sub-facility to be serviced according to an established schedule. We believe this continuous rotation of system resources to be so important that we recommend switching the sub-facilities at least once, and preferably, several times, per day; although this is possible to implement manually, we prefer to enable the master controller 62 to control the sequencing of the several switch-over operations. One further aspect of this sophistication in control is the ability to perform *stress testing* of the several sub-systems under controlled conditions so as to assure appropriate response to real-time emergencies.

[0036] In our First Parent Provisional, we have disclosed an alternate embodiment comprising an appliance immersion tank facility wherein the function of the plenum facility 36 is performed by a manifold facility comprising a ladder-arrangement of tubular spray bars, each bar of which supplies dielectric fluid to a respective appliance slot. As we noted, one particular advantage of this

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arrangement is that individual spray bars may be shut off if the respective appliance slot is not occupied and, thus, save energy. To further increase energy efficiency, we have provided optional vertical flow barriers adapted to partition the tank into an active portion, having active appliances, and a stagnant portion, having no active appliances. One further enhancement we disclosed is the provision of temperature sensors per appliance slot, such that the flow rate through each spray bar can be dynamically varied as a function of the temperature of the dielectric fluid exiting the respective slot. Other operative configurations will be readily perceived by those skilled in this art.

[0037] In a manner analogous to the embodiment described in our First Parent Provisional, it would be advantageous, from an energy point of view, to provide a plurality of flow barrier plates 66 (shown by way of example only in Fig. 11), each adapted to be attached to the top of the plenum facility 36 so as substantially to block the flow of the dielectric fluid through the row(s) of orifices in the plenum plate 36a corresponding to at least a respective one of the appliance slots 18a; an elastomeric layer (not shown) could be provided on the interface surface of the plate(s) 66 to enhance the sealing effect. Such an arrangement would allow the total flow through the plenum facility 36 to be adjusted, in the field, as a function of the actual number of active appliances 16 in the tank 14. Further, this arrangement can incorporate a relocatable vertical baffle plate 68 (see Fig. 11) adapted substantially to partition the tank 14 into an active portion 14a containing the active appliances 16 and an inactive portion 14b containing no appliances (or at least no active appliances 16); preferably, the baffle plate 68 is adapted to be mounted in the appliance rack facility 28 in a manner similar to an actual appliance 16 (the baffle plate 68 need not fully block the flow of dielectric fluid between the active portion 14a and inactive portion 14b, but only significantly impede the flow between these portions). Note that, in the example scenario illustrated in Fig. 11, we have shown one possible arrangement of a total of 8 active appliances 16 distributed across 16 appliance slots 18a so as to spread the total heat load across adjacent empty slots 18a. Such an optimal arrangement is possible only if less than a majority of the available appliance slots 18a are occupied by an active appliance 16. Clearly, such optional

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adjunct facilities enhance flexibility in operation, accommodating dynamic adjustment of the flow rates in the primary circulation sub-facilities 28a and 28b under variable heat loads, while providing opportunities to conserve energy that might otherwise be expended moving the dielectric fluid through the inactive portion 14b of the tank 14. Other operative configurations will be readily perceived by those skilled in this art.

[0038] In our Second Parent Provisional, we have disclosed another embodiment comprising a more conventional, less-modularized instantiation with appropriate flow and control facilities. In this embodiment, we chose to implement tank clusters, comprising, *e.g.*, 4 appliance immersion tank facilities, with substantially all of the other equipment being constructed from stand-alone, commercially available components. Such an arrangement offers greater opportunities to select and install improved components, or to add enhancements to the installation, as deemed desirable after initial installation. Other operative configurations will be readily perceived by those skilled in this art.

[0039] As we noted above with reference to the embodiment illustrated in Fig. 12, the secondary flow header facility is well adapted to allow any secondary circulation sub-facility 30 to be connected to any active heat exchanger 32. Such a facility provides great flexibility in dealing with unusual system conditions, especially in installations wherein the secondary circulation sub-facilities 30a and 30b are each sized to support a cluster of tank modules 10. Imagine, for example, that, while one of the secondary circulation facilities 30, say sub-facility 30a, is being serviced, the activities of the set of appliances 16 in one tank 14 in the cluster are higher than normal, resulting in a rise in temperature in that tank 14 above the desired maximum. In response, the master controller 62 can direct Primary Controllers 58a and 58b assigned to tank 14 to operate both of the primary circulation sub-facilities 28a and 28b simultaneously, *i.e.*, in parallel. Using the secondary flow header facility, the heat being extracted by both of the heat exchangers 32a and 32b may be dissipated using the resources of the single on-line secondary circulation sub-facility 30b. Thus, one clear advantage of this alternate embodiment is the ability dynamically to perform *load balancing* across

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all system resources. Other operative configurations to support sub-system load balancing will be readily perceived by those skilled in this art.

[0040] Preferably, one or more filters (not shown) are included in the flow path through each of the primary circulation sub-facilities 28a and 28b to remove any particulates or other undesirable foreign matter that may have been picked up by the dielectric fluid on its passage though the entire primary circulation facility 28; chemical sensors may also be provided to detect the presence of unexpected chemicals that may indicate failure of sub-components within one of the appliances 16. Similar components, such as pH sensors, may also included in the secondary fluid circulation facility 30.

[0041] As can be seen generally in Fig. 1, we provide a pair of low dielectric fluid level sensors 70a and 70b adapted to trigger an alarm signal in the event that, for whatever reason, the level of the dielectric fluid in the tank 14 drops below a predetermined minimum level. Additionally, the responsive primary controller 58 can initiate other actions to address the detected problem, including activating audio alarms, transmitting electronic alert signals and the like.

[0042] To solve a reciprocal problem, namely leakage from an external portion of the primary circulation loop 28 resulting in the dielectric fluid in the tank 14 being *back-siphoned* through the plenum facility 36, we recommend incorporating a *siphon breaker* 72 (see, Fig. 1) in the supply pipe at a predetermined location well above the plenum facility 36 but somewhat below the level of the weir 24. Such a siphon breaker can be as simple as a relatively small diameter hole 72 drilled through the supply pipe at the selected location; due to the relatively high viscosity of the dielectric fluid, even when heated, any resulting leakage during normal operation will be relatively insignificant. Other operative responses to address these and other unusual fluidic conditions will be readily perceived by those skilled in this art.

[0043] As is known (see, *e.g.*, Best), many conventional, commercially available electrical/electronic appliances include components that will not function correctly if immersed in a dielectric fluid, especially one as *viscous* as mineral oil: cooling fans and rotating media disk drives. In general, all cooling fans are

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unnecessary in an immersion cooling system and can be simply removed. The media drives, however, are usually necessary for normal appliance operation. One option is to remove each drive, totally seal the drive against fluid entry, and reinstall the now-sealed drive (pre-sealed drives are also available). Another option is to remove the drive and mount it on the interconnect panel facility 24; typically special cabling will be required to re-attach the drive to the internal appliance *socket*. Yet another option is to replace the rotating media drive with a *solid-state drive* having no moving components. Other operative configurations will be readily perceived by those skilled in this art.

[0044] It will be recognized that, in all of the embodiments described herein, emphasis was placed on minimizing the total volume of the dielectric fluid circulating throughout each immersion module 10. We submit that the key concept here is to move the secondary fluid to the point of heat exchange with the primary fluid, rather than to move the primary fluid to the point of heat exchange with the secondary fluid. Thus, in our preferred embodiment, all of the essential components of the primary circulation facility 28 are tightly co-located with the tank 14 so as to form a highly-integrated module. Further, our placement of the reservoir 42 outside of (but immediately adjacent to) the tank 14 tends to reduce the total volume of the dielectric fluid (as opposed to the alternative arrangement we proposed in our First Provisional, wherein a recovery trough was disposed within the tank 14); then, we positioned the components comprising the primary circulation sub-facilities 28 so as to be vertically beneath the *footprint* of the reservoir 42. In addition to conserving valuable floor space in a typical *data center* installation, the resulting modular configuration facilitates both easy initial installation and subsequent upgrade to efficiently satisfy increasing data center workloads. Indeed, our invention greatly enhances system *scalability*, a key concern to data center operators. Finally, our system-wide redundancy substantially assures fail-soft operation during periods of unusual environmental conditions, infrastructure instability or political unrest.

[0045] Although we have described our invention in the context of particular embodiments, one of ordinary skill in this art will readily realize that many

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modifications may be made in such embodiments to adapt either to specific implementations. By way of example, it will take but little effort to adapt our invention for use with electronic appliances other than contemporary servers; and to adjust the dimensions of the appliance accommodation slots accordingly. Similarly, practitioners in the art will readily recognize that other, known secondary circulation facilities may be employed effectively, including forced air, *vapor compression* systems, *earth-water sink loops*, *waste heat recovery and recycling* systems, and the like (see, *e.g.*, the several alternatives discussed in Best). Further, the several elements described above may be implemented using any of the various known manufacturing methodologies, and, in general, be adapted so as to be operable under either hardware or software control or some combination thereof, as is known in this art.

[0046] Thus it is apparent that we have provided an improved system and method of operation for immersion cooling of appliances and the like. In particular, we submit that such a method and apparatus provides performance generally comparable to the best prior art techniques but more efficiently and effectively than known implementations of such prior art techniques.

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CLAIMS

What we claim is:

1. An appliance immersion cooling system comprising:

a tank adapted to immerse in a dielectric fluid a plurality of electrical appliances, each in a respective appliance slot distributed vertically along, and extending transverse to, a long wall of the tank, the tank comprising:

a weir, integrated horizontally into the long wall of the tank adjacent all appliance slots, adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each appliance slot;

a primary circulation facility adapted to circulate the dielectric fluid through the tank, comprising:

a plenum, positioned adjacent the bottom of the tank, adapted to dispense the dielectric fluid substantially uniformly upwardly through each appliance slot;

a secondary fluid circulation facility adapted to extract heat from the dielectric fluid circulating in the primary circulation facility, and to dissipate to the environment the heat so extracted; and

a control facility adapted to coordinate the operation of the primary and secondary fluid circulation facilities as a function of the temperature of the dielectric fluid in the tank.

2. The system of claim 1 wherein the tank and primary circulation facility comprise a tightly co-located module.

3. The system of claim 1 wherein the tank further comprises:

an interconnect panel facility adapted to mount appliance support equipment.

4. The system of claim 1 wherein the primary circulation facility further comprises:

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at least first and second primary circulation sub-facilities, each adapted to operate independently to circulate the dielectric fluid through the tank;

wherein the control facility is further adapted to coordinate the operation of the first and second primary circulation sub-facilities and the secondary fluid circulation facilities so to maintain the temperature of the dielectric fluid in the tank substantially between a predetermined minimum temperature and a predetermined maximum temperature.

5. The system of claim 1 wherein the control facility further comprises a communication facility adapted to facilitate monitoring and control of the control facility from a remote location.

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6. A tank module adapted for use in an appliance immersion cooling system, the tank module comprising:

a tank adapted to immerse in a dielectric fluid a plurality of electrical appliances, each in a respective appliance slot distributed vertically along, and extending transverse to, a long wall of the tank, the tank comprising:

a weir, integrated horizontally into the long wall of the tank adjacent all appliance slots, adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each appliance slot;

a primary circulation facility adapted to circulate the dielectric fluid through the tank, comprising:

a plenum, positioned adjacent the bottom of the tank, adapted to dispense the dielectric fluid substantially uniformly upwardly through each appliance slot; and

a control facility adapted to control the operation of the primary fluid circulation facility as a function of the temperature of the dielectric fluid in the tank.

7. The module of claim 6 wherein the tank and primary circulation facility comprise a tightly co-located module.

8. The module of claim 6 wherein the tank further comprises:

an interconnect panel facility adapted to mount appliance support equipment.

9. The module of claim 6 wherein the primary circulation facility further comprises:

at least first and second primary circulation sub-facilities, each adapted to operate independently to circulate the dielectric fluid through the tank;

wherein the control facility is further adapted to coordinate the operation of the first and second primary circulation sub-facilities so to maintain the temperature

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of the dielectric fluid in the tank substantially between a predetermined minimum temperature and a predetermined maximum temperature.

10. The module of claim 6 wherein the control facility further comprises a communication facility adapted to facilitate monitoring and control of the control facility from a remote location.

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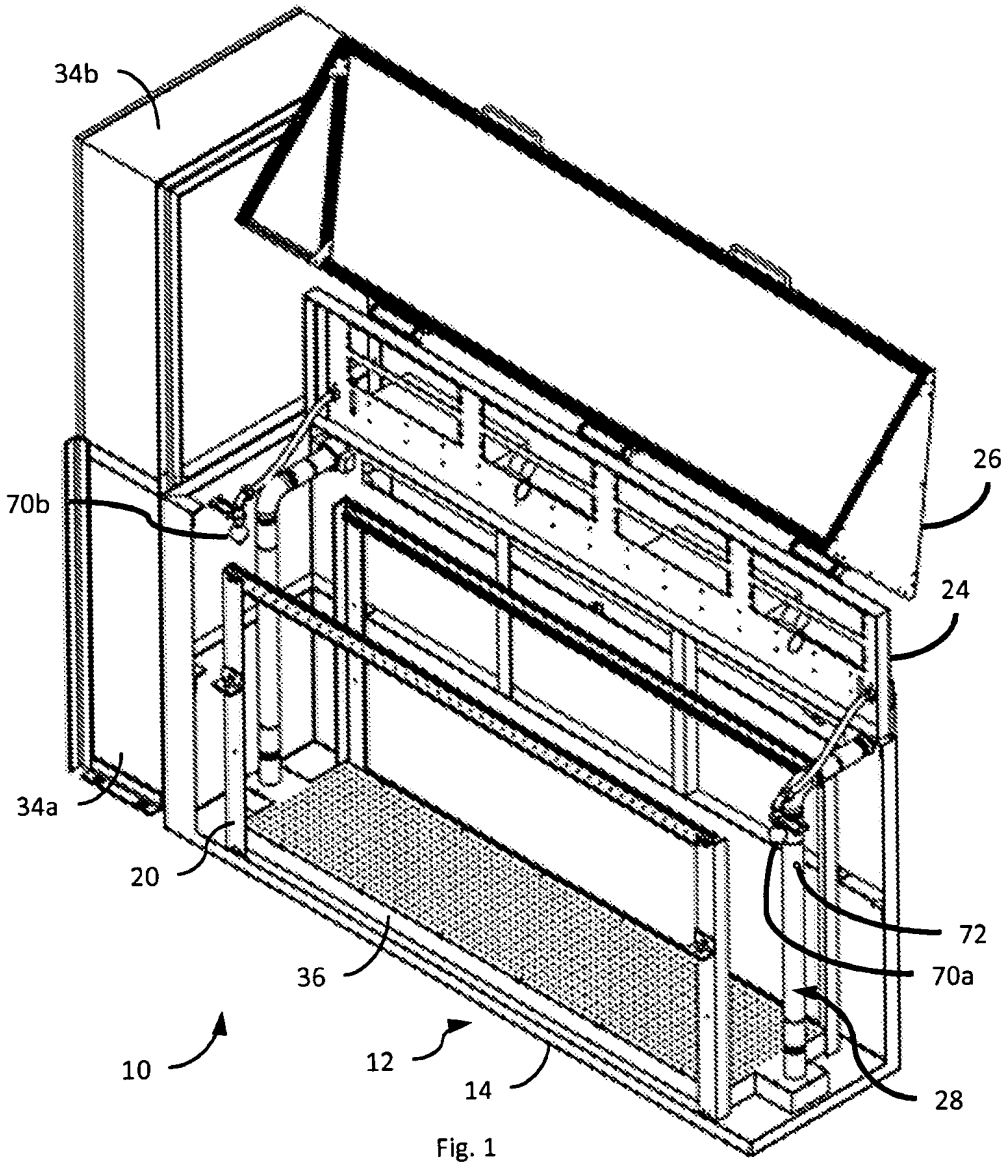


Fig. 1

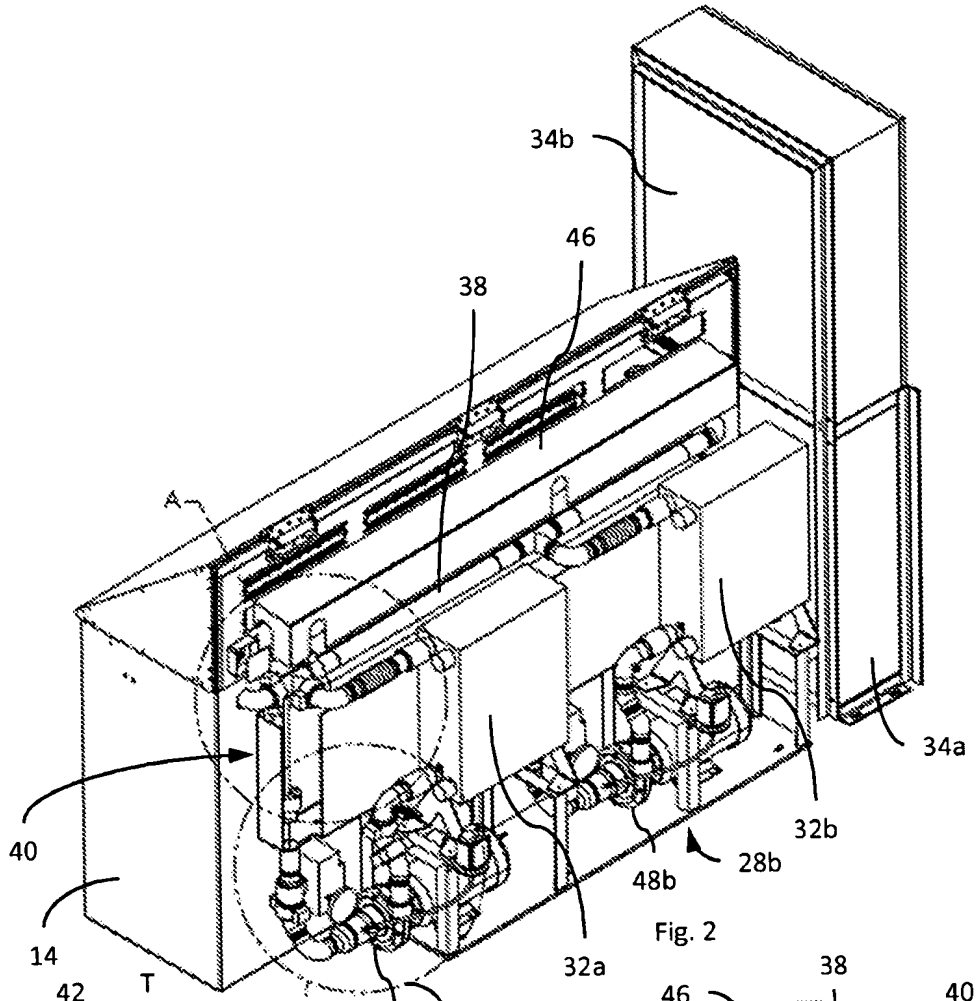


Fig. 2

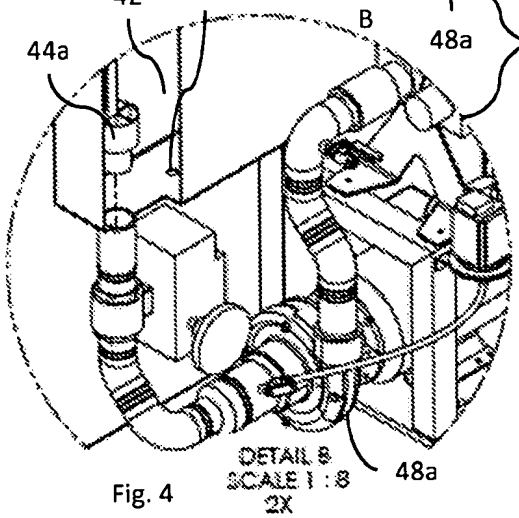


Fig. 4

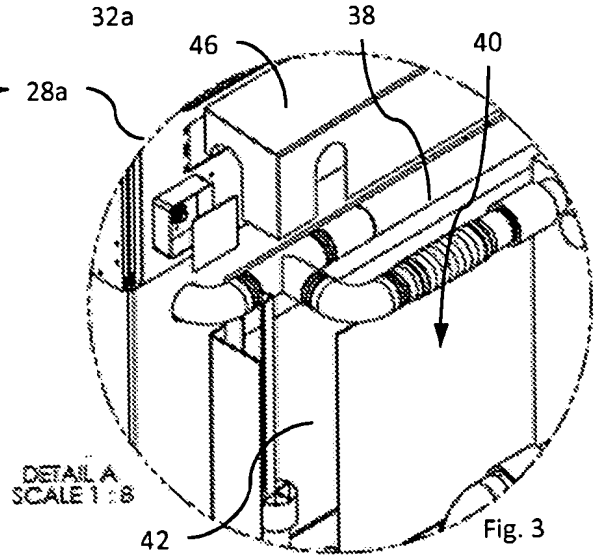


Fig. 3

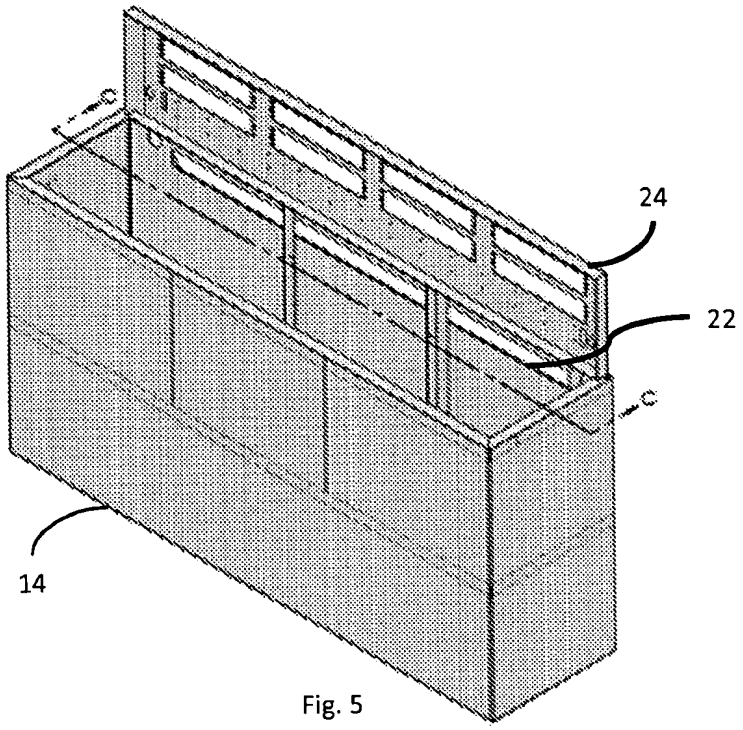
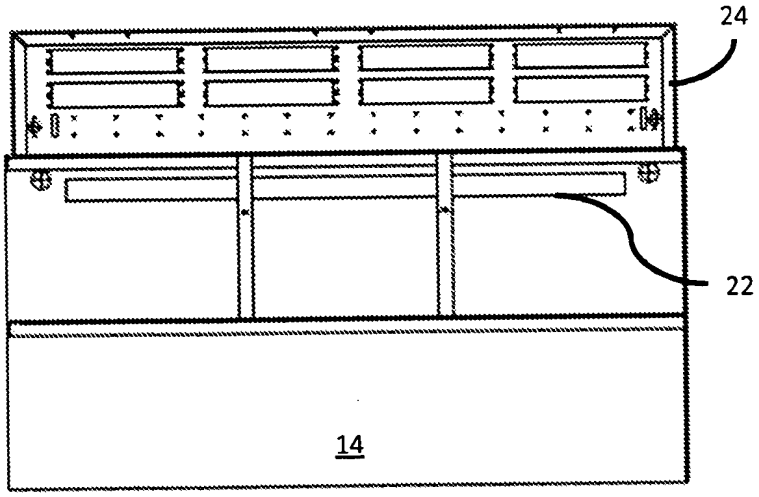


Fig. 5



Section C-C
Fig. 6

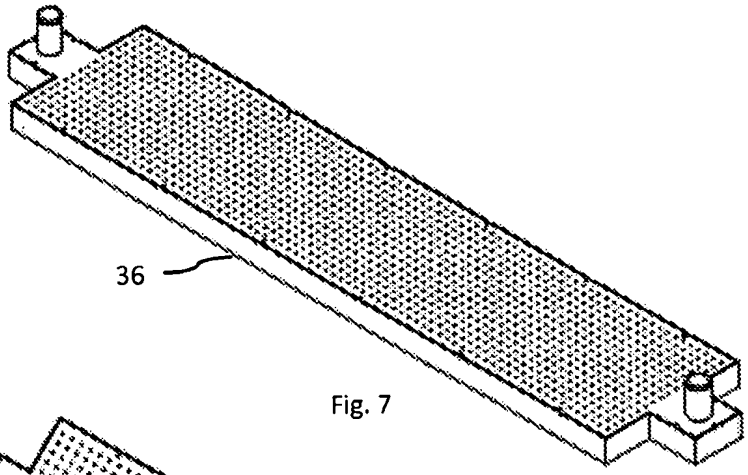


Fig. 7

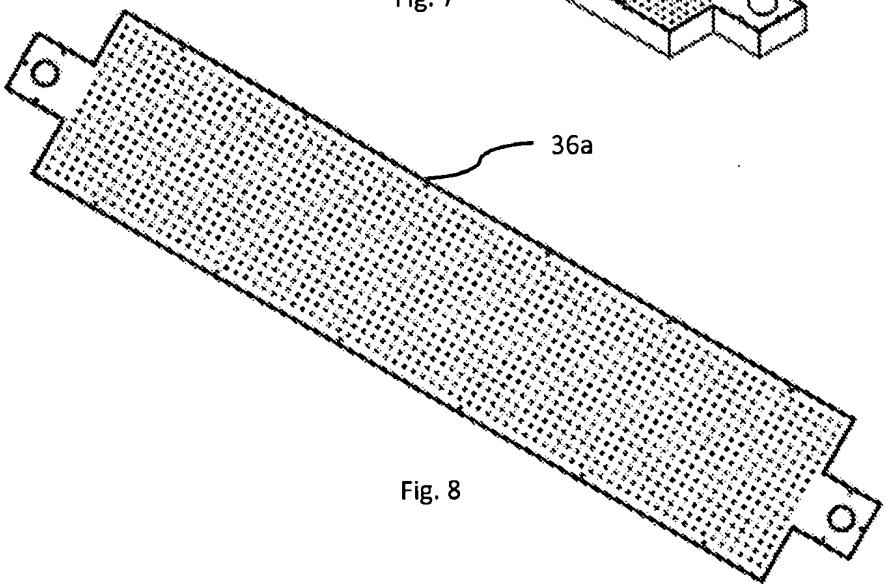


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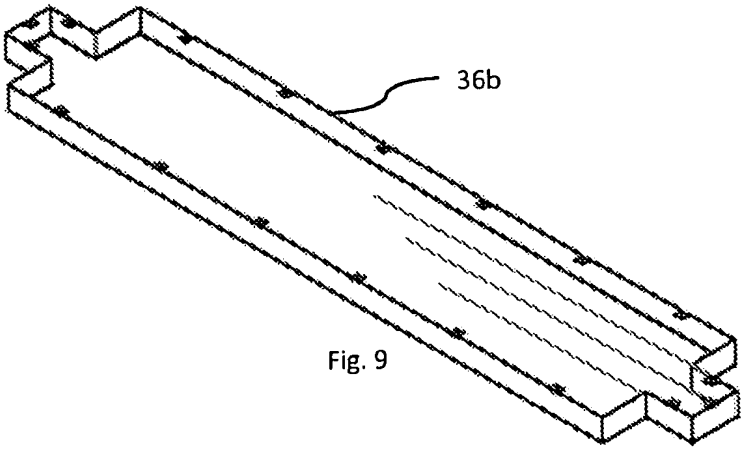


Fig. 9

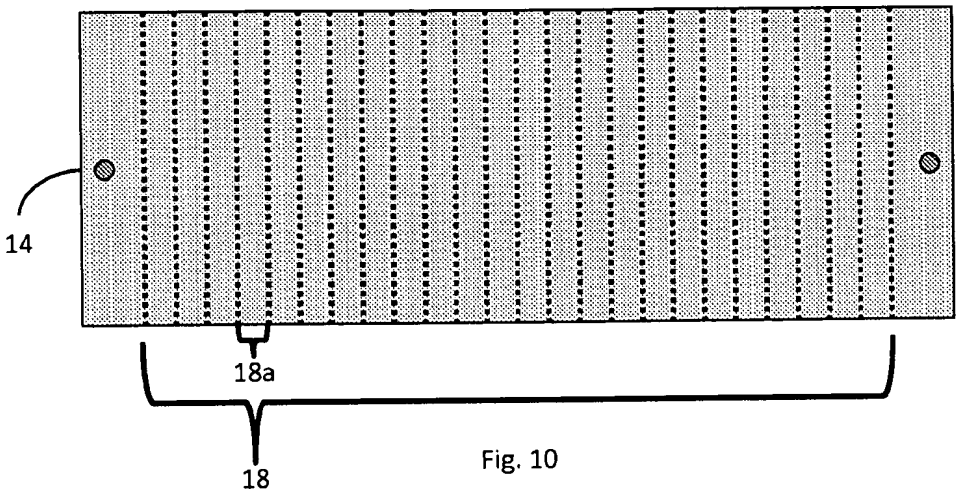


Fig. 10

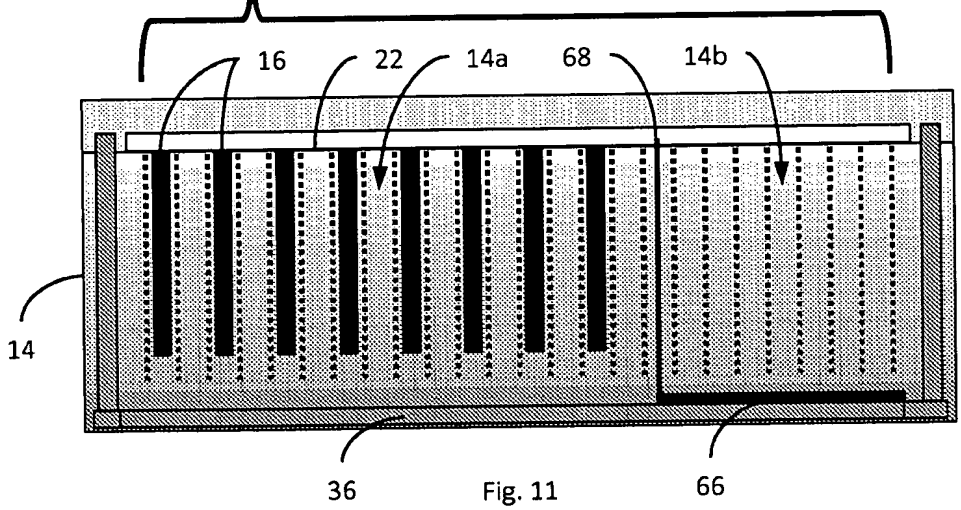


Fig. 11

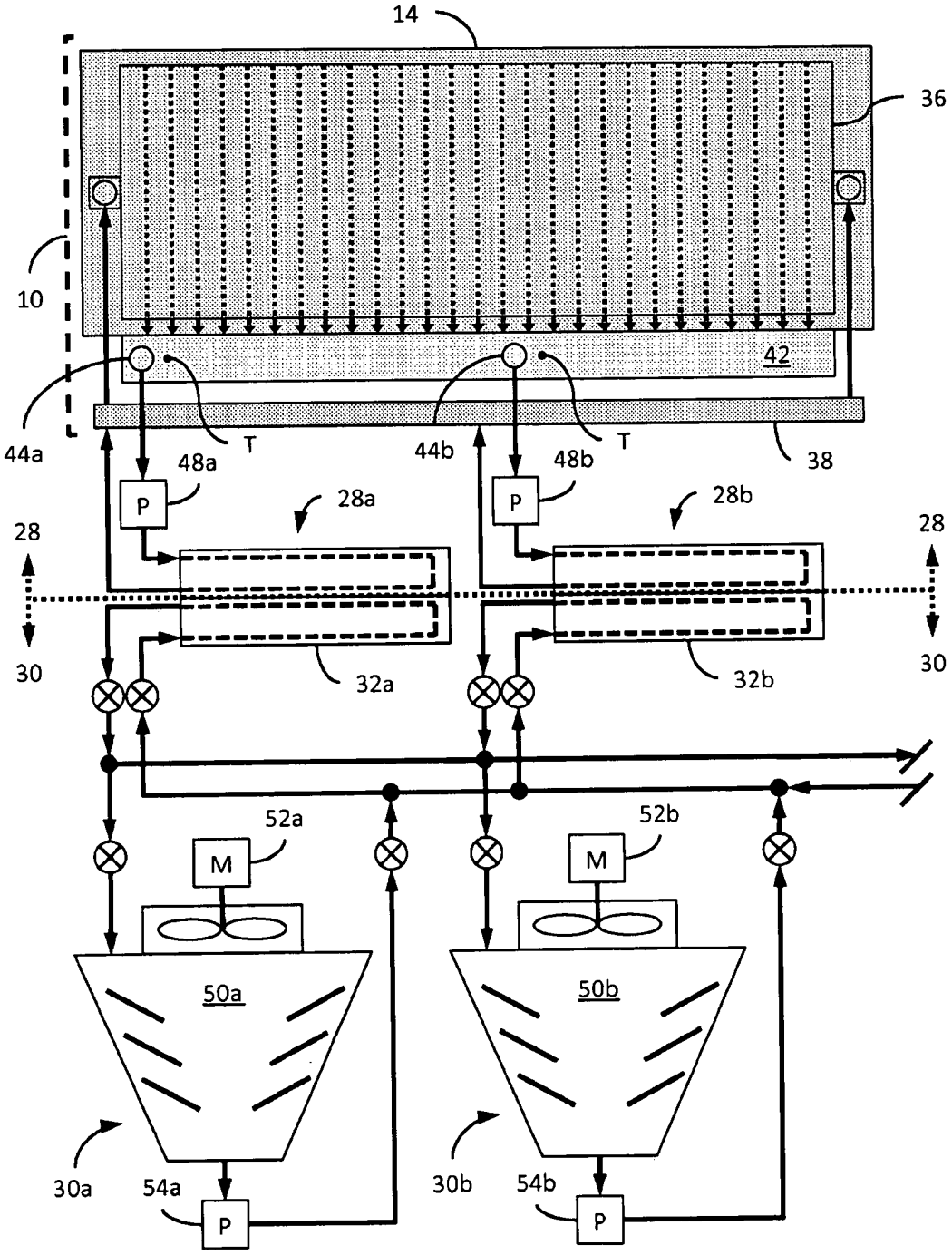

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Fig. 12

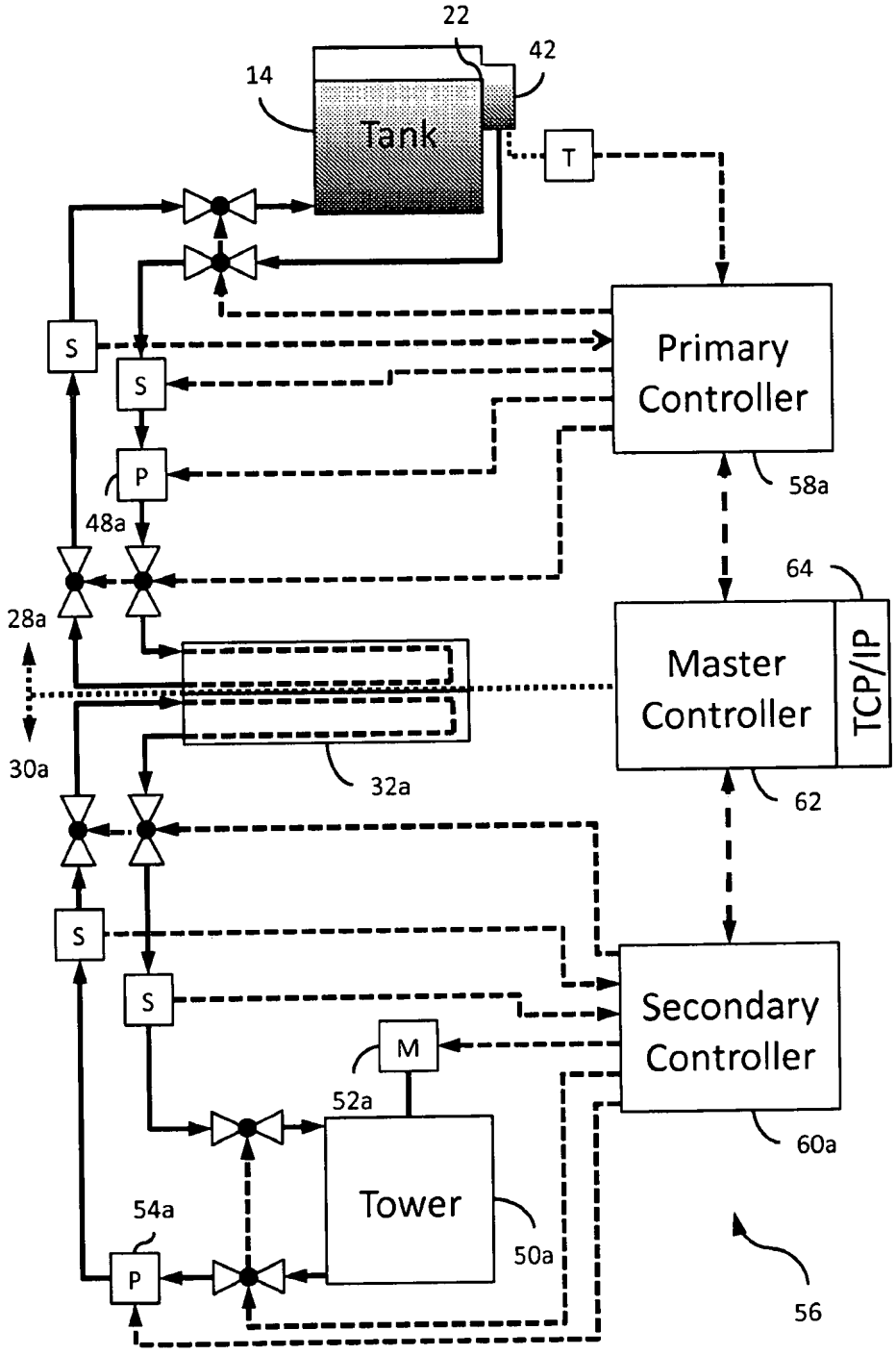

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Secondary Controller
60a
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Fig. 13

INTERNATIONAL SEARCH REPORT PCT/US2013/075126 25.04.2014

International application No.
PCT/US2013/075126

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 1/20 (2014.01)
USPC - 361/679.49
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)
IPC(8) - F25B 7/00, 49/00; F25D 23/12; G06F 1/20; H05K 7/20 (2014.01)
USPC - 62/125, 126, 127, 175, 196.4, 259.2; 165/104.33, 185, 908; 361/679.47, 679.49, 679.53, 679.54, 699, 701, 704, 719, 720, 721

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - G06F 1/20, 2200/201; Y10S 165/908 (2014.02)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Orbit, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/0132579 A1 (BEST et al) 09 June 2011 (09.06.2011) entire document	1-10
A	US 2006/0126292 A1 (PFAHNL et al) 15 June 2006 (15.06.2006) entire document	1-10
A	US 2011/0075353 A1 (ATTLESEY et al) 31 March 2011 (31.03.2011) entire document	1-10
A	US 2011/0240281 A1 (AVERY) 06 October 2011 (06.10.2011) entire document	1-10

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 April 2014	25 APR 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Sheet No. 6

Box No. VIII (iv) **DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)**

The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

Declaration of inventorship (Rules 4.17(iv) and 51*bis*.1(a)(iv))
for the purposes of the designation of the United States of America:

I hereby declare that I believe I am the original inventor or an original joint inventor of a claimed invention in the application.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/ ..... (if furnishing declaration pursuant to Rule 26*ter*).

I hereby declare that the above-identified international application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Name: Boyd, Christopher L.

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 1309 Bonham Terrace, Austin, TX 78704, USA

Inventor's Signature: Christopher L. Boyd Date: 12-13-2013
(The signature must be that of the inventor, not that of the agent)

Name: James P. Koen

Residence: Round Rock, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2302 Falcon Drive, Round Rock, Texas 78681, USA

Inventor's Signature: James P. Koen Date: 12-13-2013
(The signature must be that of the inventor, not that of the agent)

Name: David Christopher Laguna

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2011 E. 6th St. Austin, TX 78702, USA

Inventor's Signature: [signature] Date: 12/13/2013
(The signature must be that of the inventor, not that of the agent)

☒ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Sheet No. 7

Continuation of Box No. VIII (i) to (v) DECLARATION

If the space is insufficient in any of Boxes Nos. VIII (i) to (v) to furnish all the information, including in the case where more than two inventors are to be named in Box No. VIII (iv), in such case, write "Continuation of Box No. VIII . . ." (indicate the item number of the Box) and furnish the information in the same manner as required for the purposes of the Box in which the space was insufficient. If additional space is needed in respect of two or more declarations, a separate continuation box must be used for each such declaration. If this Box is not used, this sheet should not be included in the request.

Name: Thomas R. Turner
Residence: Georgetown, TX, USA
Mailing Address: 4210 Malaga Dr., Georgetown, TX 78628, USA

Signature:_____ Date: _____

Name: Kenneth D. Swinden
Residence: Hutto, TX, USA
Mailing Address: 132 Mustang Creek North Loop, Hutto, TX 78634, USA

Signature:_____ Date: _____

Name: Mario Conti Garcia
Residence: Austin, T, USA
Mailing Address: 9624 Woody Ridge View, Austin, TX 78730, USA

Signature: _____ Date: Dec, 19 2013

Name: John Charles Tribou
Residence: Austin, TX, USA
Mailing Address: 9109 Middlebie Dr., Austin, TX 78750, USA

Signature:_____ Date: _____

Search History:

Limited Classification Search

The Patent Analyst performed a limited classification search within the following US, IPC, CPC, ECLA, or F-Term classification areas:

U.S. Class/Subclass(es): 62/125, 126, 127, 175, 196.4, 259.2; 165/104.33, 185, 908; 361/679.47, 679.49, 679.53, 679.54, 699, 701, 704, 719, 720, 721

IPC (8) Class/Subclass(es): F25B 7/00, 49/00; F25D 23/12; G06F 1/20; H05K 7/20 (2014.01)

CPC Class/Subclass(es): G06F 1/20, 2200/201; Y10S 165/908 (2014.02)

See Global Search Results.

Global Patent Literature Text Search

The Patent Analyst performed the following global text search, which was not limited by classification but may or may not have been limited by other criteria:

PATBASE

#	Search query	Results
22	20 and vertical% and divert#	441
21	20 and vertical% and diver*	1269
20	OR=12:14	more than 100,000
19	PN=(US2011056660 OR US2012327597 OR US2013107452 OR US7839637 OR US8120912 OR US8125779 OR US8223498 OR US8238094 OR US8279601 OR US8534930 OR US8535787 OR US2005207134 OR US2005281005 OR US2006120038 OR US2006126292 OR US2008013276 OR US4399485 OR US6512672 OR US7593229)	17
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16	15 and weir%	0
15	UC="361/679.49"	486
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13	IC = ("H05K7/20" or "G06F1/20" or "F25B49/00" or "F25B7/00" or "H05K7/20" or "F25D23/12")	more than 100,000

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9	PN=(EP2271971 OR ITTO20080858 OR JP2011518395 OR KR101084349 OR KR101131476 OR US2008268662 OR US2011019358 OR US2011132579 OR US2011154842 OR US2011188198 OR US2011188203 OR US2011317363 OR US2012075796 OR US2012129245 OR US2012194996 OR US2013019614 OR US2013068423 OR US2013194755 OR US2013258592 OR US7724517 OR US7724524 OR US7885070 OR US7905106 OR US7911782 OR US7911793 OR US7916483 OR US7944694 OR US7961475 OR US7983040 OR US8009419 OR US8089764 OR US8089765 OR US8089766 OR US8164900 OR US8174826 OR US8179674 OR US8179677 OR US8184436 OR US8203842 OR US8240359 OR US8279597 OR US8289729 OR US8305759 OR US8345423 OR US8351206 OR US8358503 OR US8369090 OR US8369091 OR US8416572 OR US8467189 OR US8508934 OR US8547692 OR US8578606 OR US8611088 OR US8654529 OR WO10019517 OR WO10058274 OR WO10151486 OR WO11005643 OR WO11049302 OR WO11106791 OR WO12030473 OR WO12162986 OR WO13022805 OR WO13055296 OR WO13074807 OR WO13075620 OR WO14007672 OR WO14007673 OR CA2646237 OR CN1177903 OR CN2376002 OR JP10213370 OR JP11213370 OR JP18057920 OR JP2004084958 OR JP2006057920 OR KR20030019849 OR TWM284036 OR TWM285200 OR TWM289499 OR US2002117291 OR US2003081380 OR US2004221604 OR US2004246683 OR US2005007739 OR US2005036288 OR US2005068723 OR US2005105273 OR US2005122678 OR US2005152112 OR US2005162832 OR US2006007656 OR US2006012958 OR US2006012959 OR US2006037739 OR US2006039112 OR US2007025081 OR US2007034360 OR US2007227710 OR US2007267741 OR US2007268669 OR US2008017355 OR US2009260777 OR US2010101759 OR US2010101765 OR US2010103614 OR US2010103618 OR US2010103620 OR US2010246118 OR US2440930 OR US3406244 OR US3600636 OR US3741292 OR US3812402 OR US3858090 OR US4027728 OR US4302793 OR US4317224 OR US4449580 OR US4493010 OR US4590538 OR US4694378 OR US4700272 OR US4741385 OR US4765397 OR US4847731 OR US4928206 OR US4958256 OR	138

#	Search query	Results
	US5010450 OR US5021924 OR US5099908 OR US5107397 OR US5131233 OR US5270572 OR US5276590 OR US5297621 OR US5305184 OR US5448108 OR US5458185 OR US5613552 OR US5731954 OR US5757615 OR US5796583 OR US5943211 OR US6019167 OR US6052284 OR US6055157 OR US6069791 OR US6098175 OR US6115251 OR US6134108 OR US6148905 OR US6181554 OR US6234240 OR US6262890 OR US6313990 OR US6333849 OR US6450832 OR US6496367 OR US6504719 OR US6574105 OR US6625023 OR US6664627 OR US6807056 OR US6938678 OR US6947282 OR US6972954 OR US6979772 OR US6988537 OR US6992888 OR US6999316 OR US7035087 OR US7054165 OR US7120018 OR US7233501 OR US7242581 OR US7295436 OR US7307841 OR US7414845 OR US7609518)	
8	PN = US20110075353	1
7	PN=(US2012087077 OR US2013043775 OR US8644014 OR US8654532 OR WO13022805 OR US2004089001 OR US2005078447 OR US2005200205 OR US2006107674 OR US2008034777 OR US2009078401 OR US2009120618 OR US2009218078 OR US2009260777 OR US2009262495 OR US2010073863 OR US2011096503 OR US2011132579 OR US6615603 OR US6807056 OR US7342789 OR US7508666 OR US7808780)	20
6	PN = US20110240281	1
5	PN=(US2011193514 OR US2011240281 OR US2012123595 OR US2012136487 OR US7905106 OR US7911793 OR US8089764 OR US8174826 OR US8179674 OR US8248022 OR US8279597 OR US8305759 OR US8358503 OR US8467189 OR US8547692 OR US8594857 OR US8654529 OR WO12104354 OR WO13022805 OR WO13123817 OR US2005259402 OR US2007006599 OR US2007213000 OR US2008017355 OR US5297621 OR US6374627 OR US6600656 OR US7318322)	21
4	PN = US20110132579	1
3	INV=("BOYD_CHRIS" OR "BOYD_CHRISTOPHER_L" OR "TURNER_THOMAS_R")	6
2	PA=("MIDAS_GREEN_LIMITED" OR	0

#	Search query	Results
	"MIDAS_GREEN_LTD") and INV=("BOYD_CHRIS" OR "BOYD_CHRISTOPHER_L" OR "TURNER_THOMAS_R")	
1	PA=("MIDAS_GREEN_LIMITED" OR "MIDAS_GREEN_LTD")	9

Computer Accessed Text Databases Searched

The Patent Analyst searched the following computer accessed text databases:

GOOGLE PATENT: https://www.google.com/?tbm=pts

No. of Hits	Text String	Date	Other Limiting Criteria
655,000	dielectric liquid immersion, vertical slots	07 April 2014	None
23	dielectric liquid immersion tank, "vertical slots"	07 April 2014	None

GOOGLE: https://encrypted.google.com/

No. of Hits	Text String	Date	Other Limiting Criteria
655,000	dielectric liquid immersion, vertical slots	07 April 2014	None
23	dielectric liquid immersion tank, "vertical slots"	07 April 2014	None

YOUTUBE: https://www.youtube.com/

No. of Hits	Text String	Date	Other Limiting Criteria
12	dielectric liquid immersion tank	07 April 2014	None

ProQuest Dialog

Search #	Search	Databases	Results	Date
S1	(dielectric liquid immersion tank) AND (vertical W/5 slot*)	97 databases	5°	07 April 2014
S2	(dielectric liquid tank) AND (vertical W/5 slot*)	97 databases	32°	07 April 2014

Date search was completed: 08 April 2014
DD/ AJ

Petitioner Green Revolution Cooling, Inc., Ex-1002
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference JMG001-01	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US2013/075126	International filing date *(day/month/year)* 13 December 2013	(Earliest) Priority Date *(day/month/year)* 14 December 2012
Applicant MIDAS GREEN TECHNOLOGY, LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 1

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

International application No.
PCT/US2013/075126

Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)

A appliance immersion tank system comprising: a generally rectangular tank adapted to immerse in a dielectric fluid a plurality of appliances, each in a respective appliance slot distributed vertically along, and extending transverse to, the long axis of the tank; a primary circulation facility adapted to circulate the dielectric fluid through the tank; a secondary fluid circulation facility adapted to extract heat from the dielectric fluid circulating in the primary circulation facility, and to dissipate to the environment the heat so extracted; and a control facility adapted to coordinate the operation of the primary and secondary fluid circulation facilities as a function of the temperature of the dielectric fluid in the tank.

INTERNATIONAL SEARCH REPORT PCT/US2013/075126 25.04.2014

International application No.
PCT/US2013/075126

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 1/20 (2014.01)
USPC - 361/679.49
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)
IPC(8) - F25B 7/00, 49/00; F25D 23/12; G06F 1/20; H05K 7/20 (2014.01)
USPC - 62/125, 126, 127, 175, 196.4, 259.2; 165/104.33, 185, 908; 361/679.47, 679.49, 679.53, 679.54, 699, 701, 704, 719, 720, 721

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - G06F 1/20, 2200/201; Y10S 165/908 (2014.02)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Orbit, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/0132579 A1 (BEST et al) 09 June 2011 (09.06.2011) entire document	1-10
A	US 2006/0126292 A1 (PFAHNL et al) 15 June 2006 (15.06.2006) entire document	1-10
A	US 2011/0075353 A1 (ATTLESEY et al) 31 March 2011 (31.03.2011) entire document	1-10
A	US 2011/0240281 A1 (AVERY) 06 October 2011 (06.10.2011) entire document	1-10

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 April 2014	25 APR 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

WO 2014/109869
PCT/US2013/075126

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

FIRST NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION (TO DESIGNATED OFFICES WHICH DO NOT APPLY THE 30 MONTH TIME LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

MEYERS, Jeffrey, Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 78619
ETATS-UNIS D'AMERIQUE

Date of mailing *(day/month/year)* 24 July 2014 (24.07.2014)	
Applicant's or agent's file reference JMG001-01	**IMPORTANT NOTICE**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/075126	13 December 2013 (13.12.2013)	14 December 2012 (14.12.2012)

Applicant: MIDAS GREEN TECHNOLOGY, LLC

1. **ATTENTION**: For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), **does apply**, please see Form PCT/IB/308(Second and Supplementary Notice) (to be issued promptly after the expiration of 28 months from the priority date).

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, **does not apply**, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93*bis*.1. The International Bureau has effected that communication on the date indicated below:
17 July 2014 (17.07.2014)

   None

   In accordance with Rule 47.1(c-*bis*)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, **does not apply**, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93*bis*.1 :

   LU, TZ, UG

   In accordance with Rule 47.1(c-*bis*)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS for entry into the national phase**

   For the designated Office(s) listed above, and unless a demand for international preliminary examination has been filed before the expiration of **19 months** from the priority date (see Article 39(1)), the applicable time limit for entering the national phase will, **subject to what is said in the following paragraph,** be **20 MONTHS** from the priority date.

   In practice, **time limits other than the 20-month time limit** will continue to apply, for various periods of time, in respect of certain of the designated Offices listed above. For **regular updates on the applicable time limits** (20 or 21 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

   It is the applicant's **sole responsibility** to monitor all these time limits.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 82 70

Authorized officer: Nora Lindner

e-mail: pt05.pct@wipo.int

Form PCT/IB/308(First Notice) (January 2004)

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT/US13/75126
International Application No.

13 DEC 2013 (13.12.13)
International Filing Date

RO/US
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* JMG001-01

Box No. I TITLE OF INVENTION

APPLIANCE IMMERSION COOLING SYSTEM

Box No. II APPLICANT ☐ This person is also inventor

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Midas Green Technology, LLC
8500 Shoal Creek
Building 2, Suite K
Austin, TX 78757
USA

Telephone No.
512.420.8099

Facsimile No.

Applicant's registration No. with the Office

E-mail authorization: Marking one of the check-boxes below authorizes the receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority to use the e-mail address indicated in this Box to send, notifications issued in respect of this international application to that e-mail address if those offices are willing to do so.

☒ as advance copies followed by paper notifications; or ☒ exclusively in electronic form (no paper notifications will be sent).

E-mail address: jim@midasgreentech.com

State *(that is, country)* of nationality:
USA

State *(that is, country)* of residence:
USA

This person is applicant for the purposes of: ☒ all designated States ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MYERS, Jeffrey Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 8619
USA

Telephone No.
512.858.7453

Facsimile No.

Agent's registration No. with the Office
27,362

E-mail authorization: Marking one of the check-boxes below authorizes the receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority to use the e-mail address indicated in this Box to send, notifications issued in respect of this international application to that e-mail address if those offices are willing to do so.

☒ as advance copies followed by paper notifications; or ☒ exclusively in electronic form (no paper notifications will be sent).

E-mail address: jvm@jvmyers.com

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

BOYD, Christopher L.
1309 Bonham Terrace
Austin, TX 78704
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

KOEN, James P.
2302 Falcon Drive
Round Rock, TX, 78681
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Laguna, David Christopher
2011 E. 6th Street
Austin, TX 78702
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

TURNER, Thomas R.
4210 Malaga Dr.
Georgetown, TX 78628
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 55 of 656; IPR2025-00196

Supplemental Box *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. *If, in any of the Boxes, except Boxes Nos. VIII(i) to (v) for which a special continuation box is provided, **the space is insufficient** to furnish all the information: in such case, write "Continuation of Box No...." (indicate the number of the Box) and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

   (i) ***if more than one person is to be indicated as applicant and/or inventor** and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;*

   (ii) *if, in Box No. II or in any of the sub-boxes of Box No. III, the indication **"the States indicated in the Supplemental Box"** is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;*

   (iii) *if, in Box No. II or in any of the sub-boxes of Box No. III, **the inventor or the inventor/applicant is not inventor for the purposes of all designated States**: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;*

   (iv) *if, in addition to the agent(s) indicated in Box No. IV, there are **further agents**: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;*

   (v) *if, in Box No. VI, there are **more than three earlier applications whose priority is claimed**: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI.*

2. *If the applicant intends to make an indication of the wish that the international application be treated, in certain designated States, as an application for a patent of addition, certificate of addition, inventor's certificate of addition or utility certificate of addition: in such case, write the name or two-letter code of each designated State concerned and the indication "**patent of addition**," "**certificate of addition**," "**inventor's certificate of addition**" or "**utility certificate of addition**," the number of the parent application or parent patent or other parent grant and the date of grant of the parent patent or other parent grant or the date of filing of the parent application (Rules 4.11(a)(i) and 49bis.1(a) or (b)).*

3. *If the applicant intends to make an indication of the wish that the international application be treated, in the United States of America, as a continuation or continuation-in-part of an earlier application: in such case, write "United States of America" or "US" and the indication "**continuation**" or "**continuation-in-part**" and the number and the filing date of the parent application (Rules 4.11(a)(ii) and 49bis.1(d)).*

Continuation of Box No. III:

Kenneth D. Swinden
132 Mustang Creek North Loop
Hutto, TX 78634
USA
Inventor Only
Nationality: USA
Residence: USA

Mario Conti Garcia
9624 Woody Ridge View
Austin, TX 78730
USA
Inventor Only
Nationality: USA
Residence: USA

John Charles Tribou
9109 Middlebie Dr.
Austin, TX 78750
USA
Nationality: USA
Residence: USA

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Box No. V DESIGNATIONS

The filing of this request **constitutes under Rule 4.9(a) the designation** of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.

However,

☐ DE Germany **is not designated** for any kind of national protection

☐ JP Japan **is not designated** for any kind of national protection

☐ KR Republic of Korea **is not designated** for any kind of national protection

(The check-boxes above may only be used to exclude (irrevocably) the designations concerned if, at the time of filing or subsequently under Rule 26bis.1, the international application contains in Box No. VI a priority claim to an earlier national application filed in the particular State concerned, in order to avoid the ceasing of the effect, under the national law, of this earlier national application.)

Box No. VI PRIORITY CLAIM AND DOCUMENT

The priority of the following earlier application(s) is hereby claimed:

Filing date of earlier application *(day/month/year)*	Number of earlier application	Where earlier application is:		
		national application: country or Member of WTO	regional application: regional Office	international application: receiving Office
item (1) 14/12/2012	61/737,200	USA		
item (2) 7/6/2013	61/832,211	USA		
item (3)				

☐ Further priority claims are indicated in the Supplemental Box.

Furnishing the priority document(s):

☒ The **receiving Office** is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application(s) was filed with the receiving Office which, for the purposes of this international application, is the receiving Office)* identified above as:

☒ all items ☐ item (1) ☐ item (2) ☐ item (3) ☐ other, see Supplemental Box

☐ The **International Bureau** is requested to obtain from a digital library a certified copy of the earlier application(s) identified above, using, where applicable, the access code(s) indicated below *(if the earlier application(s) is available to it from a digital library)*:

☐ item (1) access code _____ ☐ item (2) access code _____ ☐ item (3) access code _____ ☐ other, see Supplemental Box

Restore the right of priority: the receiving Office is requested to restore the right of priority for the earlier application(s) identified above or in the Supplemental Box as item(s) (_____). *(See also the Notes to Box No. VI; further information must be provided to support a request to restore the right of priority.)*

Incorporation by reference: where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if more than one International Searching Authority is competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)*:

ISA/ US

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Continuation of Box No. VII USE OF RESULTS OF EARLIER SEARCH, REFERENCE TO THAT SEARCH

☐ The ISA indicated in Box No. VII is requested to take into account the results of the earlier search(es) indicated below (*see also Notes to Box VII: use of results of more than one earlier search*).

Filing date *(day/month/year)*	Application Number	Country *(or regional Office)*

☐ **Statement (Rule 4.12(ii))**: this international application is the same, or substantially the same, as the application in respect of which the earlier search was carried out except, where applicable, that it is filed in a different language.

☐ **Availability of documents**: the following documents are available to the ISA in a form and manner acceptable to it and therefore do not need to be submitted by the applicant to the ISA (Rule 12*bis*.1(f)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a translation of the earlier application into a language which is accepted by the ISA,
- ☐ a translation of the results of the earlier search into a language which is accepted by the ISA,
- ☐ a copy of any document cited in the results of the earlier search. *(If known, please indicate below the document(s) available to the ISA):*

☐ **Transmit copy of results of earlier search and other documents** *(where the earlier search was not carried out by the ISA indicated above but by the same Office as that which is acting as the receiving Office)*: the **receiving Office** is requested to prepare and transmit to the ISA (Rule 12*bis*.1(c)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a copy of any document cited in the results of the earlier search.

* Where the results of the earlier search are neither available from a digital library nor transmitted by the receiving Office, the applicant is required to submit them to the receiving Office (Rule 12*bis*.1(a)) (*See item 11. in the check-list and also Notes to Box No. VII*).

Filing date *(day/month/year)*	Application Number	Country *(or regional Office)*

☐ **Statement (Rule 4.12(ii))**: this international application is the same, or substantially the same, as the application in respect of which the earlier search was carried out except, where applicable, that it is filed in a different language.

☐ **Availability of documents**: the following documents are available to the ISA in a form and manner acceptable to it and therefore do not need to be submitted by the applicant to the ISA (Rule 12*bis*.1(f)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a translation of the earlier application into a language which is accepted by the ISA,
- ☐ a translation of the results of the earlier search into a language which is accepted by the ISA,
- ☐ a copy of any document cited in the results of the earlier search. *(If known, please indicate below the document(s) available to the ISA):*

☐ **Transmit copy of results of earlier search and other documents** *(where the earlier search was not carried out by the ISA indicated above but by the same Office as that which is acting as the receiving Office)*: the **receiving Office** is requested to prepare and transmit to the ISA (Rule 12*bis*.1(c)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a copy of any document cited in the results of the earlier search.

* Where the results of the earlier search are neither available from a digital library nor transmitted by the receiving Office, the applicant is required to submit them to the receiving Office (Rule 12*bis*.1(a)) (*See item 11. in the check-list and also Notes to Box No. VII*).

☐ Further earlier searches are indicated on a continuation sheet.

Box No. VIII DECLARATIONS

The following **declarations** are contained in Boxes Nos. VIII (i) to (v) *(mark the applicable check-boxes below and indicate in the right column the number of each type of declaration)*:		Number of declarations
☐ Box No. VIII (i)	Declaration as to the identity of the inventor	:
☐ Box No. VIII (ii)	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	:
☐ Box No. VIII (iii)	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	:
☒ Box No. VIII (iv)	Declaration of inventorship (only for the purposes of the designation of the United States of America)	:
☐ Box No. VIII (v)	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	:

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Box No. IX CHECK LIST for EFS-Web filings - this sheet is only to be used when filing an international application with RO/US via EFS-Web

This international application **contains** the following:	Number of sheets
(a) request form PCT/RO/101 (including any declarations and supplemental sheets)	8
(b) description (excluding any sequence listing part of the description, see (f), below)	14
(c) claims	4
(d) abstract	1
(e) drawings (if any)	7
(f) sequence listing part of the description in the form of an **image file** (e.g. PDF)	
Total number of sheets (including the sequence listing part of the description if **filed as an image file**)	34

(g) sequence listing part of the description

- ☐ filed in the form of an **Annex C/ST.25 text file**
- ☐ WILL BE filed separately on physical data carrier(s), on the same day and in the form of an **Annex C/ST.25 text file**

Indicate type and number of physical data carrier(s) .....

This international application is **accompanied by** the following item(s) *(mark the applicable check-boxes below and indicate in right column the number of each item)*:	Number of items
1. ☒ fee calculation sheet	1
2. ☒ original separate power of attorney	1
3. ☐ original general power of attorney	
4. ☐ copy of general power of attorney; reference number:	
5. ☐ priority document(s) identified in Box No. VI as item(s)	
6. ☐ Translation of international application into *(language)*:	
7. ☐ separate indications concerning deposited microorganism or other biological material	
8. ☐ *(only where item (f) is marked in the left column)* copy of the sequence listing in electronic form (Annex C/ST.25 text file) not forming part of the international application but **furnished only for the purposes of international search** under Rule 13*ter*	
9. ☐ *(only where item (f) is marked in the left column)* a statement confirming that "the information recorded in electronic form submitted under Rule 13*ter* is identical to the sequence listing as contained in the international application" as filed via EFS-Web:	
10. ☐ copy of results of earlier search(es) (Rule 12*bis*.1(a))	
11. ☐ other *(specify)*:	

Figure of the drawings which should accompany the abstract: 1

Language of filing of the international application: English

Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

/Jeffrey Van Myers, Reg. No. 27,362/

13-12-2013

For receiving Office use only

1. Date of actual receipt of the purported international application: 13 DEC 2013
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA / US
6. ☐ Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 59 of 656; IPR2025-00196

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING
AVAILABILITY OF THE PUBLICATION
OF THE INTERNATIONAL APPLICATION

To:

MEYERS, Jeffrey, Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 78619
ETATS-UNIS D'AMERIQUE

Date of mailing *(day/month/year)* 17 July 2014 (17.07.2014)	
Applicant's or agent's file reference JMG001-01	**IMPORTANT NOTICE**
International application No. PCT/US2013/075126	International filing date *(day/month/year)* 13 December 2013 (13.12.2013)
Priority date *(day/month/year)* 14 December 2012 (14.12.2012)	
Applicant MIDAS GREEN TECHNOLOGY, LLC	

The applicant is hereby **notified** that the International Bureau:

☒ has **published** the above-indicated international application on 17 July 2014 (17.07.2014) under No. WO 2014/109869

☐ has **republished** the above-indicated international application on under No. WO
For an explanation as to the reason for this republication of the international application, reference is made to INID codes (15), (48) or (88) (*as the case may be*) on the front page of the published international application.

A copy of the international application is available for viewing and downloading on WIPO's website at the following address: www.wipo.int/pctdb (in the appropriate field of the structured search, enter the PCT or WO number).

The applicant may also obtain a paper copy of the published international application from the International Bureau by sending an e-mail to patentscope@wipo.int or by submitting a written request to the contact details provided below.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 82 70

Authorized officer
Nora Lindner

e-mail: pt05.pct@wipo.int

Form PCT/IB/311 (January 2009)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: JEFFREY VAN MEYERS
J.V. MYERS & ASSOCIATES, PC
P.O. BOX 130
DRIFTWOOD, TX 78619

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing *(day/month/year)*	25 APR 2014
Applicant's or agent's file reference: JMG001-01	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No.: PCT/US2013/075126	International filing date *(day/month/year)*: 13 December 2013
Applicant: MIDAS GREEN TECHNOLOGY, LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.

   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 Telephone No. PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2010)

From the INTERNATIONAL BUREAU

PCT

INVITATION TO CORRECT
DECLARATIONS MADE IN THE REQUEST
UNDER PCT RULE 4.17

(PCT Rules 4.17 and 26*ter*.2(a))

To:

MEYERS, Jeffrey, Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 78619
ETATS-UNIS D'AMERIQUE

Date of mailing *(day/month/year)* 09 January 2014 (09.01.2014)	
Applicant's or agent's file reference JMG001-01	**REPLY DUE** **See below**
International application No. PCT/US2013/075126	International filing date *(day/month/year)* 13 December 2013 (13.12.2013)
Applicant MIDAS GREEN TECHNOLOGY, LLC	

1. The applicant is hereby **invited to submit to the International Bureau a corrected declaration** within the time limit indicated below and as explained in the Annex. The applicant's attention is drawn to the fact that the declaration has **not been examined** for compliance with national law requirements of the designated State(s) for which that declaration is made.

   When? Within 16 months from the priority date, provided that any corrected declaration which is received by the International Bureau after the expiration of that time limit shall be considered to have been received on the last day of that time limit if it reaches it before the technical preparations for international publication have been completed (Rule 26*ter*.1).

   How? By submitting a replacement sheet containing a corrected declaration accompanied by a letter explaining the correction (see Section 216). See Sections 211 to 215 for the applicable standardized wording.

   Where? Directly to the International Bureau at the address indicated below.

   If the corrected declaration is submitted to the receiving Office, that Office shall mark the date of receipt on it and transmit it promptly to the International Bureau. The declaration shall be considered to have been submitted to the International Bureau on the date marked (see Section 317).

2. **Failure to correct the declaration within the time limit** will result in the declaration, **as originally filed**, being published as part of the international application (Rule 48.2(a)(x)).

   Any declaration received after the expiration of the time limit under Rule 26*ter*.1 will have to be submitted by the applicant directly to the designated Offices concerned; it is only in the case of a signed declaration of inventorship for the purposes of the designation of the United States of America (Rule 4.17(iv)) that the original declaration will be returned to the applicant (see Section 419(d)).

3. **In respect of national phase processing**, the applicant's attention is drawn to Rule 51*bis*.2 which provides that the designated Office shall not, unless it may reasonably doubt the veracity of the declaration concerned, require any document or evidence relating to the subject matter of any declaration complying with Rule 4.17(i) to (iv) which is contained in the request or submitted to the International Bureau or directly to the designated Office. Note, however, that Rule 51*bis*.2 may not apply in respect of certain States. For further information, see Notes to the request form, Box No. VIII.

4. A copy of this Invitation is being sent to the receiving Office.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 89 75

Authorized officer

Poupel Sylvie

e-mail pt05.pct@wipo.int
Telephone No. +41 22 338 74 05

ANNEX TO FORM PCT/IB/370

International application No.
PCT/US2013/075126

The International Bureau has found the following defect(s) in the declaration(s) listed below:

1. ☐ declaration as to the identity of the inventor (Rules 4.17(i) and 51*bis*.1(a)(i) and Section 211), in respect of:

2. ☐ declaration as to the applicant's entitlement, as at the international filing date, to apply for or be granted a patent (Rules 4.17(ii) and 51*bis*.1(a)(ii) and Section 212), in respect of:

3. ☐ declaration as to the applicant's entitlement, as at the international filing date, to claim priority of the earlier application (Rules 4.17(iii) and 51*bis*.1(a)(iii) and Section 213), in respect of:

4. ☒ declaration of inventorship (only for the purposes of the designation of the United States of America) (Rules 4.17(iv) and 51*bis*.1(a)(iv) and Section 214), in respect of:

   a. *(name(s) included in the declaration)*: BOYD, Christopher, L. et al.

   ☐ is not in the prescribed wording

   ☒ is not signed by all inventors named in the declaration

   ☐ other *(specify)*:

5. ☐ declaration as to non-prejudicial disclosures or exceptions to lack of novelty (Rules 4.17(v) and 51*bis*.1(a)(v) and Section 215), in respect of:

PTO/SB/08a (04-09)
Approved for use through 05/31/2009. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	PCT/US13/75126
Filing Date	13-12-2013
First Named Inventor	BOYD, Christopher L.
Art Unit	
Examiner Name	
Attorney Docket Number	JMG001-01

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 4590538	11-18-1981	Cray	All
		US- 5167511	11-27-1992	Krajewski	All
		US-			
		US-			
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours 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, U.S. 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

PTO/SB/08b (04-09)
Approved for use through 05/31/2009. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	PCT/US13/75126
Filing Date	13-12-2013
First Named Inventor	BOYD, Christopher L.
Art Unit	
Examiner Name	
Attorney Docket Number	JMG001-01

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	4	"The CRAY-2 Computer System", marketing brochure of Cray Research, Inc 1985	
	5	PATEL, Nilay, "Puget Custom Computer's mineral-oil-cooled PC", web-presentation posted 12 May 2007 at 11:57AM	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. 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. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours 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, U.S. 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.**

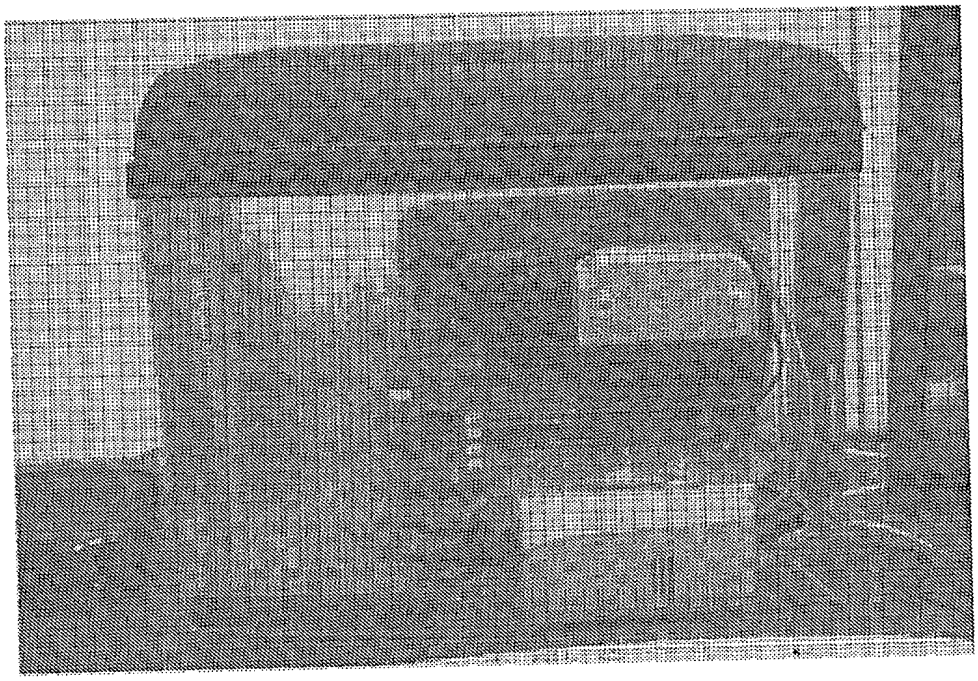
If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

Best Available Copy

FILED UNDER

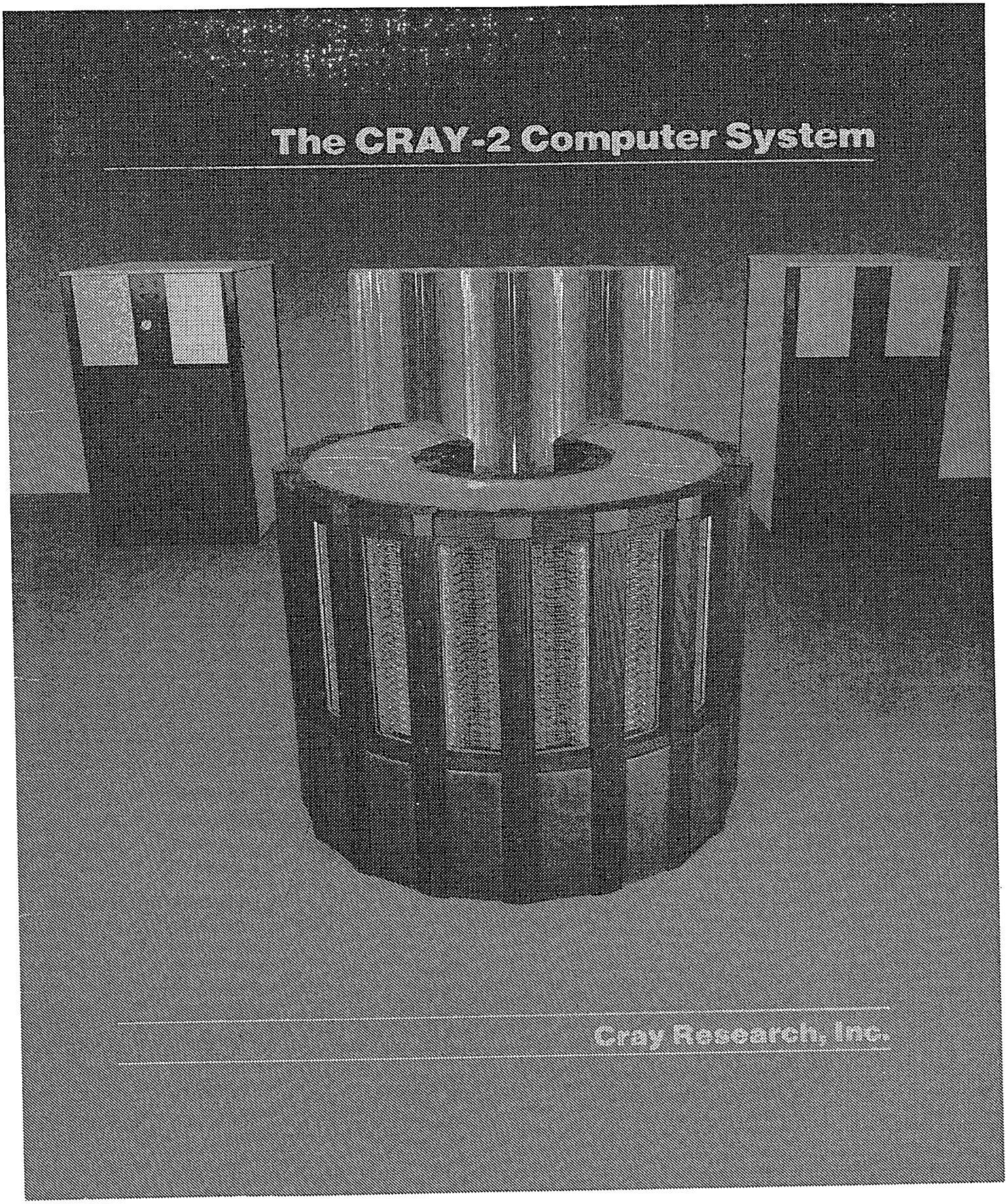
Puget Custom Computer's mineral-oil-cooled PC

By Nilay Patel *posted May 12th 2007 11:57AM*



We've definitely seen our share of (and), but most setups aren't as, uh, immersive as Puget Custom Computer's mineral-oil-cooled PC. Essentially a motherboard in an aquarium topped off with fluid, the Washington company claims the oil effectively cools system components for up to 12 hours at peak load. While traditional homebrew oil-cooling setups use vegetable oil, the Puget crew chose mineral oil because it's perfectly clear and, more importantly, doesn't go rancid after a while. Disadvantage? Large quantities of mineral oil are difficult to find -- Puget had to explain what they were doing to a local vet, who normally uses the stuff as a horse laxative. That means those of you looking to build one of these better get friendly with Fido's doc, cause Puget isn't planning on selling these. Peep a vid of the crazy setup -- including the aquarium's bubble bar in action --

Best Available Copy



Best Available Copy

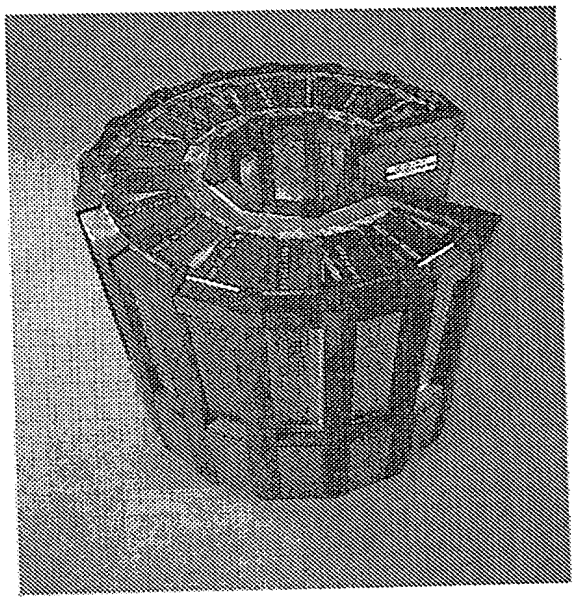
Cray Research's mission is to lead in the development and marketing of high-performance systems that make a unique contribution to the markets they serve. For close to a decade, Cray Research has been the industry leader in large-scale computer systems. Today, the majority of supercomputers installed worldwide are Cray systems. These systems are used in advanced research laboratories around the world and have gained strong acceptance in diverse industrial environments. No other manufacturer has Cray Research's breadth of success and experience in supercomputer development.

The company's initial product, the CRAY-1 Computer System, was first installed in 1976. The CRAY-1 quickly established itself as the standard of value for large-scale computers and was soon recognized as the first commercially successful vector processor. For some time previously, the potential advantages of vector processing had been understood, but effective practical implementation had eluded computer architects. The CRAY-1 broke that barrier, and today vectorization techniques are used commonly by scientists and engineers in a wide variety of disciplines.

With its significant innovations in architecture and technology, the CRAY-2 Computer System sets the standard for the next generation of supercomputers. The CRAY-2 design allows many types of users to solve problems that cannot be solved with any other computers. The CRAY-2 provides an order of magnitude increase in performance over the CRAY-1 at an attractive price/performance ratio.

Best Available Copy

Introducing the CRAY-2 Computer System



The CRAY-2 Computer System sets the standard for the next generation of supercomputers. It is characterized by a large Common Memory (256 million 64-bit words), four Background Processors, a clock cycle of 4.1 nanoseconds (4.1 billionths of a second) and liquid immersion cooling. It offers effective throughput six to twelve times that of the CRAY-1 and runs an operating system based on the increasingly popular UNIX™ operating system.

The CRAY-2 Computer System uses the most advanced technology available. The compact mainframe is immersed in a fluorocarbon liquid that dissipates the heat generated on the densely packed electronic components. The logic and memory circuits are contained in eight-layer, three-dimensional modules. The large Common Memory is constructed of the most dense memory chips available, and the logic circuits are constructed from the fastest silicon chips available.

The CRAY-2 mainframe contains four independent Background Processors, each more powerful than a CRAY-1 computer. Featuring a clock cycle time of 4.1 nanoseconds — faster than any other computer system available — each of these processors offers exceptional scalar and vector processing capabilities. The four Background Processors can operate independently on separate jobs or concurrently on a single problem. The very high-speed Local Memory integral to each Background Processor is available for temporary storage of vector and scalar data.

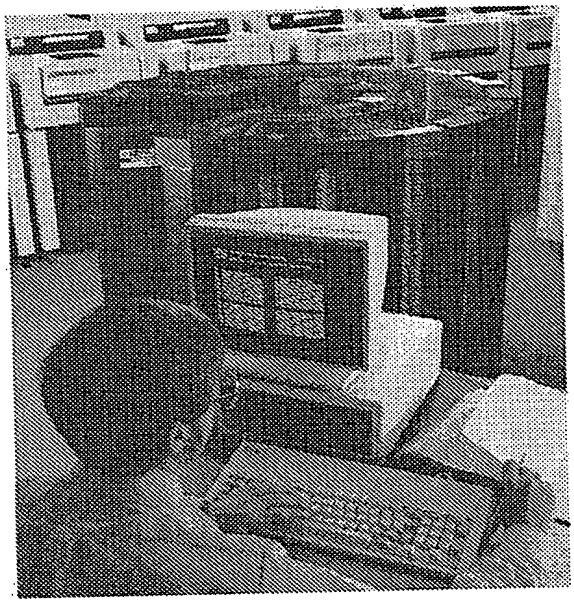
Common Memory is one of the most important features of the CRAY-2. It consists of 256 million 64-bit words randomly accessible from any of the four Background Processors and from any of the high-speed and common data channels. The memory is arranged in four quadrants with 128 interleaved banks. All memory access is performed automatically by the hardware. Any user may use all or part of this memory.

In conventional memory-limited computer systems, I/O wait times for large problems that use out-of-memory storage run into hours. With the large Common Memory of the CRAY-2, many of these problems become CPU-bound.

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Control of network access equipment and the high-speed disk drives is integral to the CRAY-2 mainframe hardware. A single Foreground Processor coordinates the data flow between the system Common Memory and all external devices across four high-speed I/O channels. The synchronous operation of the Foreground Processor with the four Background Processors and the external devices provides a significant increase in data throughput.

To complement the new CRAY-2 architecture, Cray Research has developed an interactive operating system based on AT&T's UNIX System V. The CRAY-2 Operating System is supported by a FORTRAN compiler based on the proven Cray Research FORTRAN compiler, CFT.

The CRAY-2 Computer System represents a major advance in large-scale computing. The combination of four high-speed Background Processors, a high-speed Local Memory, a huge Common Memory, an extremely powerful I/O capability and a comprehensive software product offers unsurpassed and balanced performance for the user.

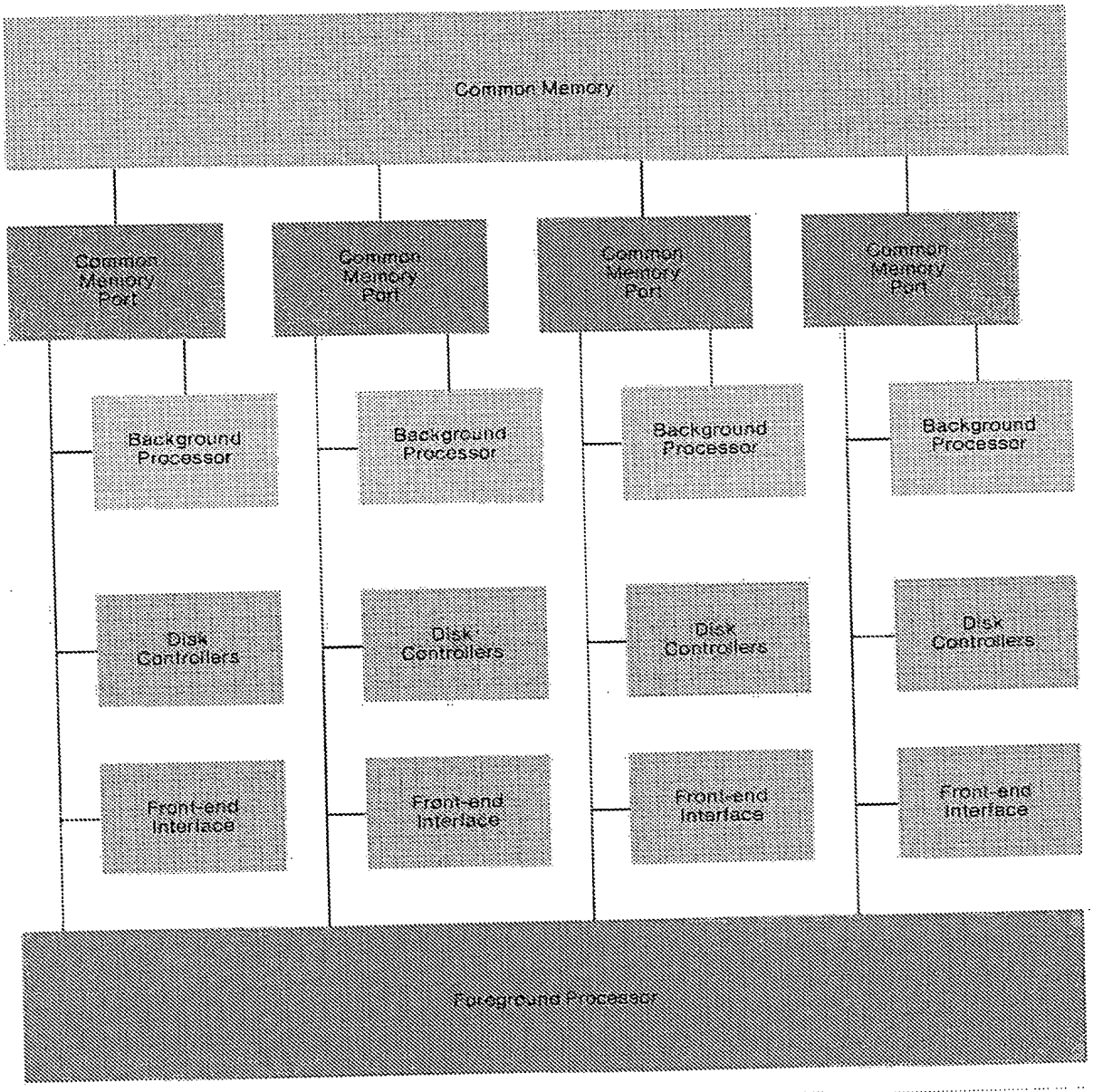
Features of the CRAY-2

- ☐ Extremely large directly addressable Common Memory
- ☐ Fastest cycle time available in a computer system (4.1 nsec)
- ☐ Scalar and vector processing combined with multiprocessing
- ☐ Integral Foreground Processor
- ☐ Elegant architecture
- ☐ Extremely high reliability
- ☐ Uses high density memory chips and extremely fast silicon logic chips
- ☐ Liquid immersion cooling
- ☐ An operating system based on industry recognized UNIX system
- ☐ Automatic vectorizing FORTRAN compiler

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CRAY-2 system overview

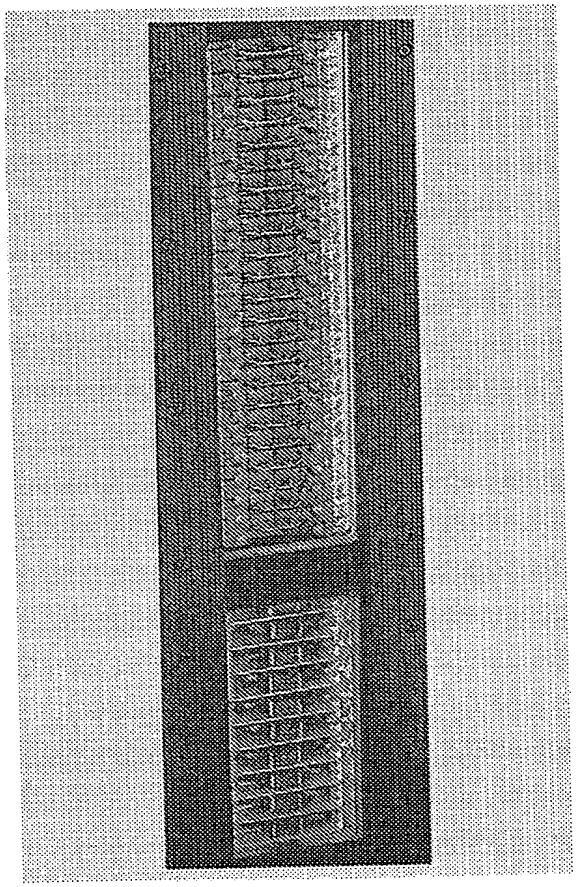


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Physical characteristics



The CRAY-2 mainframe is elegant in appearance as well as in architecture. The memory, computer logic and DC power supplies are integrated into a compact mainframe composed of 14 vertical columns arranged in a 300° arc.

The upper part of each column contains a stack of 24 modules and the lower part contains power supplies for the system. Total cabinet height, including the power supplies, is 45 inches, and the diameter of the mainframe is 53 inches. Thus, the "footprint" of the mainframe is a mere 16 square feet of floor space.

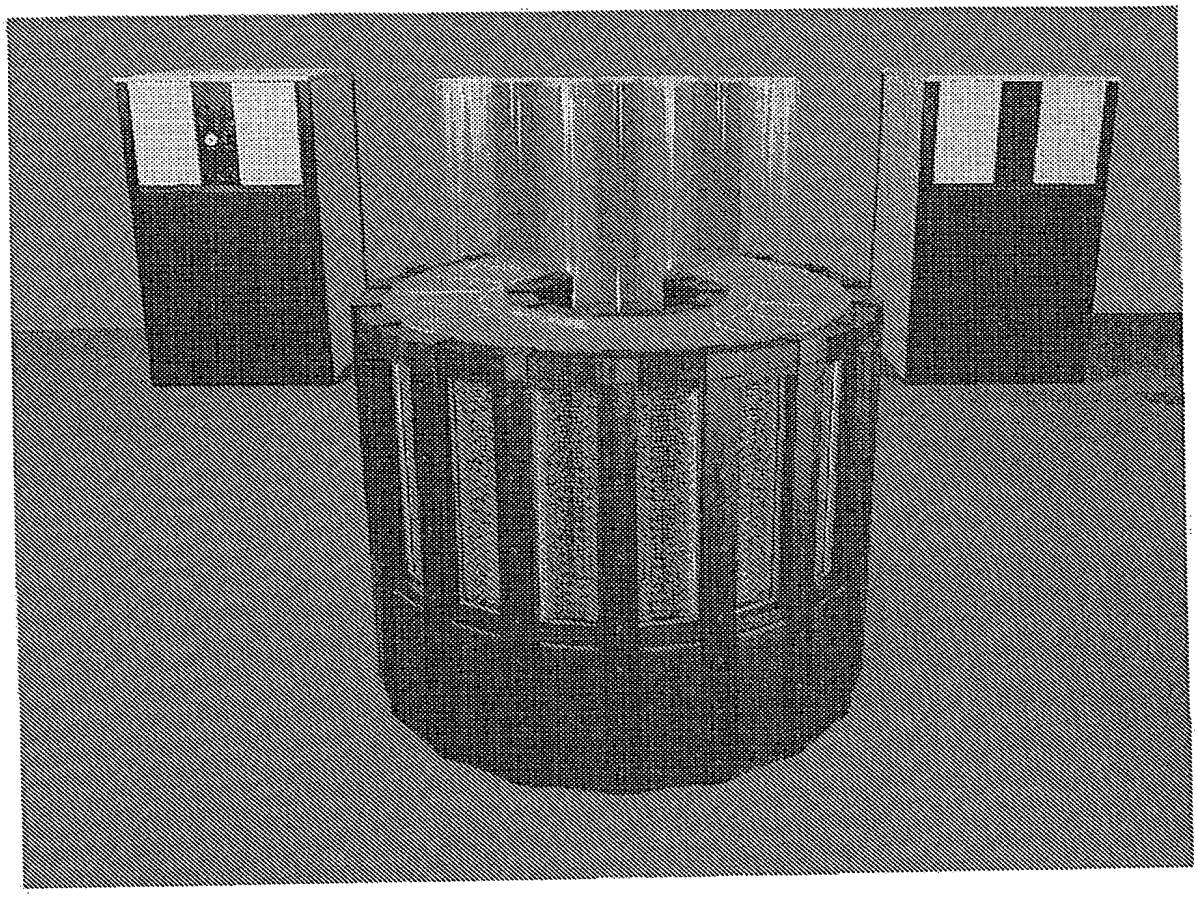
An inert fluorocarbon liquid circulates in the mainframe cabinet in direct contact with the integrated circuit packages. This liquid immersion cooling technology allows for the small size of the CRAY-2 mainframe and is thus largely responsible for the high computation rates.

Physical characteristics

- Occupies only 16 sq ft of floor space
- Stands 45 inches high, diameter is 53 inches
- Weighs 5500 pounds
- 14 columns arranged in a 300° arc
- Liquid immersion cooling
- Uses 16-gate array logic chips
- Three-dimensional modules
- 320 pluggable modules
- 195 KW power consumption
- 400 Hz power from motor generators
- Chilled water heat exchange

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Architecture and design

In addition to the cooling technology, the CRAY-2's extremely high processing rates are achieved by a balanced integration of scalar and vector capabilities and a large Common Memory in a multiprocessing environment.

The significant architectural components of the CRAY-2 Computer System include four identical Background Processors, 256 million 64-bit words of Common Memory, a Foreground Processor and a maintenance control console.

Each of the four identical Background Processors contains registers and functional units to perform both vector and scalar operations. The single Foreground Processor supervises the four Background Processors, while the large Common Memory complements the processors and provides architectural balance, thus assuring extremely high throughput rates.

Onsite maintenance is possible via the maintenance control console.

Background Processors

Each Background Processor consists of a computation section, a control section and a high-speed Local Memory. The computation section performs arithmetic and logical calculations. These operations and the other functions of a Background Processor are coordinated through the control section. Local Memory is used to store temporarily scalar and vector data during computations. Each Local Memory is 16,384 64-bit words.

Control and data paths for one Background Processor are shown in the block diagram (opposite page).

Computation section

The computation section contains registers and functional units that operate together to execute a program of instructions stored in memory.

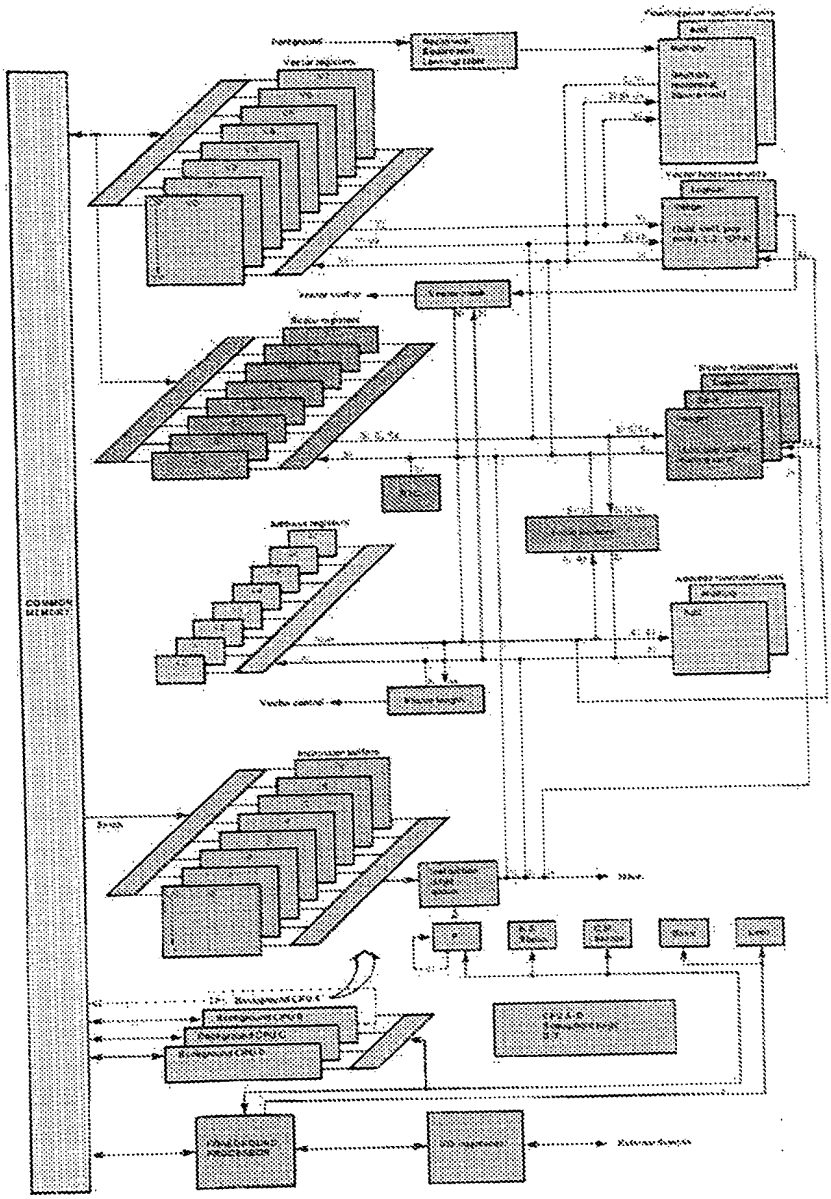
Computation section characteristics

- ☐ Twos complement integer and signed magnitude floating-point arithmetic
- ☐ Address and arithmetic registers
  - Eight 32-bit address (A) registers
  - Eight 64-bit scalar (S) registers
  - Eight 64-element vector (V) registers, 64 bits per element
- ☐ Address functional units
  - Add/subtract
  - Multiply
- ☐ Scalar functional units
  - Add/subtract
  - Shift
  - Logical
  - Population/parity
  - Leading zero count
- ☐ Vector functional units
  - Logical
  - Integer
    - Shift
    - Add/subtract
    - Population/parity
    - Leading zero count
    - Compressed/iota
- ☐ Floating-point functional units
  - Add/subtract
  - Multiply/reciprocal/square root
- ☐ Scatter and gather vector operations to and from Common Memory

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CRAY-2 system organization



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Local Memory

Each Background Processor contains 16,384 64-bit words of Local Memory. Local Memory is treated as a register file to hold scalar operands during computation. It may also be used for temporary storage of vector segments where these segments are used more than once in a computation in the vector registers. The access time for Local Memory is four clock periods, and accesses can overlap accesses to Common Memory. This Local Memory replaces the B and T registers on the CRAY-1 and is readily available for user jobs. One application is for small matrices.

Local Memory characteristics

- 16,384 64-bit words
- Holds scalar and vector operands during computation
- Temporary storage of vector segments
- Four clock period access time to first word
- Overlapping register accesses with Common Memory accesses
- Replaces CRAY-1 B and T registers

Control section

Each Background Processor contains an identical independent control section of registers and instruction buffers for instruction issue and control.

Control section characteristics

- Eight instruction buffers, each holding 64 16-bit instruction parcels
- 128 basic instruction codes
- 32-bit Program Address register
- 32-bit Base Address register
- 32-bit Limit Address register
- 64-bit real-time clock
- Eight Semaphore flags to provide interlocks for Common Memory access
- 32-bit Status register

Each Background Processor has a 64-bit real-time clock. These clocks and the Foreground Processor real-time clock are synchronized at system start-up and are advanced by one count in each clock period.

Background Processor intercommunication

Synchronization of two or more Background Processors cooperating on a single job is achieved through use of one of the eight Semaphore flags shared by the Background Processors. These flags are one-bit registers providing interlocks for common access to shared memory fields. A Background Processor is assigned access to one Semaphore flag by a field in the Status register. The Background Processor has instructions to test and branch, set and clear a Semaphore flag.

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Common Memory

One of the primary technological advantages of the CRAY-2 Computer System is its extremely large directly addressable Common Memory. Featuring 268,435,456 words, this Common Memory is significantly larger than that offered on any other commercially available computer system. It allows the individual user to run programs that would be impossible to run on any other system. It also enhances multiprogramming by allowing an exponential increase in the number of jobs that can reside concurrently in memory (that is, that can be multiprogrammed).

Common Memory is arranged in four quadrants of 32 banks each, for a total of 128 banks. A word of memory consists of 64 data bits and 8 error correction bits (SECDED). This memory is shared by the Foreground Processor, Background Processors and peripheral equipment controllers. Each bank of memory has an independent data path to each of the four Common Memory ports. Each bi-directional Common Memory port connects to a Background Processor and a foreground communications channel.

Total memory bandwidth is 64 gigabits or 1 billion words per second.

Common Memory characteristics

- ☐ 256 million words
- ☐ 64 data bits, 8 error correction bits per word
- ☐ 128 banks, 2 million words per bank
- ☐ Dynamic MOS memory technology

Foreground Processor and I/O section

The Foreground Processor supervises overall system activity among the Foreground Processor, Background Processors, Common Memory and peripheral controllers. System communication occurs through four high-speed synchronous data channels.

Firmware control programs for normal system operation and a set of diagnostic routines for system maintenance are integral to the Foreground Processor.

Control circuitry for external devices is also located within the CRAY-2 mainframe.

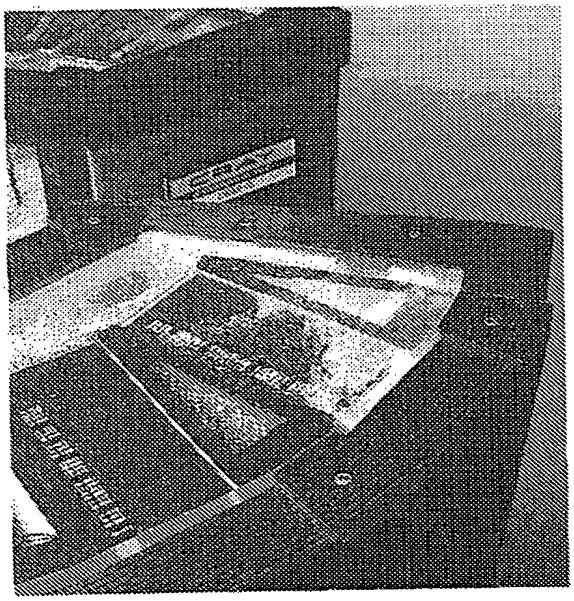
Foreground communication channels

The Foreground Processor is connected to four 4-gigabit communication channels. These channels link the Background Processors, Foreground Processor, peripheral controllers and Common Memory. Each channel connects one Background Processor, one group of peripheral controllers, one Common Memory port and the Foreground Processor. Data traffic travels directly between controllers and Common Memory.

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CRAY-2 technology



Technological innovations on the CRAY-2 include the use of liquid immersion cooling and the eight-layer, three-dimensional modules.

Liquid immersion cooling

Effective cooling techniques are central to the design of high-speed computational systems. Densely packed components result in shorter signal paths, thus contributing to higher speeds. Traditionally, the tradeoff has been lower reliability due to increased operating temperatures, but this is no longer a limitation. The liquid immersion cooling technology used by the CRAY-2 is a breakthrough in the design of cooling systems for large-scale computers. It places the cooling medium in direct contact with the components to be cooled, thus efficiently reducing and stabilizing the operating temperature and increasing system reliability.

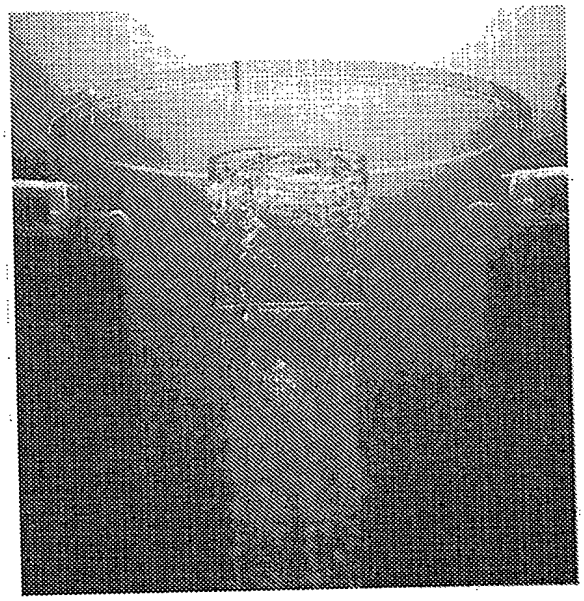
The CRAY-2 mainframe operates in a cabinet filled with a colorless, odorless, inert fluorocarbon fluid. The fluid is nontoxic and nonflammable, and has high dielectric (insulating) properties. It also has high thermal stability and outstanding heat transfer properties. The coolant flows through the module circuit boards at a velocity of one inch per second and is in direct contact with the integrated circuit packages and power supplies.

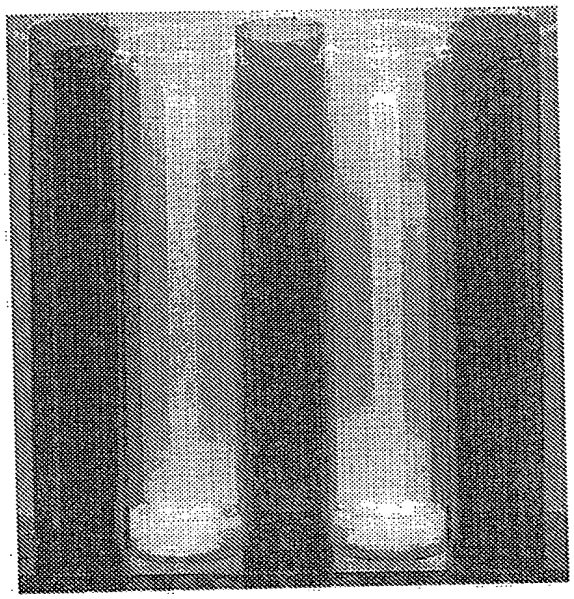
Liquid immersion cooling characteristics

- The key to densely packed electronics
- "Valveless" cooling system
  - 200 gallon closed system
  - Room temperature cooling ranges
  - Accompanying stand pipe and reservoir
  - Shell and tube heat exchange
- Chilled water cooling
- Fluorocarbon fluid
  - Colorless
  - Odorless
  - Inert, nontoxic and nonflammable
  - High insulant properties
  - High thermal stability
  - High heat transfer capacity

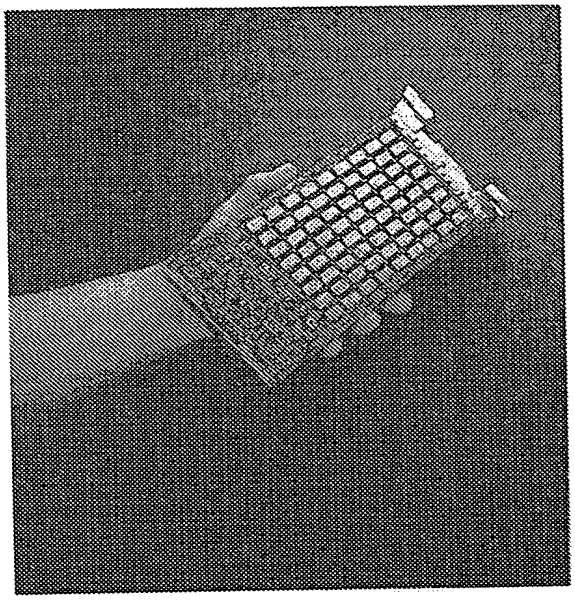
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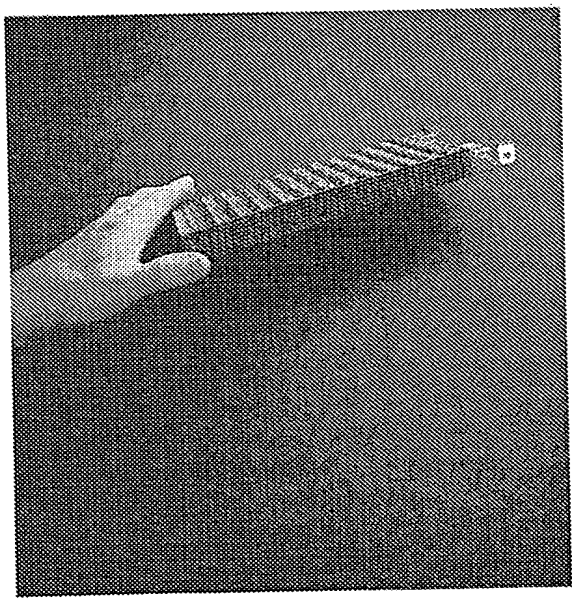
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Module technology design

The CRAY-2 hardware is constructed of synchronous networks of binary circuits. These circuits are packaged in 320 pluggable modules, each of which contains approximately 750 integrated circuit packages. Total integrated circuit population in the system is approximately 240,000 chips, nearly 75,000 of which are memory.

The pluggable modules are three-dimensional structures with an 8 x 8 x 12 array of circuit packages. Eight printed circuit boards form the module structure. Circuit interconnections are made in all three dimensions within the module. Each module measures 1 x 4 x 6 inches, weighs 2 pounds, consists of approximately 40% integrated circuits by volume and consumes 300 to 500 watts of power.

The CRAY-2 Common Memory consists of 128 memory banks with two million words per bank. Each memory bank occupies a circuit module.

CRAY-2 logic networks are constructed of 16-gate array integrated circuits packaged in three-dimensional structures.

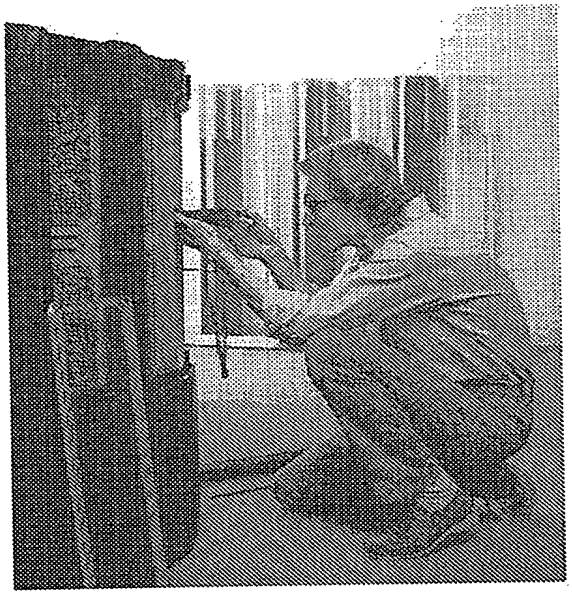
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CRAY-2 reliability

A notable increase in reliability is another benefit of the immersion cooling technology. All components rapidly dissipate heat to the fluid, thus preventing high chip temperatures. These chip temperatures are substantially lower than those achieved by other types of cooling and result in significantly reduced chip failure rates. Efficient heat dissipation also prevents destructive thermal shocks that might result from large temperature differentials and fluctuations.

In addition, a fifteen-to-one decrease in module count per CPU from the CRAY-1 and a ten-to-one reduction in memory module count enhance failure isolation, producing a corresponding increase in maintenance efficiency.



CRAY-2 maintenance

If a module should fail, effective and timely maintenance is a routine operation. Diagnostic software quickly isolates the problem to the failing module. The immersion fluid is quickly pumped into the reservoir adjacent to the mainframe. The front panel is easily removed for ready access to the module, which can then be replaced. The front panel is then reinstalled and the fluid quickly returned to the mainframe. The entire operation requires only a few minutes. Once the system is restarted, further diagnosis and repair of the faulty module can occur on site.

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CRAY-2 software

Cray Research has made a major commitment to the development of a comprehensive and useful user environment through an aggressive software development program.

The CRAY-2 Computer System comes with state-of-the-art software including an operating system based on AT&T UNIX System V, an automatic vectorizing FORTRAN compiler, a comprehensive set of utilities and libraries and a C language compiler. The software has extensive development objectives beyond initial deliveries, including expanded networking capabilities and application program migration.

The choice of an operating system based on UNIX provides the CRAY-2 user with a well-defined program development environment joined with the advanced computational power of the CRAY-2. The user can access the power of the system through the FORTRAN compiler (CFT) and the optimizing library routines. CFT is a proven compiler that performs automatic vectorization and will conform to the ANSI X3.9-1978 FORTRAN 77 standard.

Software summary

- The CRAY-2 Operating System, based on the proven UNIX System V and enhanced to fit the large-scale scientific computer environment
- CFT, a vectorizing and optimizing FORTRAN compiler
- An optimized FORTRAN mathematical and I/O subroutine library
- A scientific subroutine library optimized for the CRAY-2
- A multitasking library that allows user partitioning of an application into concurrently executing tasks
- A wide variety of system utilities to support the needs of interactive and batch processing
- A C language compiler that supports the needs of system software written in C language
- CAL, the CRAY macro assembler, that provides access to all CRAY-2 instructions

CRAY-2 Operating System

The CRAY-2 Operating System is based on UNIX System V, an operating system developed by AT&T Bell Laboratories. In recent years, versions of UNIX have become available on many different computer systems. UNIX is written in a high-level language called C and contains a kernel and a large, diverse set of utilities and library programs.

The kernel is the heart of the system. It has a simple, well-constructed and clean structure with short and efficient software control paths. It supports a small number of system call primitives that library and application programs can use together to perform more complex tasks. The kernel is procedure-oriented, encompassing many processes that dynamically share a common data area used to control the operation of the CRAY-2 system. The system is oriented towards an interactive environment with a hierarchical file structure. This structure features directories, user ownership and file protection/privacy.

The kernel of the CRAY-2 Operating System has been substantially enhanced in the areas of I/O processing and in the efficient use of very large data files. Other significant enhancements include support for asynchronous I/O, improved file system reliability, multiprocessing and user multitasking.

Users may initiate asynchronous processes to communicate with one another and to pass data between them. A variety of command structures (shells) are possible. The CRAY-2 Operating System offers a standard shell; others may be created to provide different command interfaces for the users. A batch processing capability is provided for efficient use of the system by large, long-running jobs.

The operating system supports high-level languages (including FORTRAN and C) and the mechanism to deliver a common operating system environment across a variety of interconnected computer systems. It delivers the ultimate in computational performance possible on the CRAY-2.

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CRAY-2 FORTRAN Compiler and Libraries

The CRAY-2 FORTRAN compiler, CFT Version 2, is based on CFT, the highly successful CRAY-1 compiler that was the first in the industry to automatically vectorize codes.

CFT Version 2 automatically vectorizes inner DO-loops, provides normal program optimization and exploits many of the unique features of the CRAY-2 architecture. It does this without sacrificing high compilation rates.

The compiler and FORTRAN library offer current Cray customers a high level of source code compatibility by making available FORTRAN extensions, compiler directives and library interfaces available on other Cray Research products.

The FORTRAN library and a library of highly optimized scientific subroutines enable the user to take maximum advantage of the architecture of the hardware. The I/O library provides the FORTRAN user with convenient and efficient use of external devices at maximum data rates for large files.

Multitasking

Multitasking is a feature that allows two or more parts of a program to be executed in parallel. This results in substantial throughput improvements over serially executed programs. The performance improvements are in proportion to the number of tasks that can be constructed for the program and the number of Background Processors that can be applied to these separate tasks.

In conjunction with vectorization and large memory support, a flexible multitasking capability provides a major performance step in large-scale scientific computing. The user interface to the CRAY-2 multitasking capability is a set of FORTRAN-callable library routines that are compatible with similar routines available on other Cray products.

CRAY-2 FORTRAN features

- ☐ ANSI standard compiler
- ☐ Automatic optimization of code
  - Vectorizes inner loops
  - Uses Local Memory
- ☐ Portability of application codes is a primary goal
- ☐ Very high compilation rates
- ☐ Library routines
  - Scientific library
  - I/O library
  - Multitasking library

C Language

The C programming language is a high-level language used extensively in the creation of the CRAY-2 Operating System and the majority of the utility programs that comprise the system. It is a modern computer language that is available on processors ranging from microcomputers to mainframe computers and now to Cray computers. C is useful for a wide range of applications and system-oriented programs. The availability of C complements the scientific orientation of FORTRAN.

Utilities

A useful and appropriate set of software tools assist both interactive and batch users in the efficient use of the system. Operational support facilities enable proper management of the system.

CAL

The CRAY-2 Assembler, CAL Version 2, provides a powerful macro assembly language that allows the user to take advantage of all CRAY-2 instructions, while using an instruction syntax and macro capability that is similar to the CRAY-1 assembler.

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Applications

The CRAY-2 Computer System provides balanced performance for computationally intensive large-scale applications. Generating solutions to many important problem classes depends heavily on the number of data points that can be considered and the number of computations that can be performed. The CRAY-2 provides substantial increases over its predecessors with respect both to the number of data points and the computation rate. Researchers and engineers realistically can apply the CRAY-2 to problems previously considered computationally intractable, as well as solving more commonplace problems faster and with greater accuracy.

One such application is the simulation of physical phenomena — the analysis and prediction of the behavior of physical systems through computer modeling. Such simulation is common in weather forecasting, aircraft and automotive design, energy research, geophysical research and seismic analysis. The CRAY-2 opens the door to true three-dimensional simulation in a wide variety of problem domains. The CRAY-2 also offers a challenging opportunity for new solutions to applications in such fields as genetic engineering, artificial intelligence, quantum chemistry and economic modeling.

The CRAY-2 offers dramatic improvements in throughput via the balanced exploitation of large memory, fast vector and scalar computation rates, and multiprocessing. Problems with previously prohibitive I/O requirements can now fit in memory. Vectorization and multiprocessing promote very high computation rates. In practical terms, this means that problems previously considered large-scale become medium- or even small-scale on the CRAY-2. And problems previously considered unsolvable or too costly to solve become solvable and economically feasible with the CRAY-2.

Applications

- ☐ Fluid dynamics
- ☐ Circuit simulation and design
- ☐ Structural analysis
- ☐ Energy research
- ☐ Weather forecasting
- ☐ Atmospheric and oceanic research
- ☐ Quantum chemistry
- ☐ Artificial intelligence
- ☐ Genetic engineering
- ☐ Signal image processing
- ☐ Molecular dynamics
- ☐ Petroleum exploration and extraction
- ☐ Process design
- ☐ Economic modeling

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Offering advanced architecture, advanced technology and advanced software, the CRAY-2 clearly leads the industry in large-scale computing. The CRAY-2 leads in technology by offering the fastest processor clock cycle (4.1 nanoseconds), the largest memory (256 million words) and four vector and scalar multi-processing Background Processors. The CRAY-2 leads the industry in computer architecture by applying the fastest or most dense components available and packaging them in three-dimensional modules immersed in liquid coolant. The CRAY-2 leads the industry in software by converting an industry recognized and accepted operating system and tailoring it to the needs of large-scale computers, by providing a FORTRAN compiler that automatically takes advantage of the system architecture and by offering extensions available to the operating systems that promote efficient use of the system.

About Cray Research, Inc.

Cray Research, Inc. was organized in 1972 by Seymour R. Cray, a leading designer of large-scale scientific computers, and by a small group of associates experienced in the computer industry. The company was formed to design, develop, manufacture and market large-capacity, high-speed computers. The first model produced was the CRAY-1 Computer System.

Mr. Cray has been a leading architect of large scientific computers for more than 25 years. From 1957 to 1968, he served as a director of Control Data Corporation (CDC) and was a senior vice president at the time of his resignation in early 1972. In that time, he was the principal architect in the design and development of the CDC 1604, 6600 and 7600 Computer Systems. Prior to his association with CDC, Mr. Cray was employed at the Univac Division of Sperry Rand Corporation and its predecessor companies, Engineering Research Associates and Remington Rand. Mr. Cray has been the principal designer and developer of both the CRAY-1 and the CRAY-2 Computer Systems.

Today, Cray Research is the world leader in supercomputers, with over 100 CRAY-1 and CRAY X-MP systems installed worldwide. The company employs nearly 2500 people and operates manufacturing, research, development and administrative facilities in Chippewa Falls, Wisconsin and the Minneapolis, Minnesota area. The company has sixteen domestic sales and support offices and eight subsidiary operations in Western Europe, Canada and Japan.



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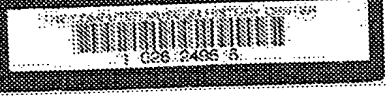
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JEFFREY VAN MYERS
J.V. MYERS & ASSOCIATES, PC
P.O. BOX 130
DRIFTWOOD, TEXAS 78619

PCT

NOTIFICATION CONCERNING PAYMENT OF PRESCRIBED FEES

(PCT Rules 12*bis*.1(c), 14, 15 and 16 and Administrative Instructions, Sections 102*bis*(c), 304, 323(b) and 707)

Date of mailing *(day/month/year)*	18 Dec 2013
Applicant's or agent's file reference: JMG001-01	**PAYMENT DUE** see item 3 for time limits

International application No.	International filing date/Date of receipt *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/075126	13 Dec. 2013	14 Dec 2012

Applicant: MIDAS GREEN TECHNOLOGY, LLC

1. The applicant is hereby notified that this receiving Office has received:

☐ **the payment** of all the prescribed fees, and ☐ **an overpayment**, which will be refunded in due course.

☒ **no or insufficient payment** of the prescribed fees and the applicant is hereby **invited to pay the balance due**, as summarized under item 2, within the time limit(s) indicated under item 3.

2. **Fees and payment calculation:**

3,712.00	–	3,696.00	=	16.00
Total fees payable		Amount paid		Balance

☒ The details of the calculation are given in the Annex.

3. **Time limit(s) for payment and amount(s) payable (Rules 14.1, 15.3 and 16.1(f)):**

☒ within ONE MONTH from the date of receipt of the international application (**for the transmittal fee** (if any), **the search fee** and **the international filing fee**). The amount payable for each fee is the amount applicable on the date of receipt of the international application.

☐ within 16 MONTHS from the priority date (only for the fee for priority document). The applicant's attention is drawn to the fact that the request made by the applicant under Rule 17.1(b) will be considered not to have been made unless the fee is paid within that time limit.

4. Additional observations *(if necessary)*:

☒ The search copy will not be transmitted to the International Searching Authority until the search fee is paid (therefore the start of the international search will be delayed) (Rule 23.1(a) and (b)).

Name and mailing address of the receiving Office	Authorized officer
Mail Stop PCT, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450	Phyllis Williams
Facsimile No. 571-273-3201	Telephone No. 703-756-1421

Form PCT/RO/102 (July 2010)

ANNEX TO FORM PCT/RO/102
CALCULATION OF THE PRESCRIBED FEES

International application No.
PCT/US2013/075126

[T] Transmittal Fee

Prescribed amount:		240.00 [T]	☒ correct amount
Amount paid:	−	240.00	☐ overpayment
Balance:	=	0.00	☐ balance due

[S] Search Fee

Prescribed amount:		2,080.00 [S]	☒ correct amount
Amount paid:	−	2,080.00	☐ overpayment
Balance:	=	0.00	☐ balance due

[I] International Filing Fee

Fixed amount for first 30 sheets: 1,312.00 [i1]

5 (Number of sheets in excess of 30 *(excluding pages referred to in Section 707(a-bis))*) x 16.00 (Fee per sheet) = 80.00 [i2]

Reduction where the international application is filed *(See PCT Applicant's Guide, International Phase for details on the availability of this reduction)*:

on paper together with a copy in electronic form, in character coded format, of the request and the abstract	−	0.00 [r]
or in electronic form, the request not being in character coded format	−	0.00 [r]
or in electronic form, the request being in character coded format	−	0.00 [r]
or in electronic form, the request, description, claims and abstract being in character coded format	−	0.00 [r]
Sub-total:	=	1,392.00 [i1+i2-r]

Applicants from certain States are entitled to a reduction of 90% of the international filing fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 10% of the sub-total entered at (i1+i2-r); (see Notes to the Fee Calculation Sheet as annexed to the Request Form, PCT/RO/101, for details):

	=	1,392.00 [I]	
Amount paid:	−	1,376.00	☐ correct amount
		16.00	☐ overpayment
Balance:	=		☒ balance due

[P] Fee for Priority Document

Prescribed amount:		0.00 [P]	☒ correct amount
Amount paid:	−	0.00	☐ overpayment
Balance:	=	0.00	☐ balance due

[ES] Fee for Earlier Search Documents

Prescribed amount:		0.00 [ES]	☐ correct amount
Amount paid:	−	0.00	☐ overpayment
Balance:	=	0.00	☐ balance due

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 89 of 656; IPR2025-00196

PATENT COOPERATION TREATY

From the RECEIVING OFFICE

To:

JEFFREY VAN MYERS
J.V. MYERS & ASSOCIATES, PC
P.O. BOX 130
DRIFTWOOD, TEXAS 78619

PCT

NOTIFICATION CONCERNING PAYMENT OF PRESCRIBED FEES

(PCT Rules 12*bis*.1(c), 14, 15 and 16 and Administrative Instructions, Sections 102*bis*(c), 304, 323(b) and 707)

Date of mailing *(day/month/year)*	31 Dec 2013
PAYMENT DUE	see item 3 for time limits

Applicant's or agent's file reference		
JMG001-01		
International application No.	International filing date/Date of receipt *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/075126	13 Dec 2013	14 Dec 2012

Applicant
MIDAS GREEN TECHNOLOGY, LLC

1. The applicant is hereby notified that this receiving Office has received:

☒ **the payment** of all the prescribed fees, and ☐ **an overpayment**, which will be refunded in due course.

☐ **no or insufficient payment** of the prescribed fees and the applicant is hereby **invited to pay the balance due**, as summarized under item 2, within the time limit(s) indicated under item 3.

2. **Fees and payment calculation:**

3,696.00	–	3,696.00	=	0.00
Total fees payable		Amount paid		Balance

☐ The details of the calculation are given in the Annex.

3. **Time limit(s) for payment and amount(s) payable (Rules 14.1, 15.3 and 16.1(f)):**

☐ within ONE MONTH from the date of receipt of the international application (**for the transmittal fee** (if any), **the search fee** and **the international filing fee**). The amount payable for each fee is the amount applicable on the date of receipt of the international application.

☐ within 16 MONTHS from the priority date (only for the fee for priority document). The applicant's attention is drawn to the fact that the request made by the applicant under Rule 17.1(b) will be considered not to have been made unless the fee is paid within that time limit.

4. Additional observations *(if necessary)*:

☐ The search copy will not be transmitted to the International Searching Authority until the search fee is paid (therefore the start of the international search will be delayed) (Rule 23.1(a) and (b)).

Name and mailing address of the receiving Office	Authorized officer
Mail Stop PCT, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450	Nina D Butler
Facsimile No. 571-273-3201	Telephone No. 571-272-9027

Form PCT/RO/102 (July 2010)

ANNEX TO FORM PCT/RO/102
CALCULATION OF THE PRESCRIBED FEES

International application No.
PCT/US2013/075126

[T] Transmittal Fee

Prescribed amount:	240.00 [T]	☒ correct amount
Amount paid:	240.00	☐ overpayment
Balance:	0.00	☐ balance due

[S] Search Fee

Prescribed amount:	2,080.00 [S]	☒ correct amount
Amount paid:	2,080.00	☐ overpayment
Balance:	0.00	☐ balance due

[I] International Filing Fee

Fixed amount for first 30 sheets: 1,312.00 [i1]

4 (Number of sheets in excess of 30 *(excluding pages referred to in Section 707(a-bis))*) x 16.00 (Fee per sheet) = 64.00 [i2]

Reduction where the international application is filed *(See PCT Applicant's Guide, International Phase for details on the availability of this reduction)*:

on paper together with a copy in electronic form, in character coded format, of the request and the abstract	0.00 [r]
or in electronic form, the request not being in character coded format	0.00 [r]
or in electronic form, the request being in character coded format	0.00 [r]
or in electronic form, the request, description, claims and abstract being in character coded format	0.00 [r]

Sub-total: 1,376.00 [i1+i2-r]

Applicants from certain States are entitled to a reduction of 90% of the international filing fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 10% of the sub-total entered at (i1+i2-r); (see Notes to the Fee Calculation Sheet as annexed to the Request Form, PCT/RO/101, for details):

	1,376.00 [I]	☒ correct amount
Amount paid:	1,376.00	☐ overpayment
Balance:	0.00	☐ balance due

[P] Fee for Priority Document

Prescribed amount:	0.00 [P]	☒ correct amount
Amount paid:	0.00	☐ overpayment
Balance:	0.00	☐ balance due

[ES] Fee for Earlier Search Documents

Prescribed amount:	0.00 [ES]	☐ correct amount
Amount paid:	0.00	☐ overpayment
Balance:	0.00	☐ balance due

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 91 of 656; IPR2025-00196

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF RECEIPT OF RECORD COPY

(PCT Rule 24.2(a))

To:

MEYERS, Jeffrey, Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 78619
ETATS-UNIS D'AMERIQUE

Date of mailing *(day/month/year)*	IMPORTANT NOTIFICATION
09 January 2014 (09.01.2014)	
Applicant's or agent's file reference: JMG001-01	International application No.: PCT/US2013/075126

The applicant is hereby **notified** that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

MIDAS GREEN TECHNOLOGY, LLC (all designated States)

International filing date: 13 December 2013 (13.12.2013)

Priority date(s) claimed: 14 December 2012 (14.12.2012)
07 June 2013 (07.06.2013)

Date of receipt of the record copy by the International Bureau: 03 January 2014 (03.01.2014)

List of designated Offices:

AP: BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW
EA: AM, AZ, BY, KG, KZ, RU, TJ, TM
EP: AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR
OA: BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG
National: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW

ATTENTION: The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau. **In addition, the applicant's attention is drawn to:**

- time limits for entry into the national phase (see www.wipo.int/pct/en/texts/time_limits.htmland *PCT Applicant's Guide*, National Phase, especially Chapters 3 and 4)
- requirements regarding priority documents (if applicable) (see *PCT Applicant's Guide*, International Phase, paragraph 5.070)

A copy of this notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 89 75

Authorized officer
Poupel Sylvie
e-mail pt05.pct@wipo.int
Telephone No. +41 22 338 74 05

1/RKW44VYVGGXMJ0

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 92 of 656; IPR2025-00196

PCT

POWER OF ATTORNEY

(for an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.4)

The undersigned applicant(s) (Owner should be indicated as they appear in the Request Form (PCT/RO/101)):

Midas Green Technology, LLC
8500 Shoal Creek
Building 2, Suite K
Austin, TX 78757
USA

hereby appoints (appoint) the following person as: ☒ agent ☐ common representative

Name and address
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

MYERS, Jeffrey Van
J. V. Myers & Associates, Inc.
P. O. Box 130
Chetwood, TX 78619
USA

to represent the undersigned before

☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the Authority specified for supplementary search only: _____
(please indicate the Authority(ies) specified for supplementary search)
☐ the International Preliminary Examining Authority only

in connection with the international application identified below:

Title of the invention: APPLIANCE IMMERSION COOLING SYSTEM

Applicant's or agent's file reference: JMG001-01

International application number (if already known):

filed with the following Office: US as receiving Office
and to make or receive payments on behalf of the undersigned.

Signature of the applicant(s) (where there are several applicants, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading the request or this power):

Name: _____ Capacity: CEO

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/US2013/075126**
International filing date:		**13 December 2013 (13.12.2013)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**61/737,200**
	Filing date:	**14 December 2012 (14.12.2012)**
Date of receipt at the International Bureau:		**03 January 2014 (03.01.2014)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

590233

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 01, 2014

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *61/737,200*
FILING DATE: *December 14, 2012*
RELATED PCT APPLICATION NUMBER: *PCT/US13/75126*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US61/737,200*

Certified by

David J. Kappos

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1 — Remove

Given Name	Middle Name	Family Name	City	State	Country
John	H.	Miller Jr.	Austin	TX	US

Inventor 2 — Remove

Given Name	Middle Name	Family Name	City	State	Country
James	P.	Koen	Austin	TX	US

Inventor 3 — Remove

Given Name	Middle Name	Family Name	City	State	Country
John	C.	Tribou	Austin	TX	US

Inventor 4 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Mike		Rainone	Palestine	TX	US

Inventor 5 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Talbot		Presley	Palestine	TX	US

Inventor 6 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Jeffrey	Van	Myers	Driftwood	TX	US

Inventor 7 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Christopher	L	Boyd	Austin	TX	US

Inventor 8 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Kenneth	D	Tooke	Austin	TX	US

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

Inventor 9					Remove
Given Name	Middle Name	Family Name	City	State	Country
David	Christopher Thoma	Laguna	Austin	TX	US

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Title of Invention	Server Immersion Tank System
Attorney Docket Number (if applicable)	JMG001-00

Correspondence Address

Direct all correspondence to (select one):

◉ The address corresponding to Customer Number	○ Firm or Individual Name
Customer Number	44070

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

◉ No.

○ Yes, the name of the U.S. Government agency and the Government contract number are:

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

Entity Status

Applicant claims small entity status under 37 CFR 1.27

(•) Yes, applicant qualifies for small entity status under 37 CFR 1.27

( ) No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey Van Myers/			Date (YYYY-MM-DD)	2012-12-14
First Name	Jeffrey	Last Name	Myers	Registration Number (If appropriate)	27362

This collection of information is required by 37 CFR 1.51. 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. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours 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, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or paten. Accordingly, pursuant to the requirements of the Act, please be advised that : (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, t o a n other federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

[0001] Goal: substantially constant pressure at all Spray Heads (at bottom of Tank):

[0002] 1. For example, as in Fig. 1, 13 Spray Bars, each having, e.g., 10 Spray Heads (not shown) each of x-sectional area of 1 unit.

[0003] 1.1. Spray Bars 1 & #13 have x-sectional area of 5 units (Optional: 5 Spray Heads of 1 unit area, or 10 Spray Heads of 0.5 unit area).

[0004] 1.2. Spray Bars #2-#12 have x-sectional area of 10 units.

[0005] 1.3. Total x-sectional area of ALL Spray Bars is 120 units.

[0006] 2. Each (x2) Header Manifold has x-sectional area of 60 units, i.e., 1/2 total x-sectional area of all Spray Bars.

[0007] 3. Total x-sectional area of Supply Manifold is 120 units.

[0008] Result: relative pressure drop at Supply-to-Headers minimal; pressure drop at Header-to-Spray Bar is related to position, but inverse relationship wrt 'top' and 'bottom' Headers compensates (subject to frictional losses, slight differences from ideal x-sectional areas, etc.)

[0009] 1. Each Spray Bar has an area-efficient (e.g, ball, gate) shutoff valve at each end, adjacent the connection to the respective Header, all valves being set at system setup/change via an actuating rod manually inserted from above; when both closed, no fluid is delivered to the Spray Heads.

[0010] 2. The Spray Bars are spaced such that a Server may be suspended in each inter-Spray Bar gap, thus forming respective 'flow slots' the flow patterns of which project upward from the Spray Heads, through the inter-Server gaps, and, ultimately into open fluid return channel(s) (e.g., weirs) extending horizontally along the long side(s) of the tank.

[0011] 3. Servers are inserted starting from, e.g., the 'left' end of tank, each suspended in a respective 'Server-slot' between adjacent Spray Bars, with no Server-slot vacancies allowed.

[0012] 4. If any empty Server-slots remain, a full tank width/height flow barrier is inserted into the Server-slot immediately to the 'right' of the 'right-most' active

Server, and the shutoff valves at both ends of all 'idle' Spray Bars are closed, thus forming a stagnant fluid reservoir (with proportional system energy savings).

[0013] Operation: Heat developed on the 'left-facing' major surface of Server #1 is extracted by fluid flow developed in flow-slot #1 by Spray Bar #1, while heat developed on the 'right-facing' major surface is extracted by fluid flow developed in flow-slot #2 by Spray Bar #2. Similarly, heat developed on the 'left-facing' major surface of Server #2 is extracted by fluid flow developed in flow-slot #2 by Spray Bar #2, while heat developed on the 'right-facing' major surface is extracted by fluid flow developed in flow-slot #3 by Spray Bar #3; and so on.

[0014] (Optional) The shutoff valves of the Spray Bar servicing the 'right-most' active 'flow slot' (i.e., between the 'right-most' active Server and the flow barrier) may be partially closed to compensate for the reduced heat being radiated/conducted into this flow slot.

[0015] (Optional) Each shutoff valve is controlled by a respective servo, with the valve-pair of each Spray Bar being controlled by a single Valve Controller in response to temperature sensor(s) suspended in the respective flow-slot somewhat below the 'top' surfaces of the adjacent Servers (to more accurately measure the temperature of the fluid exiting the respective flow-slot before significant mixing with fluid flowing in adjacent flow-slots).

[0016] (Optional) A 'smart' Master Controller monitors a selected set of the flow-slot temp sensors, and coordinates the activities of all active flow-slot Valve Controllers. Due to the huge heat storage capacity of the entire fluid mass and concomitant system temperature lag, determining the energy saving contribution of this Master Controller will be problematic, but nonetheless this function contributes to the end goal of protecting the set of active Servers from sustained excessive heat excursions.

[0017] (Option) The gaps between the 'side' surfaces of each Server and the adjacent side(s) of the Tank may be blocked using appropriately sized flow baffles to facilitate more precise control of fluid flow in each flow-slot.

[0018] (Option) As in Fig. 2, dispose infra-red (IR) shields between adjacent blades to reflect/absorb IR radiation from one blade to the next adjacent blade.

Reflection can be achieved using highly polished metal/mirrored plates, e.g., gold-plated; absorption can be achieved using flat-black or black-anodized plates. Fins can be added to enhance effectiveness. Multiple layers may also be employed with an interlayer gap for vertical flow of the cooling fluid.

[0019] (Option) Also as in Fig. 2, orient the Spray Bar(s) longitudinally with Spray Head(s) aligned with inter-blade gaps. If more than one Spray Head per gap, arrange radially so as that the flow pattern resembles a fan, as in Fig. 3. Individual Spray Heads can be fan-shaped. Spray Heads can be fixed flow rate or variable flow rate or a mixture of both as required for specific applications. Variable flow rate can be adjusted manually or by servo-mechanism.

[0020] (Option) Also as shown in Fig. 3, Supplementary Spray Bars, oriented vertically but with horizontally-oriented 'aimable' Spray Head(s), can be provided to provide flow of cooling fluid directly onto local blade hotspots. Such Supplementary Spray Bars can be supplied either from the primary Spray Bars or via special Supplementary Manifolds disposed either at the bottom/top of the tank or adjacent the tank side(s).

[0021] (Option) Dispose within the tank a bladder to contain the fluid and all related structures. This allows the tank to be modular, bolt-together panels as the fluid sealing is accomplished via the bladder. Over time, as necessary, the bladder can be drained and replaced without any special expense or effort to clean the inside surfaces of the tank. Based on heuristic evaluation, the shape of the tank can be optimized to minimize hot spots, e.g., form a narrow "waist" in the long side walls to develop a Venturi-like region wherein fluid flow is accelerated past a specific horizontal zone of the blades.

[0022] (Option) Spray Head design can be selected to match heat signature of each blade. Spray Heads can be fixed flow rate or variable flow rate or a mixture of both as required for specific applications. Spray Heads can be mounted on short flex-tubes to provide directional distribution for augmented cooling. In some applications, selected Spray Bars/Heads can be supplied from an auxiliary cooling source operating independently of the main fluid source.

[0023] (Option) Attach a solid-state temperature sensor on or adjacent to each Supplemental Spray Head to provide closed-loop control of a servo-controlled valves supplying such Spray Head.

[0024] (Option) Provide servo-mechanical arrangement to dynamically reposition each Supplemental Spray Head. Attach an RFID tag on each Supplemental Spray Head to provide closed-loop control of the repositioning system.

[0025] (Option) Provide array of temperature sensors together with RFID tags on the Supplemental Spray Heads to allow software monitoring of local hot spots, with automatic repositioning of nearby Supplemental Spray Heads to detected hot spots. Same system can provide servo-control of Spray Head supply valves to resolve larger scale heat zone problems.

[0026] (Option) In addition to, or as a supplement to, the static weir fluid return system, provide active fluid extraction. To prevent loss of suction, provide fluid level sensor(s) to reduce or shut off active extraction before the fluid level drops below the suction point.

[0027] (Option) Design blades specifically for fluid immersion, e.g., with no enclosure, no fans. Orient component heatsinks so as to maximize heat transfer to the cooling fluid while minimizing vertical fluid flow resistance/turbulence. Relocate *essential* moving components, e.g., rotating disk devices, from blades to locations adjacent the respective blade but outside the cooling fluid. For multi-server blades (or blades with more than one significant local heat generating component), distribute the major heat generating components vertically/horizontally to spread the heat signature more evenly vertically/horizontally across the entire surface of the blade. When feasible, mount components on both sides of the blade to facilitate heat distribution to the fluid flow on both sides of the blade.

[0028] The cooling system can be any of several known types: vapor compression; water evaporative ("swamp cooler"); dessicant; ground water source; ambient air source, etc. Choice will be based on geographic location,

availability of energy resources, installation/operating costs, etc. Automatic switch-over to alternative systems can be provided to minimize operating cost.

Electronic Acknowledgement Receipt

EFS ID:	14469753
Application Number:	61737200
International Application Number:	
Confirmation Number:	5753
Title of Invention:	Server Immersion Tank System
First Named Inventor/Applicant Name:	John H. Miller, Jr.
Customer Number:	44070
Filer:	Jeffrey Van Myers
Filer Authorized By:	
Attorney Docket Number:	JMG001
Receipt Date:	14-DEC-2012
Filing Date:	
Time Stamp:	11:18:48
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	$125
RAM confirmation Number	9950
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Provisional Cover Sheet (SB16)	JMG001_PCS_121214.pdf	2071456 77a542714667a6c8841b56706a80f86e0da8db39c	no	4
Warnings:					
Information:					
2	Specification	JMG001_p_121214.pdf	6854641 e2e8e7cf21f943b5db189d5445fc38c15c6cb78b	no	38
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	28824 a86ba99a0a56136eae5d4490eb28a2ff65e04e7d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	8954921		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

(Optional) The shutoff valves of the Spraybar servicing the 'right-most' active 'flow slot' (i.e., between the 'right-most' active Server and the flow barrier) may be partially closed to compensate for the reduced heat being radiated/conducted into this flow slot.

(Optional) Each shutoff valve is controlled by a respective servo, with the valve-pair of each Spraybar being controlled by a single Valve Controller in response to temperature sensor(s) suspended in the respective flow-slot somewhat below the 'top' surfaces of the adjacent Servers (to more accurately measure the temperature of the fluid exiting the respective flow-slot before significant mixing with fluid flowing in adjacent flow-slots).

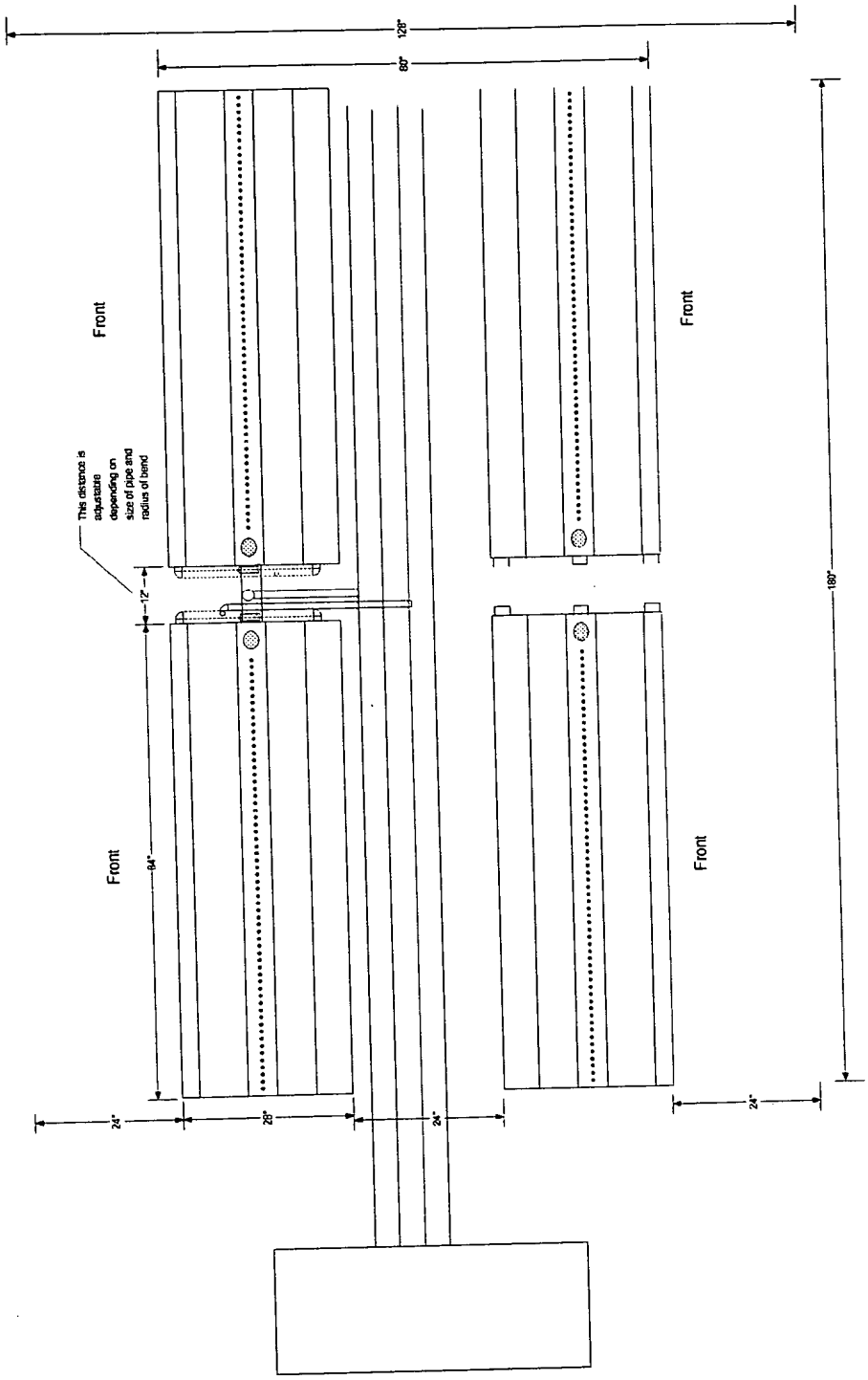
(Optional) A 'smart' Master Controller monitors a selected set of the flow-slot temp sensors, and coordinates the activities of all active flow-slot Valve Controllers. Due to the huge heat storage capacity of the entire fluid mass and concomitant system temperature lag, determining the energy saving contribution of this Master Controller will be problematic, but nonetheless this function contributes to the end goal of protecting the set of active Servers from sustained excessive heat excursions.

(Option) The gaps between the 'side' surfaces of each Server and the adjacent side(s) of the Tank may be blocked using appropriately sized flow baffles to facilitate more precise control of fluid flow in each flow-slot.

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 107 of 656; IPR2025-00196

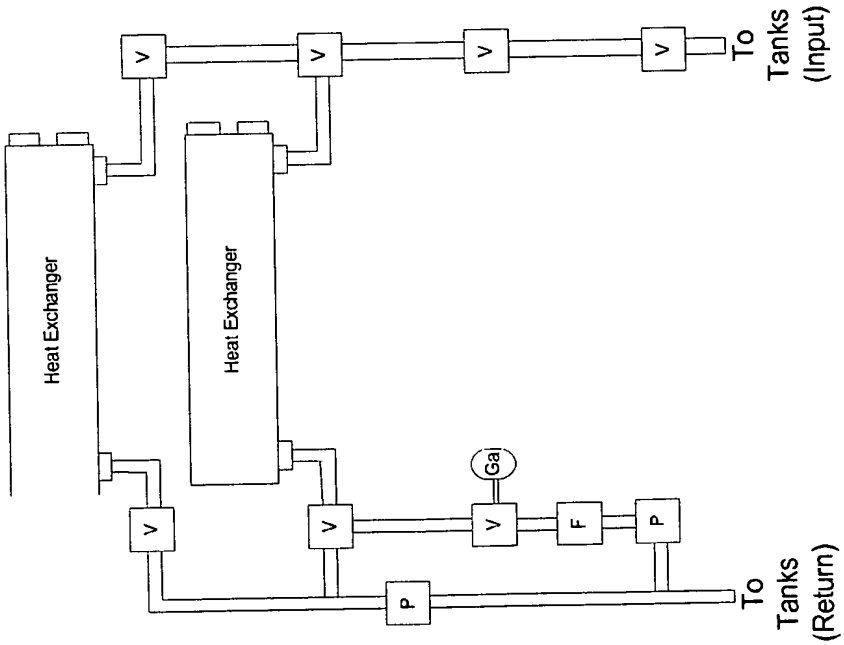
Removable to hide cabling and connectors
Right Side
26"
2.5"
Left Side
26"
19"
4.5"
Servers rest on inside rail.
These items to be added later. Punch outs to be created during manufacture.
Top
Front
24 Port Leviton Patch
24 Power Ports
84"
47"
56.75"

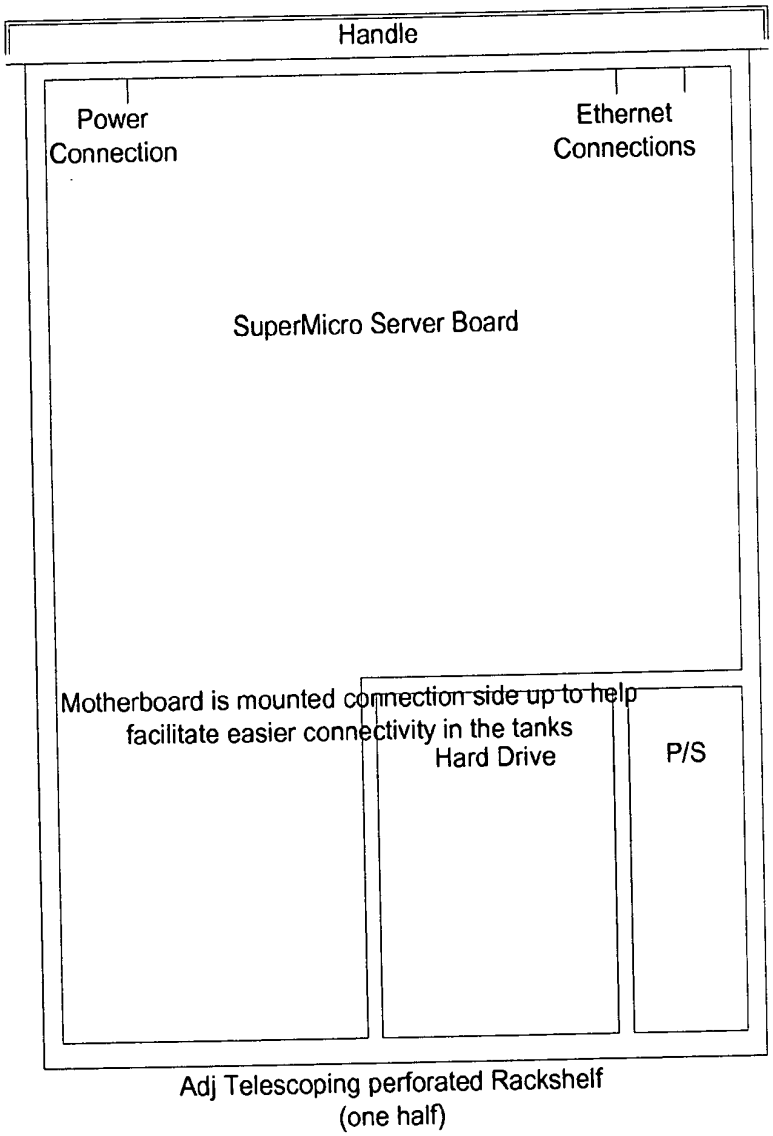
Top
Front
Right Side
Left Side
24 Port Leviton Patch
24 Port Leviton Patch
24 Port Leviton Patch
8 Power Ports
8 Power Ports
8 Power Ports
2.5"
19"
4.5"
25"
26"
26"


126"
80"
Front
Front
This distance is adjustable depending on size of pipe and radius of bend
12"
84"
Front
Front
180"
24"
28"
24"
24"

Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front

Right Side
26"
2.5"
Left Side
19"
4.5"
26"
26"
24 Port Leviton Patch
24 Port Leviton Patch
24 Port Leviton Patch
8 Power Ports
8 Power Ports
8 Power Ports
25"
Front


Heat Exchanger
Heat Exchanger
V
V
V
V
To
Tanks
(Input)
V
V
Ga
V
F
P
P
To
Tanks
(Return)



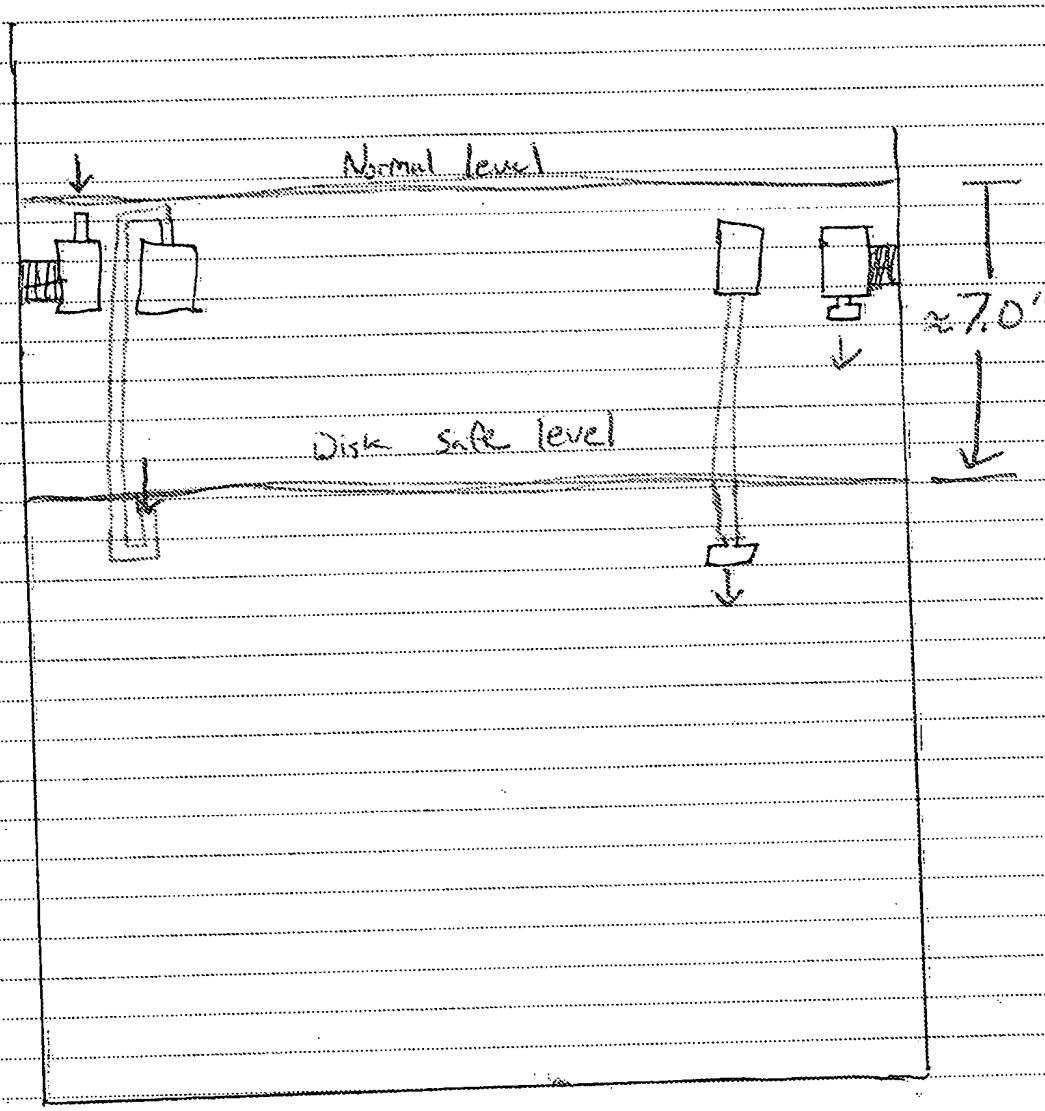
Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 114 of 656; IPR2025-00196

Page No. _____ 10-2-2012

Dripped O.I level for servers w/ unsealed disks.

O.I is about 7" lower and nozzles are lowered on threaded tube to sit a few inches below the oil level.

intake is extended via tube/pipe to sit just below o.i level with intake pointing up.



To Page No. _____

Discussed & Understood by me,

Date 11-15-12

Invented by: D. Chris Laguna

Recorded by:

Date

Midas Green Tech – 1U Low Energy High Density Rack (LEHDR)
Power
Power
Motherboard
SuperMicro X8DTT Series
2.5" SATA X 2
ULT40443
Power
Power
Motherboard
SuperMicro X8DTT Series
2.5" SATA X 2
ULT40443
LEHDR 1U Style 1
Support for: (2) 16.7" x 7.0" Motherboard*, (1) 20.0" x 3.0" x 1.65" Power Suppl
(4) 2.5" Hard Drives
* = Maximum component dimensions
Overall Dimensions: 17.5" x 30" x 1.75"
Sled (Node) Dimensions: (without handle) 7.5" x 21.75" x 1.7"
Chris Laguna – Midas Green Tech – July 2012
Perforated along bottom for air flow.
Read & Understood by me.
Date 11-15-12
Invented by: D. Chris Laguna
Recorded by:
Date 8/6/2012

SLED Assembly

SLED = Super Low Energy Device, Midas Green Tech's oil-ready and optimized server.

All steps should be done utilizing an ESD safe environment with the proper tools.

Planning

- Determine type of SLED from customer order details
- Single Server
    - Dual Server
    - Triple Server
    - Quad Server
    - Other

- Determine Form Factor
    - 1U
    - 2U
    - 3U
    - 4U
    - Other

- Establish Server(s) Specifications
- Select Processor(s)
    - Select Motherboard(s)
    - Select Power Supply(s)
    - Select Heat Sink(s)
    - Select Memory Configuration
    - Select Disk Configuration
    - Select Peripherals
    - Select Chassis
    - Select necessary cables, adapters, I/O ports, brackets, mounts, screws and materials

- Verify and Finalize SLED Layout
- Use component templates to plan layout with I/O ports facing the front (top) of the SLED
- Verify tolerances are in place for cabling and assembly
- Confirm component compatibility
- Finalize layout

- Order/Obtain Parts

Fabrication

- Clean and inspect chassis for defects
- Remove any unnecessary chassis components (fans, mounts, etc.)
- Use component templates to mark necessary modifications to chassis. Modifications can be the addition of mounting points, removal of chassis components, additional ventilation holes and brackets to secure server components
- Modify chassis for server components

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- Modify chassis for server components

- Remove any sharp corners or edges
- Clean and ensure modified chassis is clean and dry
- Verify chassis modifications with server component templates
- Dry-fit server components to verify clearances and tolerances

Assembly

- Install motherboard mounts and motherboard verifying proper mount alignment and making note of cable connection points
- Remove motherboard and return to protective sleeve
- Install power supply and power distribution (if applicable) components
- Make note of routing of power cabling, make every attempt to conceal power cables under motherboard mounts
- Install storage components, and run necessary cabling
- Install I/O cabling, including power switches, LED indicators, LAN, video and USB connections if necessary
- Before installing in chassis, install the processor and heat sink into the motherboard using indium foil instead of thermal grease. Any motherboard or peripheral components with a removable heat sink will need any thermal greases, compounds or tape removed and surfaces cleaned
- Mount motherboard on mounts and secure with the proper screws taking caution to the cabling being ran below the motherboard
- Connect all cabling
- Double check clearances and fit of components
- Install memory and any peripherals, including hard drives
- Clean up cabling and secure any loose cables and connections
- Finalize chassis assembly with mounting brackets and handles

Initial Testing

- Temporarily install fans on all processors
- Double check all cables are properly installed and secure, all components are installed and secured
- Connect monitor, keyboard and USB/CD/DVD-ROM containing testing software
- Connect power and power on the server
- Verify in server BIOS that all peripherals are recognized and working

If server does not power on, utilize the motherboard manual for troubleshooting

- Run memtest for at least 5 minutes to do a quick check of the installed memory
- Connect Ethernet
- Install OS of choice to verify proper server functionality including RAIDs, Networking, etc.

Burn-in and Stress Testing

- Only begin burn-in once testing is complete and you are satisfied with the function of the server
- With the server still out of the oil and fans installed continue:
- Boot form stress-test CD (stresslinux.org or similar)
- Run stress utilities at 50% utilization for at least 2 hours. Run at 100% utilization for 2 more
- Verify server passes stress test by analyzing software logs and reports

If a component fails, isolate the component, remove it and replace it, repeat the testing above

- Finalize server prep for oil submersion, removing fans and finishing chassis assembly
- Lift server so that it is oriented vertically as it will be installed in the tanks, check for loose components
- Submerge server in testing tank
- Restart the stress test and allow it to run at 50% utilization for another 2 hours, 100% utilization for at least 2 hours and time permitting, overnight at 50% utilization
- Analyze for failures and replace any failed components

Release to production

- Remove any testing equipment and media
- Format hard drives and run a DOD wipe to clear any stored data.
- Install OS and setup as indicated in order details

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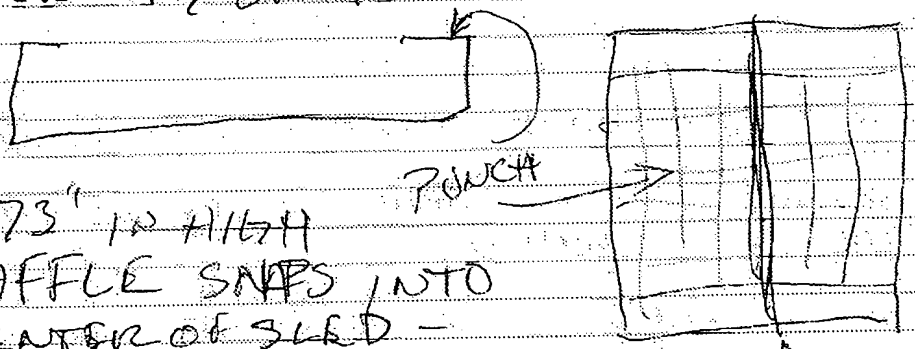
Project No.
Book No.
Page No.

IMPROVED SLED PACKAGE

ISSUES WITH CURRENT SLED —
- LONG ASSEMBLY TIME
- NO PROTECTION AGAINST SHORTS WHILE INSERTING OR REMOVING SYSTEMS FROM TANK
- POSSIBLE POOR COOLANT FLOW DUE TO OPEN DESIGN

NEW SLED BASE
USE STAMPED STEEL FOR BOTTOM — PUNCH 5MM X 5MM (MAYBE SMALLER) ROUND HOLES IN A MATRIX ON BOTTOM — ALLOWS USE OF STAB-LOCKING NYLON MOUNTS FOR PC BOARDS

SIDES OF SLED COME UP 1.75", FOLD OVER — PUNCHED 1 ROW ON FOLDOVER FOR SNAP MOUNTING OF TOP



1.73" IN HIGH BAFFLE SNAPS INTO CENTER OF SLED — PREVENTS COOLANT MIXING BETWEEN BOARDS ON SLED

SLED TOP IS MOLDED PLASTIC SHEET WITH SMALL POSTS ON EDGE TO INTERLOCK WITH SLED BASE EDGE. ALSO INCLUDES MOUNTPOINTS FOR SEVERAL SMALL PUSHBUTTON SWITCHES (POWER, REBOOT, ETC).

To Page No. 2

Read & Understood by me:	Date	Invented by:	Date
	3-14-12	CHRIS BOYD	3-12-2012
		Recorded by: CHRIS BOYD	

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Project No. _____
Book No. _____ TITLE IMPROVED SLED PACKAGE

Page No. 1

ASSEMBLY —

TECH PRINTS OUT MOUNTING TEMPLATE FOR MOTHERBOARD AND ALIGNS THEM IN UPPER RIGHT & LEFT OF SLED BASE.

TECH PUSHES STAB-LOCK POSTS INTO SLED BASE AT POINTS NOTED ON TEMPLATE

TECH INSTALLS CPU, RAM, HEATSINKS, INDIUM FOIL, ETC TO PREP BOARD FOR IMMERSION SERVICE

TECH PLACES MOTHERBOARD OVER TOP OF STAB-LOCK POSTS & PUSHES INTO PLACE

TECH INSTALLS BAFFLE - BAFFLE HAS MOLDED IN STAB-LOCKS AND CABLE CLIPS/TIE POINTS

TECH SNAPS BOOT DRIVE INTO MOLDED CARRIER WITH STAB LOCKS - SNAPS INTO SLED

TECH MOUNTS PSU ONTO SLED W STAB-LOCKING BRACKETS

TECH CONNECTS POWER, DISK, POWER SWITCH, RESET SWITCH CABLES TO BOARD

TECH SNAPS SLED TOP ONTO SLED

ASSEMBLY COMPLETE, READY FOR TEST & BURN IN

To Page No. 4

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Date 3-14-12

Invented by:

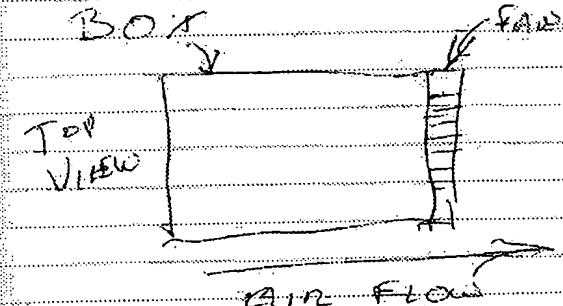
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Date

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Project No.
TITLE COOLING SYSTEM FOR IMPROVED Sheet Book No.
From Page No. 1

MANUFACTURERS OF MOTHERBOARDS, SERVERS, ETC. ARE CURRENTLY RELUCTANT TO WARRANTY BOARDS IMMERSED IN MINERAL OIL. TO MINIMIZE OUR RISK DOE IN "INFANT MORTALITY," WE CAN BURN IN TEST SYSTEMS DESTINED FOR IMMERSION IN AIR—

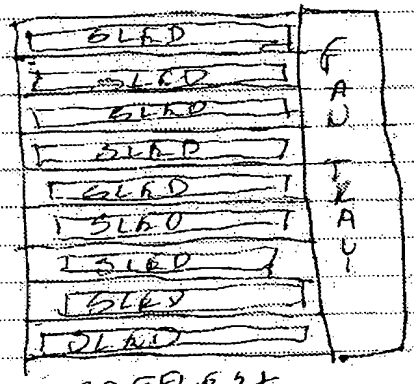


SLIDE FAN TRAY INTO BOX.

TURN ON FAN TRAY TO PULL AIR THROUGH BOX, OVER BOARDS & OTHER COMPONENTS

RUN BURN-IN TESTS.

MULTIPLE BOARDS/SLEDS CAN BE TESTED @ SAME TIME



SOLID BAFFLES TO SIDES, TOP, BOTTOM TO FORCE COOLING AIR OVER BOARDS UNDER TEST

ADVANTAGES —

- SYSTEMS UNDER TEST ARE EASILY ACCESSED & HANDLED BY TECHS
- NO "VOIDED WARRANTY" ISSUES FROM BOARD MANUFACTURERS FOR EARLY FAILURES
- ALLOWS US TO USE A VAR FOR SYSTEM ASSEMBLY
- NO OILY PARTS SHIPPED TO US TRIGGERING SECURITY INSPECTIONS OF PACKAGE

To Page No.

Witnessed & Understood by me,	Date	Invented by: CHRIS BOYD	Date
	3-14-12	Recorded by: CHRIS BOYD	3-12-2012

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Project No.
Book No. TITLE GREEN NOTES
This Page No. 1

3-12-2012 SYCLES RAIN WATER RUNOFF FOR USE IN COOLING TOWERS
3-2012 - DEPLOY ALL SYSTEMS @ 208/240V & 3% POWER SAVINGS FOR FREE

To Page No.

Read & Understood by me.

Date 3-14-12

Invented by:

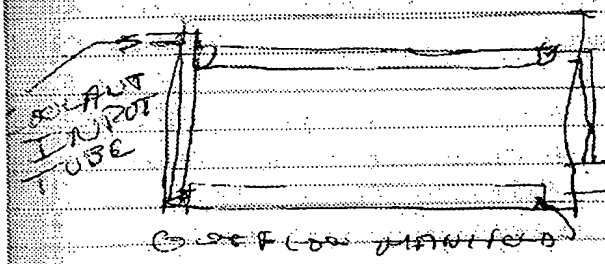
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TITLE FORCED CONVECTION IMMERSION COOLING

From Page No. X



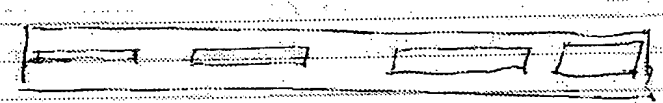
GOAL - IMPROVE FORCED CONVECTION COOLING EFFIENCY BY AVOIDING MIXING OF COOLANT.

COLD FLUID FLOWS INTO TANK VIA TUBE CONNECTED TO A SLOTTED MANIFOLD. COLD FLUID DISPLACES WARM FROM BELOW. WARM FLUID OVERFLOWS U-SHAPED DRAINS ON ~~BOTH~~ BOTH SIDES OF TANK WALL.

(NOTE - A SPINE ON THE SIDE OF THE U-TUBE COULD ACT AS A CONVENIENT MOUNT POINT FOR SERVER EARS.) U-TUBE PROFILE

U-TUBES DRAIN INTO A CLOSED SUMP CONTAINER FOR RECIRCULATION THRU HEAT EXCHANGER. NOTE THAT THE PUMP CANNOT DRAIN THE TANK.

POSSIBLE SLOTTED OUTFLOW MANIFOLD PROFILE:



I SUSPECT SLOTS WOULD NEED TO BE NARROW AT THE END CLOSEST TO THE POINT WHERE COOLANT IS INJECTED, AND GET PROGRESSIVELY WIDER TO ~~AC~~ ACCOUNT FOR PRESSURE CREATING LOSS AS COOLANT FLOWS DOWN THE ~~TUBE~~ TUBE.
-COULD ALSO USE A SERIES OF PROGRESSIVELY LARGER ROUND HOLES.

To Page No. _____

Witnessed & Understood by me:	Date	Invented by:	Date
[signature]	3-14-12	Chris Boyd	3-2-2012
		Recorded by: Chris Boyd	

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Project No.
Book No.

From Page No. X

TITLE METHOD FOR AUTHENTICATING GRAPHICS SERVED BY A WEB OTHER SERVER TO PREVENT PHISHING, TRADEMARK ISSUES

— EXTEND CURRENT STANDARD OPEN FORMATS LIKE JPEG, JPEG2000, OR PNG TO INCLUDE META DATA ABOUT THE SERVER(S) THAT ARE AUTHORIZED TO SERVE THE GRAPHIC. THIS COULD INCLUDE, BUT IS NOT LIMITED TO:

IP SUBNET OR ADDRESS
PTR RECORD
REFERRING URL
REFERRING DOMAIN NAME
HTTPS URL WITH GRAPHIC OWNER'S PUBLIC KEY

THIS DATA IS COMPRESSED & CRYPTO SIGNED WITH THE GRAPHIC OWNER'S ~~PUBLIC KEY~~ PRIVATE KEY.

NORMAL TRANSACTION WORKS SOMETHING LIKE THIS

USER	LEGIT SERVER 1	LEGIT SERVER 2
HTTP GET SECURE.JPG →		
← SECURE.JPG		
DECOMPRESS META DATA & GET KEY URL		
HTTPS GET KEY-PUB.PEM →		
← KEY-PUB.PEM		
SSL CERTS MATCH		
META DATA MATCH		
DISPLAY GRAPHIC		

To Page No.

Witnessed & Understood by me: [signature]
Date: 11-15-12
Invented by: CHRIS BOYD
Recorded by: CHRIS BOYD
Date: 6-6-2012

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TLF

Page No. 6

THIS SCHEME HELPS PREVENT THINGS LIKE PHISHING —

USER — PHISH SERVER — CRAIT SERVER 2

HTTP GET STOLEN.JPG →
← STOLEN.JPG ←

DECRYPT META DATA & GET KEY URL

HTTPS GET KEY-PUB.PEM →
← KEY-PUB.PEM ←

META DATA MISMATCH! ALERT USER TO PROBABLE PHISH!

FOR BEST SECURITY, KEY URL SHOULD BE ON A DNSSEC SIGNED DOMAIN NAME.

NEEDS WIDE SUPPORT IN BROWSERS, EMAIL CLIENTS GRAPHICS ARTS PACKAGES, ETC.

POSSIBLE EXTENSION? DEVELOP A WAY FOR A DOMAIN NAME TO SIGNAL THEY ALWAYS USE THIS SCHEME — MAYBE AN ADDITIONAL TXT RECORD IN DNS?

To Page No. X

Witnessed & Understood by me,

Date 1-15-17

Invented by: CHRIS BOYD

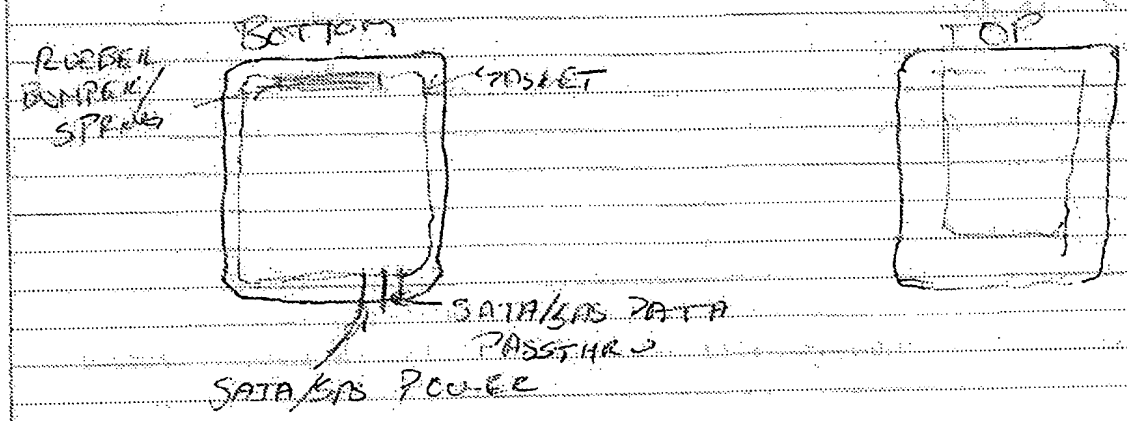
Recorded by: CHRIS BOYD

Date 6-6-2017

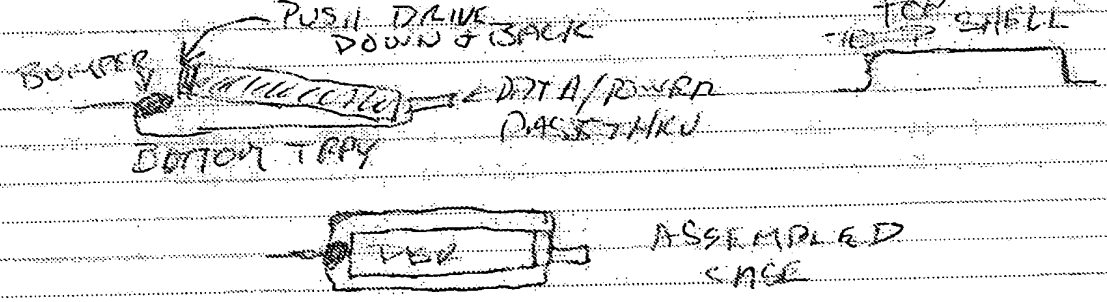
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8 Project No.
Book No.
TITLE DISK DRIVE PACKAGING FOR HIGH IMMERSION
From Page No. X

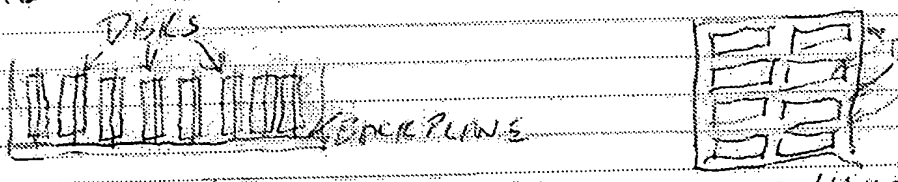
SNAPPED ALUMINUM ENCLOSURE - CLAMSHELLS TOGETHER TO SEAL DISK DRIVE - WITH OIL RESISTANT GASKET.



DISK DRIVE SNAPS INTO PLACE & IS SECURED BY DATA/POWER CONNECTORS & RUBBER BUMPER



ASSEMBLED DISK CASES CAN BE MOUNTED EASILY IN A DISK ARRAY CABINET SIMILAR TO A BACKBLAZE OR EQUIVALENT.



To Page No. 9

Witnessed & Understood by me,

Invented by: CHRIS BOYD
Recorded by: CHRIS BOYD

Date: 4-21-2014

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Project No.
Book No.

TITLE DISK DRIVE PACKAGING FEATURE

From Page No. 8

IMMERSION

EDGES OF DRIVE CASE ARE USED AS MOUNTING RAIL GUIDES TO HOLD DRIVE IN THE ARRAY.

CABINETS CAN BE LIFTED OUT PART WAY FOR DRIVE REPLACEMENT OR MAINTENANCE, LEAVING CONTROLLER SUBMERGED FOR COOLING.

CAN BE RETROFITTED TO BACK BLACK CABINETS.

To Page No.

Witnessed & Understood by me,

Date 11-15-12

Invented by: CHRIS BOYD

Recorded by: CHRIS BOYD

Date 3-21-2002

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10 Project No. _____
Book No. _____ TITLE IR SENSING FOR TANK

From Page No. X

USE MULTIPLE IR SENSORS, POSSIBLY WITH WIDE ANGLE LENSES INSIDE TANK TO MONITOR COOLANT SURFACE TEMPERATURE - OR, USE A DIGITAL IMAGING SENSOR - POSSIBLY JUST A MODIFIED DIGITAL CAMERA SENSOR - WITH IMAGE PROCESSING SOFTWARE TO DETECT A COMPLEX SCENE FOR TANK TEMPS & POSSIBLE HOT SPOTS

EITHER APPROACH COULD BE ADVANTAGEOUS, COMPARED TO SIMPLE TEMPERATURE SENSORS, FOR ADJUSTING COOLANT FLOW RATES. IR ENERGY SHOULD RADIATE THROUGH THE OIL/COOLANT FROM HOT COMPONENTS BEFORE WARMED COOLANT CONVECTS OR IS FORCED TO TOP TO TRIGGER SIMPLE TEMP SENSOR.

To Page No. _____

Witnessed & Understood by me. _____ Date 11-15-07 Invented by CHRIS BOYD Date 5-24-07
Recorded by CHRIS BOYD

TITLE Air Containment System

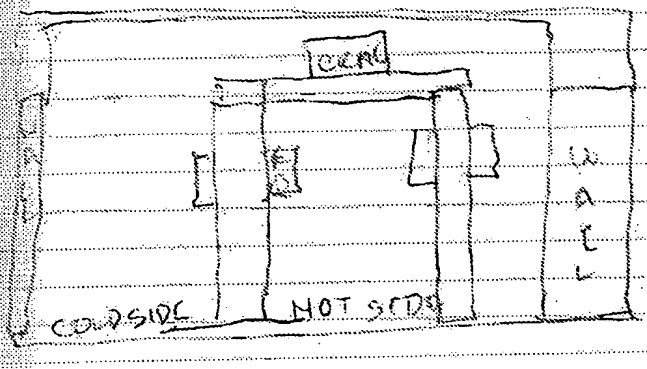
Project No.

Book No.

Con Page No. X

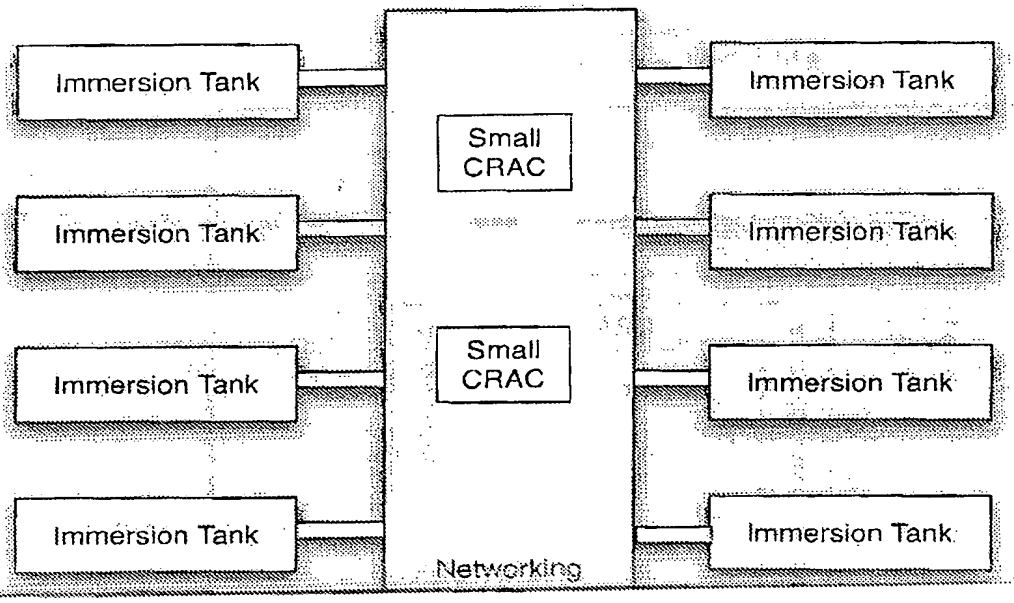
SINCE NOT ALL EQUIPMENT CAN BE IMMERSION COOLED, WE NEED TO PROVIDE AN EFFICIENT METHOD TO COOL THIS GEAR.

USING A SYSTEM TO CONTAIN TOTAL CONTAINMENT OF HOT COLD AIR SHOULD PROVIDE AN ACCEPTABLY LOW PUE, EVEN IN CASES WHERE NO OUTSIDE AIR CAN BE USED.

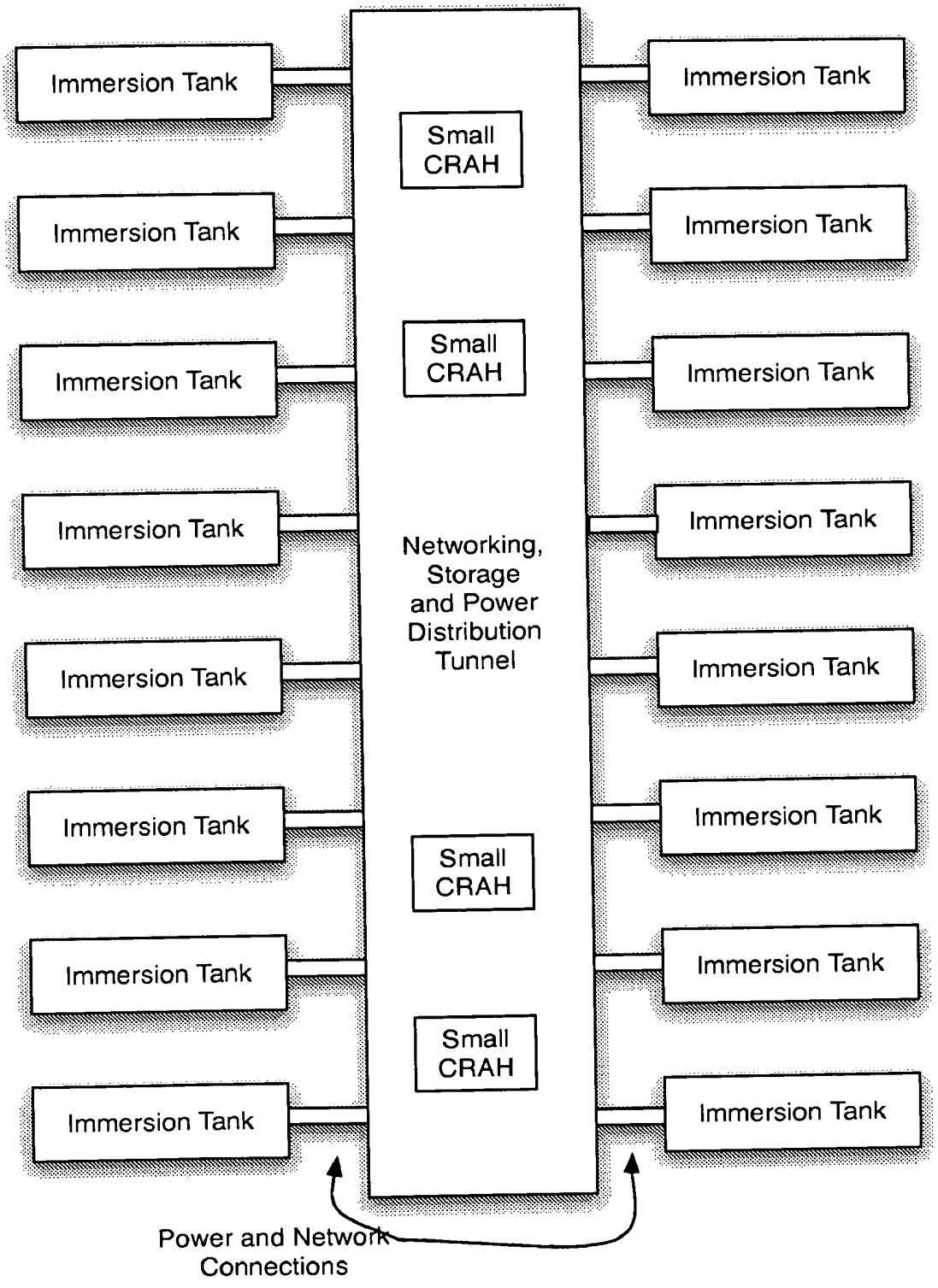


AIRFLOW → ← AIRFLOW

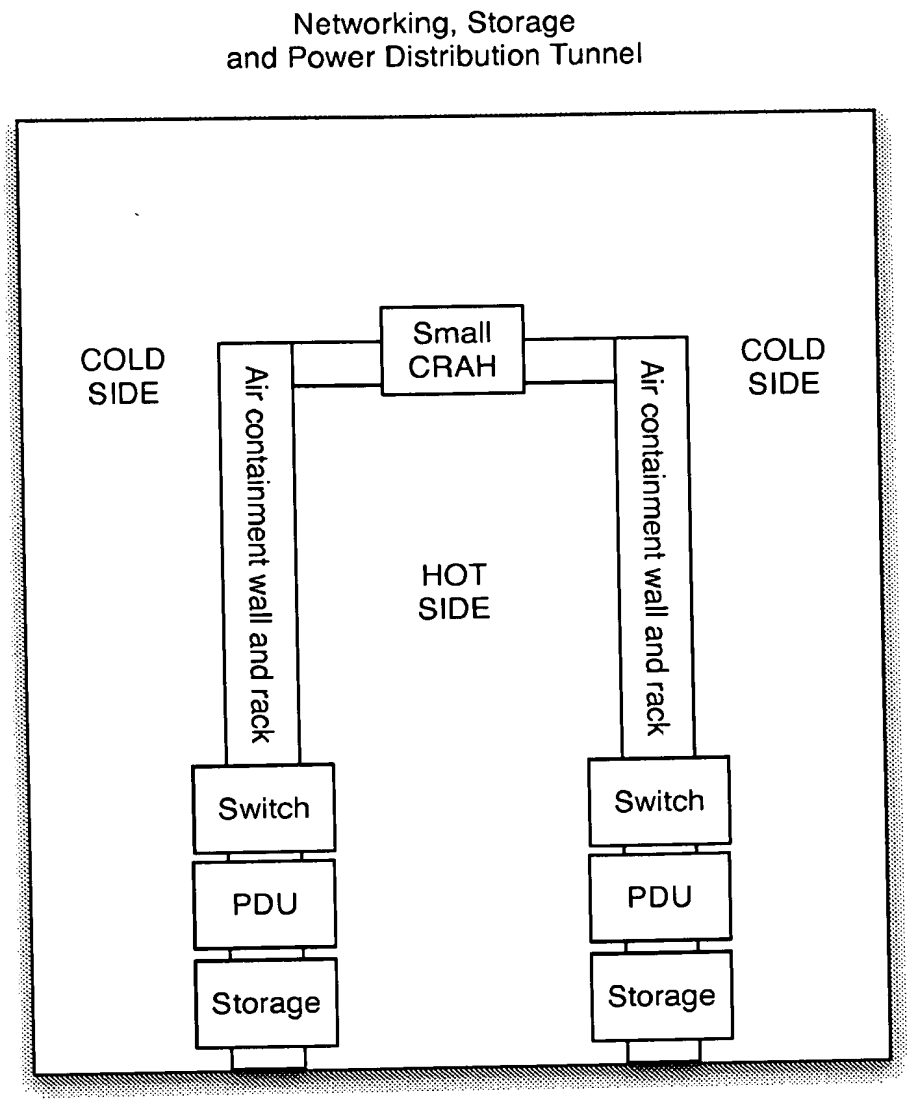
Top View



Top View


Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Small CRAH
Small CRAH
Small CRAH
Networking, Storage and Power Distribution Tunnel
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Power and Network Connections

End View


Networking, Storage
and Power Distribution Tunnel
COLD
SIDE
Small
CRAH
COLD
SIDE
Air containment wall and rack
Air containment wall and rack
HOT
SIDE
Switch
PDU
Storage
Switch
PDU
Storage

Best Available Copy

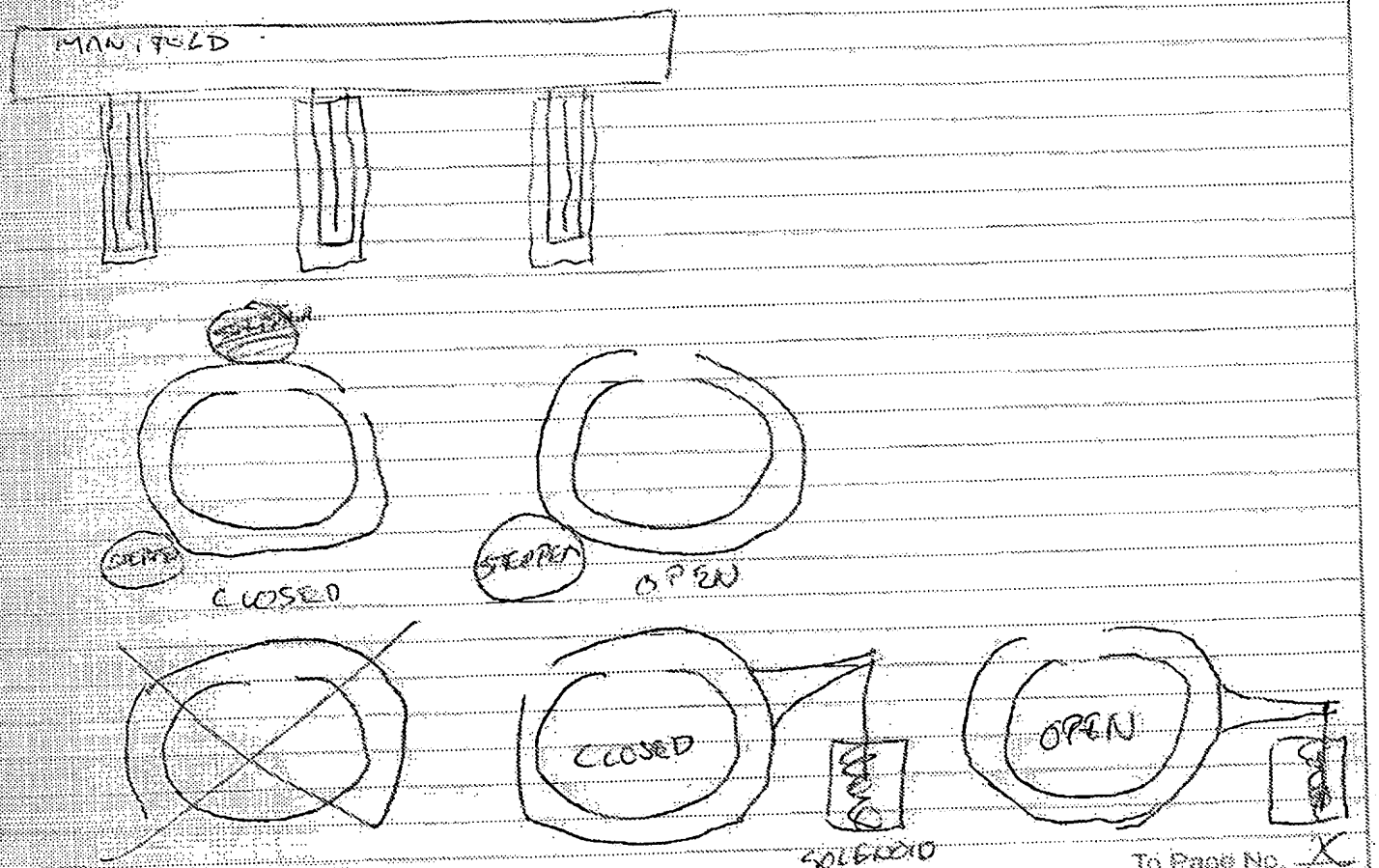
Project No.
Book No.

TITLE Flow Metering System

From Page No. X

ONE WAY TO ADJUST COOLANT FLOW INTO TANK—

TWO TUBES— ONE LARGER & ONE SMALLER, AND SIZED SUCH THEY FIT ONE INSIDE THE OTHER. CUT SLOTS TO EACH TUBE. FEED COOLANT INTO SMALLER TUBE, AND ROTATE OUTER TUBE TO EXPOSE WIDER OR NARROWER SLOT FOR COOLANT TO FLOW OUT OF. ROTATE TUBE WITH STEPPER OR SOLENOID ACTING ON ARM ATTACHED TO TUBE. STEPPER PROBABLY BEST FOR DIGITAL CONTROL. SOLENOID MAYBE BEST FOR ANALOG CONTROL.



To Page No. X

Read & Understood by/no.

Date 11-14-12

Invented by: CHRIS BOYD

Recorded by: CHRIS BOYD

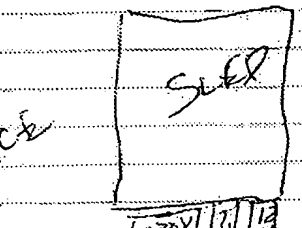
Date 10-18-2012

Best Available Copy

TITLE: ENHANCED SLED

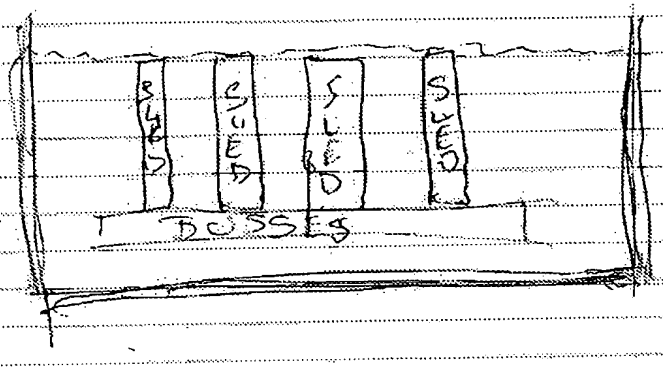
Project No.
Book No.

From Page No. X



ALTERNATE MEANS OF POWER DISTRIBUTION TO SLEDS
— INSTALL A POWER BUSS IN THE RACK TO DISTRIBUTE POWER TO SLED BOARDS.

SLEDS SNAP INTO POWER CONNECTOR TO DRAW 120VAC (CONVENTIONAL PSU) OR DIRECT 5VDC/12VDC POWER DIRECTLY TO THE MOTHERBOARD.



To Page No.

Witnessed & Understood by me: C Boyd
Date: 10-26-2012
Invented by: Kim Tooke
Recorded by: Chris Boyd
Date: 10/24/2012

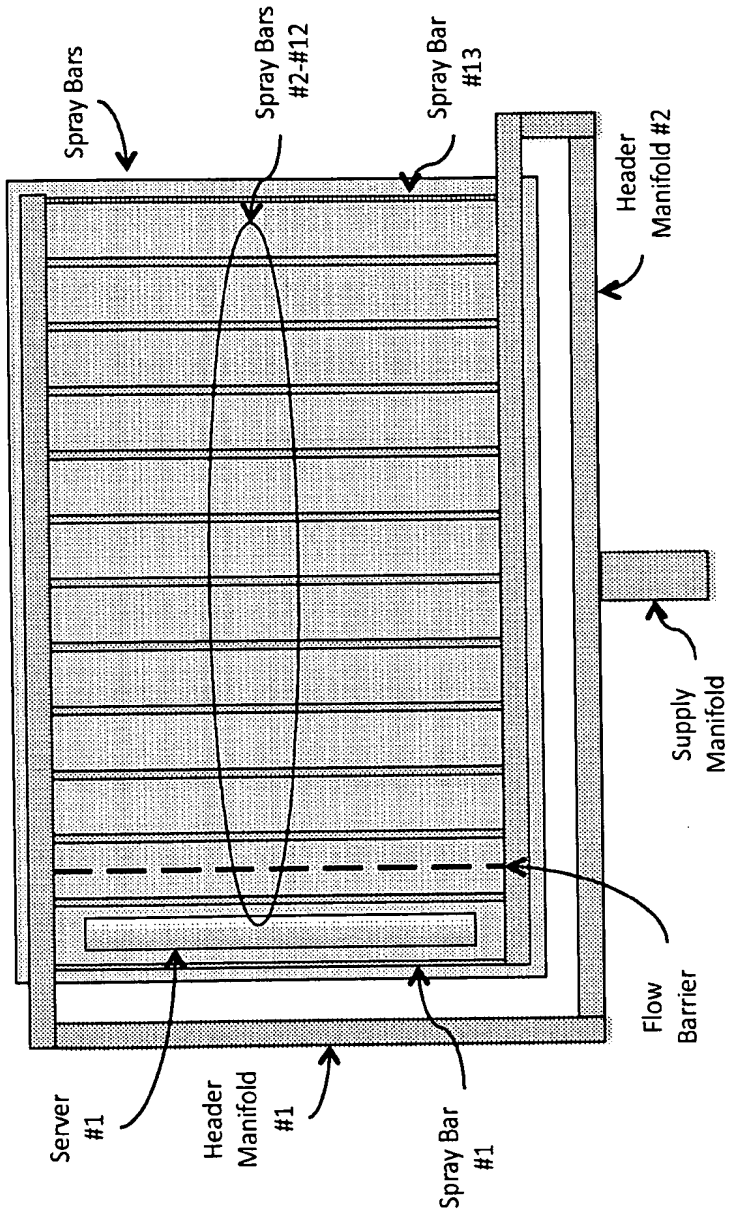

Spray Bars
Spray Bars #2-#12
Spray Bar #13
Header Manifold #2
Supply Manifold
Flow Barrier
Server #1
Header Manifold #1
Spray Bar #1

Fig. 1

Spray Bar #2
Spray Bar #1
IR Barrier
Server #1
Header Manifold #1
Supply Manifold

Fig. 2

Fig. 3

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International application number:		**PCT/US2013/075126**
International filing date:		**13 December 2013 (13.12.2013)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**61/832,211**
	Filing date:	**07 June 2013 (07.06.2013)**
Date of receipt at the International Bureau:		**03 January 2014 (03.01.2014)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

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1211 Geneva 20, Switzerland
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THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 01, 2014

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *61/832,211*
FILING DATE: *June 07, 2013*
RELATED PCT APPLICATION NUMBER: *PCT/US13/75126*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US61/832,211*

Certified by

David J. Kappos

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

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Given Name	Middle Name	Family Name	City	State	Country
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Inventor 2 — Remove

Given Name	Middle Name	Family Name	City	State	Country
James	P.	Koen	Austin	TX	US

Inventor 3 — Remove

Given Name	Middle Name	Family Name	City	State	Country
John	C.	Tribou	Austin	TX	US

Inventor 4 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Mike		Rainone	Palestine	TX	US

Inventor 5 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Talbot		Presley	Palestine	TX	US

Inventor 6 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Jeffrey	Van	Myers	Driftwood	TX	US

Inventor 7 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Christopher	L	Boyd	Austin	TX	US

Inventor 8 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Kenneth	D	Tooke	Austin	TX	US

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Inventor 9					Remove
Given Name	Middle Name	Family Name	City	State	Country i
David	Christopher Thoma	Laguna	Austin	TX	US

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Title of Invention	Server Immersion Tank System
Attorney Docket Number (if applicable)	JMG001-02

Correspondence Address

Direct all correspondence to (select one):

◉ The address corresponding to Customer Number	○ Firm or Individual Name
Customer Number	44070

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

◉ No.

○ Yes, the name of the U.S. Government agency and the Government contract number are:

EFS - Web 1.0.1

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
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Entity Status

Applicant claims small entity status under 37 CFR 1.27

(•) Yes, applicant qualifies for small entity status under 37 CFR 1.27

( ) No

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Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey Van Myers/			Date (YYYY-MM-DD)	2013-06-07
First Name	Jeffrey	Last Name	Myers	Registration Number (If appropriate)	27362

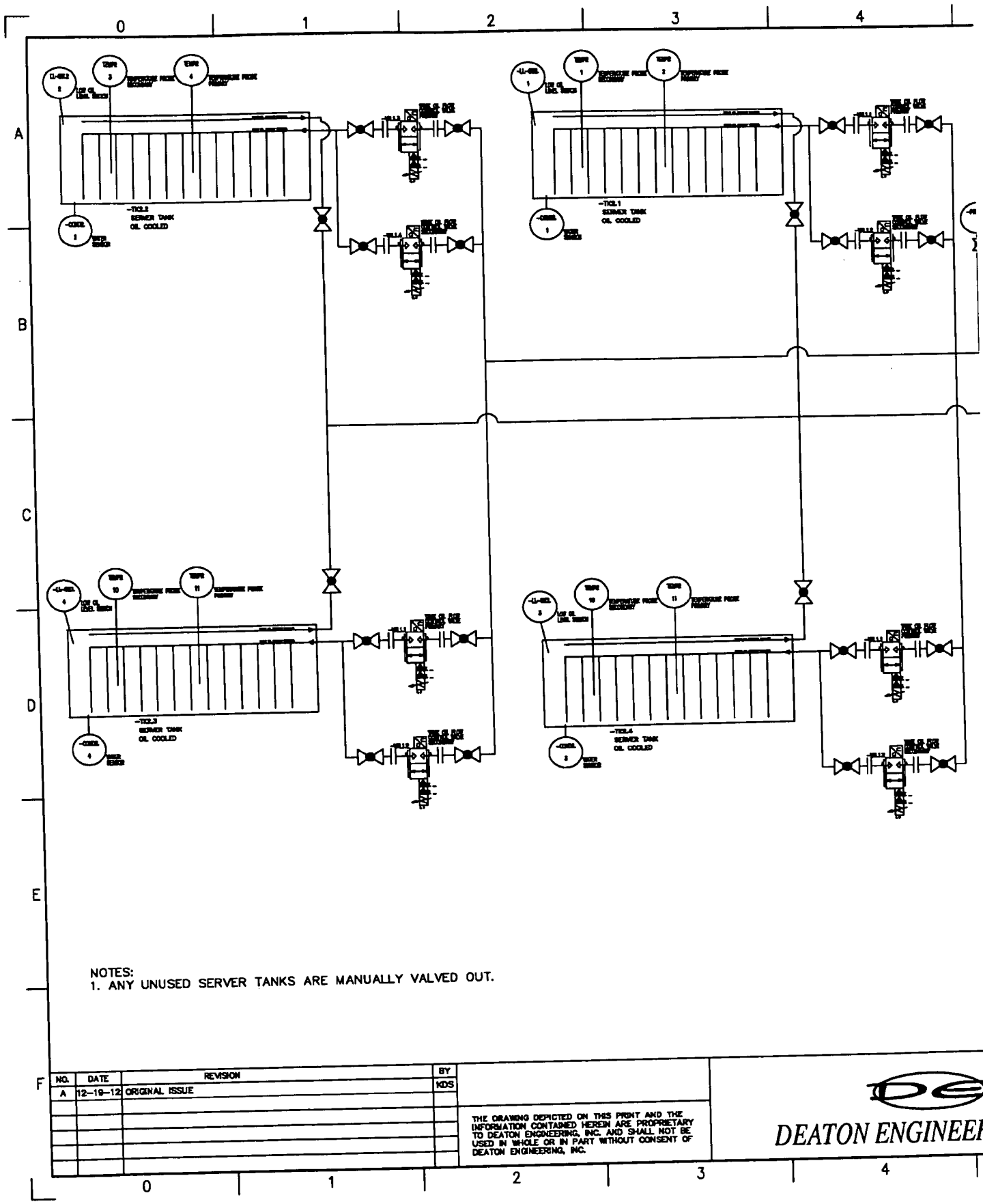
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, t o a n other federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

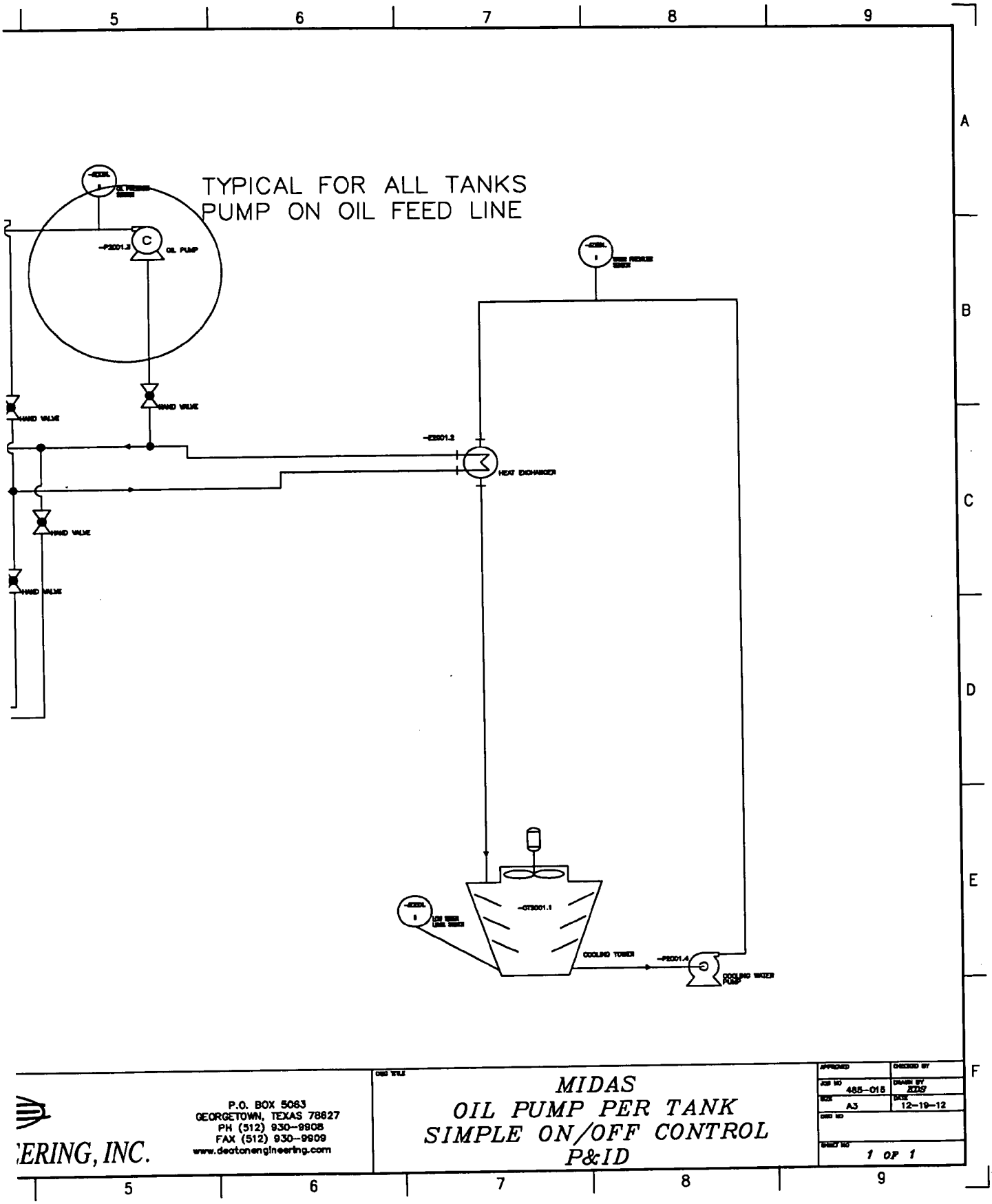


NOTES:
1. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.

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A	12-19-12	ORIGINAL ISSUE	KDS

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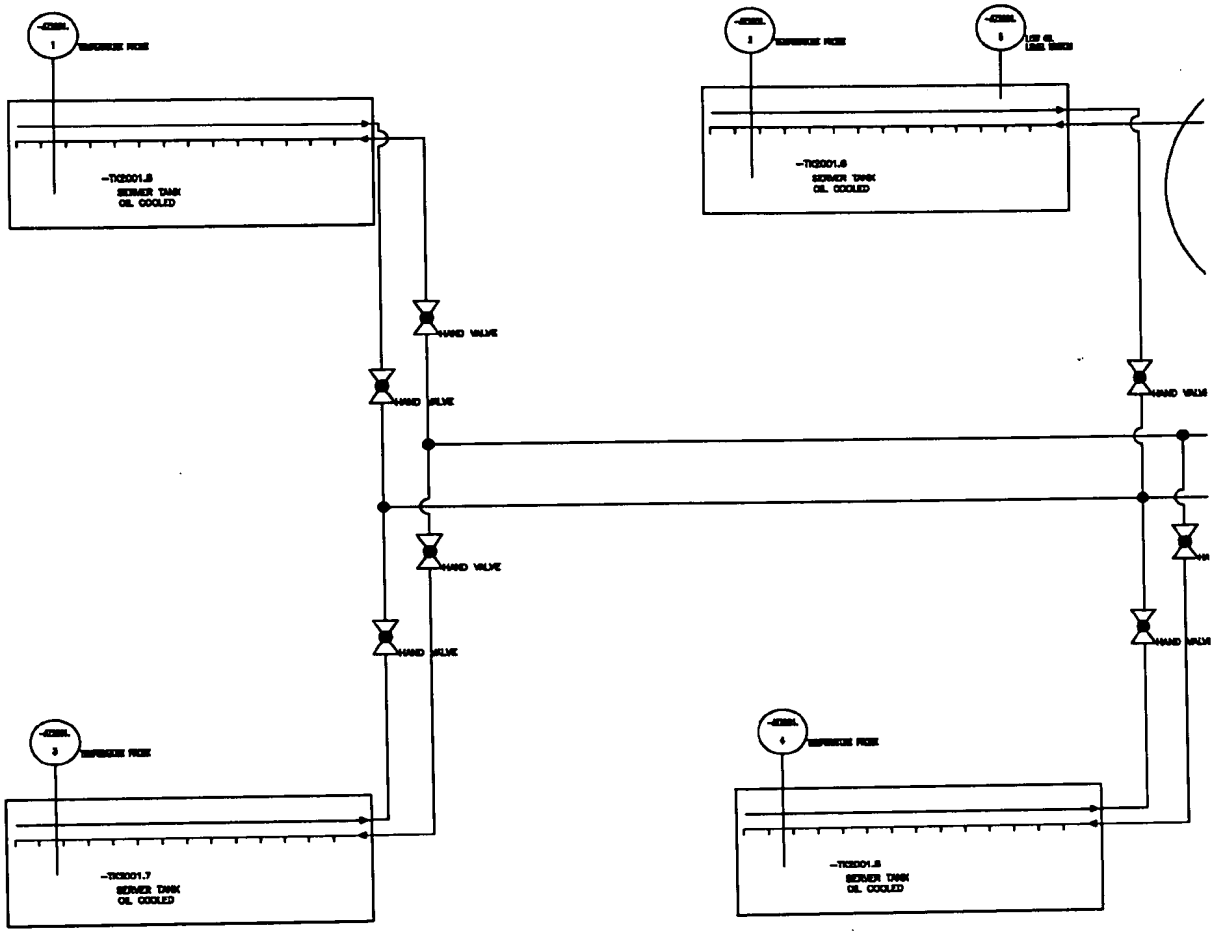


P.O. BOX 5063
GEORGETOWN, TEXAS 78627
PH (512) 930-9908
FAX (512) 930-9909
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MIDAS
OIL PUMP PER TANK
SIMPLE ON/OFF CONTROL
P&ID

APPROVED	CHECKED BY
JOB NO 485-015	DRAWN BY JDS
SIZE A3	DATE 12-19-12
DWG NO	
SHEET NO 1 OF 1	

B

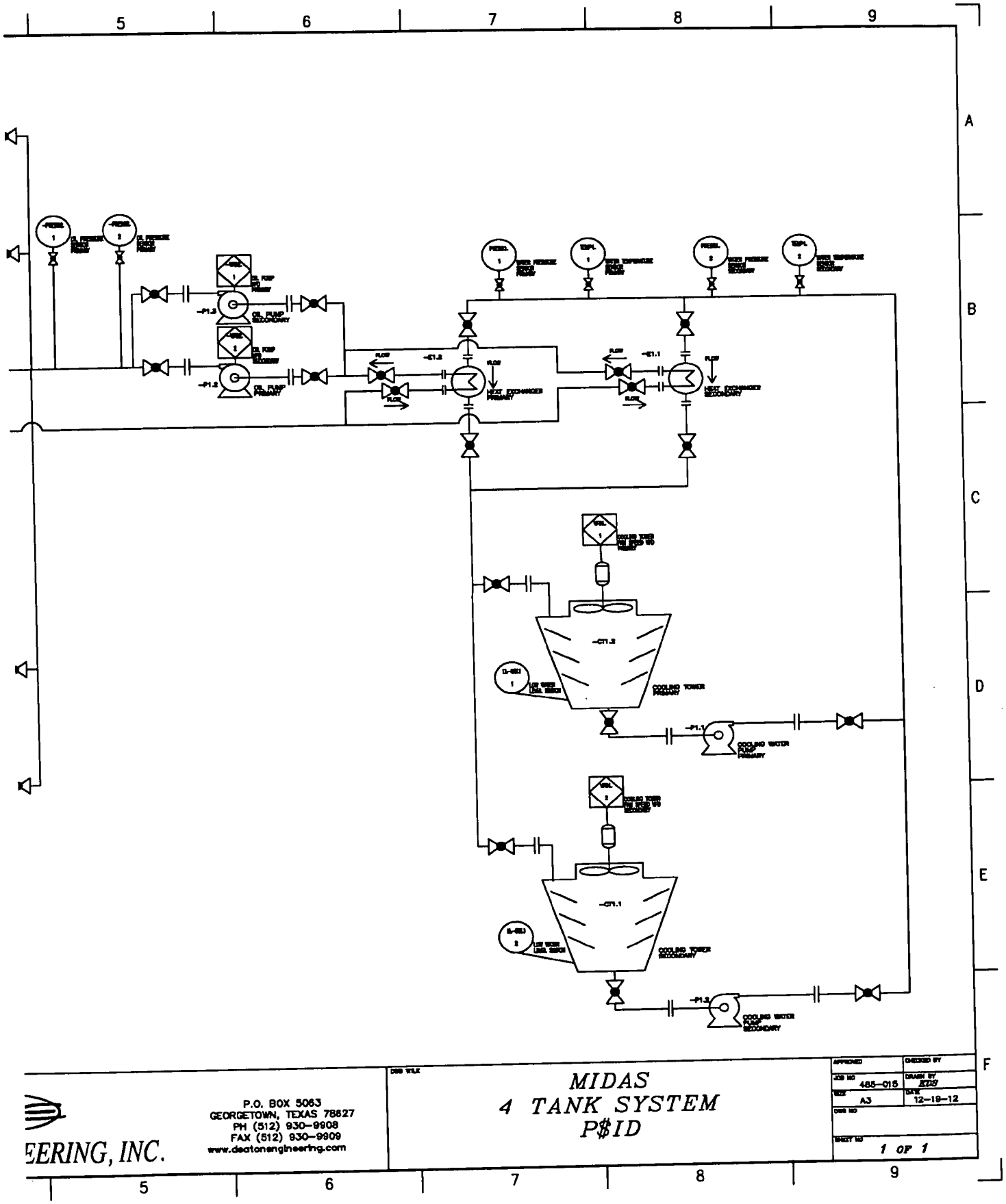


NOTES:
1. ON/OFF CONTROL PER TANK
2, OIL PUMP AT EACH TANK WILL REGULATE FLOW TO TANKS DURING COOLING OPERATION BASED ON HEAT OF EACH TANK.
3. WHEN TEMPERATURE IN ANY SERVER TANK RAISES ABOVE 95 F THE OIL PUMP FOR THAT TANK, WATER PUMP, AND COOLING TOWER FAN ALL START.
4. WHEN TEMPERATURE IN THAT SERVER TANKS DROPS BELOW 95 F THE OIL PUMP TURNS OFF.
5. WHEN THE OIL PUMP TURNS OFF THE WATER PUMP AND COOLING TOWER FAN CONTINUE TO RUN FOR 30 MINUTES.
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.
7. ADDED LEVEL SENSOR TO COOLING TOWER WATER.

NO.	DATE	REVISION	BY
A	12-19-12	ORIGINAL ISSUE	KDS

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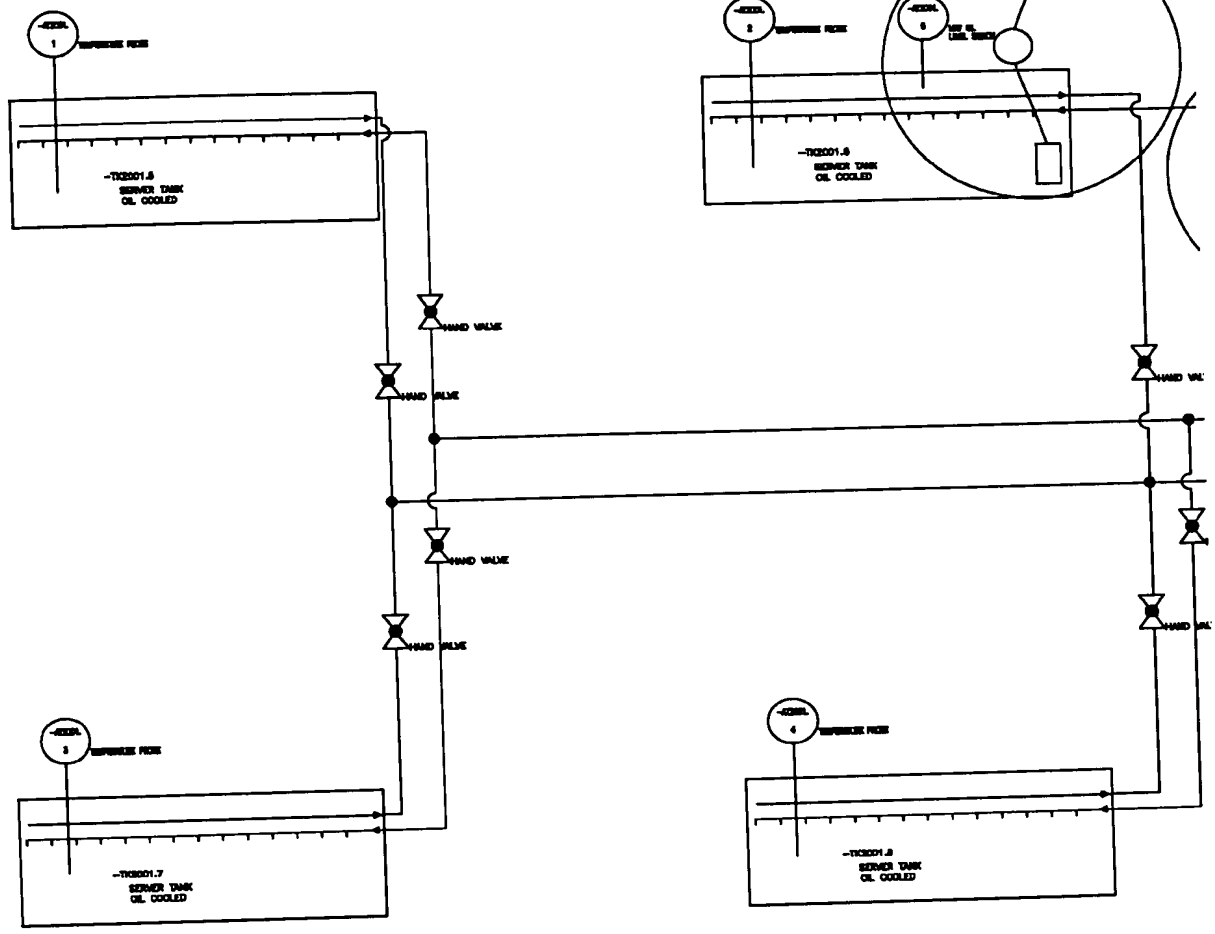
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GEORGETOWN, TEXAS 78627
PH (512) 930-9908
FAX (512) 930-9909
www.deatonengineering.com

MIDAS
4 TANK SYSTEM
P$ID

APPROVED	CHECKED BY
JOB NO 485-015	DRAWN BY KDS
SIZE A3	DATE 12-19-12
DWG NO	
SHEET NO	1 OF 1

C

TYP
STI



NOTES:
1. ON/OFF CONTROL PER TANK
2, OIL PUMP AT EACH TANK WILL REGULATE FLOW TO TANKS DURING COOLING OPERATION BASED ON HEAT OF EACH TANK.
3. WHEN TEMPERATURE IN ANY SERVER TANK RAISES ABOVE 95 F THE OIL PUMP FOR THAT TANK, WATER PUMP, AND COOLING TOWER FAN ALL START.
4. WHEN TEMPERATURE IN THAT SERVER TANKS DROPS BELOW 95 F THE OIL PUMP TURNS OFF.
5. WHEN THE OIL PUMP TURNS OFF THE WATER PUMP AND COOLING TOWER FAN CONTINUE TO RUN FOR 30 MINUTES.
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.
7. ADDED LEVEL SENSOR TO COOLING TOWER WATER
8. ADDED OPTIONAL TANK STIRRING DEVICE

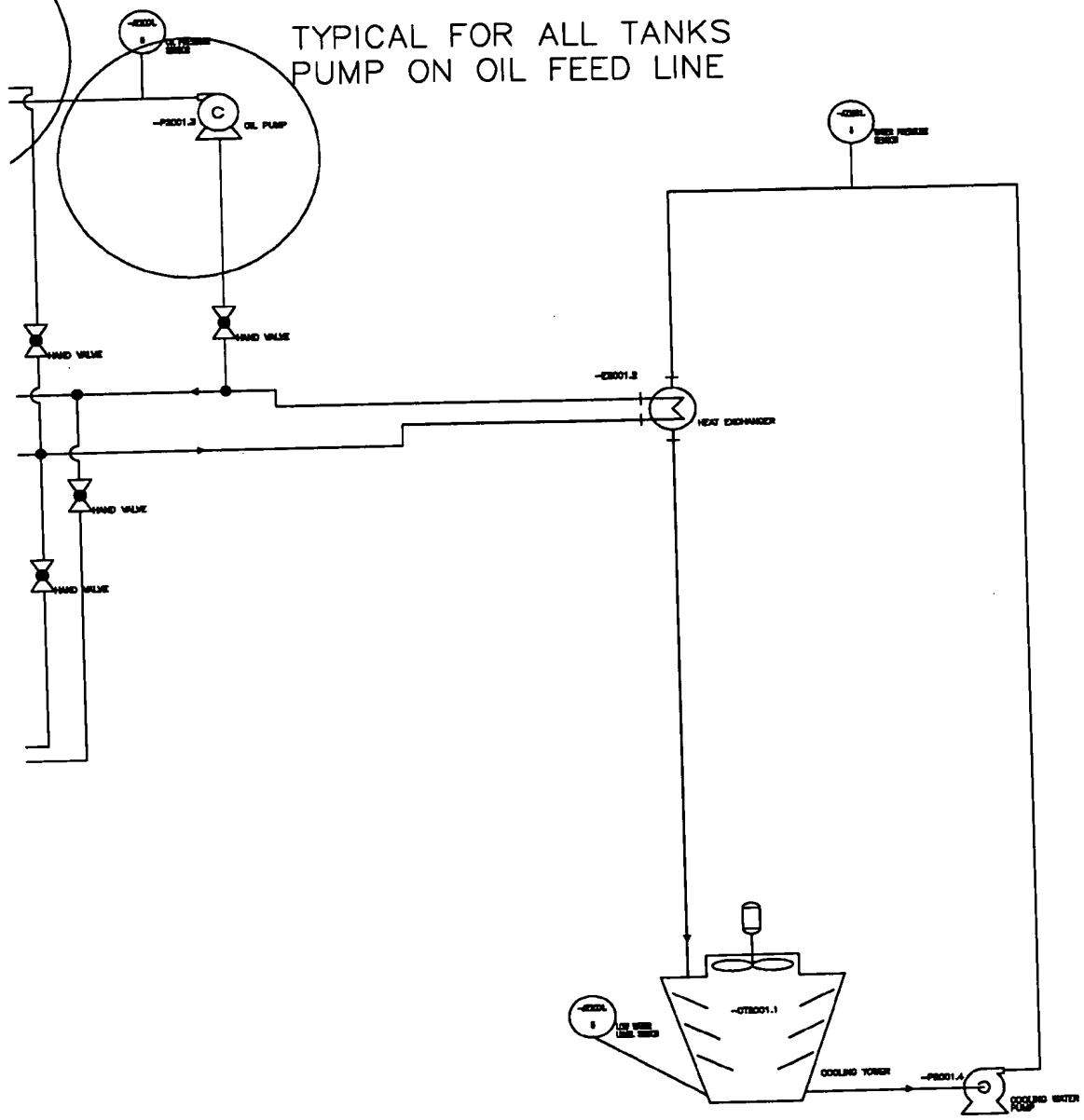
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TYPICAL FOR ALL TANKS
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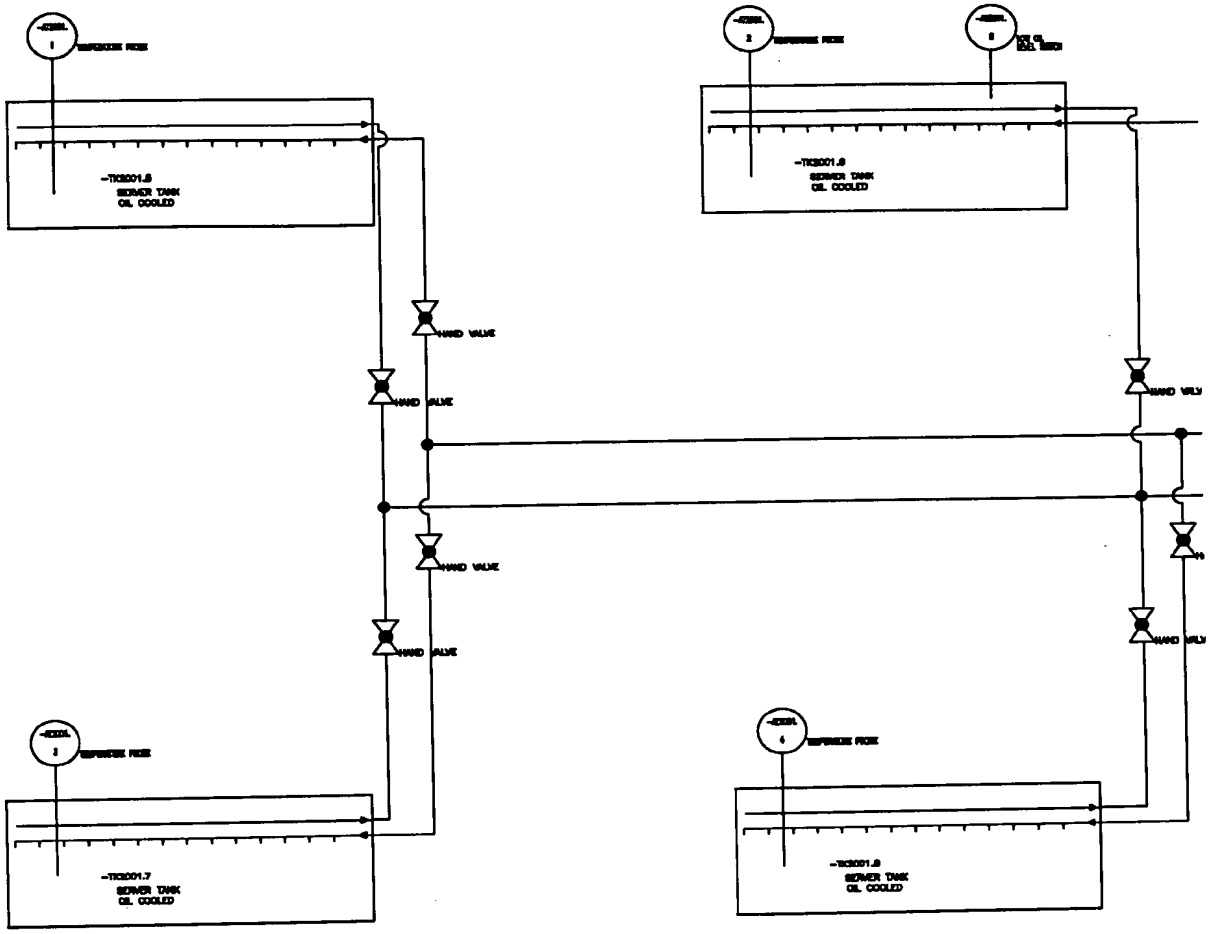
TYPICAL FOR ALL TANKS
PUMP ON OIL FEED LINE



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OIL PUMP PER TANK
SIMPLE ON/OFF CONTROL
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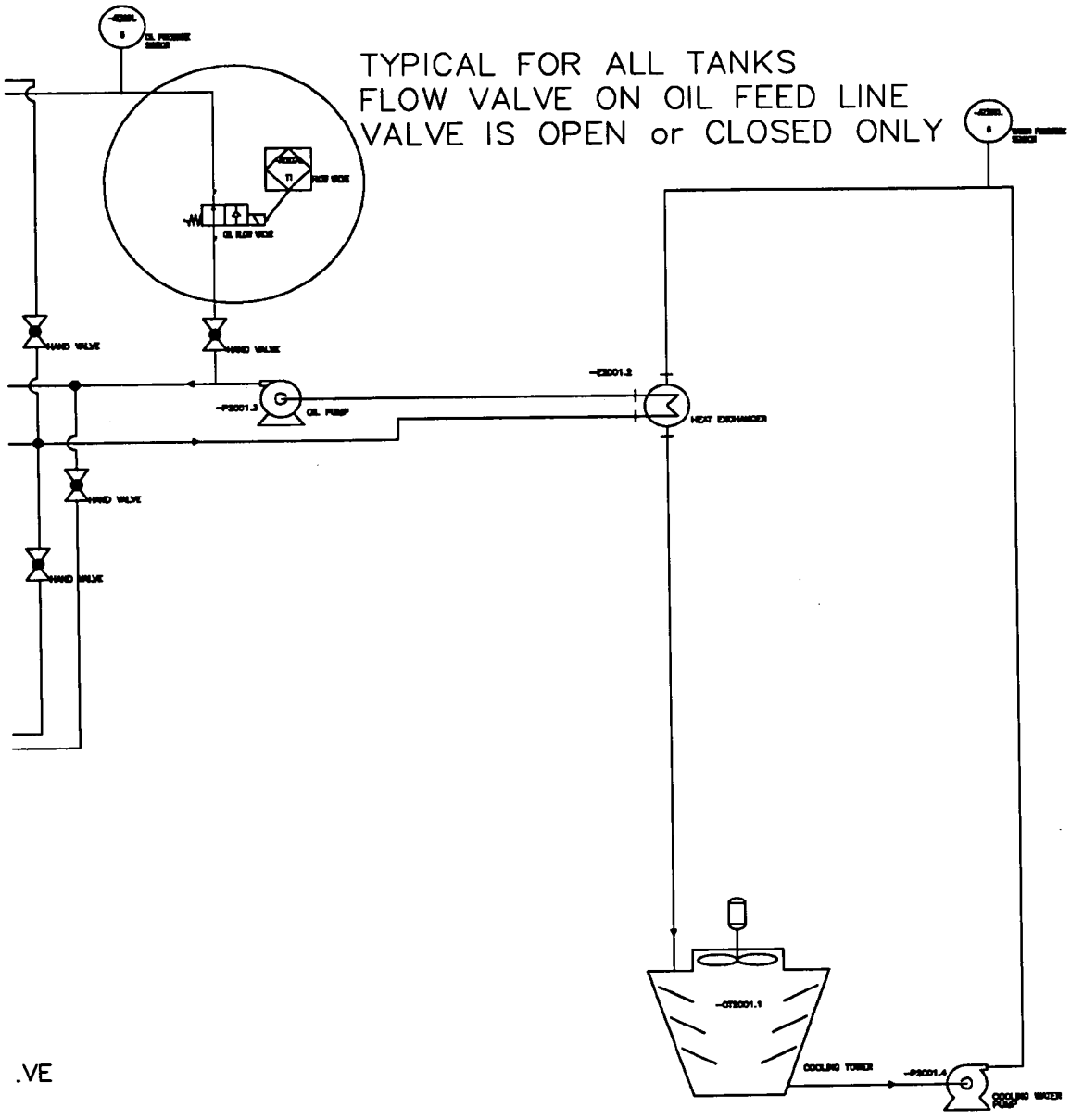


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1. ON/OFF CONTROL PER TANK
2, FLOW VALVE AT EACH TANK WILL REGULATE FLOW TO TANKS DURING COOLING OPERATION BASED ON HEAT OF EACH TANK.
3. WHEN TEMPERATURE IN ANY SERVER TANK RAISES ABOVE 95 F THE OIL PUMP, WATER PUMP, AND COOLING TOWER FAN ALL START. ALSO, THE FLOW VALVE FOR THAT TANK OPENS.
4. WHEN TEMPERATURE IN THAT SERVER TANKS DROPS BELOW 95 F THE FLOW VALVE FOR THAT TANK CLOSES.
5. WHEN ALL SERVER TANKS ARE BELOW 95 F THE OIL PUMP TURNS OFF.
5. WHEN THE OIL PUMP TURNS OFF THE WATER PUMP AND COOLING TOWER FAN CONTINUE TO RUN FOR 30 MINUTES.
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.

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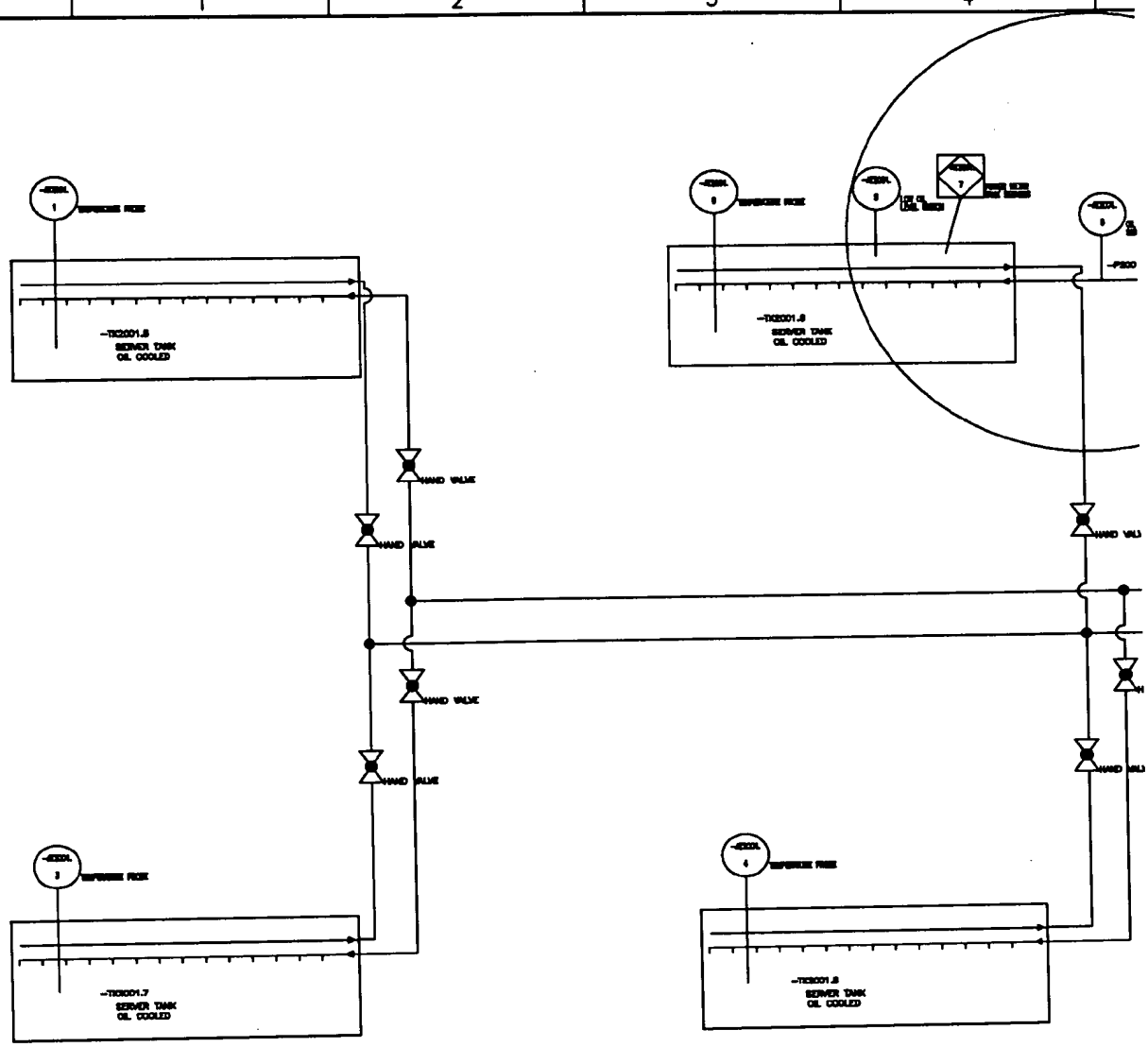
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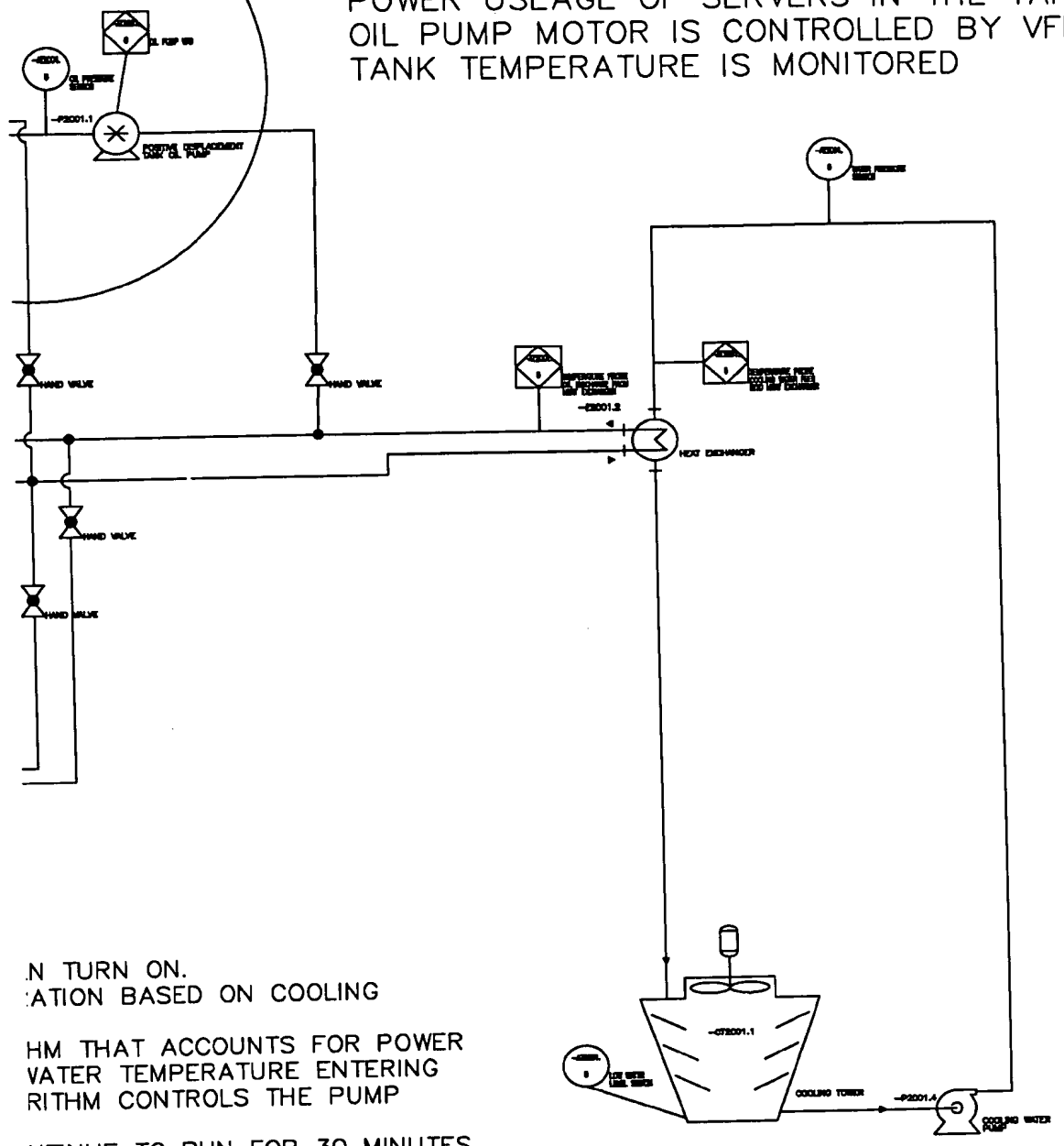
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5. WHEN ALL OIL PUMPS TURN OFF THE WATER PUMP AND COOLING TOWER FAN CONTINU
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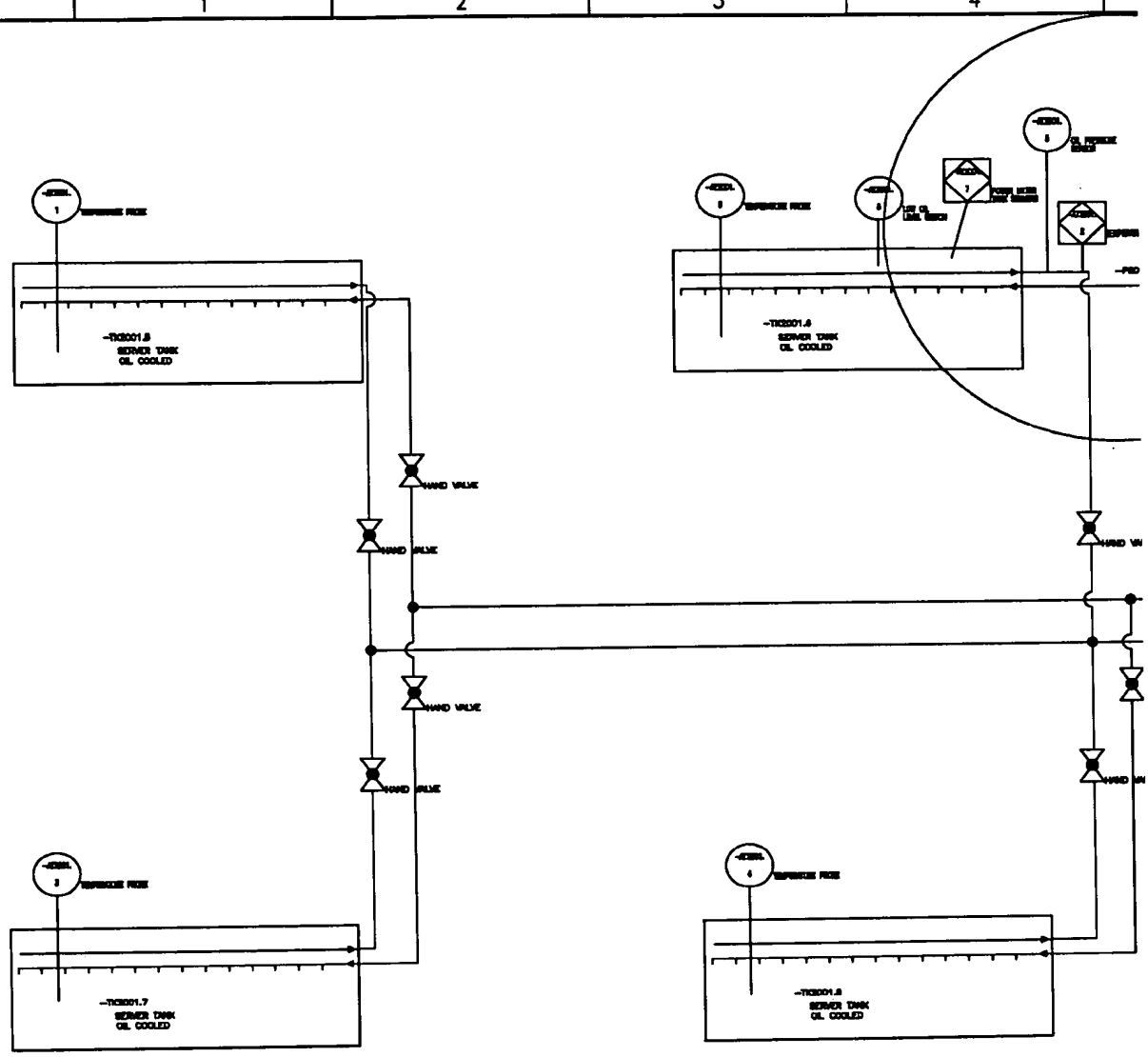
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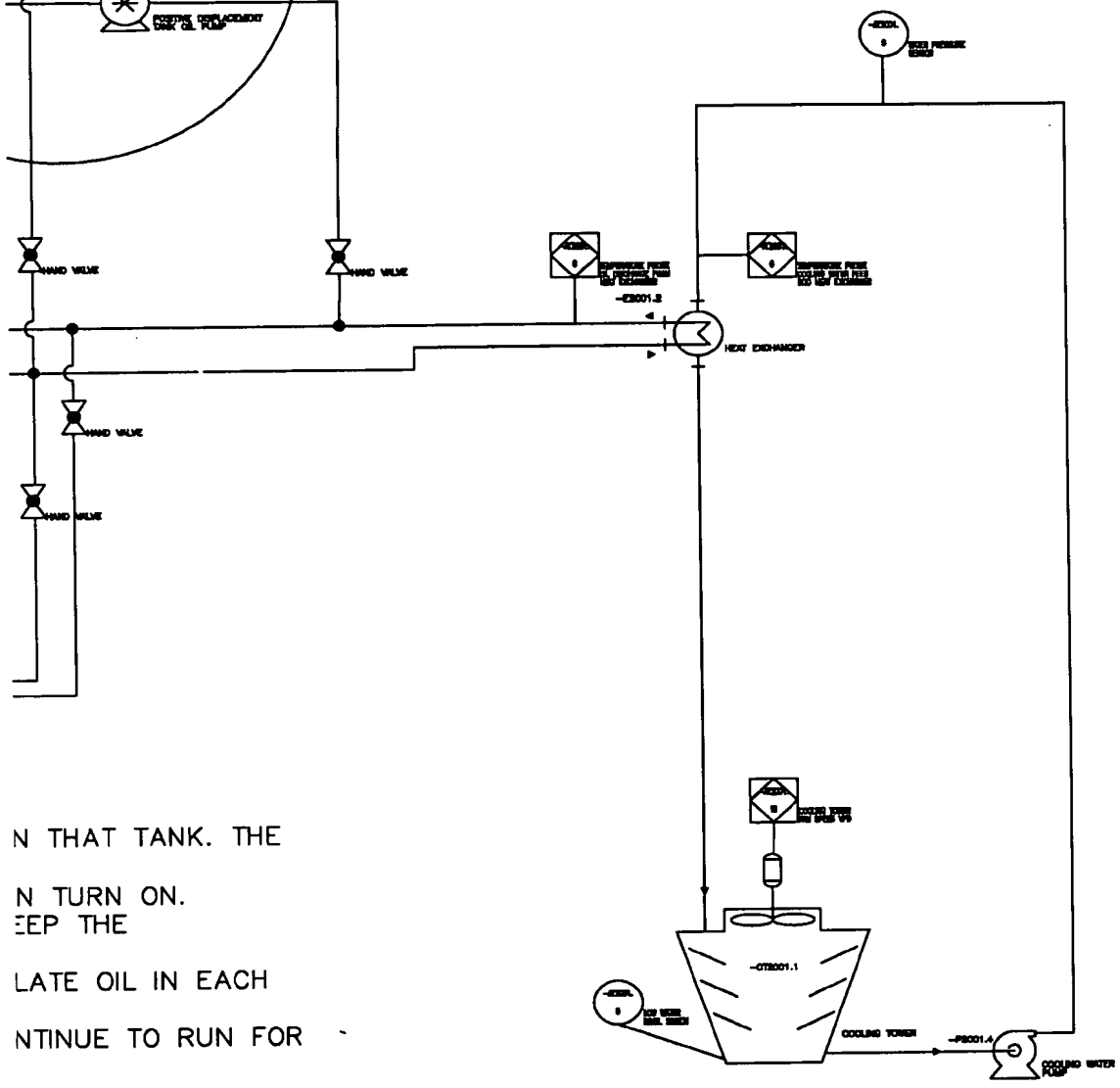
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4. TANK OIL PUMPS CAN BE RAN AT A SLOW SPEED (20%) ALL THE TIME TO CIRCULATE
TANK TO PREVENT ANY HOT SPOTS.
5. WHEN ALL OIL PUMPS TURN OFF THE WATER PUMP AND COOLING TOWER FAN CONTINU
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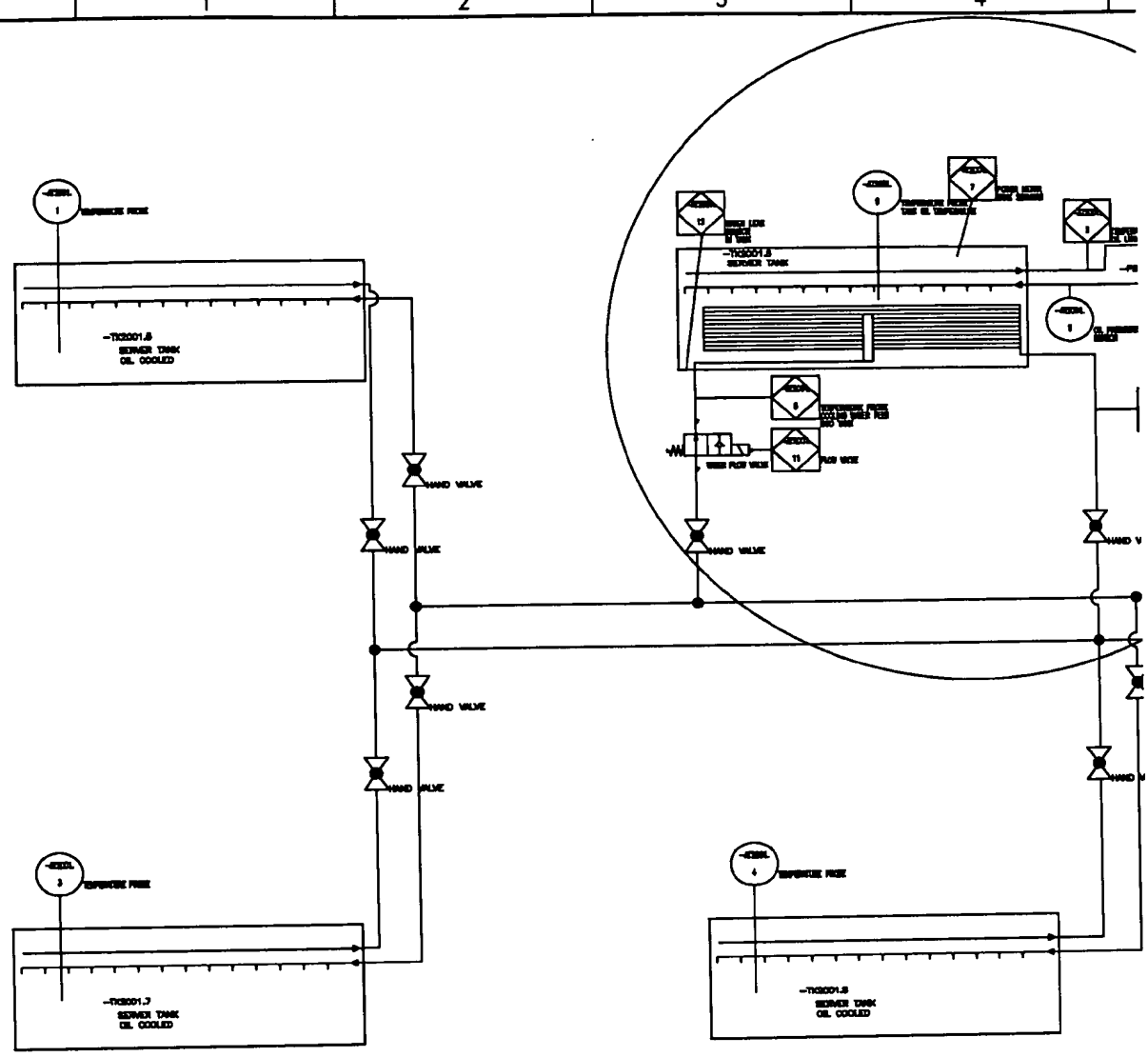
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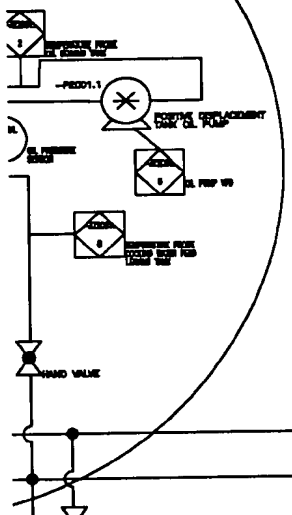
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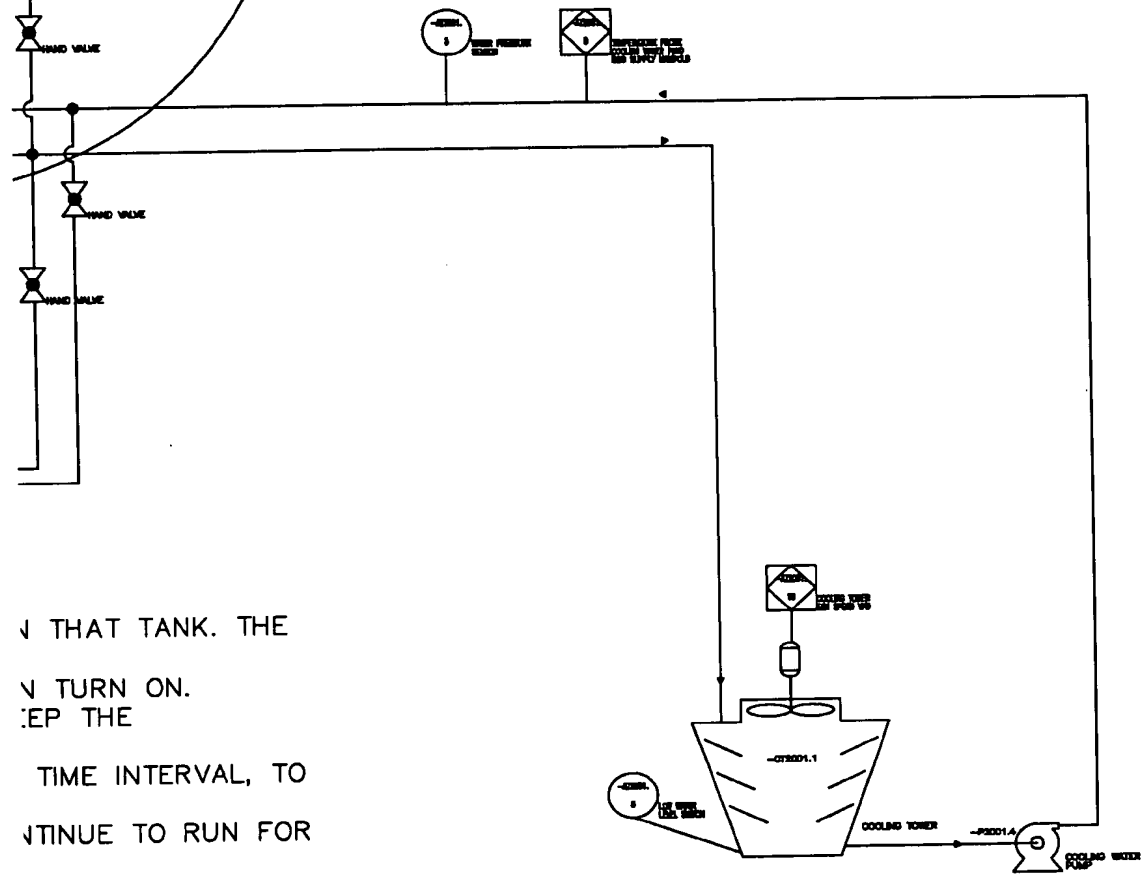
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Electronic Acknowledgement Receipt

EFS ID:	15976940
Application Number:	61832211
International Application Number:	
Confirmation Number:	3648
Title of Invention:	Server Immersion Tank System
First Named Inventor/Applicant Name:	John H. Miller, Jr.
Customer Number:	44070
Filer:	Jeffrey Van Myers
Filer Authorized By:	
Attorney Docket Number:	JMG001-02
Receipt Date:	07-JUN-2013
Filing Date:	
Time Stamp:	11:25:35
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	$130
RAM confirmation Number	9123
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Provisional Cover Sheet (SB16)	JMG001_PCS_130607.pdf	2071470 24eabb671de54338a9d2554721aa6164b60 54bb2	no	4
Warnings:					
Information:					
2	Specification	JMG001_p_130607.pdf	459013 8d41ea3e4b21764de986ba992fdee13e593 1e37e	no	14
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	28954 e3fba237d162734cee0dc2bbaf4bb91f1b5 6b33d	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2559437	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
JEFFREY VAN MYERS
J.V. MYERS & ASSOCIATES, PC
P.O. BOX 130
DRIFTWOOD, TEXAS 78619

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NOTIFICATION OF RECEIPT
OF SEARCH COPY

(PCT Rule 25.1)

Date of mailing *(day/month/year)*	31 Dec 2013
Applicant's or agent's file reference: JMG001-01	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/075126	13 Dec 2013	14 Dec 2012

Applicant

MIDAS GREEN TECHNOLOGY, LLC

1. **Where the International Searching Authority and the receiving Office are not the same Office:**
The applicant is hereby notified that the search copy of the international application was received by this International Searching Authority on the date indicated below.

Where the International Searching Authority and the receiving Office are the same Office:
The applicant is hereby notified that the search copy of the international application was received on the date indicated below.

31 Dec 2013 *(date of receipt)*

2. ☐ The search copy was accompanied by a nucleotide and/or amino acid sequence listing in electronic form.

3. ☐ The search copy contained a nucleotide and/or amino acid sequence listing in electronic form.

4. **Time limit for establishment of international search report and written opinion of the International Searching Authority**
The applicant is informed that the time limit for establishing the international search report and the written opinion of the International Searching Authority is three months from the date of receipt indicated above or nine months from the priority date, whichever time limit expires later (Rules 42.1 and 43*bis*.1(a)).

A copy of this Notification has been sent to the International Bureau and, where the first sentence of paragraph 1 applies, to the receiving Office.

Name and mailing address of the ISA/	Authorized officer
Mail Stop PCT, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450	Nina D Butler
Facsimile No. 571-273-3201	Telephone No. 571-272-9027

Form PCT/ISA/202 (July 2009)

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

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NOTIFICATION CONCERNING SUBMISSION, OBTENTION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

MEYERS, Jeffrey, Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 78619
ETATS-UNIS D'AMERIQUE

Date of mailing *(day/month/year)* 10 January 2014 (10.01.2014)	
Applicant's or agent's file reference JMG001-01	**IMPORTANT NOTIFICATION**
International application No. PCT/US2013/075126	International filing date *(day/month/year)* 13 December 2013 (13.12.2013)
International publication date *(day/month/year)* **Not yet published**	Priority date *(day/month/year)* 14 December 2012 (14.12.2012)
Applicant MIDAS GREEN TECHNOLOGY, LLC	

The applicant is hereby notified of the date of receipt (or of obtaining by the International Bureau) of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to the date of receipt, **the priority document concerned was submitted or transmitted to or obtained by the International Bureau in compliance with Rule 17.1(a), (b) or (b-*bis*)**. This Form replaces any previously issued notification concerning submission, transmittal or obtaining of priority documents.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
14 December 2012 (14.12.2012)	61/737,200	US	03 January 2014 (03.01.2014)
07 June 2013 (07.06.2013)	61/832,211	US	03 January 2014 (03.01.2014)

The letters "NR" denote a priority document which, on the date of mailing of this Form, had not yet been received or obtained by the International Bureau in compliance with Rule 17.1(a), (b) or (b-*bis*). Where the applicant has failed to either submit, request to prepare and transmit, or to request the International Bureau to obtain the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

An asterisk "*" next to a date of receipt, denotes a priority document submitted or transmitted to or obtained by the International Bureau but not in compliance with Rule 17.1(a), (b) or (b-*bis*) (the priority document was received after the time limit prescribed in Rule 17.1(a); the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b) or the request to the International Bureau to obtain the priority document was made after the applicable time limit under Rule 17.1(b-*bis*)). Even though the priority document was not furnished in compliance with Rule 17.1(a), (b) or (b-*bis*), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as the priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 89 75

Authorized officer
Nora Lindner
e-mail pt05.pct@wipo.int
Telephone No. +41 22 338 74 05

APPLIANCE IMMERSION COOLING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is related to the following Provisional Applications:

1. Serial Number 61/737,200, filed 14 December 2012 ("*First Parent Provisional*"); and

2. Serial Number 61/832,211, filed 7 June 2013 ("*Second Parent Provisional*");

and hereby claims benefit of the filing dates thereof pursuant to 37 CFR §1.78(a)(4). (Collectively, "*Parent Provisionals*"). The subject matter of the Parent Provisionals, each in its entirety, is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention.

[0002] The present invention relates generally to electrical appliance cooling systems, and, in particular, to an improved appliance immersion cooling system and method of operation.

2. Description of the Related Art.

[0003] In general, in the descriptions that follow, we will *italicize* the first occurrence of each special term of art which should be familiar to those skilled in the art of *immersion cooling* systems. In addition, when we first introduce a term that we believe to be new or that we will use in a context that we believe to be new, we will **bold** the term and provide the definition that we intend to apply to that term.

[0004] US 4,590,538, "Immersion Cooled High Density Electronic Assembly", Cray (filed 18 November 1981 and issued 20 May 1986) ("Cray"), is an early example of an immersion system for cooling electronic components during normal operation. On information and belief, the machine disclosed therein was the Cray-2 super-computer ("Cray-2") manufactured by Cray Research, Inc. ("Cray Research"), of Chippewa Falls, Wisconsin. Of particular interest to the present application is the description of the significant advantages resulting from

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 165 of 656; IPR2025-00196

using an *electrically non-conductive* or *dielectric fluid* to extract heat from electronic circuit assemblies during normal operation (see, *e.g.*, col. 1, line 66 - col. 2, line 29).

[0005] On information and belief, Cray Research released, in 1985, a marketing brochure entitled "The CRAY-2 Computer System" (a copy of which is submitted herewith) describing the Cray-2. Of particular interest in this brochure is the description therein of the significant advantages resulting from using a dielectric fluid to extract heat from electronic circuit assemblies during normal operation (see, pages 10 and 13).

[0006] US 5,167,511, "High Density Interconnect Apparatus", Krajewski, *et al.* (issued 27 November 1992) ("Krajewski"), discloses another example of an immersion system for cooling electronic components during normal operation (see, *e.g.*, col. 2, lines 43-51). On information and belief, a machine implementing the Krajewski system was also marketed by Cray Research as a follow-on super-computer to the Cray-2.

[0007] One particular problem in the vertical-stack-type systems disclosed in the above references is the necessity of draining the cooling fluid whenever physical access to the electronic modules was required. In general, such an operation, besides being time consuming, requires the entire system to be switched off, especially if the component requiring attention is an essential element in the system architecture, such as the central processing unit ("CPU"). One possible solution to this problem is to immerse circuit assemblies vertically into a tank containing the cooling fluid such that each of the various assemblies can be withdrawn independently from the tank for servicing, replacement, upgrade, *etc.* One interesting example of such a system is disclosed in a web-presentation entitled "Puget Custom Computer's mineral-oil-cooled PC", by Nilay Patel ("Puget") (posted 12 May 2007 at 11:57AM; a copy of which is submitted herewith). As noted by the author, the lack of supplemental apparatus in the Puget system to extract waste heat from the oil inherently limited its operating capabilities.

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 166 of 656; IPR2025-00196

[0008] Another problem with the Cray Research systems in particular is the nature and cost of the chosen cooling fluid: *fluorocarbon* liquids. As is known, other dielectric fluids, such as *mineral oil*, have better heat transfer characteristics; of course, being an oil, the use thereof does represent a greater residue problem on modules that may be repairable. Notwithstanding, the Puget system implemented precisely this design choice.

[0009] US Patent Application Publication 2011/0132579, "Liquid Submerged, Horizontal Computer Appliance Rack and Systems and Method of Cooling such a Appliance Rack", Best, *et al.* ("Best"), discloses a appliance immersion tank system, include support apparatus for extracting waste heat from the tank cooling fluid and dissipating to the environment the heat so extracted. Although an improvement in several respects over the prior art discussed above, this system exhibits, *inter alia*, the following problems: generally non-uniform flow patterns through the several appliance slots within the tank, potentially resulting in uneven cooling across all slots; constricted dielectric fluid supply and return ports resulting in unnecessarily high fluid flow velocities at the respective points of connection to the tank; poor *scalability*; and inadequate attention to *fail-soft operation*.

[0010] The subject matter of all of the prior art references discussed above, each in its entirety, is expressly incorporated herein by reference.

[0011] We submit that what is needed is an improved appliance tank immersion system and method of operation. In particular, we submit that such a system should provide performance generally comparable to the best prior art techniques but more efficiently and effectively than known implementations of such prior art techniques.

BRIEF SUMMARY OF THE INVENTION

[0012] In accordance with a preferred embodiment of our invention, ...

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0013] Our invention may be more fully understood by a description of certain preferred embodiments in conjunction with the attached drawings in which:

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 167 of 656; IPR2025-00196

[0014] Fig. 1 illustrates, in partial cut-away form, a front perspective of a tank module of an appliance immersion cooling system constructed in accordance with our invention;

[0015] Fig. 2 illustrates a rear perspective of the tank module shown in Fig. 1;

[0016] Fig. 3 illustrates a close-up perspective of a detail A of Fig. 2;

[0017] Fig. 4 illustrates a close-up perspective of a detail B of Fig. 2;

[0018] Fig. 5 illustrates, in perspective view, several details of the tank shown in Fig. 1, with special emphasis on the dielectric fluid recovery weir integrated into the long rear wall of the tank;

[0019] Fig. 6 illustrates, in cross-section view, the section C-C in Fig. 5;

[0020] Fig. 7 illustrates, in perspective view, the plenum facility shown in Fig. 1;

[0021] Fig. 8 illustrates, in top plan view, the orifice plate portion of the plenum facility shown in Fig. 7;

[0022] Fig. 9 illustrates, in perspective view, the chamber portion of the plenum facility shown in Fig. 7;

[0023] Fig. 10 illustrates, in top plan view, a plurality of appliance slots distributed vertically along, and extending transverse to, a long axis of the tank of Fig. 1;

[0024] Fig. 11 illustrates, in longitudinal cross-sectional view, the plurality of appliance slots distributed vertically along, and extending transverse to, the long axis of the tank of Fig. 1;

[0025] Fig. 12 illustrates, in flow schematic form, one instantiation of a flow arrangement suitable for implementing our invention; and

[0026] Fig. 13 illustrates, in control schematic form, one instantiation of a flow control facility suitable for implementing our invention.

[0027] In the drawings, similar elements will be similarly numbered whenever possible. However, this practice is simply for convenience of reference and to avoid unnecessary proliferation of numbers, and is not intended to imply or

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suggest that our invention requires identity in either function or structure in the several embodiments.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Shown in Fig. 1 (front view) and Fig. 2 (rear view) is a tank module 10 adapted for use in an appliance immersion cooling system constructed in accordance with a preferred embodiment of our invention. For convenience of reference, we have illustrated in Fig. 1 the tank facility 12 of the immersion module 10 in partial cut-away to emphasize several important internal facilities; we have shown the tank facility 12 in isolation in Fig. 5. In general, the tank facility 12 comprises: a tank 14 adapted to immerse in a dielectric fluid a plurality of electrical appliances 16, *e.g.*, contemporary computer *servers* (see, *e.g.*, Fig. 11), each in a respective appliance slot 18a distributed vertically along, and extending transverse to, a long axis of the tank 14 (see, generally, Fig. 10); an appliance rack facility 20 of convention design adapted to suspend the appliances 16 (see, *e.g.*, Fig. 11) in respective appliance slots 18 (see, Fig. 10); a weir 22 (best seen in isolation in Fig. 5 and Fig. 6), integrated horizontally into one long wall of the tank 14 adjacent all appliance slots 18, and adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each of the appliance slots 18; an interconnect panel facility 24 attached to the upper rear edge of the tank 14 and adapted to mount various appliance *power distribution* equipment, cable interconnection panels and the like (none shown); and a cover 26 adapted to be opened and closed from the front of the tank 14 (and which may include a translucent portion to allow viewing of the interior of the tank 14 when in the closed position). In addition to the tank facility 12, the immersion module 10 comprises: a primary circulation facility 28 (portions of which are shown in both Fig. 1 and Fig. 2); a secondary fluid circulation facility 30 (of which only redundant heat exchangers 32a and 32b are shown in Fig. 2); and control equipment cabinets 34a and 34b, each adapted to accommodate the module status and control equipment associated with a respective one of the primary circulation facilities 28a and 28b (see, Fig. 13).

[0029] As can be best seen in Fig. 2, the primary circulation facility 28 (comprising redundant sub-facilities 28a and 28b) comprises both passive

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(*conduits, couplers, etc.*) and active (*valves, pumps, sensors, etc.*) components; a subset of the passive components are shared, whereas, in general, the active components are duplicated and adapted to cooperate in operation as separate, redundant sub-facilities. Excluding the tank 14, the primary shared component is the plenum facility 36 (see, Fig. 1 and Fig. 7) comprising an orifice plate 36a (see, Fig. 8) and a plenum chamber 36b (see, Fig. 9). As can be seen in Fig. 1, cooled dielectric fluid is pumped into both ends of the plenum facility 36 via a shared distribution header 38 (see, Fig. 2 and Fig. 3). In general, the plenum plate 36a comprises at least one row of orifices vertically aligned with each appliance slot 18a, with the dimensions and flow rates of each set being adapted to provide substantially equal flow of the dielectric fluid upwardly into each appliance slot 18a. Preferably, each appliance slot 18a is supplied via several rows of orifices, thus generally tending to reduce the volume of the dielectric fluid exiting each orifice and to make the flow of dielectric fluid more uniform upwardly through the appliance slots 18. One further shared component is the dielectric fluid recovery facility 40 (Fig. 2) comprising a dielectric fluid recovery reservoir 42 (see, Fig. 3, Fig. 4 and Fig. 13) positioned vertically beneath the overflow lip of the weir 22 and adapted smoothly to receive the dielectric fluid as it flows over the weir 22; the dielectric fluid recovery reservoir 42 is further adapted to allow the recovered fluid to be removed from the reservoir 42 via redundant recovery ports 44a and 44b (only port 44a can be seen in Fig. 2 as the port 44b is obscured by the heat exchanger 32a; but see Fig. 12). As can be seen in both Fig. 3 and Fig. 4, we consider it desirable to provide a *vortex breaker* at the input of each of the recovery ports 44. Also, we provide a removable recovery reservoir cover 46 adapted to also cover a major portion of the distribution header 38; note that, in both Fig. 2 and Fig. 3, we have illustrated the reservoir cover 46 in a partially raised orientation so as to better depict details that would otherwise be obscured. Note that we have constructed the reservoir 42 such that the average height of dielectric fluid above the recovery ports 44 develops sufficient *hydrostatic head* to meet the requirements of the pumps 48, while also tending to minimize the likelihood of breaking suction during normal operation.

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[0030] At this point in the primary circulation facility 28, we provide fully redundant sub-facilities 28a and 28b, each comprising a primary circulation pump (48a and 48b) and associated passive and active components which, collectively, provide the motive power for circulating the dielectric fluid through the shared components and tank 14. As can be generally seen, each of these sub-facilities 28a and 28b is adapted to recover the dielectric fluid exiting the tank 14 via the weir 22, re-pressurize the recovered fluid, pass the re-pressurized fluid through a respective one of the heat exchangers 32a and 32b, and then back to the plenum facility 36 via the header 38.

[0031] Shown in Fig. 12 is one flow arrangement suitable for integrating our tank module 10 into a fully redundant, appliance immersion cooling system, comprising the primary circulation facility 28 and the secondary fluid circulation facility 30. In general, the secondary fluid circulation facility 30 comprises redundant secondary circulation sub-facilities 30a and 30b, each of which is adapted to circulate a cooling fluid, *e.g.*, treated water, through the respective heat exchanger 32a and 32b to extract heat from dielectric fluid counter-circulating therethrough and to dissipate to the environment the heat so extracted. In the illustrated embodiment, each of the secondary fluid sub-facilities 30a and 30b comprise conventional cooling towers 50a (including fan facility 52a) and 50b (including fan facility 52b), and secondary circulation pumps 54a and 54b. To facilitate flexible operation in installations including multiple immersion modules 10 in combination with a plurality of secondary circulation sub-facilities 30, a common header arrangement can be implemented as illustrated in the secondary fluid circulation loop, with flow control valves located at key flow control points as is known.

[0032] Shown in Fig. 13 is a control facility 56 adapted to monitor and control the operation of both the immersion module 10 (including all active components of the primary circulation facility 28), and the secondary fluid circulation facility 30. As will be evident to those skilled in this art, efficient operation of our immersion module 10 requires continuous monitoring and control of several essential operating parameters, including fluidic temperatures, pressures, conductivity and *pH* at several points in the primary and secondary circulation loops.

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Although the several sensory and control functions can be implemented using traditional dedicated hardware components, we prefer to employ at least one *programmable logic controller* ("*PLC*"), commercially available from any of a number of respected vendors, *e.g.*, the *Allen-Bradley* brand of PLCs from Rockwell Automation, Inc. In the instantiation illustrated in Fig. 13, we have depicted: a primary controller 58a adapted to monitor and control the operation of the primary circulation sub-facility 28a as a function of the temperature of the dielectric fluid in the tank 14; a secondary controller 60a adapted to monitor and control the operation of the secondary fluid circulation sub-facility 30a as a function of the temperature of the dielectric fluid flowing through the heat exchanger 32a; and a master controller 62 adapted to coordinate the activities of the primary controller 58a and secondary controller 60a. As can be seen, we have incorporated into the primary circulation sub-facility 28a: supply and return *sensors*, including a *temperature probe*, T, inserted into a *thermowell* (not shown) installed in the bottom of the reservoir 42 adjacent a respective return port 44a (note that, in Fig. 4, only one of the holes that receive the thermowells is illustrated, but both holes are illustrated in Fig. 12); a pair of sensor facilities, S, which may sense temperature, pressure and conductivity, as deemed desirable); and return (and, if desired, supply) *flow control valves* and controls for the primary circulation pump 48a; of course, a redundant set of these components exists for the primary circulation sub-facility 28b. In general, the goal is to maintain the temperature of the dielectric fluid in the tank 14 between a predetermined minimum temperature and a predetermined maximum temperature.

[0033] As noted above, we have provided separate control equipment cabinets 34a and 34b, each adapted to accommodate the several components comprising a respective one of the primary controllers 58a and 58b. For convenience of access, we prefer to co-locate with each of the cooling towers 50 a protective housing (not shown) for the respective secondary controller 60. Of course, the control facility 56 can be instantiated as a single, multi-module PLC facility, with similar or other combinations of monitoring devices as deemed most appropriate for a particular installation. Alternatively, one or more, and perhaps all, of the

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functions performed by the controllers 58, 60 and 62 may be implemented in the form of dedicated *application-specific software* executing on a conventional computer platform having the appropriate resources; indeed, it would be entirely feasible to implement the entire control facility 56 on a server 16 installed in a tank 14.

[0034] One desirable enhancement that we recommend is a remote control facility, implemented, *e.g.*, via the master controller 62 (or by way of a direct, per-controller *interface*), adapted to facilitate remote monitoring of system status (*e.g.*, temperatures, pressures, *etc.*) and control over system control parameters (*e.g.*, temperature and pressure limits, *etc.*) to the primary controllers 58 and secondary controllers 60. For example, using a conventional data communication hardware module 64, *e.g.*, an *ethernet* card implementing the *TCP/IP* protocol, a modern *web browser* can be adapted to provide a *graphical user interface* ("*GUI*") with sufficient functionality to facilitate monitoring and control of an entire installation from a remote location. Such a GUI may be implemented using any of a number of programming paradigms, *e.g.*, *PHP*, *.NET* and the like.

[0035] Operational control of redundant, continuous process flow systems is generally well known. Preferable, each of the several redundant sub-facilities are routinely activated to assure current functionality, and to allow the inactive sub-facility to be serviced according to an established schedule. We believe this continuous rotation of system resources to be so important that we recommend switching the sub-facilities at least once, and preferably, several times, per day; although this is possible to implement manually, we prefer to enable the master controller 62 to control the sequencing of the several switch-over operations. One further aspect of this sophistication in control is the ability to perform *stress testing* of the several sub-systems under controlled conditions so as to assure appropriate response to real-time emergencies.

[0036] In our First Parent Provisional, we have disclosed an alternate embodiment comprising an appliance immersion tank facility wherein the function of the plenum facility 36 is performed by a manifold facility comprising a ladder-arrangement of tubular spray bars, each bar of which supplies dielectric fluid to a respective appliance slot. As we noted, one particular advantage of this

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arrangement is that individual spray bars may be shut off if the respective appliance slot is not occupied and, thus, save energy. To further increase energy efficiency, we have provided optional vertical flow barriers adapted to partition the tank into an active portion, having active appliances, and a stagnant portion, having no active appliances. One further enhancement we disclosed is the provision of temperature sensors per appliance slot, such that the flow rate through each spray bar can be dynamically varied as a function of the temperature of the dielectric fluid exiting the respective slot. Other operative configurations will be readily perceived by those skilled in this art.

[0037] In a manner analogous to the embodiment described in our First Parent Provisional, it would be advantageous, from an energy point of view, to provide a plurality of flow barrier plates 66 (shown by way of example only in Fig. 11), each adapted to be attached to the top of the plenum facility 36 so as substantially to block the flow of the dielectric fluid through the row(s) of orifices in the plenum plate 36a corresponding to at least a respective one of the appliance slots 18a; an elastomeric layer (not shown) could be provided on the interface surface of the plate(s) 66 to enhance the sealing effect. Such an arrangement would allow the total flow through the plenum facility 36 to be adjusted, in the field, as a function of the actual number of active appliances 16 in the tank 14. Further, this arrangement can incorporate a relocatable vertical baffle plate 68 (see Fig. 11) adapted substantially to partition the tank 14 into an active portion 14a containing the active appliances 16 and an inactive portion 14b containing no appliances (or at least no active appliances 16); preferably, the baffle plate 68 is adapted to be mounted in the appliance rack facility 28 in a manner similar to an actual appliance 16 (the baffle plate 68 need not fully block the flow of dielectric fluid between the active portion 14a and inactive portion 14b, but only significantly impede the flow between these portions). Note that, in the example scenario illustrated in Fig. 11, we have shown one possible arrangement of a total of 8 active appliances 16 distributed across 16 appliance slots 18a so as to spread the total heat load across adjacent empty slots 18a. Such an optimal arrangement is possible only if less than a majority of the available appliance slots 18a are occupied by an active appliance 16. Clearly, such optional

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adjunct facilities enhance flexibility in operation, accommodating dynamic adjustment of the flow rates in the primary circulation sub-facilities 28a and 28b under variable heat loads, while providing opportunities to conserve energy that might otherwise be expended moving the dielectric fluid through the inactive portion 14b of the tank 14. Other operative configurations will be readily perceived by those skilled in this art.

[0038] In our Second Parent Provisional, we have disclosed another embodiment comprising a more conventional, less-modularized instantiation with appropriate flow and control facilities. In this embodiment, we chose to implement tank clusters, comprising, *e.g.*, 4 appliance immersion tank facilities, with substantially all of the other equipment being constructed from stand-alone, commercially available components. Such an arrangement offers greater opportunities to select and install improved components, or to add enhancements to the installation, as deemed desirable after initial installation. Other operative configurations will be readily perceived by those skilled in this art.

[0039] As we noted above with reference to the embodiment illustrated in Fig. 12, the secondary flow header facility is well adapted to allow any secondary circulation sub-facility 30 to be connected to any active heat exchanger 32. Such a facility provides great flexibility in dealing with unusual system conditions, especially in installations wherein the secondary circulation sub-facilities 30a and 30b are each sized to support a cluster of tank modules 10. Imagine, for example, that, while one of the secondary circulation facilities 30, say sub-facility 30a, is being serviced, the activities of the set of appliances 16 in one tank 14 in the cluster are higher than normal, resulting in a rise in temperature in that tank 14 above the desired maximum. In response, the master controller 62 can direct Primary Controllers 58a and 58b assigned to tank 14 to operate both of the primary circulation sub-facilities 28a and 28b simultaneously, *i.e.*, in parallel. Using the secondary flow header facility, the heat being extracted by both of the heat exchangers 32a and 32b may be dissipated using the resources of the single on-line secondary circulation sub-facility 30b. Thus, one clear advantage of this alternate embodiment is the ability dynamically to perform *load balancing* across

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all system resources. Other operative configurations to support sub-system load balancing will be readily perceived by those skilled in this art.

[0040] Preferably, one or more filters (not shown) are included in the flow path through each of the primary circulation sub-facilities 28a and 28b to remove any particulates or other undesirable foreign matter that may have been picked up by the dielectric fluid on its passage though the entire primary circulation facility 28; chemical sensors may also be provided to detect the presence of unexpected chemicals that may indicate failure of sub-components within one of the appliances 16. Similar components, such as pH sensors, may also included in the secondary fluid circulation facility 30.

[0041] As can be seen generally in Fig. 1, we provide a pair of low dielectric fluid level sensors 70a and 70b adapted to trigger an alarm signal in the event that, for whatever reason, the level of the dielectric fluid in the tank 14 drops below a predetermined minimum level. Additionally, the responsive primary controller 58 can initiate other actions to address the detected problem, including activating audio alarms, transmitting electronic alert signals and the like.

[0042] To solve a reciprocal problem, namely leakage from an external portion of the primary circulation loop 28 resulting in the dielectric fluid in the tank 14 being *back-siphoned* through the plenum facility 36, we recommend incorporating a *siphon breaker* 72 (see, Fig. 1) in the supply pipe at a predetermined location well above the plenum facility 36 but somewhat below the level of the weir 24. Such a siphon breaker can be as simple as a relatively small diameter hole 72 drilled through the supply pipe at the selected location; due to the relatively high viscosity of the dielectric fluid, even when heated, any resulting leakage during normal operation will be relatively insignificant. Other operative responses to address these and other unusual fluidic conditions will be readily perceived by those skilled in this art.

[0043] As is known (see, *e.g.*, Best), many conventional, commercially available electrical/electronic appliances include components that will not function correctly if immersed in a dielectric fluid, especially one as *viscous* as mineral oil: cooling fans and rotating media disk drives. In general, all cooling fans are

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unnecessary in an immersion cooling system and can be simply removed. The media drives, however, are usually necessary for normal appliance operation. One option is to remove each drive, totally seal the drive against fluid entry, and reinstall the now-sealed drive (pre-sealed drives are also available). Another option is to remove the drive and mount it on the interconnect panel facility 24; typically special cabling will be required to re-attach the drive to the internal appliance *socket*. Yet another option is to replace the rotating media drive with a *solid-state drive* having no moving components. Other operative configurations will be readily perceived by those skilled in this art.

[0044] It will be recognized that, in all of the embodiments described herein, emphasis was placed on minimizing the total volume of the dielectric fluid circulating throughout each immersion module 10. We submit that the key concept here is to move the secondary fluid to the point of heat exchange with the primary fluid, rather than to move the primary fluid to the point of heat exchange with the secondary fluid. Thus, in our preferred embodiment, all of the essential components of the primary circulation facility 28 are tightly co-located with the tank 14 so as to form a highly-integrated module. Further, our placement of the reservoir 42 outside of (but immediately adjacent to) the tank 14 tends to reduce the total volume of the dielectric fluid (as opposed to the alternative arrangement we proposed in our First Provisional, wherein a recovery trough was disposed within the tank 14); then, we positioned the components comprising the primary circulation sub-facilities 28 so as to be vertically beneath the *footprint* of the reservoir 42. In addition to conserving valuable floor space in a typical *data center* installation, the resulting modular configuration facilitates both easy initial installation and subsequent upgrade to efficiently satisfy increasing data center workloads. Indeed, our invention greatly enhances system *scalability*, a key concern to data center operators. Finally, our system-wide redundancy substantially assures fail-soft operation during periods of unusual environmental conditions, infrastructure instability or political unrest.

[0045] Although we have described our invention in the context of particular embodiments, one of ordinary skill in this art will readily realize that many

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modifications may be made in such embodiments to adapt either to specific implementations. By way of example, it will take but little effort to adapt our invention for use with electronic appliances other than contemporary servers; and to adjust the dimensions of the appliance accommodation slots accordingly. Similarly, practitioners in the art will readily recognize that other, known secondary circulation facilities may be employed effectively, including forced air, *vapor compression* systems, *earth-water sink loops, waste heat recovery and recycling* systems, and the like (see, *e.g.*, the several alternatives discussed in Best). Further, the several elements described above may be implemented using any of the various known manufacturing methodologies, and, in general, be adapted so as to be operable under either hardware or software control or some combination thereof, as is known in this art.

[0046] Thus it is apparent that we have provided an improved system and method of operation for immersion cooling of appliances and the like. In particular, we submit that such a method and apparatus provides performance generally comparable to the best prior art techniques but more efficiently and effectively than known implementations of such prior art techniques.

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CLAIMS

What we claim is:

1. An appliance immersion cooling system comprising:

a tank adapted to immerse in a dielectric fluid a plurality of electrical appliances, each in a respective appliance slot distributed vertically along, and extending transverse to, a long wall of the tank, the tank comprising:

a weir, integrated horizontally into the long wall of the tank adjacent all appliance slots, adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each appliance slot;

a primary circulation facility adapted to circulate the dielectric fluid through the tank, comprising:

a plenum, positioned adjacent the bottom of the tank, adapted to dispense the dielectric fluid substantially uniformly upwardly through each appliance slot;

a secondary fluid circulation facility adapted to extract heat from the dielectric fluid circulating in the primary circulation facility, and to dissipate to the environment the heat so extracted; and

a control facility adapted to coordinate the operation of the primary and secondary fluid circulation facilities as a function of the temperature of the dielectric fluid in the tank.

2. The system of claim 1 wherein the tank and primary circulation facility comprise a tightly co-located module.

3. The system of claim 1 wherein the tank further comprises:

an interconnect panel facility adapted to mount appliance support equipment.

4. The system of claim 1 wherein the primary circulation facility further comprises:

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at least first and second primary circulation sub-facilities, each adapted to operate independently to circulate the dielectric fluid through the tank;

wherein the control facility is further adapted to coordinate the operation of the first and second primary circulation sub-facilities and the secondary fluid circulation facilities so to maintain the temperature of the dielectric fluid in the tank substantially between a predetermined minimum temperature and a predetermined maximum temperature.

5. The system of claim 1 wherein the control facility further comprises a communication facility adapted to facilitate monitoring and control of the control facility from a remote location.

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6. A tank module adapted for use in an appliance immersion cooling system, the tank module comprising:

a tank adapted to immerse in a dielectric fluid a plurality of electrical appliances, each in a respective appliance slot distributed vertically along, and extending transverse to, a long wall of the tank, the tank comprising:

a weir, integrated horizontally into the long wall of the tank adjacent all appliance slots, adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each appliance slot;

a primary circulation facility adapted to circulate the dielectric fluid through the tank, comprising:

a plenum, positioned adjacent the bottom of the tank, adapted to dispense the dielectric fluid substantially uniformly upwardly through each appliance slot; and

a control facility adapted to control the operation of the primary fluid circulation facility as a function of the temperature of the dielectric fluid in the tank.

7. The module of claim 6 wherein the tank and primary circulation facility comprise a tightly co-located module.

8. The module of claim 6 wherein the tank further comprises:

an interconnect panel facility adapted to mount appliance support equipment.

9. The module of claim 6 wherein the primary circulation facility further comprises:

at least first and second primary circulation sub-facilities, each adapted to operate independently to circulate the dielectric fluid through the tank;

wherein the control facility is further adapted to coordinate the operation of the first and second primary circulation sub-facilities so to maintain the temperature

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of the dielectric fluid in the tank substantially between a predetermined minimum temperature and a predetermined maximum temperature.

10. The module of claim 6 wherein the control facility further comprises a communication facility adapted to facilitate monitoring and control of the control facility from a remote location.

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APPLIANCE IMMERSION COOLING SYSTEM

ABSTRACT OF THE DISCLOSURE

A appliance immersion tank system comprising: a generally rectangular tank adapted to immerse in a dielectric fluid a plurality of appliances, each in a respective appliance slot distributed vertically along, and extending transverse to, the long axis of the tank; a primary circulation facility adapted to circulate the dielectric fluid through the tank; a secondary fluid circulation facility adapted to extract heat from the dielectric fluid circulating in the primary circulation facility, and to dissipate to the environment the heat so extracted; and a control facility adapted to coordinate the operation of the primary and secondary fluid circulation facilities as a function of the temperature of the dielectric fluid in the tank. A plenum, positioned adjacent the bottom of the tank, is adapted to dispense the dielectric fluid substantially uniformly upwardly through each appliance slot. A weir, integrated horizontally into a long wall of the tank, is adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each appliance slot. All active and most passive components of both the primary and secondary fluid circulation facilities, and the control facility are fully redundant, and are adapted automatically to operate in a fail-soft mode.

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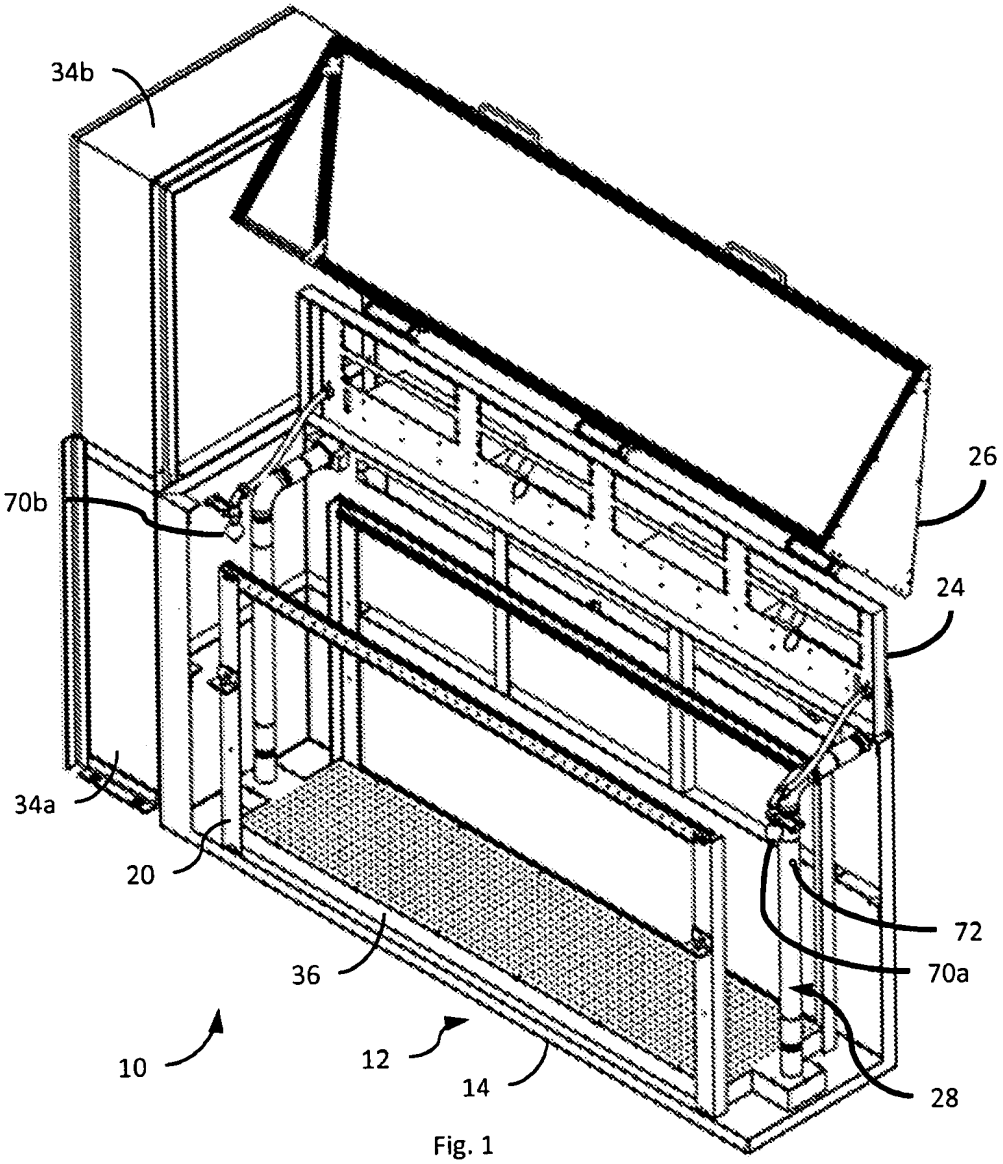


Fig. 1

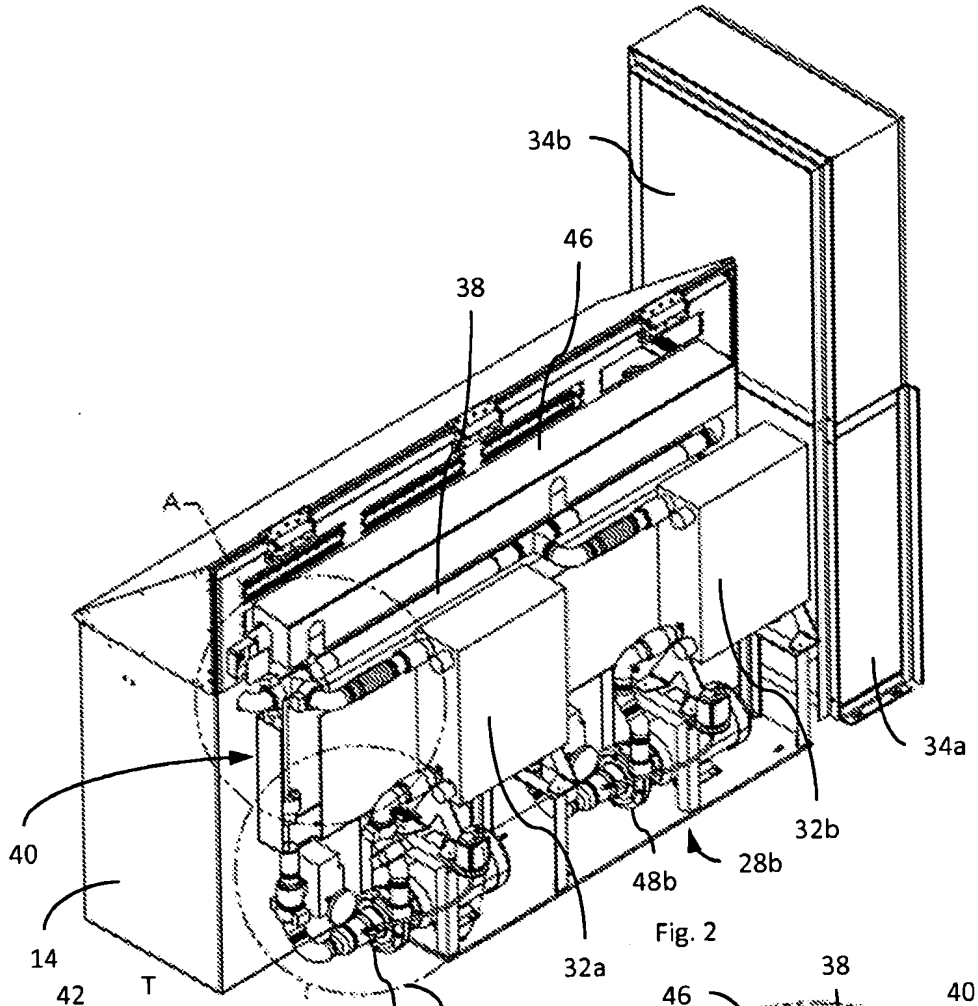


Fig. 2

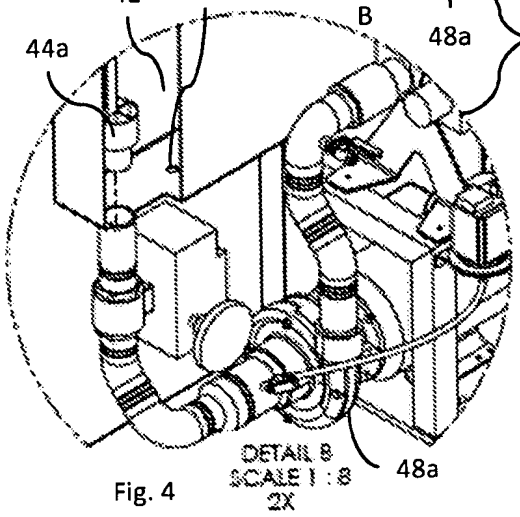


Fig. 4

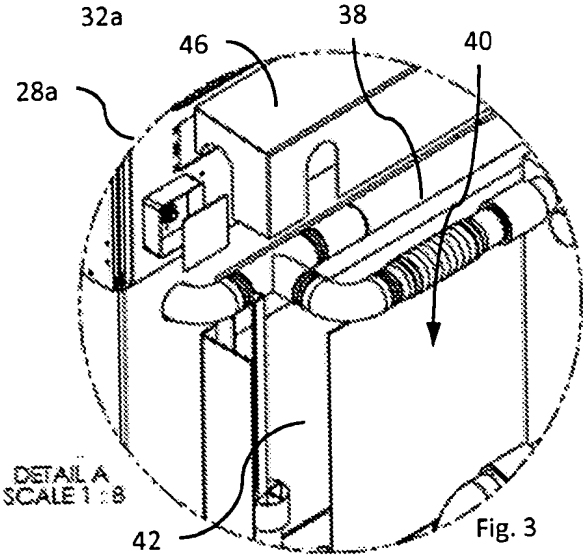


Fig. 3

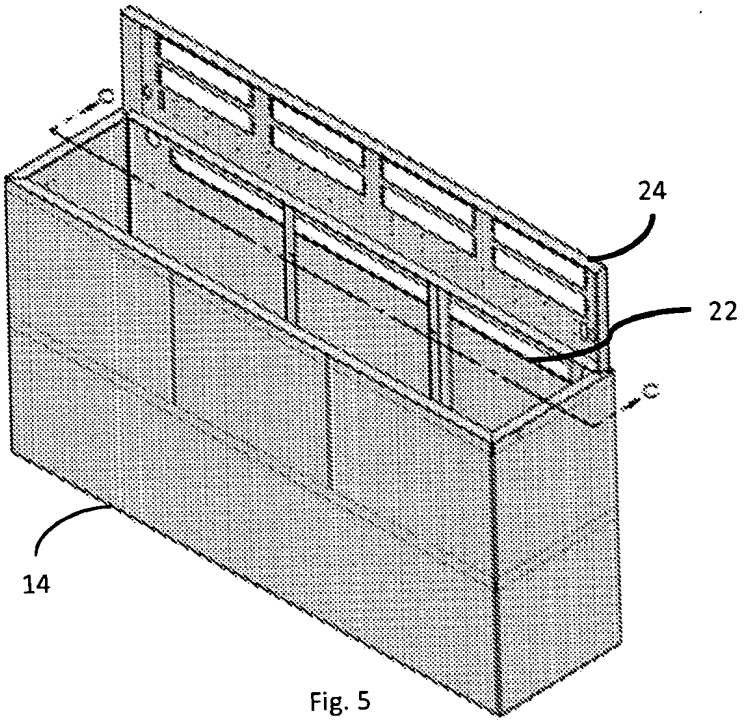
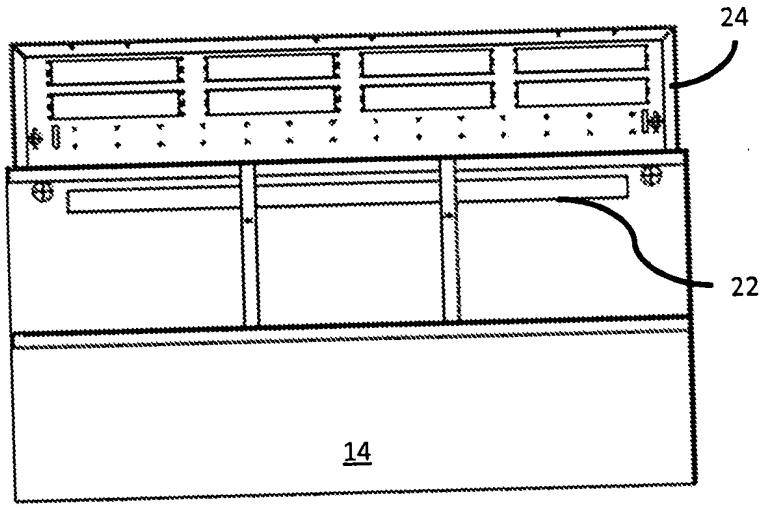


Fig. 5



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Fig. 6

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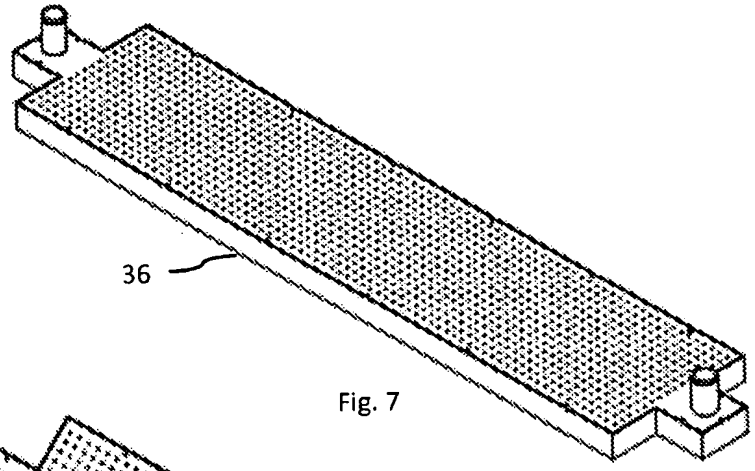


Fig. 7

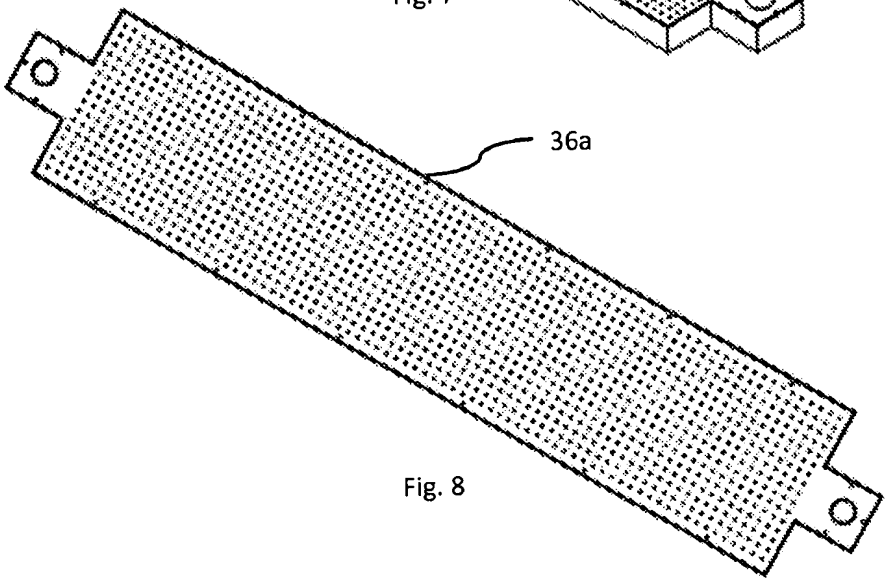


Fig. 8

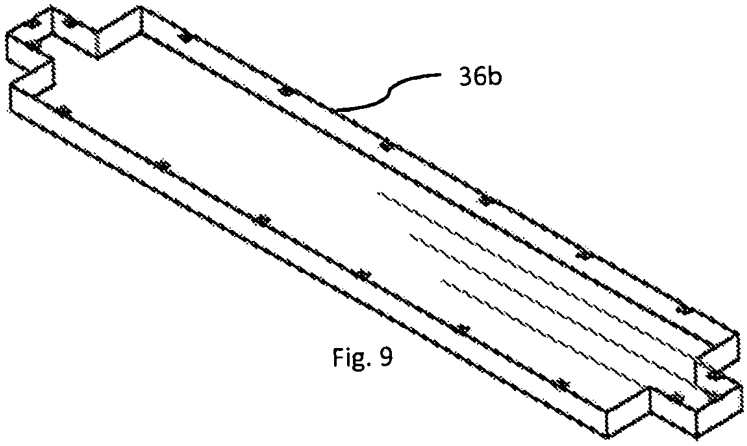


Fig. 9

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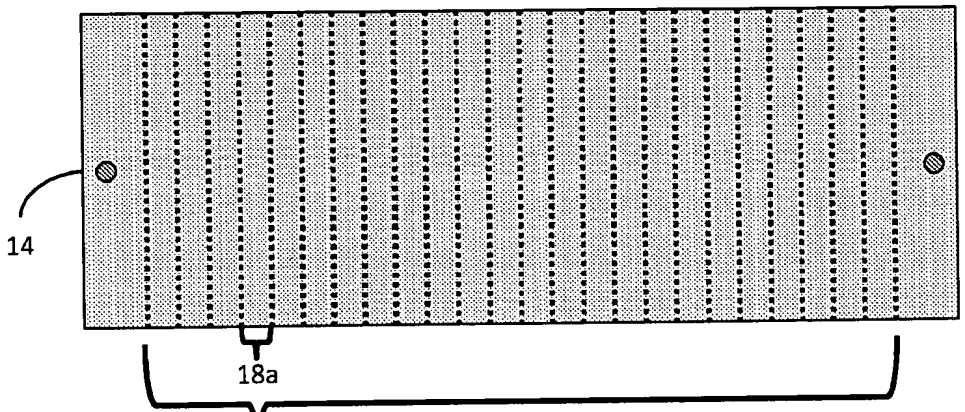


Fig. 10

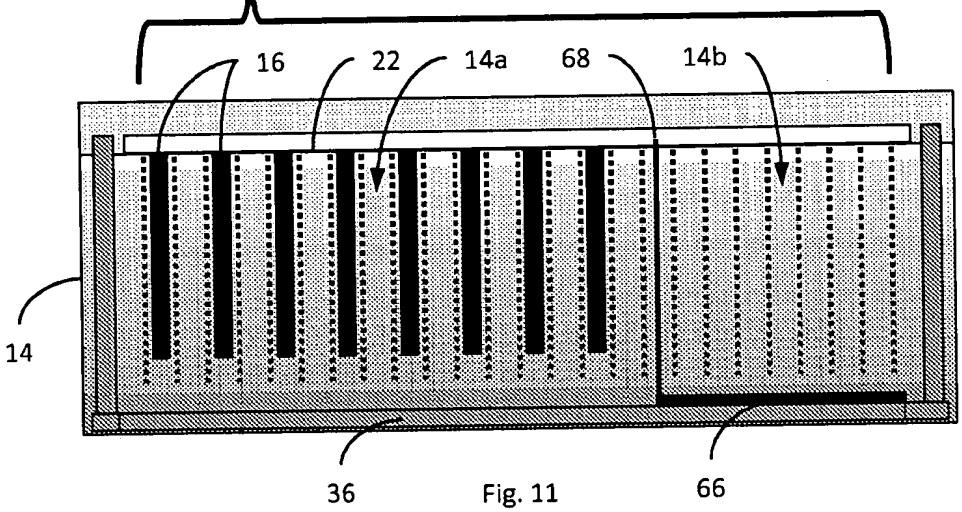


Fig. 11

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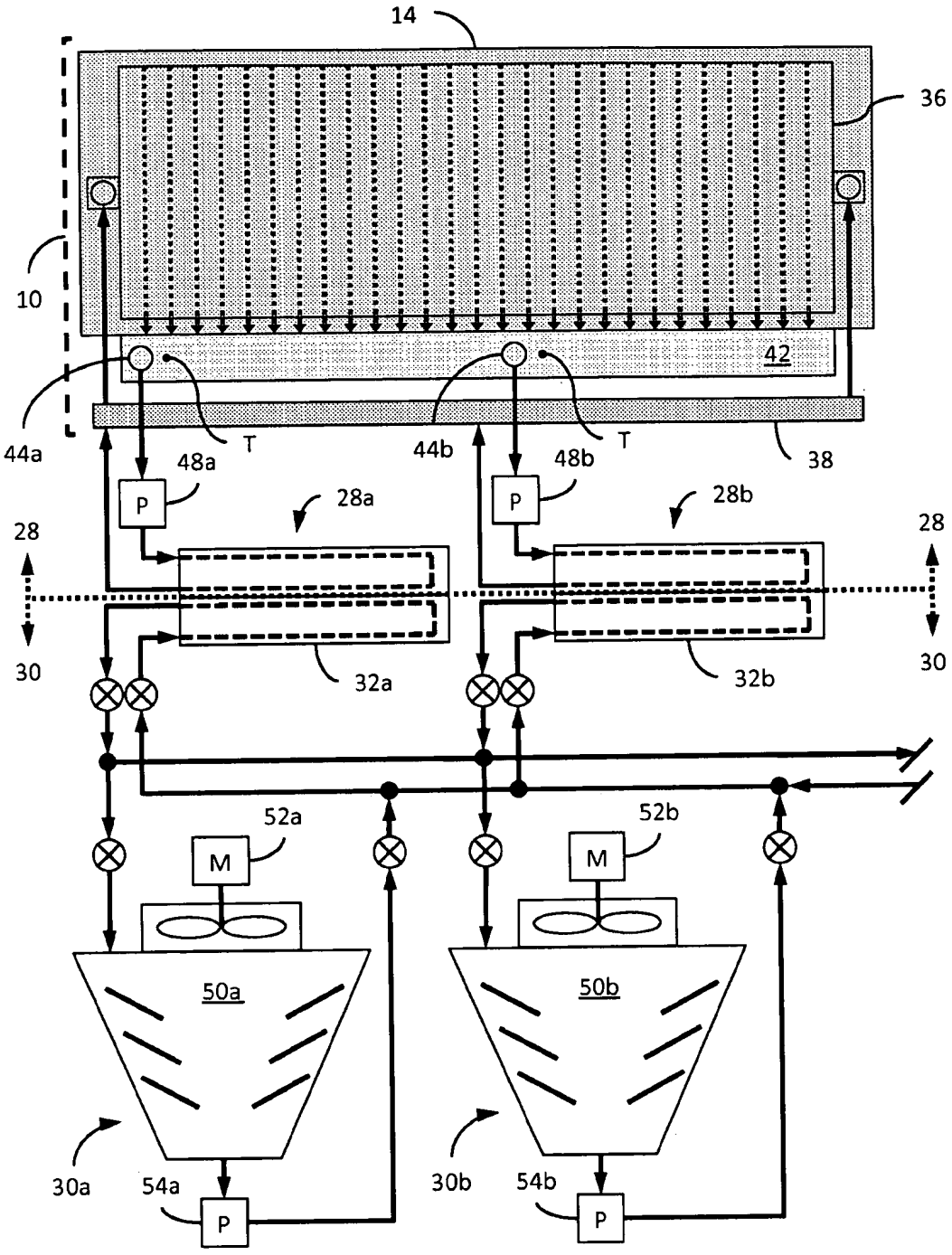

14
36
10
42
44a
T
44b
T
38
48a
48b
P
P
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28b
28
28
30
30
32a
32b
52a
52b
M
M
50a
50b
30a
54a
30b
54b
P
P

Fig. 12

6/xx

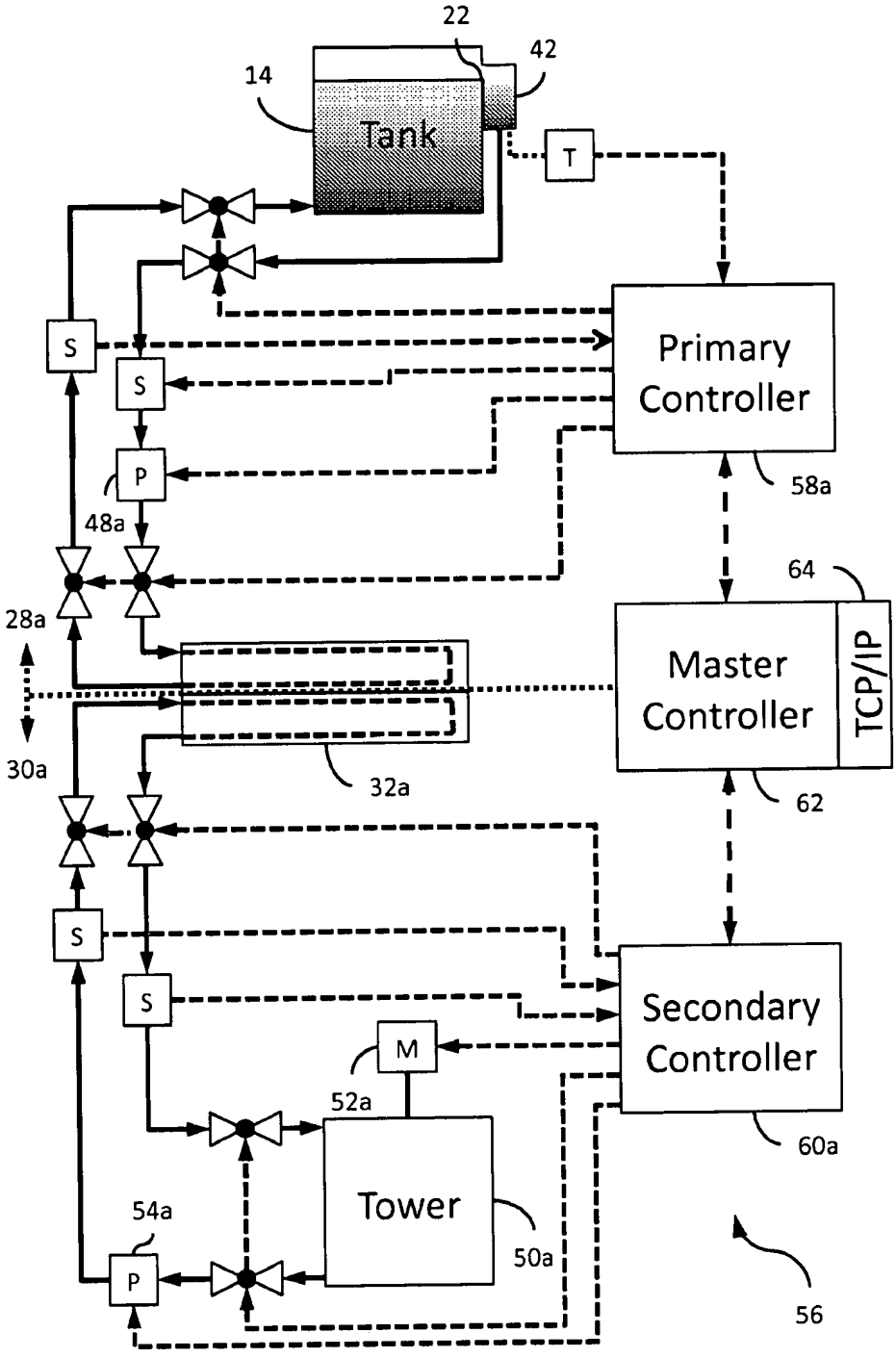


Fig. 13

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 190 of 656; IPR2025-00196

PATENT COOPERATION TREATY

From the RECEIVING OFFICE

PCT

To:
JEFFREY VAN MYERS
J.V. MYERS & ASSOCIATES, PC
P.O. BOX 130
DRIFTWOOD, TEXAS 78619

Confirmation No: 2411

NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE

(PCT Rule 20.2(c))

Date of mailing *(day/month/year)*	31 Dec 2013
Applicant's or agent's file reference: JMG001-01	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/075126	13 Dec 2013	14 Dec 2012

Applicant: MIDAS GREEN TECHNOLOGY, LLC

Title of the invention: APPLIANCE IMMERSION COOLING SYSTEM

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:

☒ was transmitted to the International Bureau on 31 Dec 2013.

☐ has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau*:

☐ because the necessary national security clearance has not yet been obtained.

☐ because *(reason to be specified)*:

* The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB/301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

3. FOREIGN TRANSMITTAL LICENSE INFORMATION — Completed by: NB

☐ Additional license for foreign transmittal not required. This subject matter is covered by a license already granted or the equivalent U.S. national application. Refer to that license for information concerning its scope.

☐ License for foreign transmittal not required. 37 CFR. 5.11(e)(1) or 37 CFR 5.11(e)(2). However, a license may be required for additional subject matter. See 37 CFR 5.15(b).

☒ Foreign transmittal license granted. 35 U.S.C. 184; 37 CFR 5.11 on 30 Dec 2013 (date):

☐ 37 CFR 5.15(a) ☒ 37 CFR 5.15(b)

Name and mailing address of the receiving Office	Authorized officer
Mail Stop PCT, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450	Nina D Butler
Facsimile No. 571-273-3201	Telephone No. 571-272-9027

Form PCT/RO/105 (July 2008)

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)

The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

Declaration of Inventorship (Rules 4.17(iv) and 51*bis*.1(a)(iv))
for the purposes of the designation of the United States of America:

I hereby declare that I believe I am the original inventor or an original joint inventor of a claimed invention in the application.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/ ..... (if furnishing declaration pursuant to Rule 26*ter*).

I hereby declare that the above-identified international application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Name: Boyd, Christopher L.

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 1309 Bonham Terrace, Austin, TX 78704, USA

Inventor's Signature: ..... Date: .....
(The signature must be that of the inventor, not that of the agent)

Name: James P. Koen

Residence: Round Rock, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2302 Falcon Drive, Round Rock, Texas 78681, USA

Inventor's Signature: ..... Date: .....
(The signature must be that of the inventor, not that of the agent)

Name: David Christopher Laguna

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2011 E. 6th St., Austin, TX 78702, USA

Inventor's Signature: ..... Date: .....
(The signature must be that of the inventor, not that of the agent)

☒ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Continuation of Box No. VIII (i) to (v) DECLARATION

If the space is insufficient in any of Boxes Nos. VIII (i) to (v) to furnish all the information, including in the case where more than two inventors are to be named in Box No. VIII (iv), in such case, write "Continuation of Box No. VIII ..." (indicate the item number of the Box) and furnish the information in the same manner as required for the purposes of the Box in which the space was insufficient. If additional space is needed in respect of two or more declarations, a separate continuation box must be used for each such declaration. If this Box is not used, this sheet should not be included in the request.

Name: Thomas R. Turner
Residence: Georgetown, TX, USA
Mailing Address: 4210 Malaga Dr., Georgetown, TX 78628, USA

Signature:_____ Date: _____

Name: Kenneth D. Swinden
Residence: Hutto, TX, USA
Mailing Address: 132 Mustang Creek North Loop, Hutto, TX 78634, USA

Signature:_____ Date: _____

Name: Mario Conti Garcia
Residence: Austin, T, USA
Mailing Address: 9624 Woody Ridge View, Austin, TX 78730, USA

Signature:_____ Date: _____

Name: John Charles Tribou
Residence: Austin, TX, USA
Mailing Address: 9109 Middlebie Dr., Austin, TX 78750, USA

Signature:_____ Date: _____

Sheet No. 6

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)

The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

Declaration of Inventorship (Rules 4.17(iv) and 51*bis*.1(a)(iv))
for the purposes of the designation of the United States of America:

I hereby declare that I believe I am the original inventor or an original joint inventor of a claimed invention in the application.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/ ..... (if furnishing declaration pursuant to Rule 26*ter*).

I hereby declare that the above-identified international application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Name: Boyd, Christopher L.

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 1309 Bonham Terrace, Austin, TX 78704, USA

Inventor's Signature: Christopher L. Boyd Date: 12-13-2013
(The signature must be that of the inventor, not that of the agent)

Name: James P. Koen

Residence: Round Rock, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2302 Falcon Drive, Round Rock, Texas 78681, USA

Inventor's Signature: James P. Koen Date: 12-13-2013
(The signature must be that of the inventor, not that of the agent)

Name: David Christopher Laguna

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2011 E. 6th St., Austin, TX 78702, USA

Inventor's Signature: David Christopher Laguna Date: 12/13/2013
(The signature must be that of the inventor, not that of the agent)

☒ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Sheet No. 7

Continuation of Box No. VIII (i) to (v) DECLARATION

*If the space is insufficient in any of Boxes Nos. VIII (i) to (v) to furnish all the information, including in the case where **more than two inventors are to be named** in Box No. VIII (iv), in such case, write "Continuation of Box No. VIII ( )" (indicate the item number of the Box) and furnish the information in the same manner as required for the purposes of the Box in which the space was insufficient. If additional space is needed in respect of two or more declarations, a separate continuation box must be used for each such declaration. If this Box is not used, this sheet should not be included in the request.*

Name: Thomas R. Turner
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Signature:_____ Date: _____

Name: Kenneth D. Swinden
Residence: Hutto, TX, USA
Mailing Address: 132 Mustang Creek North Loop, Hutto, TX 78634, USA

Signature:_____ Date: _____

Name: Mario Conti Garcia
Residence: Austin, T, USA
Mailing Address: 9624 Woody Ridge View, Austin, TX 78730, USA

Signature: _____ Date: Dec. 19 2013

Name: John Charles Tribou
Residence: Austin, TX, USA
Mailing Address: 9109 Middlebie Dr., Austin, TX 78750, USA

Signature:_____ Date: _____

590233

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 01, 2014

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *61/737,200*
FILING DATE: *December 14, 2012*
RELATED PCT APPLICATION NUMBER: *PCT/US13/75126*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US61/737,200*

UNITED STATES PATENT AND TRADEMARK OFFICE · DEPARTMENT OF COMMERCE

Certified by

David J. Kappos

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1 — Remove

Given Name	Middle Name	Family Name	City	State	Country
John	H.	Miller Jr.	Austin	TX	US

Inventor 2 — Remove

Given Name	Middle Name	Family Name	City	State	Country
James	P.	Koen	Austin	TX	US

Inventor 3 — Remove

Given Name	Middle Name	Family Name	City	State	Country
John	C.	Tribou	Austin	TX	US

Inventor 4 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Mike		Rainone	Palestine	TX	US

Inventor 5 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Talbot		Presley	Palestine	TX	US

Inventor 6 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Jeffrey	Van	Myers	Driftwood	TX	US

Inventor 7 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Christopher	L	Boyd	Austin	TX	US

Inventor 8 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Kenneth	D	Tooke	Austin	TX	US

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

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Inventor 9					Remove
Given Name	Middle Name	Family Name	City	State	Country i
David	Christopher Thoma	Laguna	Austin	TX	US

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Title of Invention	Server Immersion Tank System
Attorney Docket Number (if applicable)	JMG001-00

Correspondence Address

Direct all correspondence to (select one):

◉ The address corresponding to Customer Number	○ Firm or Individual Name
Customer Number	44070

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
◉ No.
○ Yes, the name of the U.S. Government agency and the Government contract number are:

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Entity Status

Applicant claims small entity status under 37 CFR 1.27

(•) Yes, applicant qualifies for small entity status under 37 CFR 1.27

( ) No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey Van Myers/			Date (YYYY-MM-DD)	2012-12-14
First Name	Jeffrey	Last Name	Myers	Registration Number (If appropriate)	27362

This collection of information is required by 37 CFR 1.51. 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. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours 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, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or paten. Accordingly, pursuant to the requirements of the Act, please be advised that : (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, t o a n other federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

[0001] Goal: substantially constant pressure at all Spray Heads (at bottom of Tank):

[0002] 1. For example, as in Fig. 1, 13 Spray Bars, each having, e.g., 10 Spray Heads (not shown) each of x-sectional area of 1 unit.

[0003] 1.1. Spray Bars 1 & #13 have x-sectional area of 5 units (Optional: 5 Spray Heads of 1 unit area, or 10 Spray Heads of 0.5 unit area).

[0004] 1.2. Spray Bars #2-#12 have x-sectional area of 10 units.

[0005] 1.3. Total x-sectional area of ALL Spray Bars is 120 units.

[0006] 2. Each (x2) Header Manifold has x-sectional area of 60 units, i.e., 1/2 total x-sectional area of all Spray Bars.

[0007] 3. Total x-sectional area of Supply Manifold is 120 units.

[0008] Result: relative pressure drop at Supply-to-Headers minimal; pressure drop at Header-to-Spray Bar is related to position, but inverse relationship wrt 'top' and 'bottom' Headers compensates (subject to frictional losses, slight differences from ideal x-sectional areas, etc.)

[0009] 1. Each Spray Bar has an area-efficient (e.g, ball, gate) shutoff valve at each end, adjacent the connection to the respective Header, all valves being set at system setup/change via an actuating rod manually inserted from above; when both closed, no fluid is delivered to the Spray Heads.

[0010] 2. The Spray Bars are spaced such that a Server may be suspended in each inter-Spray Bar gap, thus forming respective 'flow slots' the flow patterns of which project upward from the Spray Heads, through the inter-Server gaps, and, ultimately into open fluid return channel(s) (e.g., weirs) extending horizontally along the long side(s) of the tank.

[0011] 3. Servers are inserted starting from, e.g., the 'left' end of tank, each suspended in a respective 'Server-slot' between adjacent Spray Bars, with no Server-slot vacancies allowed.

[0012] 4. If any empty Server-slots remain, a full tank width/height flow barrier is inserted into the Server-slot immediately to the 'right' of the 'right-most' active

Server, and the shutoff valves at both ends of all 'idle' Spray Bars are closed, thus forming a stagnant fluid reservoir (with proportional system energy savings).

[0013] Operation: Heat developed on the 'left-facing' major surface of Server #1 is extracted by fluid flow developed in flow-slot #1 by Spray Bar #1, while heat developed on the 'right-facing' major surface is extracted by fluid flow developed in flow-slot #2 by Spray Bar #2. Similarly, heat developed on the 'left-facing' major surface of Server #2 is extracted by fluid flow developed in flow-slot #2 by Spray Bar #2, while heat developed on the 'right-facing' major surface is extracted by fluid flow developed in flow-slot #3 by Spray Bar #3; and so on.

[0014] (Optional) The shutoff valves of the Spray Bar servicing the 'right-most' active 'flow slot' (i.e., between the 'right-most' active Server and the flow barrier) may be partially closed to compensate for the reduced heat being radiated/conducted into this flow slot.

[0015] (Optional) Each shutoff valve is controlled by a respective servo, with the valve-pair of each Spray Bar being controlled by a single Valve Controller in response to temperature sensor(s) suspended in the respective flow-slot somewhat below the 'top' surfaces of the adjacent Servers (to more accurately measure the temperature of the fluid exiting the respective flow-slot before significant mixing with fluid flowing in adjacent flow-slots).

[0016] (Optional) A 'smart' Master Controller monitors a selected set of the flow-slot temp sensors, and coordinates the activities of all active flow-slot Valve Controllers. Due to the huge heat storage capacity of the entire fluid mass and concomitant system temperature lag, determining the energy saving contribution of this Master Controller will be problematic, but nonetheless this function contributes to the end goal of protecting the set of active Servers from sustained excessive heat excursions.

[0017] (Option) The gaps between the 'side' surfaces of each Server and the adjacent side(s) of the Tank may be blocked using appropriately sized flow baffles to facilitate more precise control of fluid flow in each flow-slot.

[0018] (Option) As in Fig. 2, dispose infra-red (IR) shields between adjacent blades to reflect/absorb IR radiation from one blade to the next adjacent blade.

Reflection can be achieved using highly polished metal/mirrored plates, e.g., gold-plated; absorption can be achieved using flat-black or black-anodized plates. Fins can be added to enhance effectiveness. Multiple layers may also be employed with an interlayer gap for vertical flow of the cooling fluid.

[0019] (Option) Also as in Fig. 2, orient the Spray Bar(s) longitudinally with Spray Head(s) aligned with inter-blade gaps. If more than one Spray Head per gap, arrange radially so as that the flow pattern resembles a fan, as in Fig. 3. Individual Spray Heads can be fan-shaped. Spray Heads can be fixed flow rate or variable flow rate or a mixture of both as required for specific applications. Variable flow rate can be adjusted manually or by servo-mechanism.

[0020] (Option) Also as shown in Fig. 3, Supplementary Spray Bars, oriented vertically but with horizontally-oriented 'aimable' Spray Head(s), can be provided to provide flow of cooling fluid directly onto local blade hotspots. Such Supplementary Spray Bars can be supplied either from the primary Spray Bars or via special Supplementary Manifolds disposed either at the bottom/top of the tank or adjacent the tank side(s).

[0021] (Option) Dispose within the tank a bladder to contain the fluid and all related structures. This allows the tank to be modular, bolt-together panels as the fluid sealing is accomplished via the bladder. Over time, as necessary, the bladder can be drained and replaced without any special expense or effort to clean the inside surfaces of the tank. Based on heuristic evaluation, the shape of the tank can be optimized to minimize hot spots, e.g., form a narrow "waist" in the long side walls to develop a Venturi-like region wherein fluid flow is accelerated past a specific horizontal zone of the blades.

[0022] (Option) Spray Head design can be selected to match heat signature of each blade. Spray Heads can be fixed flow rate or variable flow rate or a mixture of both as required for specific applications. Spray Heads can be mounted on short flex-tubes to provide directional distribution for augmented cooling. In some applications, selected Spray Bars/Heads can be supplied from an auxiliary cooling source operating independently of the main fluid source.

[0023] (Option) Attach a solid-state temperature sensor on or adjacent to each Supplemental Spray Head to provide closed-loop control of a servo-controlled valves supplying such Spray Head.

[0024] (Option) Provide servo-mechanical arrangement to dynamically reposition each Supplemental Spray Head. Attach an RFID tag on each Supplemental Spray Head to provide closed-loop control of the repositioning system.

[0025] (Option) Provide array of temperature sensors together with RFID tags on the Supplemental Spray Heads to allow software monitoring of local hot spots, with automatic repositioning of nearby Supplemental Spray Heads to detected hot spots. Same system can provide servo-control of Spray Head supply valves to resolve larger scale heat zone problems.

[0026] (Option) In addition to, or as a supplement to, the static weir fluid return system, provide active fluid extraction. To prevent loss of suction, provide fluid level sensor(s) to reduce or shut off active extraction before the fluid level drops below the suction point.

[0027] (Option) Design blades specifically for fluid immersion, e.g., with no enclosure, no fans. Orient component heatsinks so as to maximize heat transfer to the cooling fluid while minimizing vertical fluid flow resistance/turbulence. Relocate *essential* moving components, e.g., rotating disk devices, from blades to locations adjacent the respective blade but outside the cooling fluid. For multi-server blades (or blades with more than one significant local heat generating component), distribute the major heat generating components vertically/horizontally to spread the heat signature more evenly vertically/horizontally across the entire surface of the blade. When feasible, mount components on both sides of the blade to facilitate heat distribution to the fluid flow on both sides of the blade.

[0028] The cooling system can be any of several known types: vapor compression; water evaporative ("swamp cooler"); dessicant; ground water source; ambient air source, etc. Choice will be based on geographic location,

availability of energy resources, installation/operating costs, etc. Automatic switch-over to alternative systems can be provided to minimize operating cost.

Electronic Acknowledgement Receipt

EFS ID:	14469753
Application Number:	61737200
International Application Number:	
Confirmation Number:	5753
Title of Invention:	Server Immersion Tank System
First Named Inventor/Applicant Name:	John H. Miller, Jr.
Customer Number:	44070
Filer:	Jeffrey Van Myers
Filer Authorized By:	
Attorney Docket Number:	JMG001
Receipt Date:	14-DEC-2012
Filing Date:	
Time Stamp:	11:18:48
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	$125
RAM confirmation Number	9950
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Provisional Cover Sheet (SB16)	JMG001_PCS_121214.pdf	2071456 77a542714667e6c881b56706e80f86e0da8db39c	no	4
Warnings:					
Information:					
2	Specification	JMG001_p_121214.pdf	6854641 e2e8e7cf21f943b5db189d5445fc38c15c6cb78b	no	38
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	28824 a86ba99a0a56136eee5d1490eb28a2ff65e04e7d	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	8954921	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

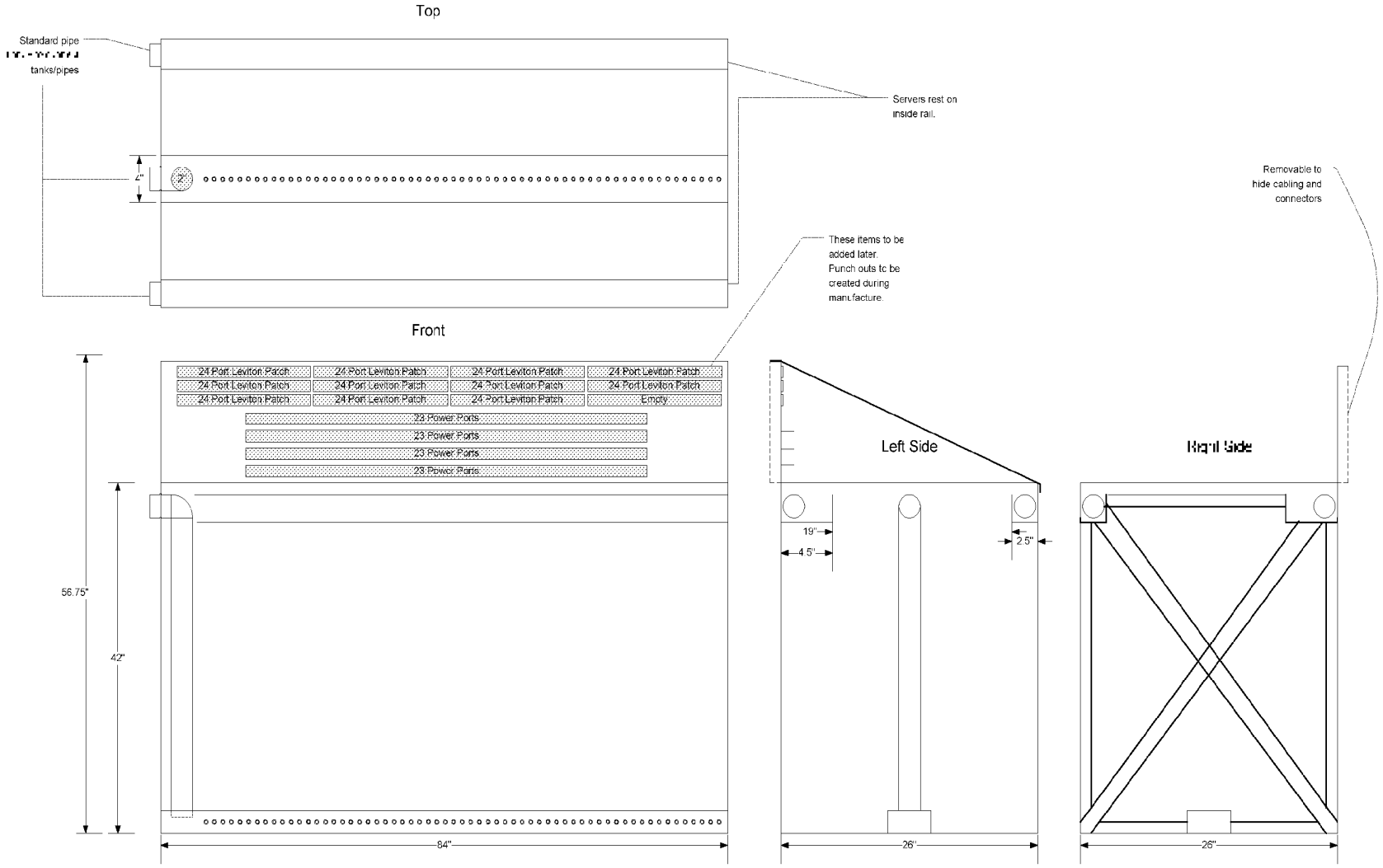
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

(Optional) The shutoff valves of the Spraybar servicing the 'right-most' active 'flow slot' (i.e., between the 'right-most' active Server and the flow barrier) may be partially closed to compensate for the reduced heat being radiated/conducted into this flow slot.

(Optional) Each shutoff valve is controlled by a respective servo, with the valve-pair of each Spraybar being controlled by a single Valve Controller in response to temperature sensor(s) suspended in the respective flow-slot somewhat below the 'top' surfaces of the adjacent Servers (to more accurately measure the temperature of the fluid exiting the respective flow-slot before significant mixing with fluid flowing in adjacent flow-slots).

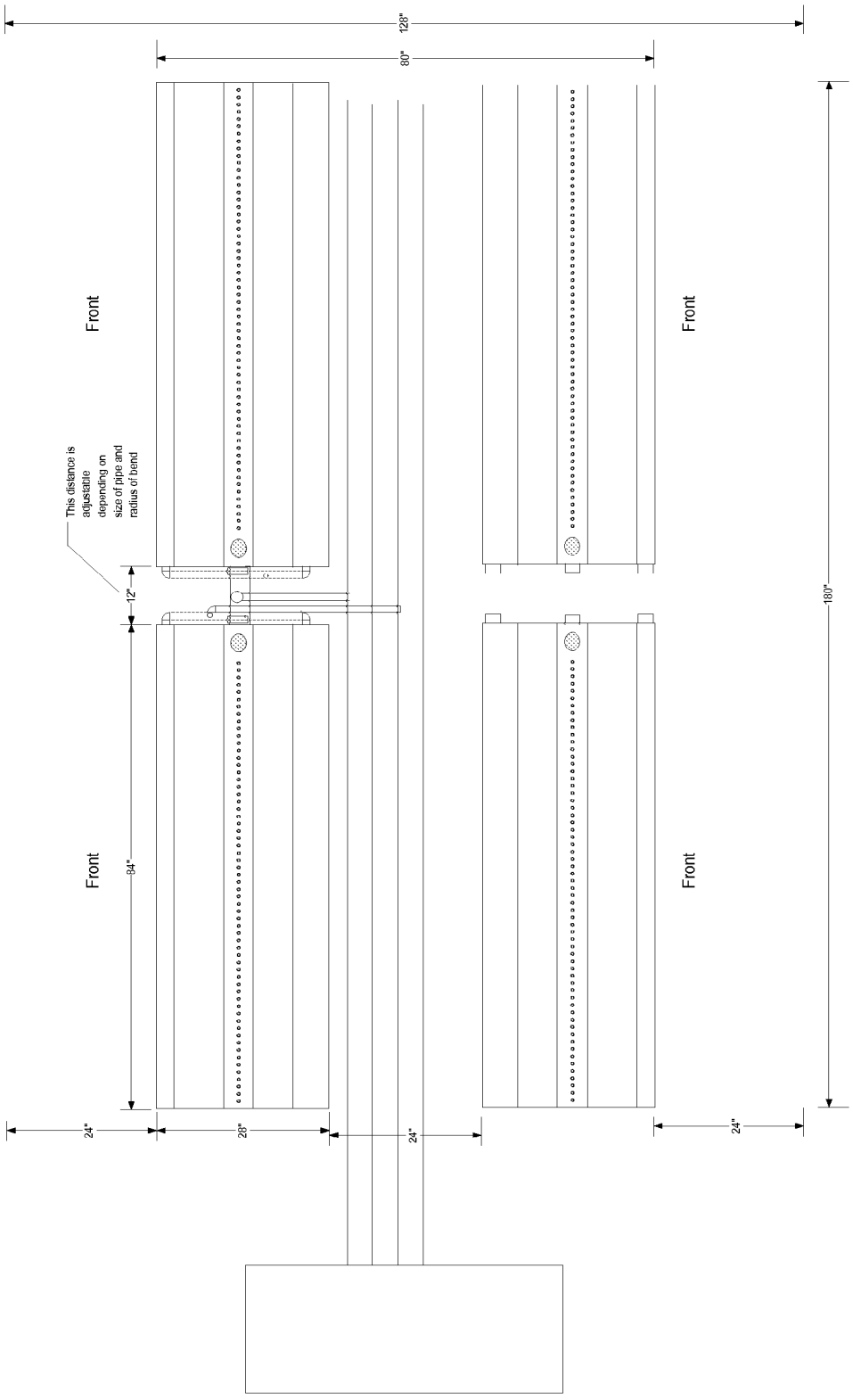
(Optional) A 'smart' Master Controller monitors a selected set of the flow-slot temp sensors, and coordinates the activities of all active flow-slot Valve Controllers. Due to the huge heat storage capacity of the entire fluid mass and concomitant system temperature lag, determining the energy saving contribution of this Master Controller will be problematic, but nonetheless this function contributes to the end goal of protecting the set of active Servers from sustained excessive heat excursions.

(Option) The gaps between the 'side' surfaces of each Server and the adjacent side(s) of the Tank may be blocked using appropriately sized flow baffles to facilitate more precise control of fluid flow in each flow-slot.



Petitioner Green Revolution Cooling, Inc., Ex-1002
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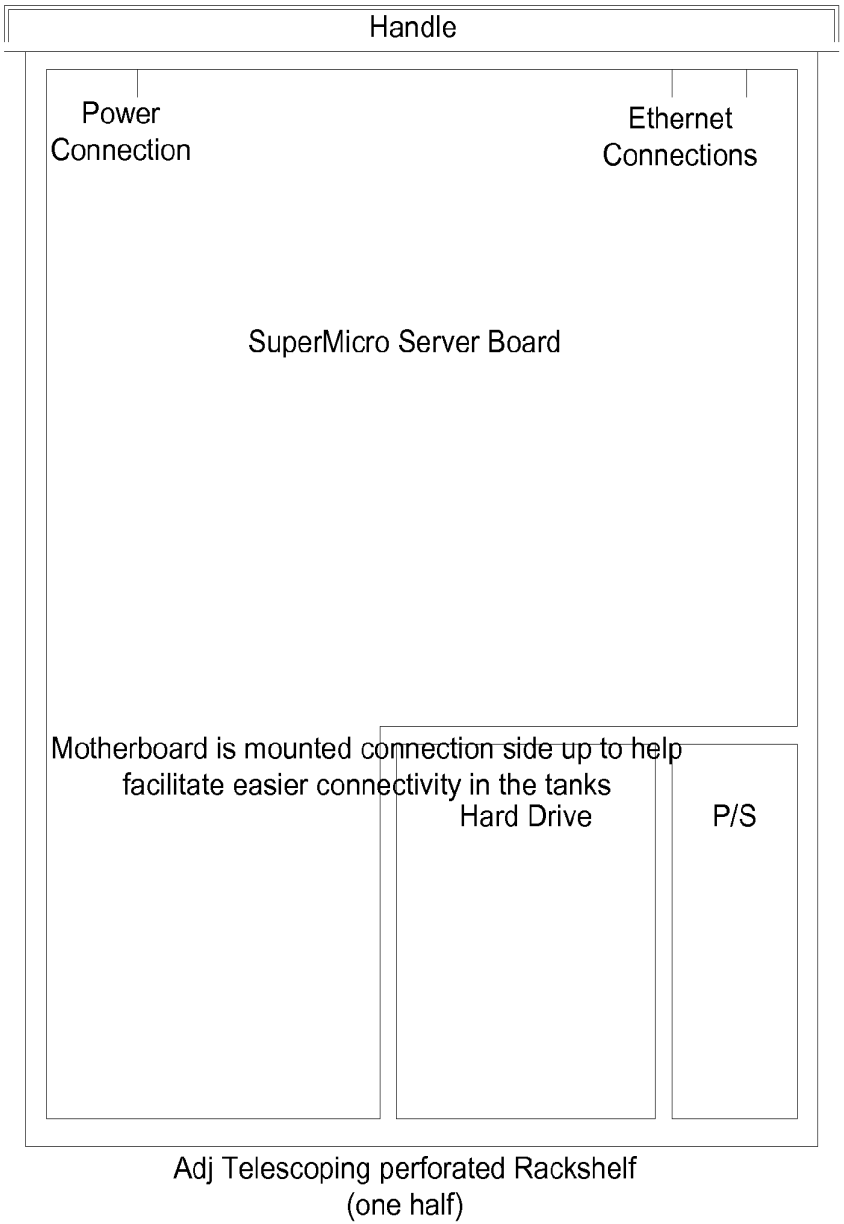
Top
2"
Front
24 Port Levitor Patch
24 Port Levitor Patch
24 Port Levitor Patch
8 Power Ports
8 Power Ports
8 Power Ports
25"
Left Side
2.5"
19"
4.5"
26"
Right Side
26"


128"
80"
Front
Front
This distance is adjustable depending on size of pipe and radius of bend
12"
84"
180"
Front
Front
24"
20"
24"
24"

Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front

Right Side
26"
Left Side
2.5"
19"
4.5"
26"
Front
24 Port Leviton Patch
24 Port Leviton Patch
24 Port Leviton Patch
8 Power Ports
8 Power Ports
8 Power Ports
26"
25"

Heat Exchanger
Heat Exchanger
V
V
V
V
V
V
V
Ga
F
P
P
To
Tanks
(Input)
To
Tanks
(Return)



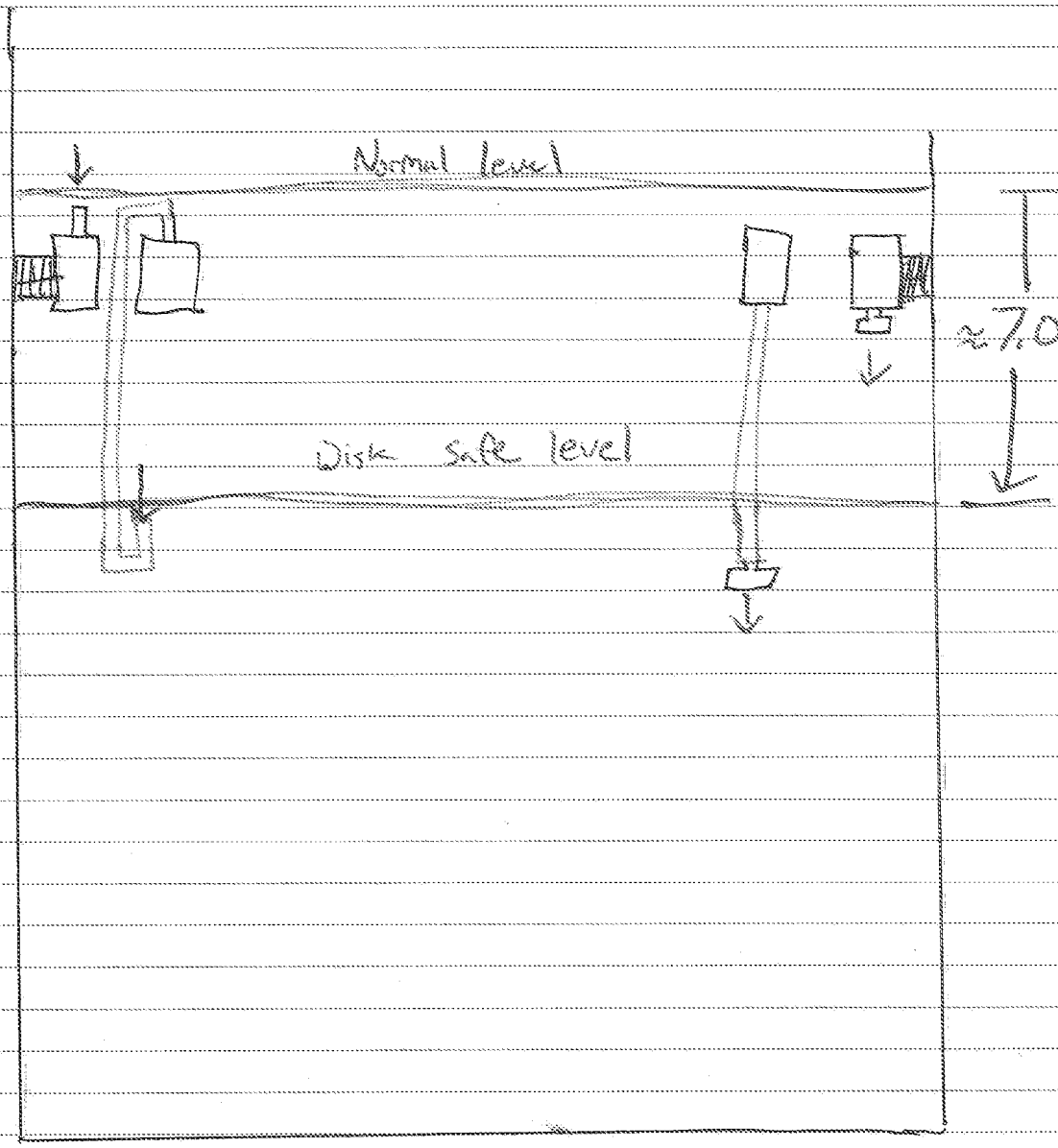
Petitioner Green Revolution Cooling, Inc., Ex-1002
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From Page No. ____ 10-2-2012

Dropped O.I level for sensors w/ unsealed disks.

O.I is about 7" lower and nozzles are lasered on threaded tube to sit a few inches below the oil level.

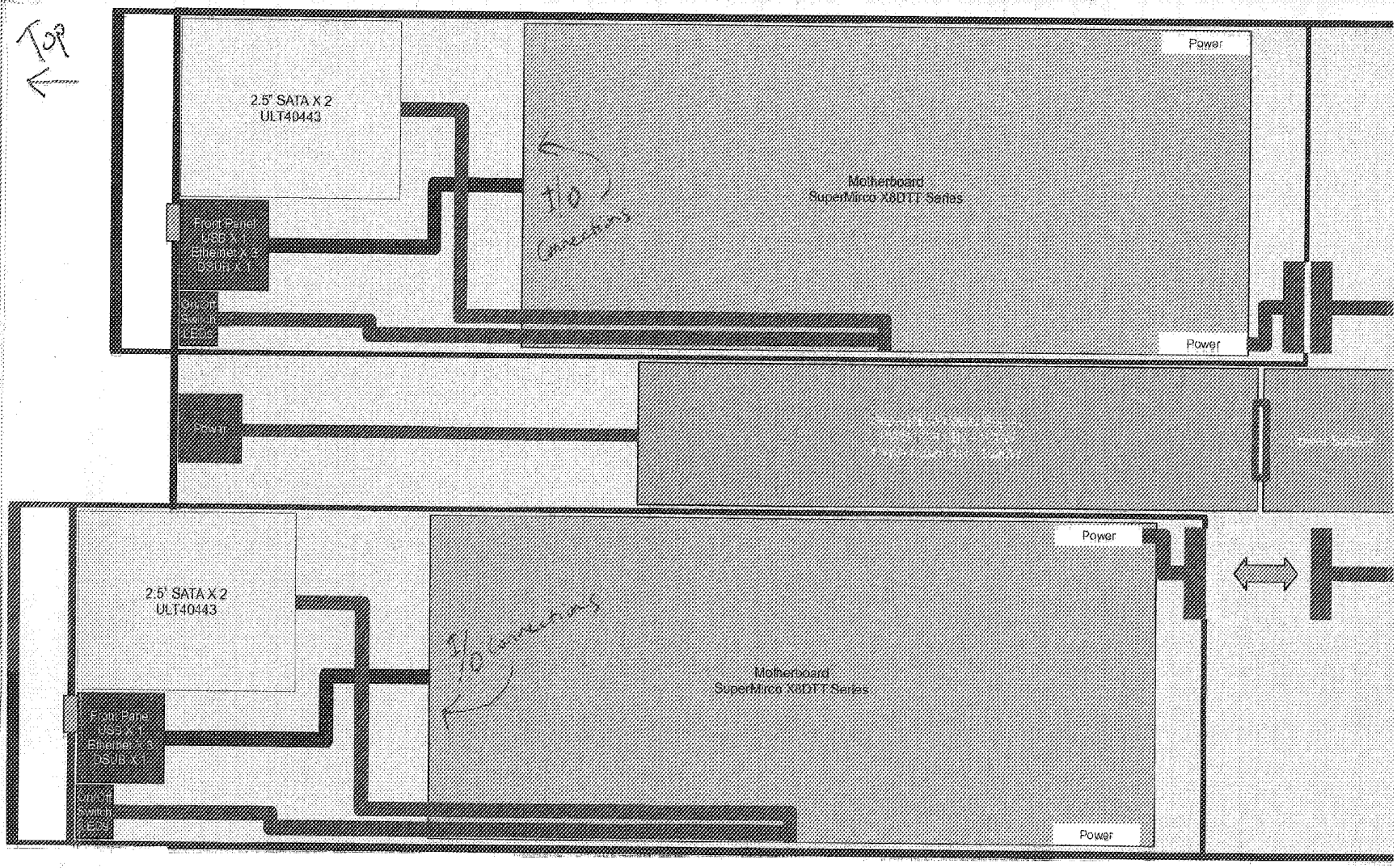
Intake is extended via tube/pipe to sit just below oil level with intake pointing up.

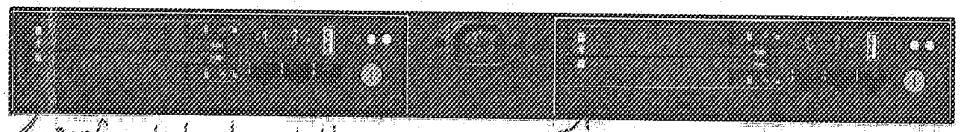


To Page No. ____

Witnessed & Understood by me, | Date 11-15-12 | Invented by: D. Chris Laguna | Recorded by: | Date 10/2/12

Midas Green Tech – 1U Low Energy High Density Rack (LEHDR)





LEHDR 1U Style 1

Support for: (2) 16.7" x 7.0" Motherboard*, (1) 20.0" x 3.0" x 1.65" Power Suppl
(4) 2.5" Hard Drives

* = Maximum component dimmensions

Overall Dimmensions: 17.5" x 30" x 1.75"

Sled (Node) Dimmensions: (without handle) 7.5" x 21.75" x 1.7"

Chris Laguna – Midas Green Tech – July 2012

Read & Understood by me

Date 11-15-12

Invented by Chris Laguna

Recorded by

Date 11/15/12

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 217 of 656; IPR2025-00196

SLED Assembly

SLED = Super Low Energy Device, Midas Green Tech's oil-ready and optimized server.

All steps should be done utilizing an ESD safe environment with the proper tools.

Planning

- Determine type of SLED from customer order details
- Single Server
    - Dual Server
    - Triple Server
    - Quad Server
    - Other

- Determine Form Factor
    - 1U
    - 2U
    - 3U
    - 4U
    - Other

- Establish Server(s) Specifications
- Select Processor(s)
    - Select Motherboard(s)
    - Select Power Supply(s)
    - Select Heat Sink(s)
    - Select Memory Configuration
    - Select Disk Configuration
    - Select Peripherals
    - Select Chassis
    - Select necessary cables, adapters, I/O ports, brackets, mounts, screws and materials

- Verify and Finalize SLED Layout
- Use component templates to plan layout with I/O ports facing the front (top) of the SLED
- Verify tolerances are in place for cabling and assembly
- Confirm component compatibility
- Finalize layout

- Order/Obtain Parts

Fabrication

- Clean and inspect chassis for defects
- Remove any unnecessary chassis components (fans, mounts, etc.)
- Use component templates to mark necessary modifications to chassis. Modifications can be the addition of mounting points, removal of chassis components, additional ventilation holes and brackets to secure server components
- Modify chassis for server components

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- Modify chassis for server components

- Remove any sharp corners or edges
- Clean and ensure modified chassis is clean and dry
- Verify chassis modifications with server component templates
- Dry-fit server components to verify clearances and tolerances

Assembly

- Install motherboard mounts and motherboard verifying proper mount alignment and making note of cable connection points
- Remove motherboard and return to protective sleeve
- Install power supply and power distribution (if applicable) components
- Make note of routing of power cabling, make every attempt to conceal power cables under motherboard mounts
- Install storage components, and run necessary cabling
- Install I/O cabling, including power switches, LED indicators, LAN, video and USB connections if necessary
- Before installing in chassis, install the processor and heat sink into the motherboard using indium foil instead of thermal grease. Any motherboard or peripheral components with a removable heat sink will need any thermal greases, compounds or tape removed and surfaces cleaned
- Mount motherboard on mounts and secure with the proper screws taking caution to the cabling being ran below the motherboard
- Connect all cabling
- Double check clearances and fit of components
- Install memory and any peripherals, including hard drives
- Clean up cabling and secure any loose cables and connections
- Finalize chassis assembly with mounting brackets and handles

Initial Testing

- Temporarily install fans on all processors
- Double check all cables are properly installed and secure, all components are installed and secured
- Connect monitor, keyboard and USB/CD/DVD-ROM containing testing software
- Connect power and power on the server
- Verify in server BIOS that all peripherals are recognized and working

If server does not power on, utilize the motherboard manual for troubleshooting

- Run memtest for at least 5 minutes to do a quick check of the installed memory
- Connect Ethernet
- Install OS of choice to verify proper server functionality including RAIDs, Networking, etc.

Burn-in and Stress Testing

- Only begin burn-in once testing is complete and you are satisfied with the function of the server
- With the server still out of the oil and fans installed continue:
- Boot form stress-test CD (stresslinux.org or similar)
- Run stress utilities at 50% utilization for at least 2 hours. Run at 100% utilization for 2 more
- Verify server passes stress test by analyzing software logs and reports

If a component fails, isolate the component, remove it and replace it, repeat the testing above

- Finalize server prep for oil submersion, removing fans and finishing chassis assembly
- Lift server so that it is oriented vertically as it will be installed in the tanks, check for loose components
- Submerge server in testing tank
- Restart the stress test and allow it to run at 50% utilization for another 2 hours, 100% utilization for at least 2 hours and time permitting, overnight at 50% utilization
- Analyze for failures and replace any failed components

Release to production

- Remove any testing equipment and media
- Format hard drives and run a DOD wipe to clear any stored data.
- Install OS and setup as indicated in order details

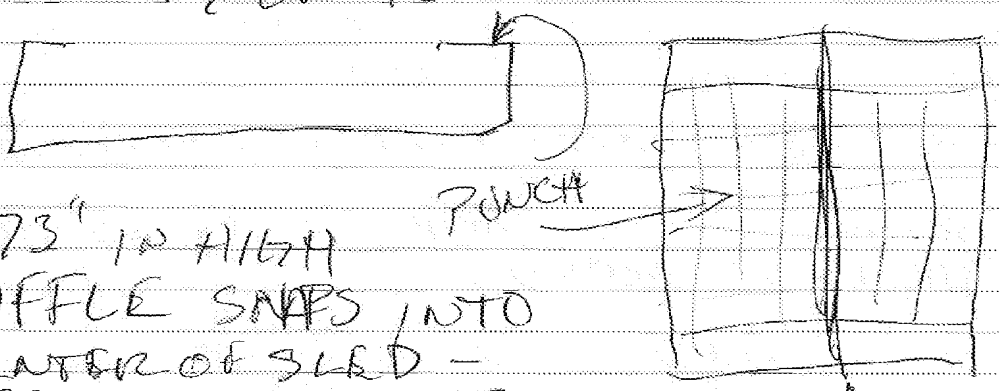
TITLE IMPROVED SLED PACKAGE Project No. Book No. 1

From Page No.

ISSUES WITH CURRENT SLED —
- LONG ASSEMBLY TIME
- NO PROTECTION AGAINST SHORTS WHILE INSERTING OR REMOVING SYSTEMS FROM TANK
- POSSIBLE POOR COOLANT FLOW DUE TO OPEN DESIGN

NEW SLED BASE
USE STAMPED STEEL FOR BOTTOM — PUNCH 5MM X 5MM (MAYBE SMALLER) ROUND HOLES IN A MATRIX ON BOTTOM — ALLOWS USE OF STAB-LOCKING NYLON MOUNTS FOR PC BOARDS

SIDES OF SLED COME UP 1.75", FOLD OVER — PUNCHED 1 ROW ON FOLDOVER FOR SNAP MOUNTING OF TOP



1.73" IN HIGH BAFFLE SNAPS INTO CENTER OF SLED — PREVENTS COOLANT MIXING BETWEEN BOARDS ON SLED.

SLED TOP IS MOLDED PLASTIC SHEET WITH SMALL POSTS ON EDGE TO INTERLOCK WITH SLED BASE EDGE. ALSO INCLUDES MOUNTPOINTS FOR SEVERAL SMALL PUSHBUTTON SWITCHES (POWER, RESET, ETC).

To Page No. 2

Explained & Understood by me,	Date	Invented by:	Date
	3-14-12	CHRIS BOYD	3-12-2012
		Recorded by: CHRIS BOYD	

Project No. _____
Book No. _____ TITLE IMPROVED SLED PACKAGE

Page No. 1

ASSEMBLY —

TECH PRINTS OUT MOUNTING TEMPLATE FOR MOTHERBOARD AND ALIGNS THEM IN UPPER RIGHT & LEFT OF SLED BASE.

TECH PUSHES STAB-LOCK POSTS INTO SLED BASE AT POINTS NOTED ON TEMPLATE

TECH INSTALLS CPU, RAM, HEATSINKS, INDIUM FOIL, ETC TO PREP BOARD FOR IMMERSION SERVICE

TECH PLACES MOTHERBOARD OVER TOP OF STAB-LOCK POSTS & PUSHES INTO PLACE

TECH INSTALLS BAFFLE - BAFFLE HAS MOLDED IN STAB-LOCKS AND CABLE CLIPS/TIE POINTS

TECH SNAPS BOOT DRIVE INTO MOLDED CARRIER WITH STAB LOCKS - SNAPS INTO SLED

TECH MOUNTS PSU ONTO SLED W STAB-LOCKING BRACKETS

TECH CONNECTS POWER, DISK, POWER SWITCH, RESET SWITCH CABLES TO BOARD

TECH SNAPS SLED TOP ONTO SLED

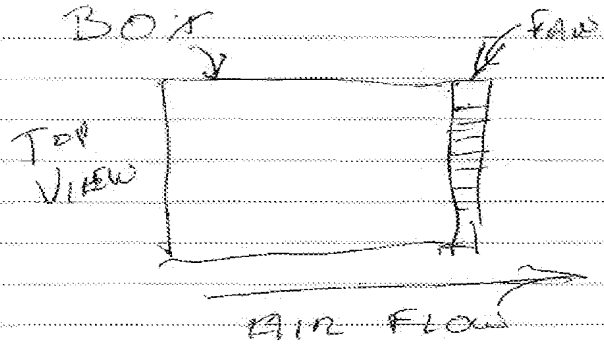
ASSEMBLY COMPLETE, READY FOR TEST & BURN IN.

To Page No. V

Read & Understood by me.	Date	Invented by:	Date
[signature]	3-14-12	Recorded by:	

Project No.
TITLE COOLING SYSTEM FOR IMMERSED SERVERS Book No.
From Page No. 1

MANUFACTURERS OF MOTHERBOARDS, SERVERS, ETC. ARE CURRENTLY RELUCTANT TO WARRANTY BOARDS IMMERSED IN MINERAL OIL. TO MINIMIZE OUR RISK DUE TO "INFANT MORTALITY," WE CAN BURN IN + TEST SYSTEMS DESTINED FOR IMMERSION IN AIR —

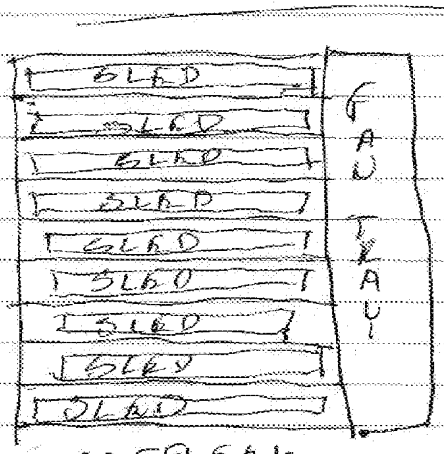


SLIDE FAN TRAY INTO BOX.

TURN ON FANTRAY TO PULL AIR THROUGH BOX, OVER BOARDS OTHER COMPONENTS

RUN BURN-IN TESTS.

MULTIPLE BOARDS/SLEDS CAN BE TESTED @ SAME TIME



SOLID BAFFLES TO SIDES, TOP, BOTTOM TO FORCE COOLING AIR OVER BOARDS UNDER TEST

ADVANTAGES —

- SYSTEMS UNDER TEST ARE EASILY ACCESSED & HANDLED BY TECHS
- NO "VOIDED WARRANTY" EXCUSE FROM BOARD MANUFACTURERS FOR EARLY FAILURES
- ALLOWS US TO USE A VISE FOR SYSTEM ASSEMBLY
- NO OILY PARTS SHIPPED TO US TRIGGERING SECURITY INSPECTIONS OF PACKAGE

To Page No. 2

Witnessed & Understood by me,	Date	Invented by: CHRIS BOYD	Date
	3-14-12	Recorded by: CHRIS BOYD	3-12-2012

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 226 of 656; IPR2025-00196

Project No. _____

Book No. _____ TITLE Green Notes

From Page No. X

3-12-2012 Store Rain Water Runoff for use in cooling towers

3-13-2012 - Deploy all systems @ 208/240V 2-3% Power Savings for free.

To Page No. _____

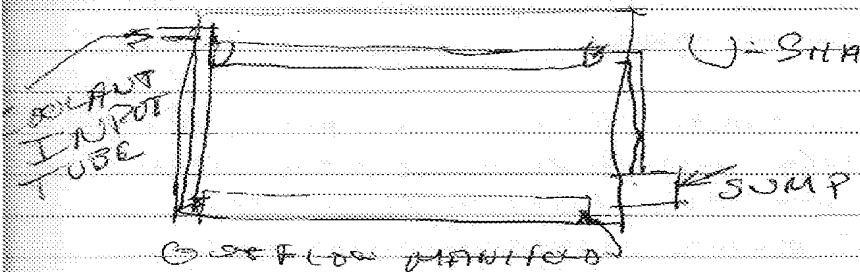
Witnessed & Understood by me,

Date 3-14-12

Invented by:

Recorded by:

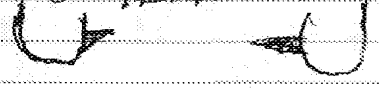
Date



GOAL - IMPROVE FORCED CONVECTION COOLING EFFIENCY BY AVOIDING MIXING OF COOLANT.

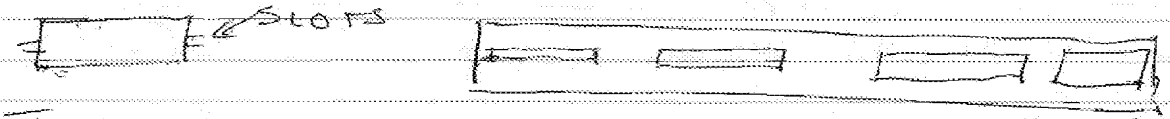
COLD FLUID FLOWS INTO TANK VIA TUBE CONNECTED TO A SLOTTED MANIFOLD. COLD FLUID DISPLACES WARM FROM BELOW. WARM FLUID OVERFLOWS U-SHAPED DRAINS ON ~~BOTH~~ BOTH SIDES OF TANK WALL.

(NOTE - A SPINE ON THE SIDE OF THE U-TUBE COULD ACT AS A CONVENIENT MOUNT POINT FOR SERVER EARS.)



U-TUBES DRAIN INTO A CLOSED SUMP CONTAINER FOR RECIRCULATION THRU HEAT EXCHANGER. NOTE THAT THE PUMP CANNOT DRAIN THE TANK.

POSSIBLE SLOTTED OUTFLOW MANIFOLD PROFILE.



I SUSPECT SLOTS WOULD NEED TO BE NARROW ON THE END CLOSEST TO THE POINT WHERE COOLANT IS INJECTED, AND GET PROGRESSIVELY WIDER TO ACCOUNT FOR PRESSURE GETTING LOWER AS COOLANT FLOWS DOWN THE ~~TUBE~~ TUBE.

-COULD ALSO USE A SERIES OF PROGRESSIVELY LARGER ROUND HOLES.

To Page No. _____

Witnessed & Understood by me,	Date	Invented by:	Date
[signature]	3-14-12	CHRIS BOYD	3-2-2012
		Recorded by: CHRIS BOYD	

Project No.
Book No.
From Page No. X

TITLE METHOD FOR AUTHENTICATING GRAPHICS SERVED BY A [illegible] OTHER SERVER TO PREVENT PHISHING, TRADEMARK [illegible]

— EXTEND CURRENT STANDARD OPEN FORMATS LIKE JPEG, JPEG2000, OR PNG TO INCLUDE META DATA ABOUT THE SERVER(S) THAT ARE AUTHORIZED TO SERVE THE GRAPHIC. THIS COULD INCLUDE, BUT IS NOT LIMITED TO:
IP SUBNET OR ADDRESS
PTR RECORD
REFERRING URL
REFERRING DOMAIN NAME
HTTPS URL WITH GRAPHIC OWNER'S PUBLIC KEY
THIS DATA IS COMPRESSED & CRYPTO SIGNED WITH THE GRAPHIC OWNER'S ~~PUBLIC KEY~~ PRIVATE KEY.

NORMAL TRANSACTION WORKS SOMETHING LIKE THIS

USER — LEGIT SERVER 1 — LEGIT SERVER 2

HTTP GET SECURE.JPG →
← SECURE.JPG

DECOMPRESS META DATA & GET KEY URL

HTTPS GET: KEY-PUB.PEM →
← KEY-PUB.PEM

SSL CERTS MATCH
META DATA MATCH

DISPLAY GRAPHIC

To Page No.

Witnessed & Understood by me.	Date	Invented by: CHRIS BOYD	Date
	11-15-12	Recorded by: CHRIS BOYD	6-6-2012

THIS SCHEME HELPS PREVENT THINGS LIKE PHISHING —

USER — PHISH SERVER — LEGIT SERVER 2

HTTP GET STOLEN.JPG →
← STOLEN.JPG

DECRYPT META DATA & GET KEY URL

HTTPS GET KEY-PUB.PEM →
← KEY-PUB.PEM

META DATA MISMATCH! ALERT USER TO PROBABLE PHISH!

FOR BEST SECURITY, KEY URL SHOULD BE ON A DNSSEC SIGNED DOMAIN NAME.

NEEDS WIDE SUPPORT IN BROWSERS, EMAIL CLIENTS GRAPHICS ARTS PACKAGES, ETC.

POSSIBLE EXTENSION? DEVELOP A WAY FOR A DOMAIN NAME TO SIGNAL THEY ALWAYS USE THIS SCHEME — MAYBE AN ADDITIONAL TXT RECORD IN DNS?

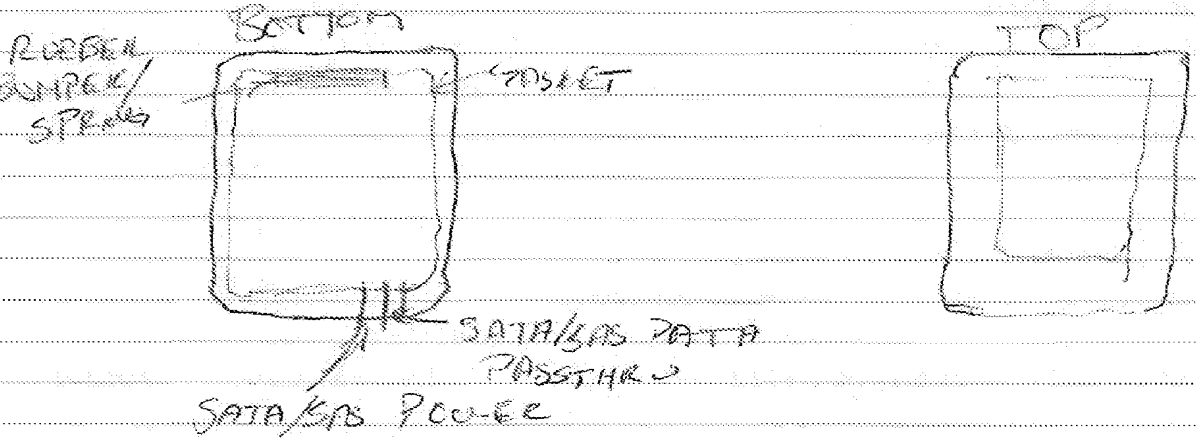
To Page No. 8

Witnessed & Understood by me, Date 11-15-17 Invented by: Chris Boyd Recorded by: Chris Boyd Date 5-6-202

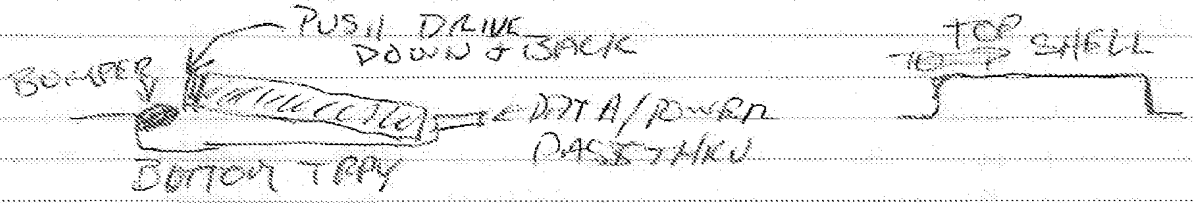
Project No.
Book No.
TITLE DISK DRIVE PACKAGING FOR FLUID IMMERSION

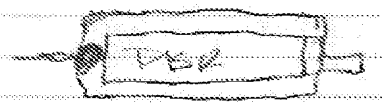
From Page No. X

SNAPPED ALUMINUM ENCLOSURE - CLAMSHELLS TOGETHER TO SEAL DISK DRIVE - WITH OIL RESISTANT GASKET

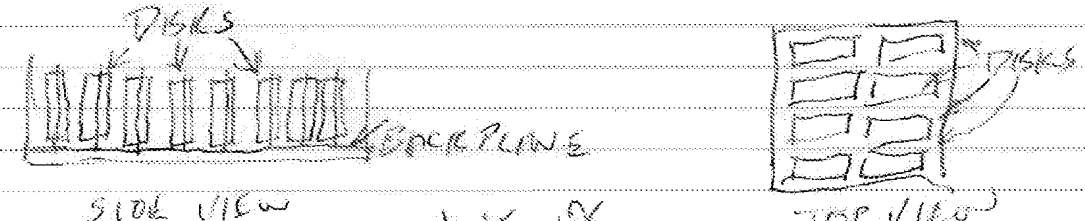


DISK DRIVE SNAPS INTO PLACE & IS SECURED BY DATA/POWER CONNECTORS & RUBBER BUMPER





ASSEMBLED DISK CAGES CAN BE MOUNTED EASILY IN A DISK ARRAY CABINET SIMILAR TO A BACKBLAZE OR EQUIVALENT.



To Page No. 9

Witnessed & Understood by me,

Invented by: CHRIS BOYD
Recorded by: CHRIS BOYD

Date: 6-21-2011

TITLE: DISC DRIVE PACKAGING FOR ARRAY

Project No.

Book No.

From Page No. 8

IMMERSION

EDGES OF DRIVE CASE ARE USED AS MOUNTING RAIL GUIDES TO HOLD DRIVE IN THE ARRAY.

CABINETS CAN BE LIFTED OUT PART WAY FOR DRIVE REPLACEMENT OR MAINTENANCE, LEAVING CONTROLLER SUBMERGED FOR COOLING.

CAN BE RETROFITTED TO RACK BLADE CABINET.

To Page No.

Witnessed & Understood by me.	Date	Invented by:	Date
	11-15-12	CHRIS BOYD	3-21-2002
		Recorded by: CHRIS BOYD	

10 Project No. _____
Book No. _____ TITLE IR SENSING FOR TANK

From Page No. X

USE MULTIPLE IR SENSORS, POSSIBLY WITH WIDE ANGLE LENSES INSIDE TANK TO MONITOR COOLANT SURFACE TEMPERATURE - OR, USE A DIGITAL IMAGING SENSOR - POSSIBLY JUST A MODIFIED DIGITAL CAMERA SENSOR - WITH IMAGE PROCESSING SOFTWARE TO DETECT & COMPENSATE FOR TANK TEMPS & POSSIBLE HOT SPOTS

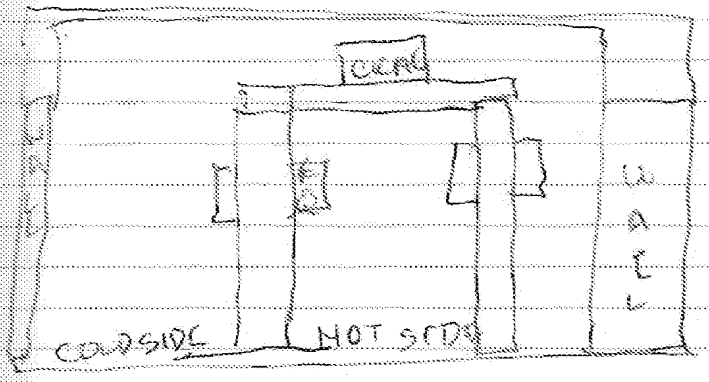
EITHER APPROACH COULD BE ADVANTAGEOUS, COMPARED TO SIMPLER TEMPERATURE SENSORS, FOR ADJUSTING COOLANT FLOW RATES, IR ENERGY SHOULD RADIATE THROUGH THE OIL/COOLANT FROM HOT COMPONENTS BEFORE WARMED COOLANT CONVECTS OR IS FORCED TO TOP TO TRIGGER SIMPLE TEMP SENSOR.

To Page No. _____

Witnessed & Understood by me.	Date	Invented by: CHRIS BOYD	Date
	11-15-12	Recorded by: CHRIS BOYD	12/7/12

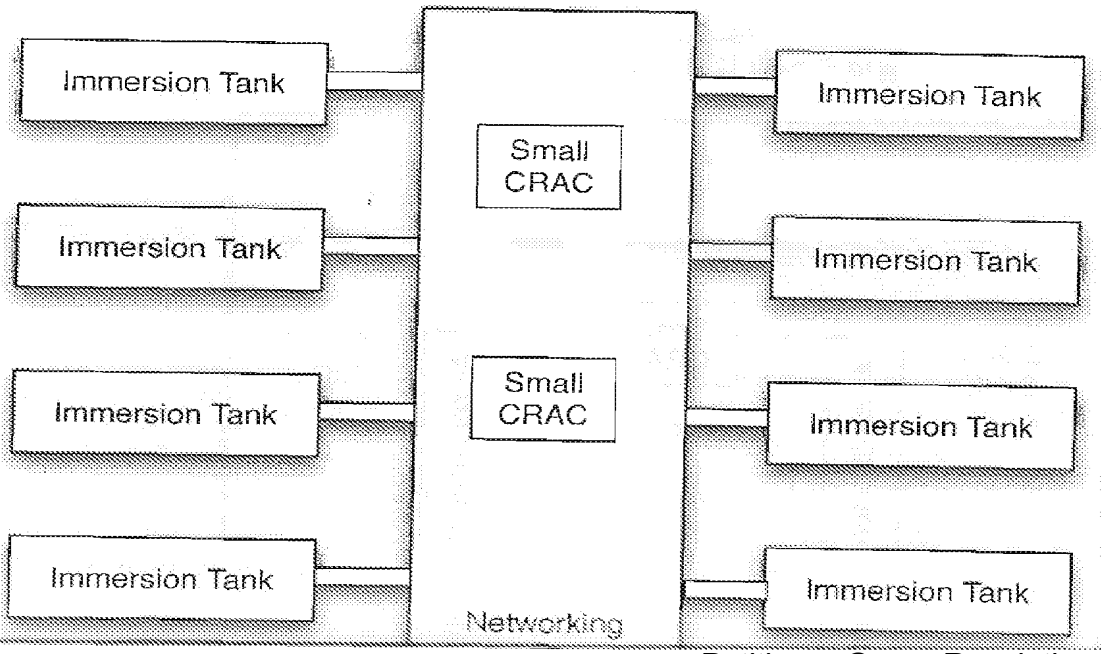
SINCE NOT ALL EQUIPMENT CAN BE IMMERSION COOLED, WE NEED TO PROVIDE AN EFFICIENT METHOD TO COOL THIS GEAR.

USING A SYSTEM TO DO TOTAL CONTAINMENT OF HOT & COLD AIR SHOULD PROVIDE AN ACCEPTABLY LOW PUE, EVEN IN CASES WHERE NO OUTSIDE AIR CAN BE USED.

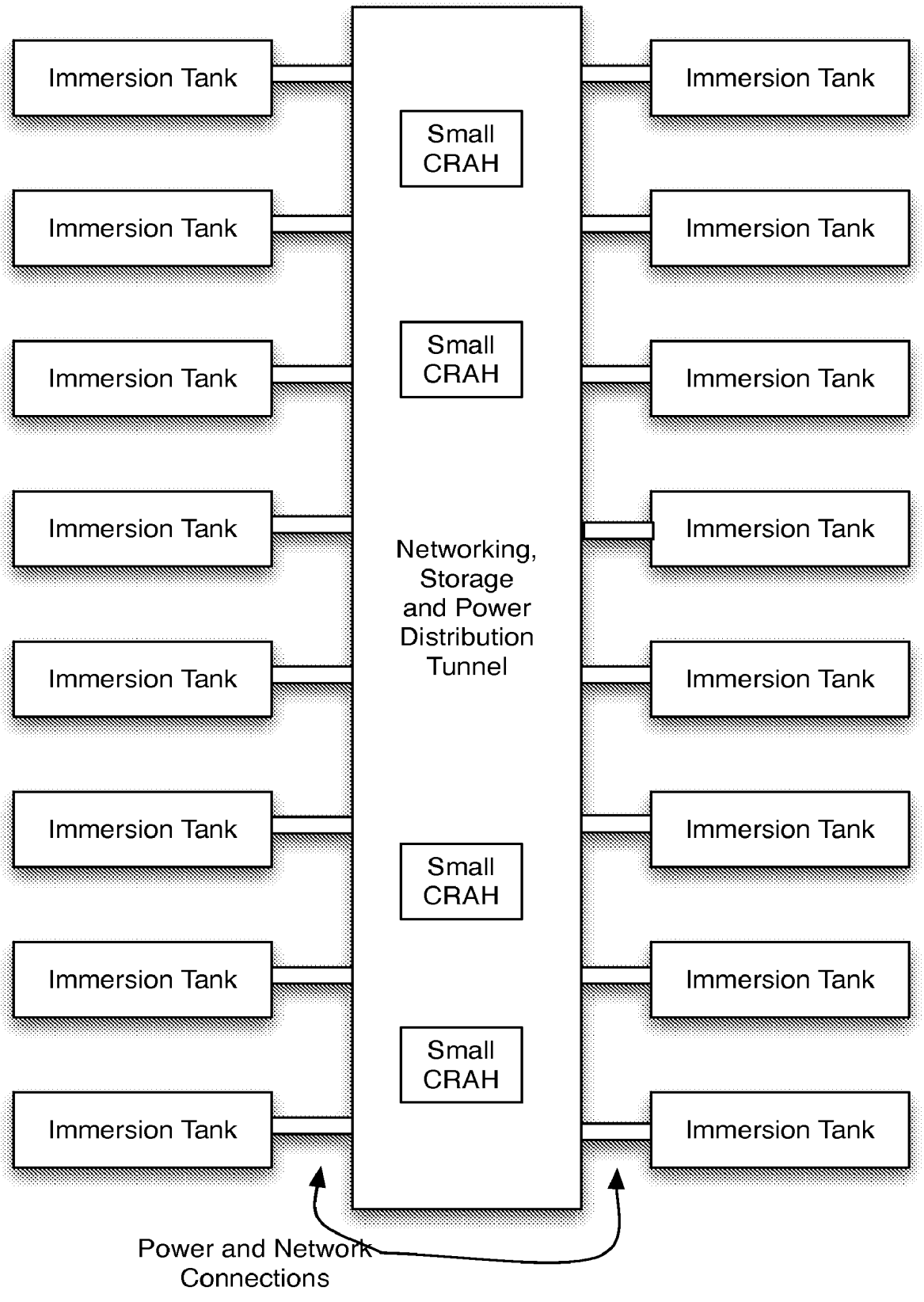


AIRFLOW → ← AIRFLOW

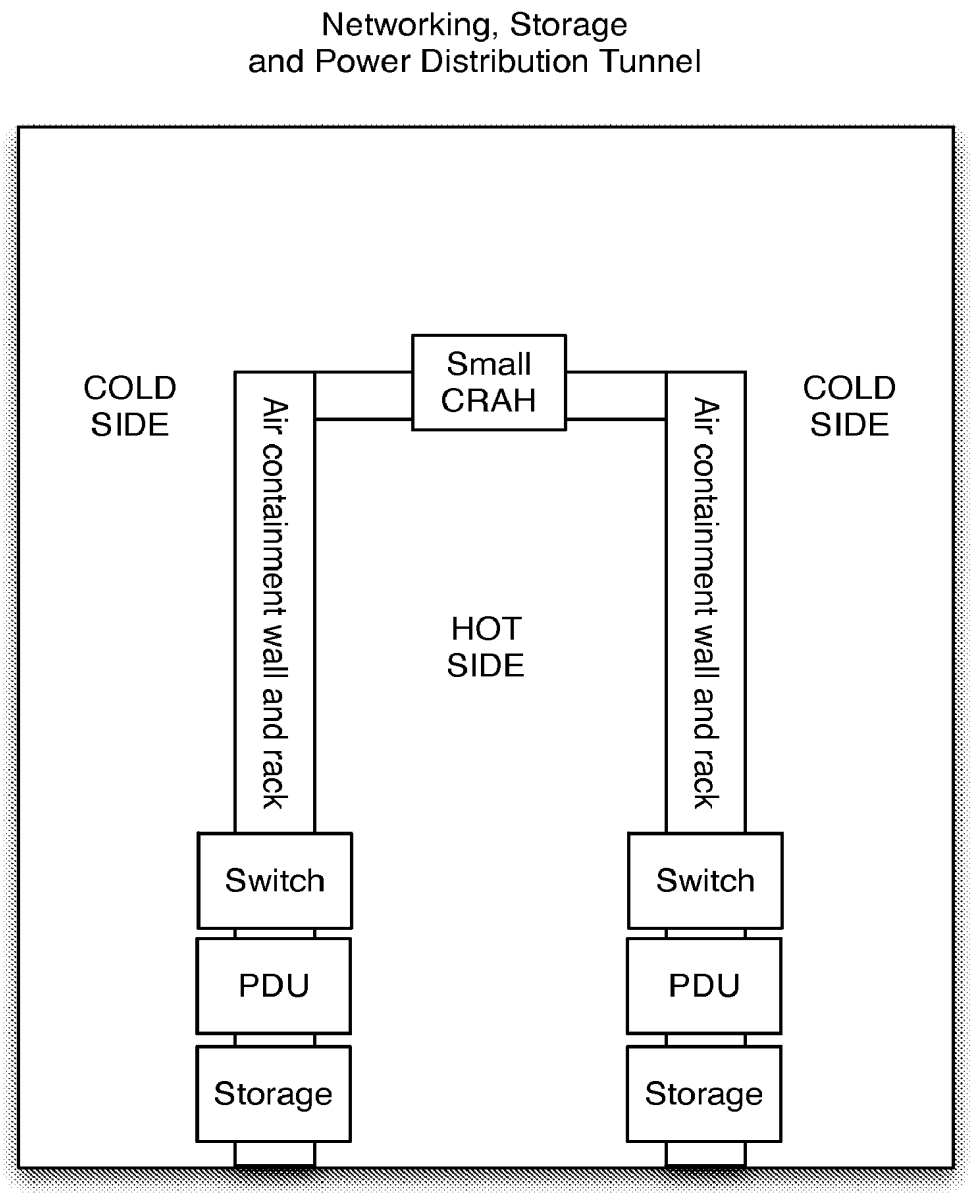
Top View



Top View


Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Small CRAH
Small CRAH
Small CRAH
Networking, Storage and Power Distribution Tunnel
Power and Network Connections

End View

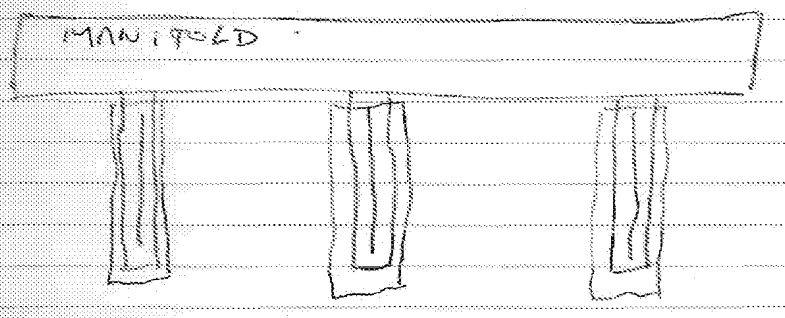

Networking, Storage
and Power Distribution Tunnel
COLD
SIDE
Small
CRAH
COLD
SIDE
Air containment wall and rack
Air containment wall and rack
HOT
SIDE
Switch
Switch
PDU
PDU
Storage
Storage

Project No. _____
Book No. _____ TITLE Flow Metering System

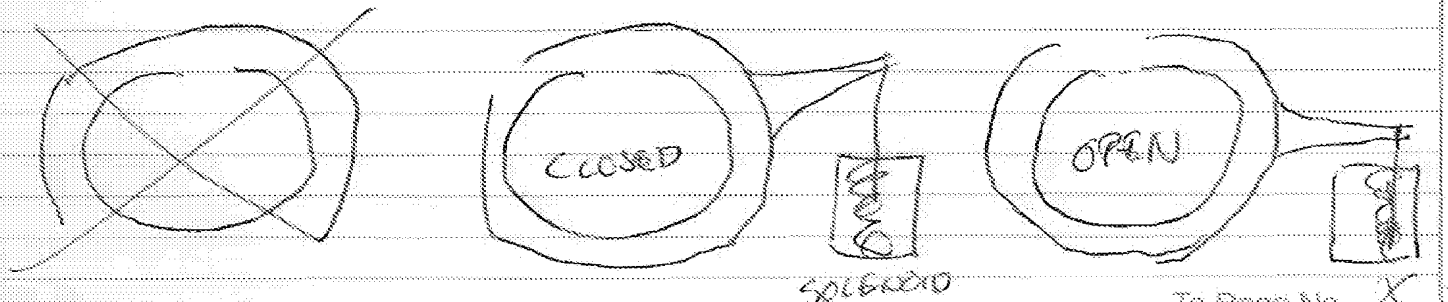
Page No. X

One way to adjust coolant flow into tank —

Two tubes — one larger & one smaller, and sized such they fit one inside the other. Cut slots in each tube. Feed coolant into smaller tube, and rotate outer tube to expose wider or narrower slot for coolant to flow out of. Rotate tube with stepper or solenoid acting on arm attached to tube. Stepper probably best for digital control. Solenoid maybe best for analog control.







To Page No. X

Read & Understood by me.

Date 11-15-12

Invented by: CHRIS BOYD

Recorded by: CHRIS BOYD

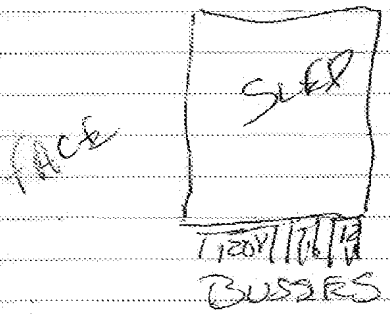
Date 10-18-2012

TITLE ENHANCED SLED

Project No.

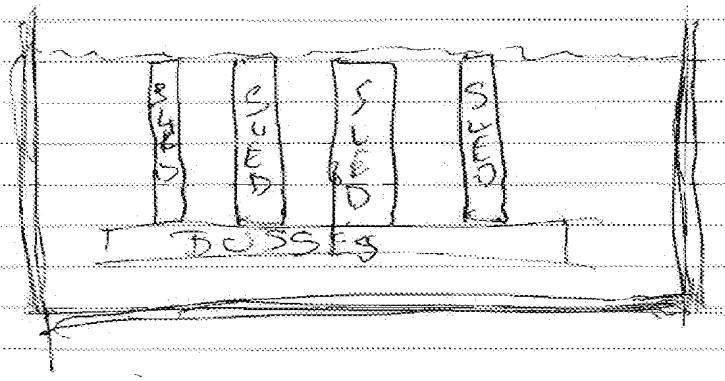
Book No.

From Page No. 1



ALTERNATE MEANS OF POWER DISTRIBUTION TO SLEDS
— INSTALL A POWER BUSS IN TH
TO DISTRIBUTE POWER TO SLED
BOARDS.

SLEDS SNAP INTO POWER CONNECTO
TO DRAW 120VAC (CONVENTIONAL PS
OR DIRECT 5VDC/12VDC POWER
DIRECTLY TO THE MOTHERBOARD.



To Page No. —

Witnessed & Understood by me)	Date	Invented by:	Date
C Boyd	10-26-2012	Ken Tooke	10/24/2012
		Recorded by: Chris Boyd	

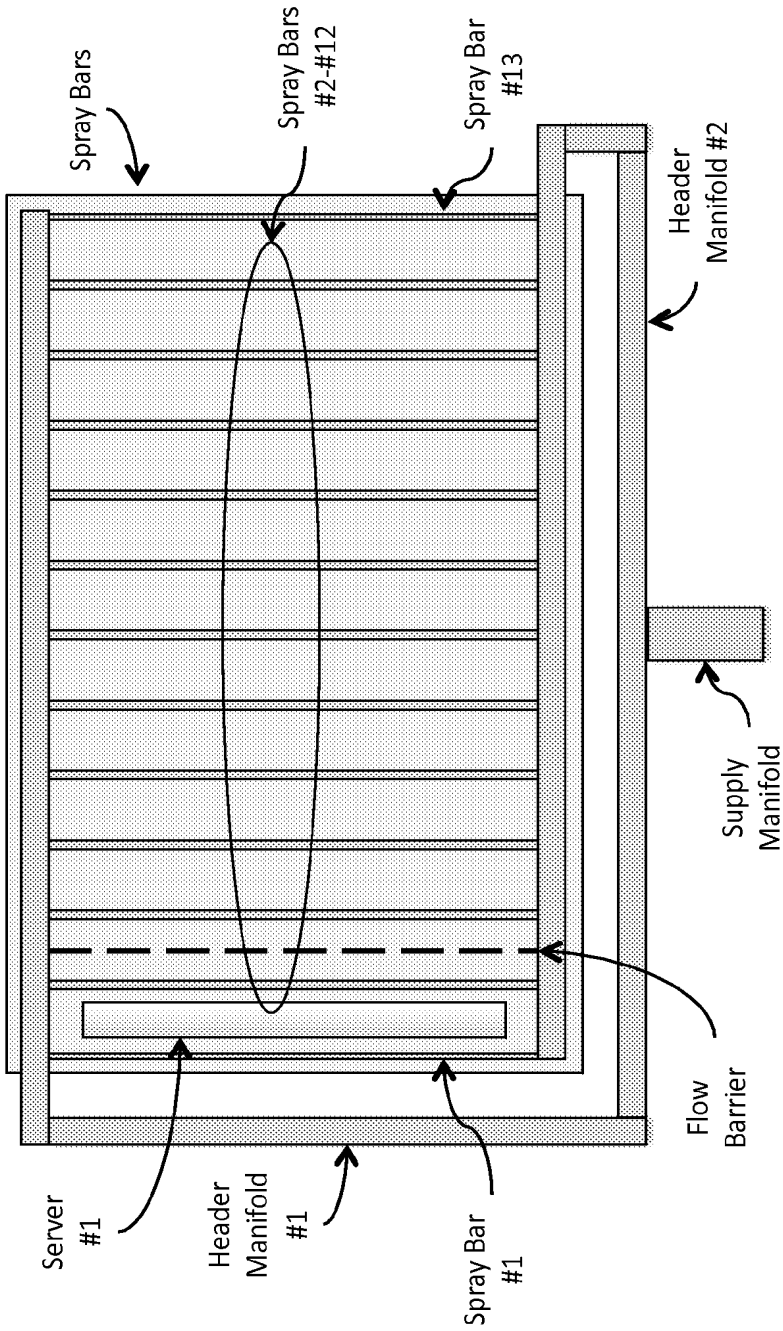

Spray Bars
Spray Bars #2-#12
Spray Bar #13
Header Manifold #2
Supply Manifold
Flow Barrier
Server #1
Header Manifold #1
Spray Bar #1

Fig. 1

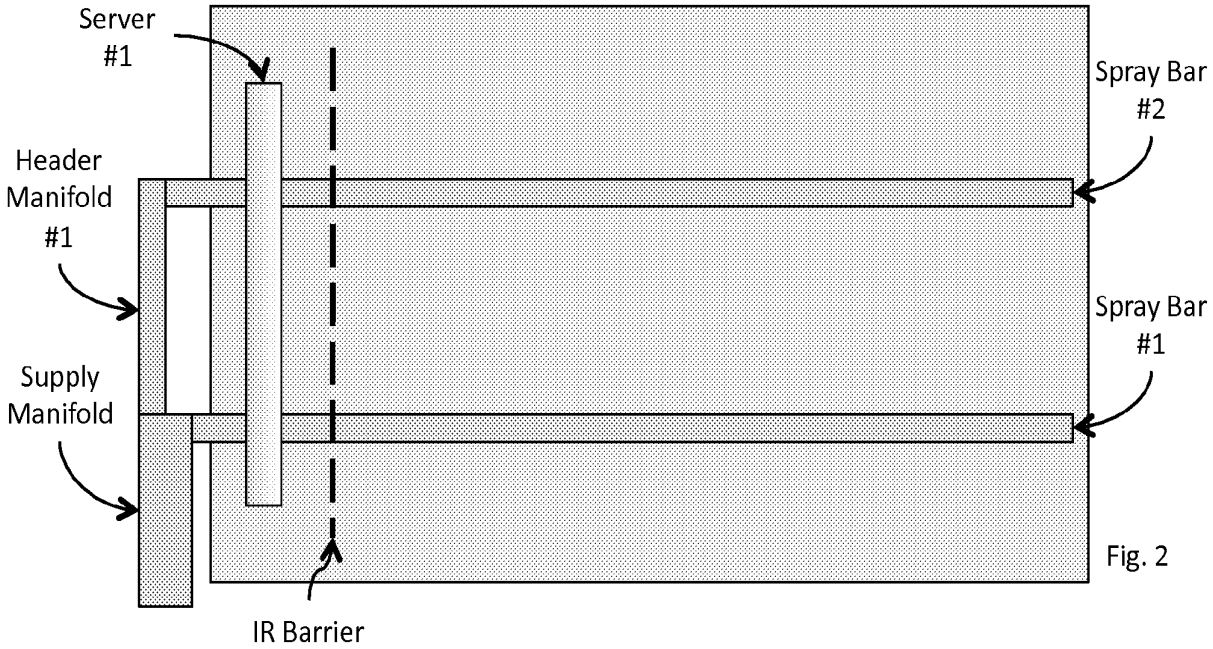


Fig. 2

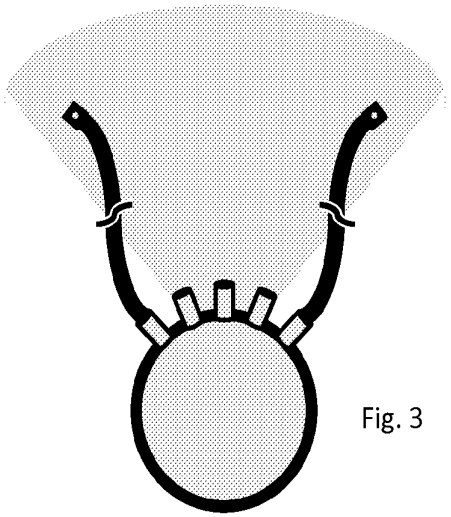


Fig. 3

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 240 of 656; IPR2025-00196

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DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/US2013/075126**
International filing date:		**13 December 2013 (13.12.2013)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**61/737,200**
	Filing date:	**14 December 2012 (14.12.2012)**
Date of receipt at the International Bureau:		**03 January 2014 (03.01.2014)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

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1211 Geneva 20, Switzerland
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THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 01, 2014

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *61/832,211*
FILING DATE: *June 07, 2013*
RELATED PCT APPLICATION NUMBER: *PCT/US13/75126*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US61/832,211*

Certified by

David J. Kappos

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

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Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
John	H.	Miller Jr.	Austin	TX	US

Inventor 2 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
James	P.	Koen	Austin	TX	US

Inventor 3 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
John	C.	Tribou	Austin	TX	US

Inventor 4 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Mike		Rainone	Palestine	TX	US

Inventor 5 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Talbot		Presley	Palestine	TX	US

Inventor 6 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Jeffrey	Van	Myers	Driftwood	TX	US

Inventor 7 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Christopher	L	Boyd	Austin	TX	US

Inventor 8 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Kenneth	D	Tooke	Austin	TX	US

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

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Inventor 9					Remove
Given Name	Middle Name	Family Name	City	State	Country i
David	Christopher Thoma	Laguna	Austin	TX	US

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Title of Invention	Server Immersion Tank System
Attorney Docket Number (if applicable)	JMG001-02

Correspondence Address

Direct all correspondence to (select one):

◉ The address corresponding to Customer Number	○ Firm or Individual Name
Customer Number	44070

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
◉ No.
○ Yes, the name of the U.S. Government agency and the Government contract number are:

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

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Entity Status

Applicant claims small entity status under 37 CFR 1.27

(●) Yes, applicant qualifies for small entity status under 37 CFR 1.27

( ) No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey Van Myers/			Date (YYYY-MM-DD)	2013-06-07
First Name	Jeffrey	Last Name	Myers	Registration Number (If appropriate)	27362

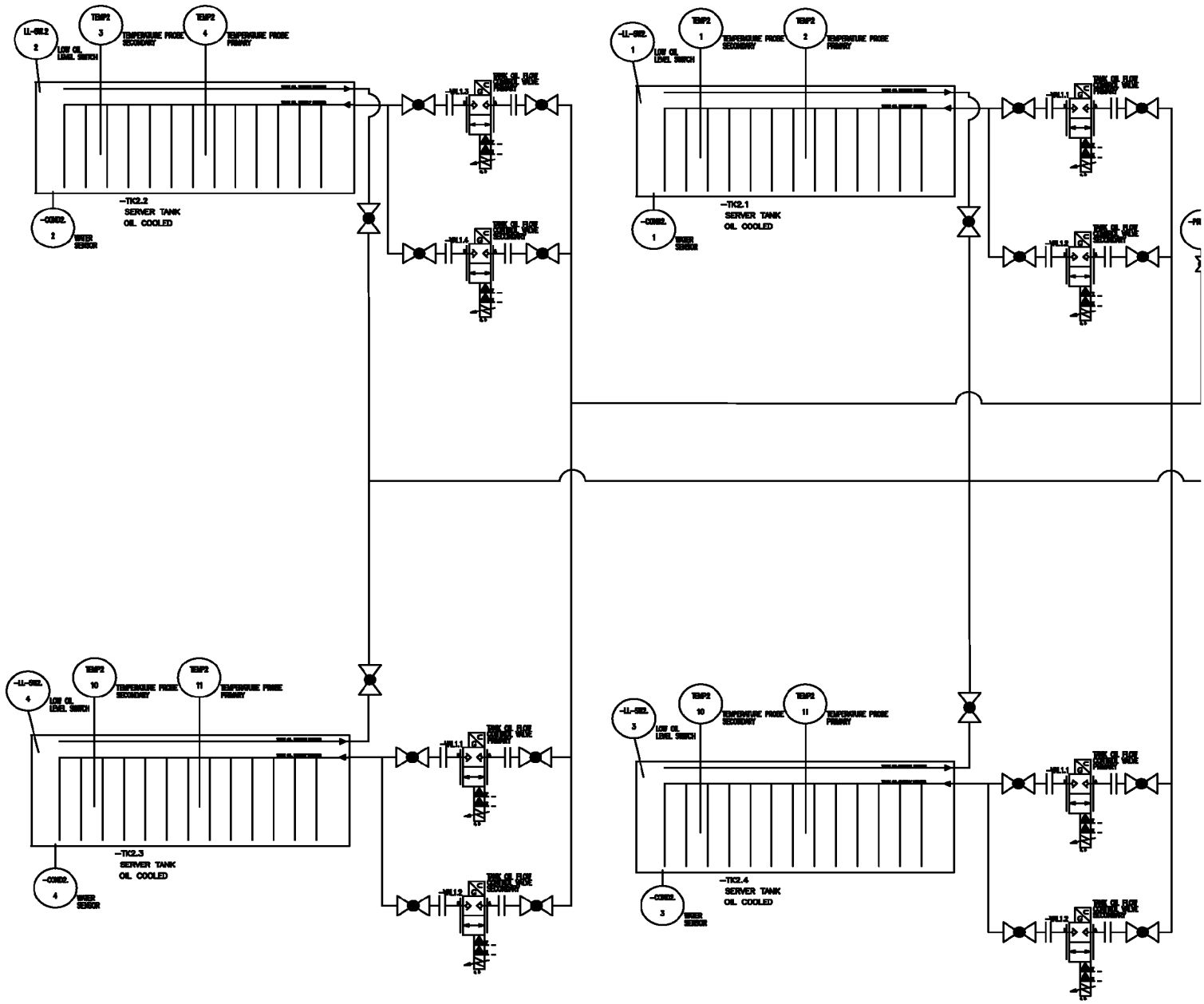
This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours 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, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

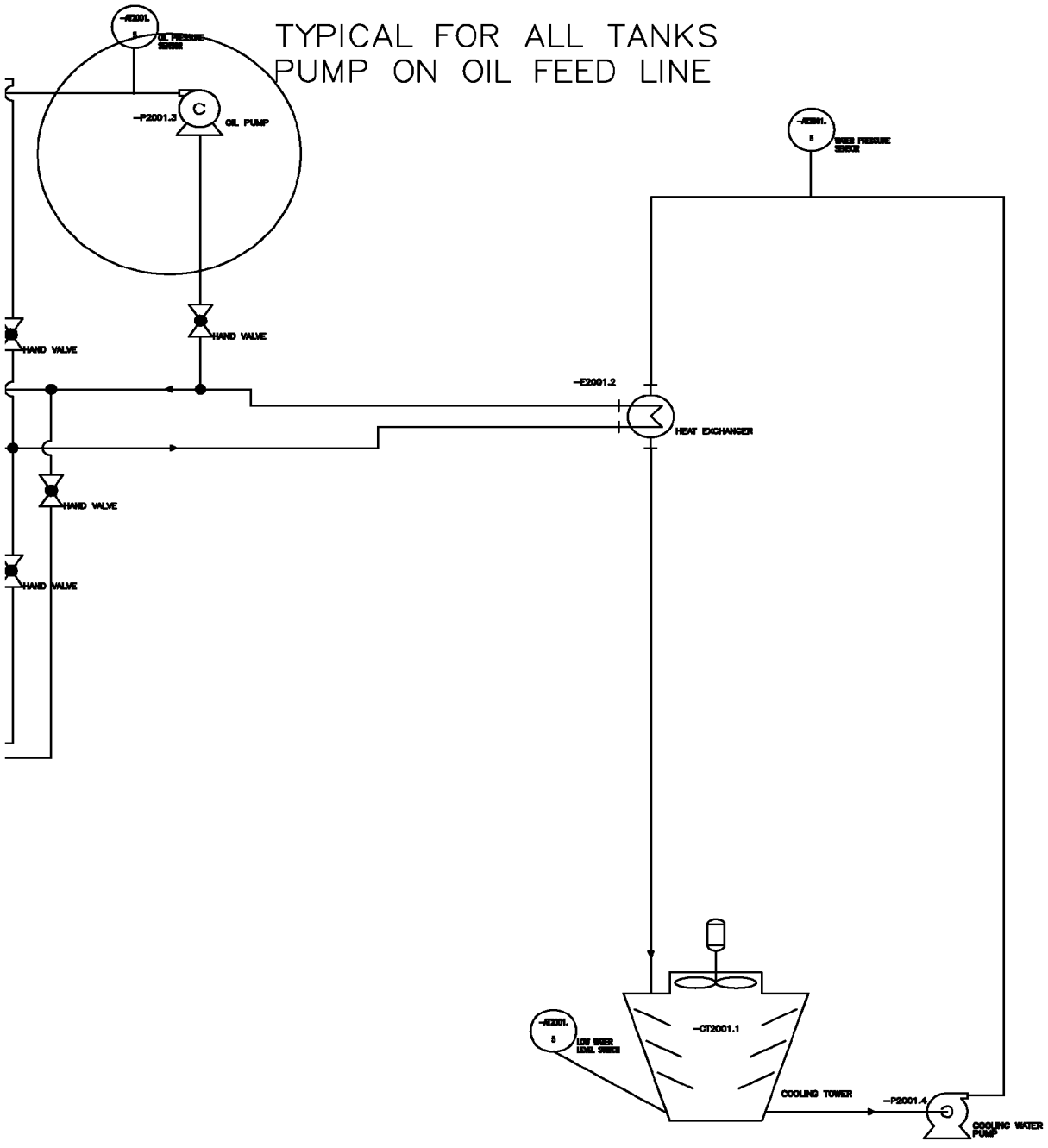


NOTES:
1. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.

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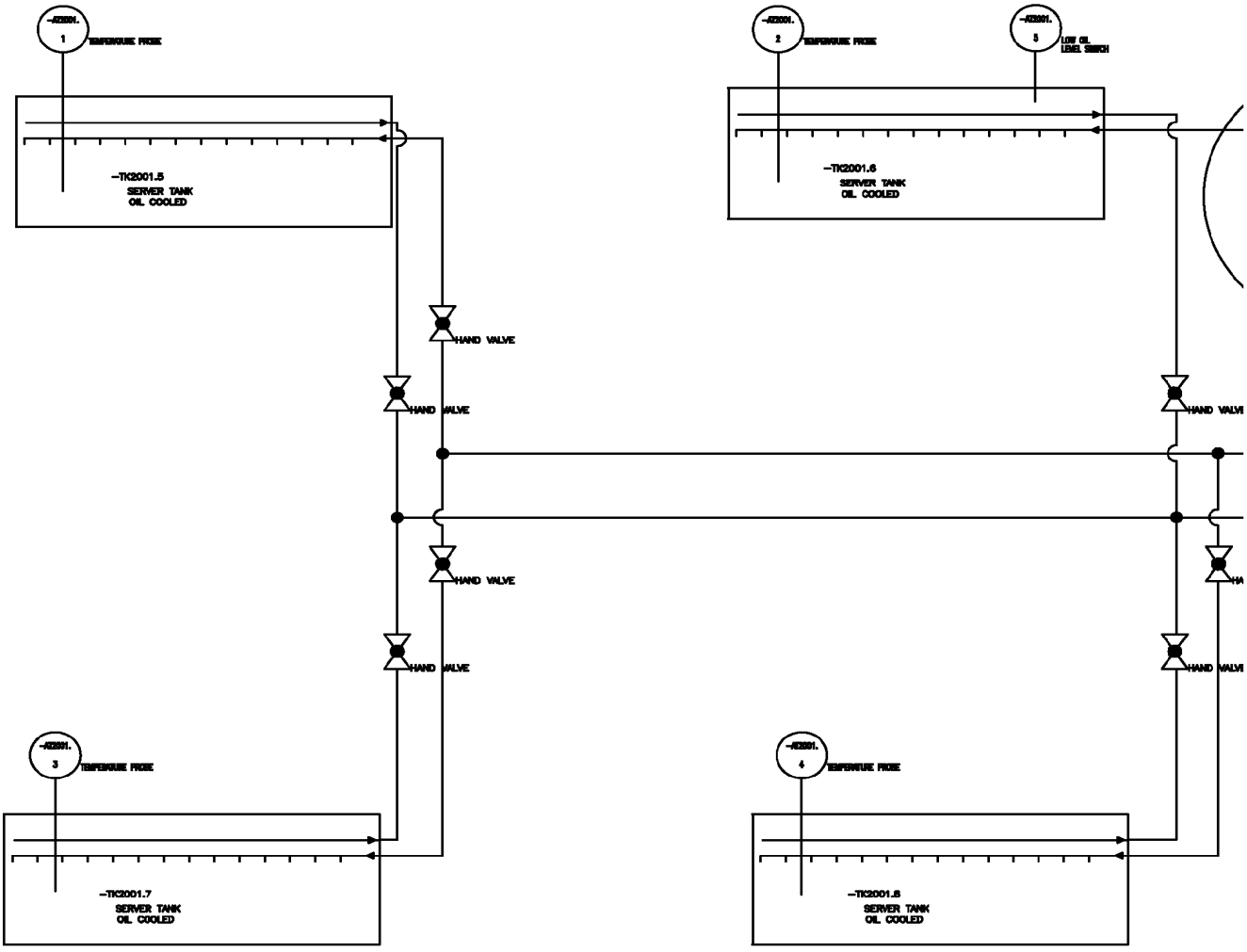


P.O. BOX 5063
GEORGETOWN, TEXAS 78627
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DWG TITLE

MIDAS
OIL PUMP PER TANK
SIMPLE ON/OFF CONTROL
P&ID

APPROVED	CHECKED BY
JOB NO 485-015	DRAWN BY KDS
SIZE A3	DATE 12-19-12
DWG NO	
SHEET NO 1 OF 1	

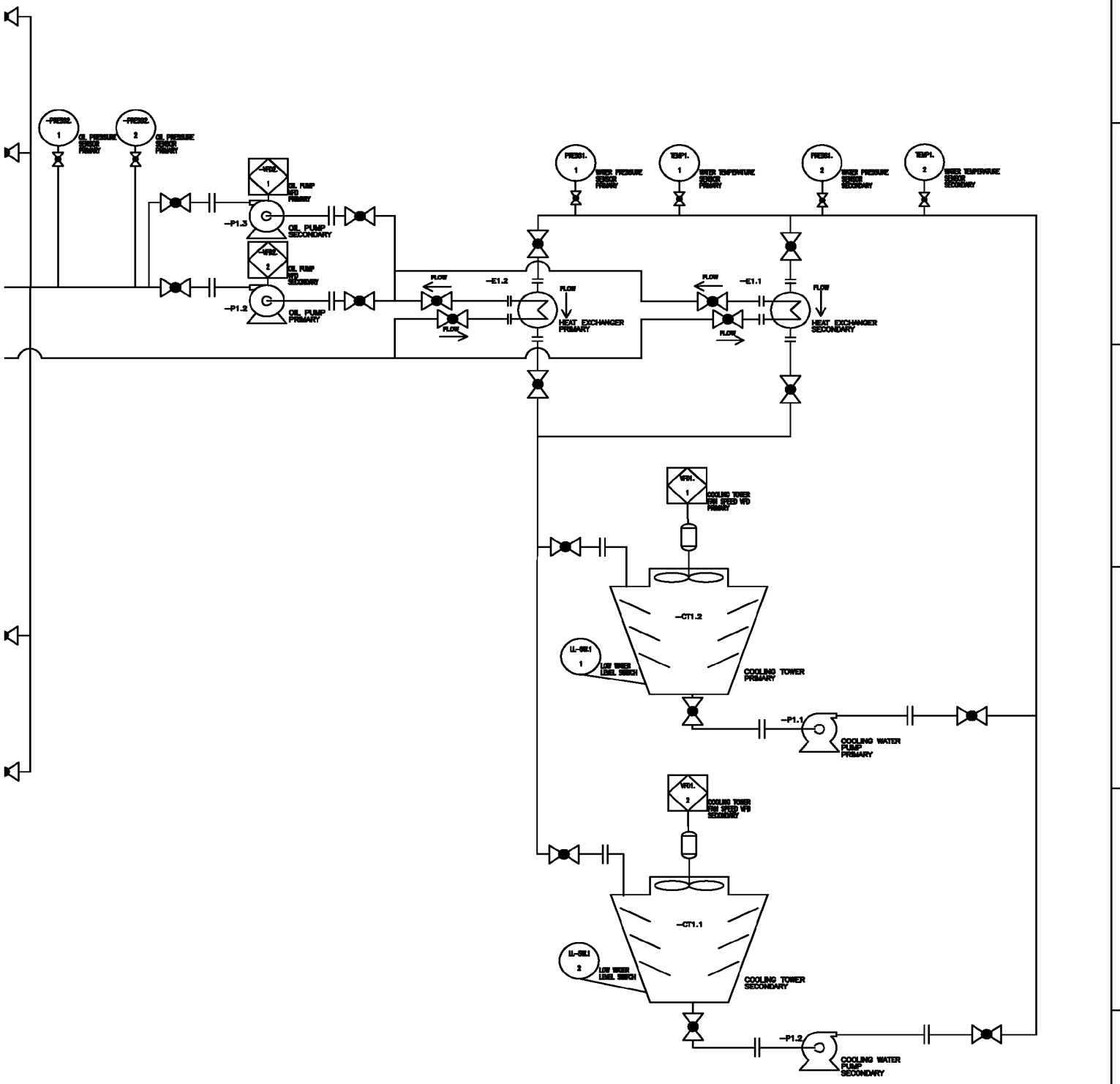


NOTES:
1. ON/OFF CONTROL PER TANK
2, OIL PUMP AT EACH TANK WILL REGULATE FLOW TO TANKS DURING COOLING OPERATION BASED ON HEAT OF EACH TANK.
3. WHEN TEMPERATURE IN ANY SERVER TANK RAISES ABOVE 95 F THE OIL PUMP FOR THAT TANK, WATER PUMP, AND COOLING TOWER FAN ALL START.
4. WHEN TEMPERATURE IN THAT SERVER TANKS DROPS BELOW 95 F THE OIL PUMP TURNS OFF.
5. WHEN THE OIL PUMP TURNS OFF THE WATER PUMP AND COOLING TOWER FAN CONTINUE TO RUN FOR 30 MINUTES.
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.
7. ADDED LEVEL SENSOR TO COOLING TOWER WATER.

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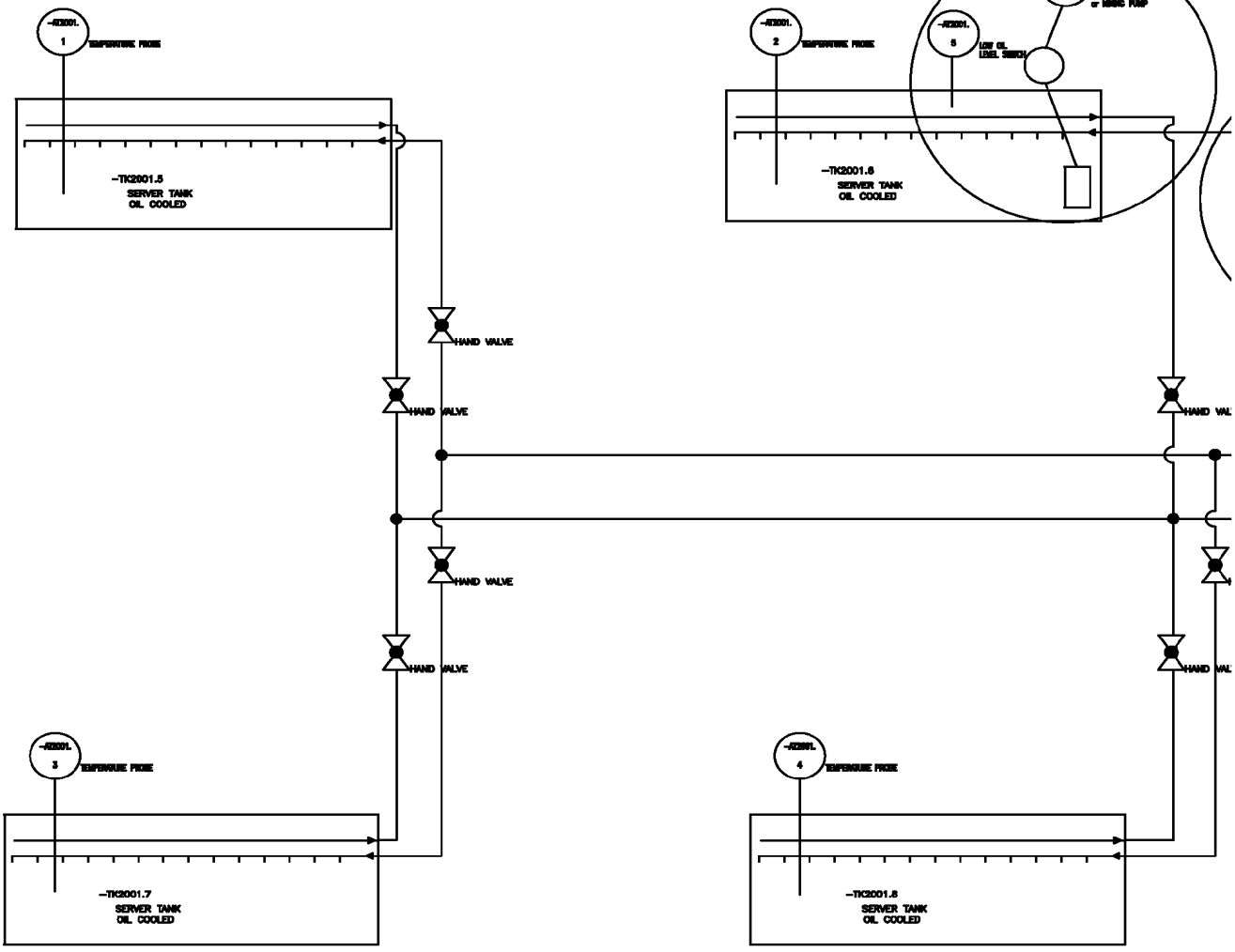
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PH (512) 930-9908
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DWG TITLE

MIDAS
4 TANK SYSTEM
P$ID

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SIZE A3	DATE 12-19-12
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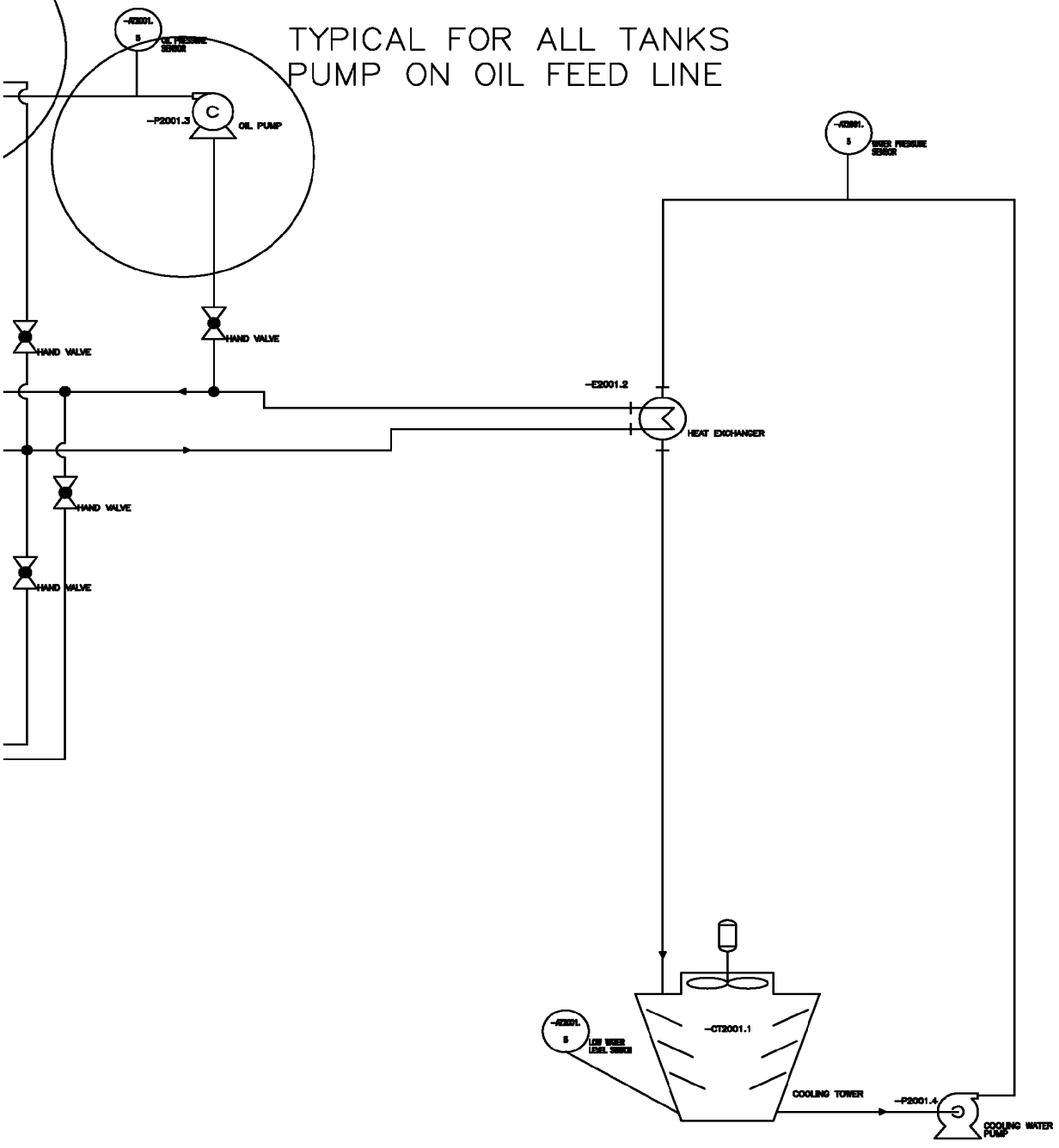
1. ON/OFF CONTROL PER TANK
2, OIL PUMP AT EACH TANK WILL REGULATE FLOW TO TANKS DURING COOLING OPERATION BASED ON HEAT OF EACH TANK.
3. WHEN TEMPERATURE IN ANY SERVER TANK RAISES ABOVE 95 F THE OIL PUMP FOR THAT TANK, WATER PUMP, AND COOLING TOWER FAN ALL START.
4. WHEN TEMPERATURE IN THAT SERVER TANKS DROPS BELOW 95 F THE OIL PUMP TURNS OFF.
5. WHEN THE OIL PUMP TURNS OFF THE WATER PUMP AND COOLING TOWER FAN CONTINUE TO RUN FOR 30 MINUTES.
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.
7. ADDED LEVEL SENSOR TO COOLING TOWER WATER
8. ADDED OPTIONAL TANK STIRRING DEVICE

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TYPICAL FOR ALL TANKS
STIRRING DEVICE OR MIX PUMP



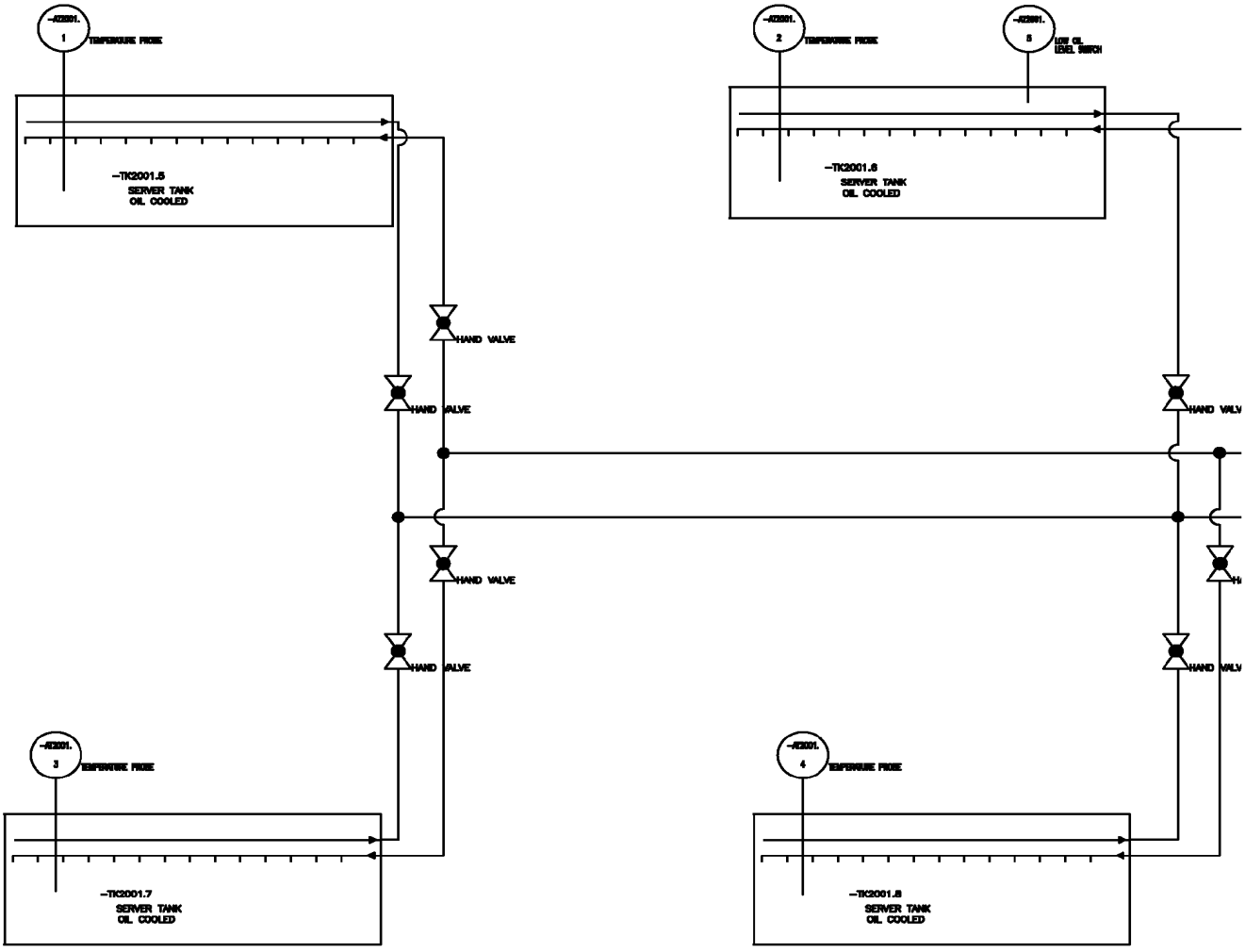
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DWG TITLE

MIDAS
OIL PUMP PER TANK
SIMPLE ON/OFF CONTROL
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DWG NO	
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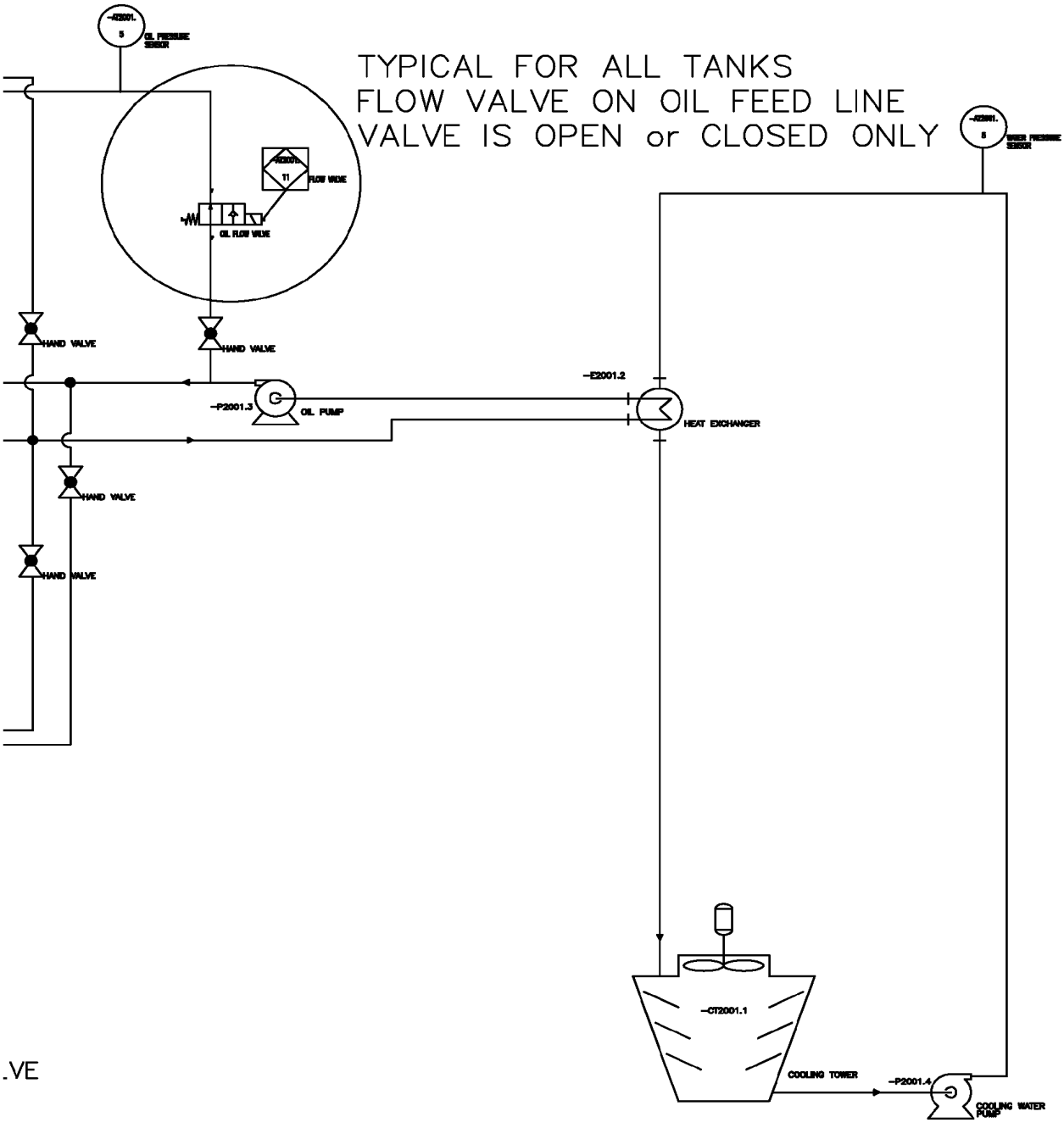
NOTES:

1. ON/OFF CONTROL PER TANK
2, FLOW VALVE AT EACH TANK WILL REGULATE FLOW TO TANKS DURING COOLING OPERATION BASED ON HEAT OF EACH TANK.
3. WHEN TEMPERATURE IN ANY SERVER TANK RAISES ABOVE 95 F THE OIL PUMP, WATER PUMP, AND COOLING TOWER FAN ALL START. ALSO, THE FLOW VALVE FOR THAT TANK OPENS.
4. WHEN TEMPERATURE IN THAT SERVER TANKS DROPS BELOW 95 F THE FLOW VALVE FOR THAT TANK CLOSES.
5. WHEN ALL SERVER TANKS ARE BELOW 95 F THE OIL PUMP TURNS OFF.
5. WHEN THE OIL PUMP TURNS OFF THE WATER PUMP AND COOLING TOWER FAN CONTINUE TO RUN FOR 30 MINUTES.
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.

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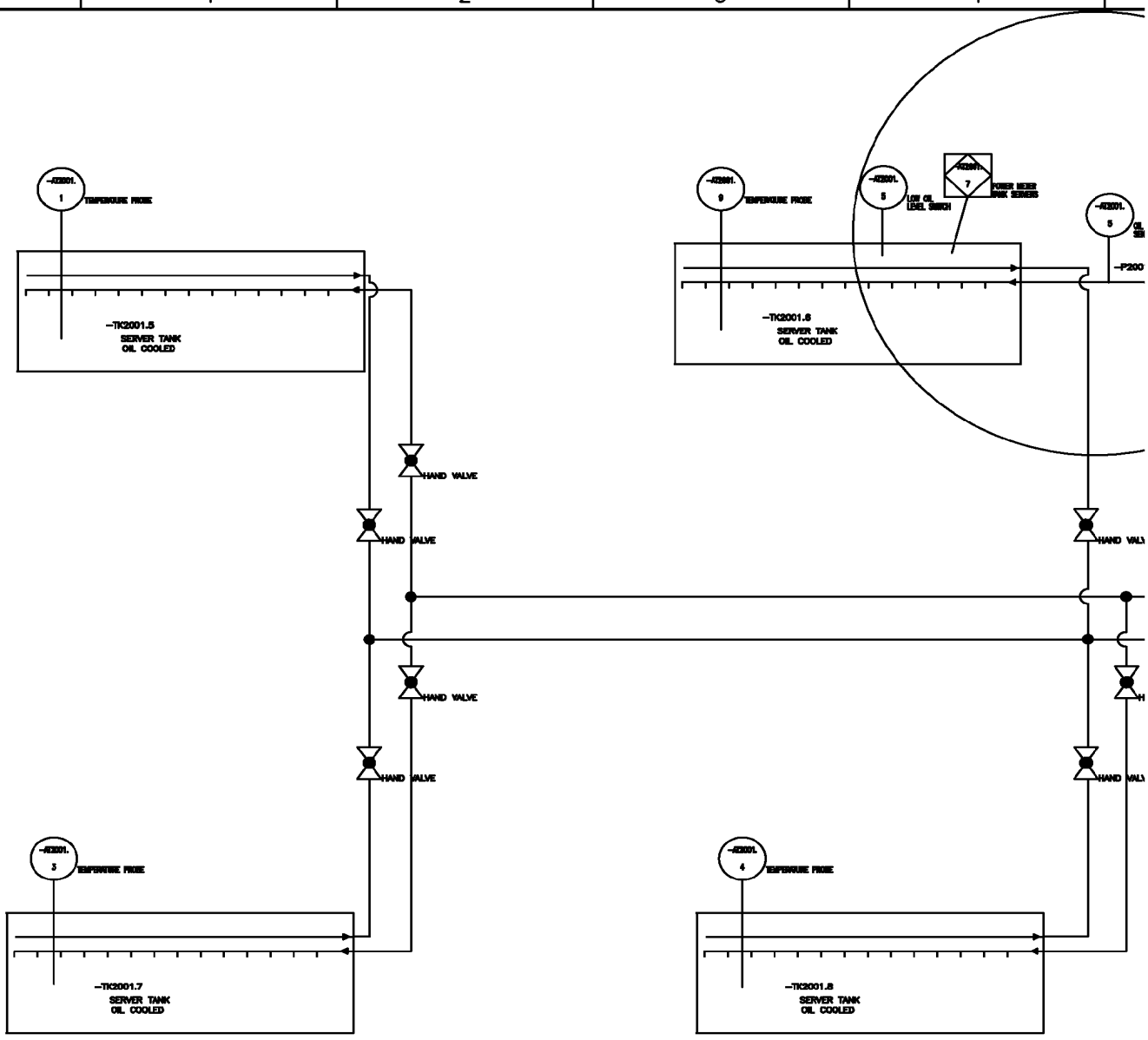
.VE

P.O. BOX 5063
GEORGETOWN, TEXAS 78627
PH (512) 930-9908
FAX (512) 930-9909
www.deatonengineering.com

DWG TITLE

MIDAS
VALVE AT EACH TANK
SIMPLE ON/OFF CONTROL
P&ID

APPROVED	CHECKED BY
JOB NO 485-015	DRAWN BY KDS
SIZE A3	DATE 12-19-12
DWG NO	
SHEET NO 1 OF 1	



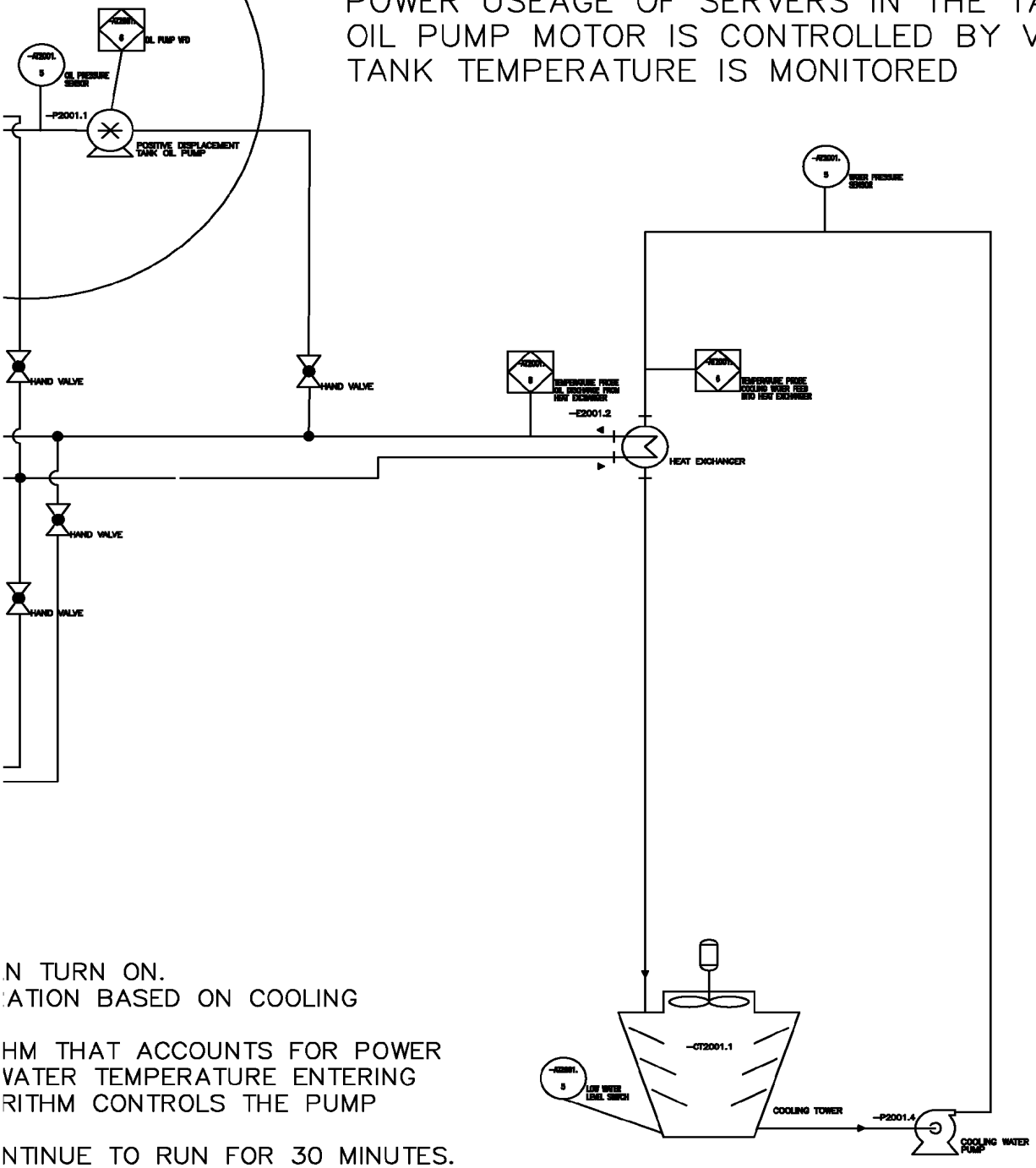
NOTES:
1. PROPORTIONAL CONTROL PER TANK.
2. WHEN ANY OF THE 4 OIL PUMPS RUN THE COOLING TOWER WATER PUMP AND FAN TUI
3, OIL PUMP AT EACH TANK WILL REGULATE FLOW TO TANKS DURING COOLING OPERATION REQUIREMENTS OF EACH TANK.
4. CONTROL OF TEMPERATURE IN EACH TANK IS BASE ON A FEEDFORWARD ALGORITHM TH USED BY SERVERS IN THE TANK, TANK TEMP, EFF. OF HEAT EXCHANGER, COOLING WATER THE HEAT EXCHANGER, REQUIREMENTS OF ALL 4 TANKS. THE OUTPUT OF THE ALGORITHM SPEED.
5. WHEN ALL OIL PUMPS TURN OFF THE WATER PUMP AND COOLING TOWER FAN CONTINU
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.

NO.	DATE	REVISION	BY
A	12-19-12	ORIGINAL ISSUE	KDS

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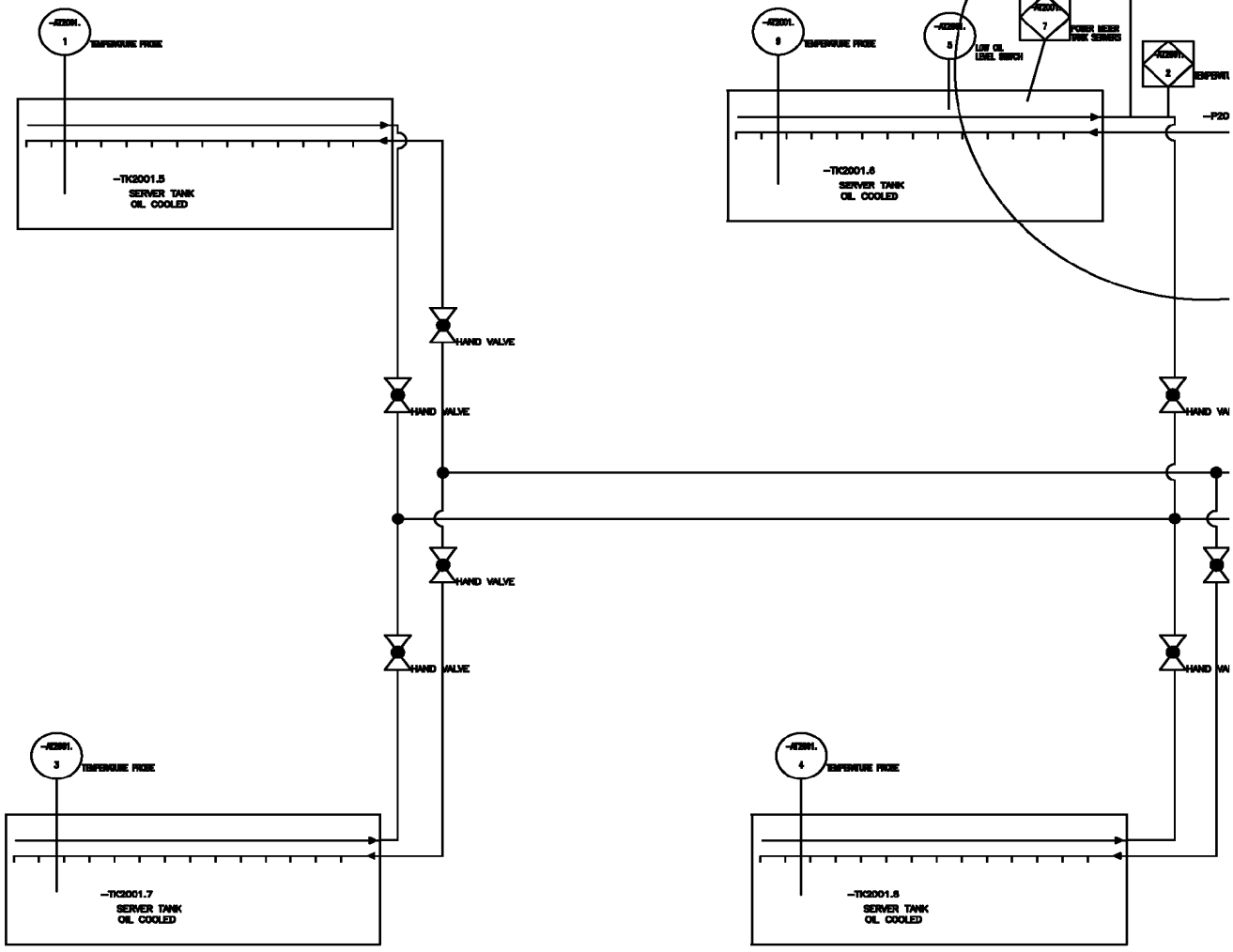
EERING, INC.

P.O. BOX 5063
GEORGETOWN, TEXAS 78627
PH (512) 930-9908
FAX (512) 930-9909
www.deatonengineering.com

DWG TITLE

MIDAS
OIL VFDs, TEMP PROBE
PROPORTIONAL CONTROL
P&ID

APPROVED	CHECKED BY
JOB NO 485-015	DRAWN BY KDS
SIZE A3	DATE 12-19-12
DWG NO	
SHEET NO 1 OF 1	



NOTES:

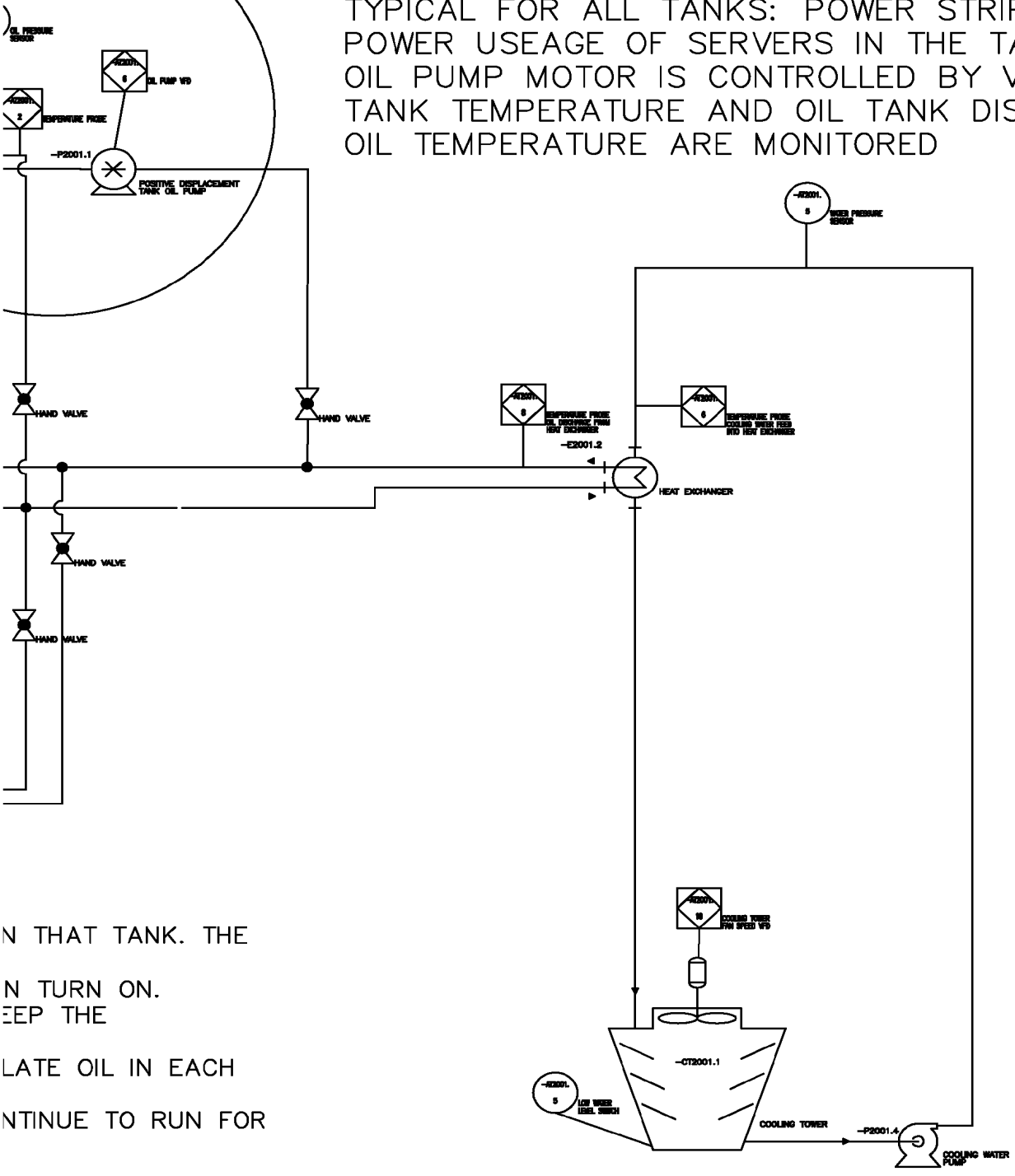
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2. WHEN ANY OF THE 4 OIL PUMPS RUN THE COOLING TOWER WATER PUMP AND FAN TUI
3, WHEN RUNNING THE COOLING TOWER FAN SPEED IS CONTROLLED BY A VFD TO KEEP T TEMPERATURE OF THE COOLING WATER ENTERING THE HEAT EXCHANGER AT 95 F.
4. TANK OIL PUMPS CAN BE RAN AT A SLOW SPEED (20%) ALL THE TIME TO CIRCULATE TANK TO PREVENT ANY HOT SPOTS.
5. WHEN ALL OIL PUMPS TURN OFF THE WATER PUMP AND COOLING TOWER FAN CONTINU 30 MINUTES.
6. ANY UNUSED SERVER TANKS ARE MANUALLY VALVED OUT.

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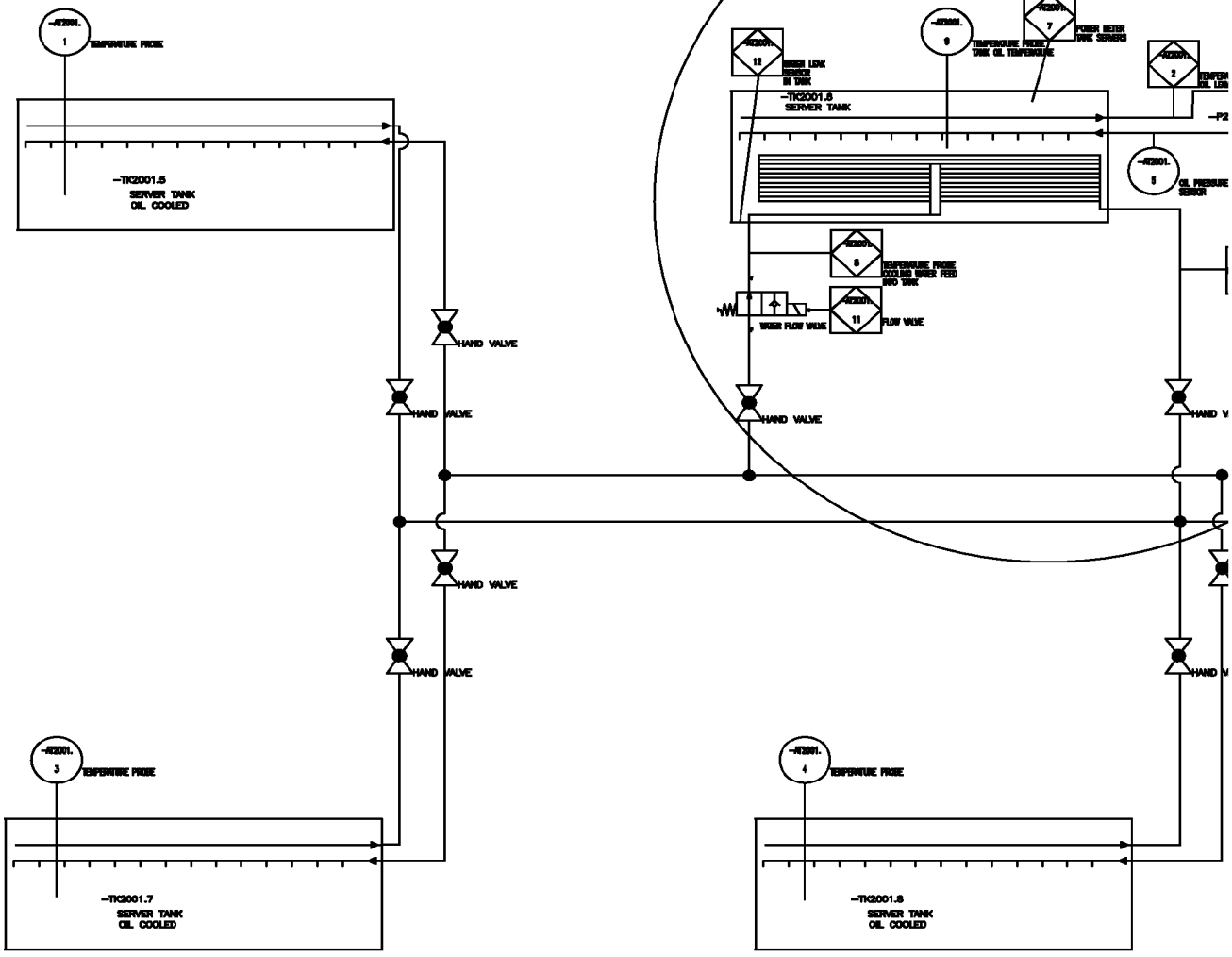
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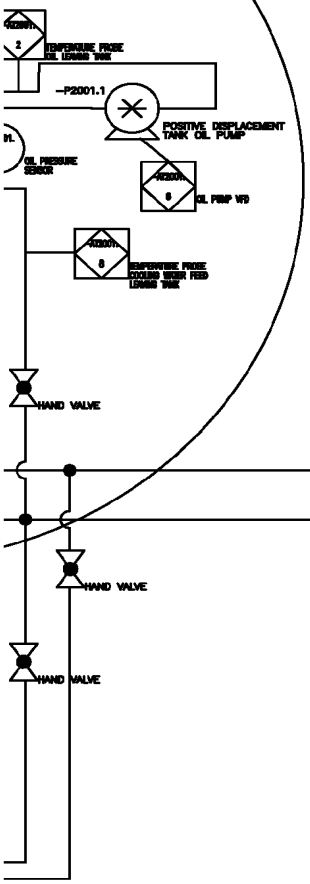
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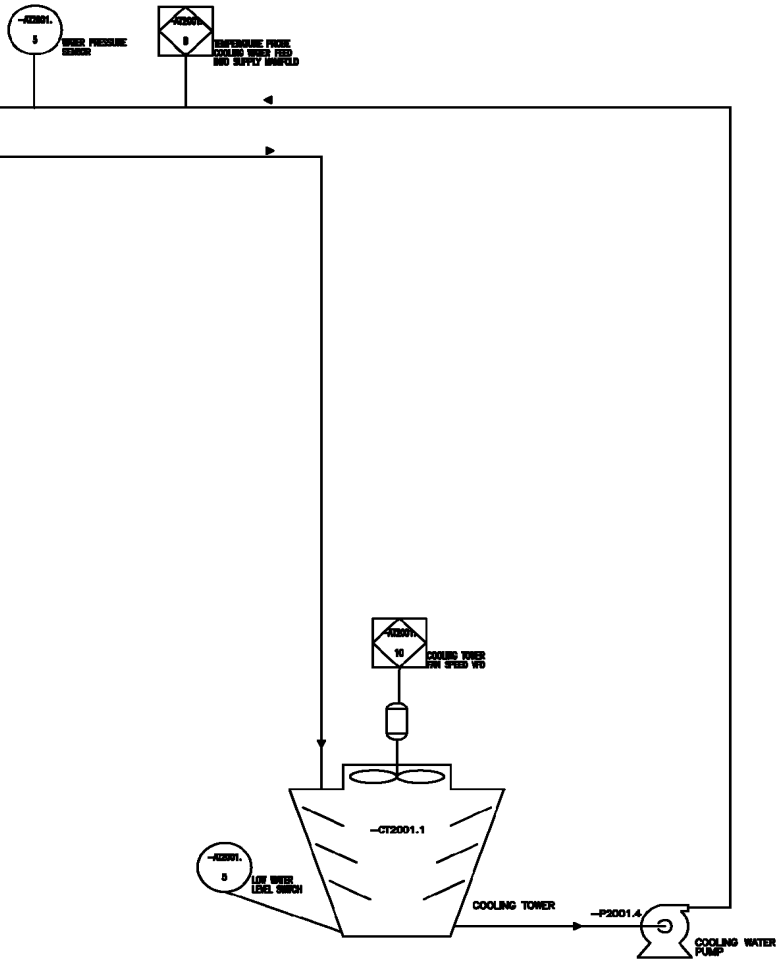
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DWG NO	
SHEET NO 1 OF 1	

Electronic Acknowledgement Receipt

EFS ID:	15976940
Application Number:	61832211
International Application Number:	
Confirmation Number:	3648
Title of Invention:	Server Immersion Tank System
First Named Inventor/Applicant Name:	John H. Miller, Jr.
Customer Number:	44070
Filer:	Jeffrey Van Myers
Filer Authorized By:	
Attorney Docket Number:	JMG001-02
Receipt Date:	07-JUN-2013
Filing Date:	
Time Stamp:	11:25:35
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	$130
RAM confirmation Number	9123
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Provisional Cover Sheet (SB16)	JMG001_PCS_130607.pdf	2071470 24eabb671de54338a9d2554724aa6164b6054bb2	no	4
Warnings:					
Information:					
2	Specification	JMG001_p_130607.pdf	459013 8d41ea3e4b21764de986ba992fdee13e5931e37e	no	14
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	28954 e3fba237d162734cee0dc2bbaf4bb91f1b56b33d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2559437		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/US2013/075126**
International filing date:		**13 December 2013 (13.12.2013)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**61/832,211**
	Filing date:	**07 June 2013 (07.06.2013)**
Date of receipt at the International Bureau:		**03 January 2014 (03.01.2014)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT/US13/75126
International Application No.

13 DEC 2013 (13.12.13)
International Filing Date

RO/US
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* JMG001-01

Box No. I TITLE OF INVENTION

APPLIANCE IMMERSION COOLING SYSTEM

Box No. II APPLICANT ☐ This person is also inventor

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Midas Green Technology, LLC
8500 Shoal Creek
Building 2, Suite K
Austin, TX 78757
USA

Telephone No.
512.420.8099

Facsimile No.

Applicant's registration No. with the Office

E-mail authorization: Marking one of the check-boxes below authorizes the receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority to use the e-mail address indicated in this Box to send, notifications issued in respect of this international application to that e-mail address if those offices are willing to do so.

☒ as advance copies followed by paper notifications; or ☒ exclusively in electronic form (no paper notifications will be sent).

E-mail address: jim@midasgreentech.com

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☒ all designated States ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MYERS, Jeffrey Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 8619
USA

Telephone No.
512.858.7453

Facsimile No.

Agent's registration No. with the Office
27,362

E-mail authorization: Marking one of the check-boxes below authorizes the receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority to use the e-mail address indicated in this Box to send, notifications issued in respect of this international application to that e-mail address if those offices are willing to do so.

☒ as advance copies followed by paper notifications; or ☒ exclusively in electronic form (no paper notifications will be sent).

E-mail address: jvm@jvmyers.com

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

BOYD, Christopher L.
1309 Bonham Terrace
Austin, TX 78704
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

KOEN, James P.
2302 Falcon Drive
Round Rock, TX, 78681
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Laguna, David Christopher
2011 E. 6th Street
Austin, TX 78702
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

TURNER, Thomas R.
4210 Malaga Dr.
Georgetown, TX 78628
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 265 of 656; IPR2025-00196

Supplemental Box *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. *If, in any of the Boxes, except Boxes Nos. VIII(i) to (v) for which a special continuation box is provided,* ***the space is insufficient*** *to furnish all the information: in such case, write "Continuation of Box No...." (indicate the number of the Box) and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

(i) ***if more than one person is to be indicated as applicant and/or inventor*** *and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;*

(ii) *if, in Box No. II or in any of the sub-boxes of Box No. III, the indication* ***"the States indicated in the Supplemental Box"*** *is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;*

(iii) *if, in Box No. II or in any of the sub-boxes of Box No. III,* ***the inventor or the inventor/applicant is not inventor for the purposes of all designated States****: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;*

(iv) *if, in addition to the agent(s) indicated in Box No. IV, there are* ***further agents****: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;*

(v) *if, in Box No. VI, there are* ***more than three earlier applications whose priority is claimed****: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI.*

2. *If the applicant intends to make an indication of the wish that the international application be treated, in certain designated States, as an application for a patent of addition, certificate of addition, inventor's certificate of addition or utility certificate of addition: in such case, write the name or two-letter code of each designated State concerned and the indication "****patent of addition,****" "****certificate of addition,****" "****inventor's certificate of addition****" or "****utility certificate of addition,****" the number of the parent application or parent patent or other parent grant and the date of grant of the parent patent or other parent grant or the date of filing of the parent application (Rules 4.11(a)(i) and 49bis.1(a) or (b)).*

3. *If the applicant intends to make an indication of the wish that the international application be treated, in the United States of America, as a continuation or continuation-in-part of an earlier application: in such case, write "United States of America" or "US" and the indication "****continuation****" or "****continuation-in-part****" and the number and the filing date of the parent application (Rules 4.11(a)(ii) and 49bis.1(d)).*

Continuation of Box No. III:

Kenneth D. Swinden
132 Mustang Creek North Loop
Hutto, TX 78634
USA
Inventor Only
Nationality: USA
Residence: USA

Mario Conti Garcia
9624 Woody Ridge View
Austin, TX 78730
USA
Inventor Only
Nationality: USA
Residence: USA

John Charles Tribou
9109 Middlebie Dr.
Austin, TX 78750
USA
Nationality: USA
Residence: USA

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 266 of 656; IPR2025-00196

Box No. V DESIGNATIONS

The filing of this request **constitutes under Rule 4.9(a) the designation** of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.

However,

☐ DE Germany **is not designated** for any kind of national protection

☐ JP Japan **is not designated** for any kind of national protection

☐ KR Republic of Korea **is not designated** for any kind of national protection

(The check-boxes above may only be used to exclude (irrevocably) the designations concerned if, at the time of filing or subsequently under Rule 26bis.1, the international application contains in Box No. VI a priority claim to an earlier national application filed in the particular State concerned, in order to avoid the ceasing of the effect, under the national law, of this earlier national application.)

Box No. VI PRIORITY CLAIM AND DOCUMENT

The priority of the following earlier application(s) is hereby claimed:

Filing date of earlier application *(day/month/year)*	Number of earlier application	Where earlier application is:		
		national application: country or Member of WTO	regional application: regional Office	international application: receiving Office
item (1) 14/12/2012	61/737,200	USA		
item (2) 7/6/2013	61/832,211	USA		
item (3)				

☐ Further priority claims are indicated in the Supplemental Box.

Furnishing the priority document(s):

☒ The **receiving Office** is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application(s) was filed with the receiving Office which, for the purposes of this international application, is the receiving Office)* identified above as:

☒ all items ☐ item (1) ☐ item (2) ☐ item (3) ☐ other, see Supplemental Box

☐ The **International Bureau** is requested to obtain from a digital library a certified copy of the earlier application(s) identified above, using, where applicable, the access code(s) indicated below *(if the earlier application(s) is available to it from a digital library)*:

☐ item (1) access code _____ ☐ item (2) access code _____ ☐ item (3) access code _____ ☐ other, see Supplemental Box

Restore the right of priority: the receiving Office is requested to restore the right of priority for the earlier application(s) identified above or in the Supplemental Box as item(s) (_____). *(See also the Notes to Box No. VI; further information **must** be provided to support a request to restore the right of priority.)*

Incorporation by reference: where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if more than one International Searching Authority is competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)*:

ISA/ US

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Continuation of Box No. VII USE OF RESULTS OF EARLIER SEARCH, REFERENCE TO THAT SEARCH

☐ The ISA indicated in Box No. VII is requested to take into account the results of the earlier search(es) indicated below (*see also Notes to Box VII; use of results of more than one earlier search*).

Filing date *(day/month/year)*	Application Number	Country *(or regional Office)*

☐ **Statement (Rule 4.12(ii))**: this international application is the same, or substantially the same, as the application in respect of which the earlier search was carried out except, where applicable, that it is filed in a different language.

☐ **Availability of documents**: the following documents are available to the ISA in a form and manner acceptable to it and therefore do not need to be submitted by the applicant to the ISA (Rule 12*bis*.1(f)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a translation of the earlier application into a language which is accepted by the ISA,
- ☐ a translation of the results of the earlier search into a language which is accepted by the ISA,
- ☐ a copy of any document cited in the results of the earlier search. *(If known, please indicate below the document(s) available to the ISA):*

☐ **Transmit copy of results of earlier search and other documents** *(where the earlier search **was not** carried out by the ISA indicated above but by the same Office as that which is acting as the receiving Office)*: the **receiving Office** is requested to prepare and transmit to the ISA (Rule 12*bis*.1(c)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a copy of any document cited in the results of the earlier search.

* Where the results of the earlier search are neither available from a digital library nor transmitted by the receiving Office, the applicant is required to submit them to the receiving Office (Rule 12*bis*.1(a)) (*See item 11. in the check-list and also Notes to Box No. VII*).

Filing date *(day/month/year)*	Application Number	Country *(or regional Office)*

☐ **Statement (Rule 4.12(ii))**: this international application is the same, or substantially the same, as the application in respect of which the earlier search was carried out except, where applicable, that it is filed in a different language.

☐ **Availability of documents**: the following documents are available to the ISA in a form and manner acceptable to it and therefore do not need to be submitted by the applicant to the ISA (Rule 12*bis*.1(f)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a translation of the earlier application into a language which is accepted by the ISA,
- ☐ a translation of the results of the earlier search into a language which is accepted by the ISA,
- ☐ a copy of any document cited in the results of the earlier search. *(If known, please indicate below the document(s) available to the ISA):*

☐ **Transmit copy of results of earlier search and other documents** *(where the earlier search **was not** carried out by the ISA indicated above but by the same Office as that which is acting as the receiving Office)*: the **receiving Office** is requested to prepare and transmit to the ISA (Rule 12*bis*.1(c)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a copy of any document cited in the results of the earlier search.

* Where the results of the earlier search are neither available from a digital library nor transmitted by the receiving Office, the applicant is required to submit them to the receiving Office (Rule 12*bis*.1(a)) (*See item 11. in the check-list and also Notes to Box No. VII*).

☐ Further earlier searches are indicated on a continuation sheet.

Box No. VIII DECLARATIONS

The following **declarations** are contained in Boxes Nos. VIII (i) to (v) *(mark the applicable check-boxes below and indicate in the right column the number of each type of declaration)*:			Number of declarations
☐	Box No. VIII (i)	Declaration as to the identity of the inventor :	
☐	Box No. VIII (ii)	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent :	
☐	Box No. VIII (iii)	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application :	
☒	Box No. VIII (iv)	Declaration of inventorship (only for the purposes of the designation of the United States of America) :	
☐	Box No. VIII (v)	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty :	

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Box No. IX CHECK LIST for EFS-Web filings - this sheet is only to be used when filing an international application with RO/US via **EFS-Web**

This international application **contains** the following:	Number of sheets
(a) request form PCT/RO/101 (including any declarations and supplemental sheets)	8
(b) description (excluding any sequence listing part of the description, see (f), below)	14
(c) claims	4
(d) abstract	1
(e) drawings (if any)	7
(f) sequence listing part of the description in the form of an **image file** (e.g. PDF)	
Total number of sheets (including the sequence listing part of the description if **filed as an image file**)	34

(g) sequence listing part of the description

- ☐ filed in the form of an **Annex C/ST.25 text file**
- ☐ WILL BE filed separately on physical data carrier(s), on the same day and in the form of an **Annex C/ST.25 text file**

Indicate type and number of physical data carrier(s)

This international application is **accompanied by** the following item(s) *(mark the applicable check-boxes below and indicate in right column the number of each item):*	Number of items
1. ☒ fee calculation sheet	1
2. ☒ original separate power of attorney	1
3. ☐ original general power of attorney	
4. ☐ copy of general power of attorney; reference number:	
5. ☐ priority document(s) identified in Box No. VI as item(s)	
6. ☐ Translation of international application into *(language)*:	
7. ☐ separate indications concerning deposited microorganism or other biological material	
8. ☐ *(only where item (f) is marked in the left column)* copy of the sequence listing in electronic form (Annex C/ST.25 text file) not forming part of the international application but **furnished only for the purposes of international search** under Rule 13*ter*	
9. ☐ *(only where item (f) is marked in the left column)* a statement confirming that "the information recorded in electronic form submitted under Rule 13*ter* is identical to the sequence listing as contained in the international application" as filed via EFS-Web:	
10. ☐ copy of results of earlier search(es) (Rule 12*bis*.1(a))	
11. ☐ other *(specify)*:	

Figure of the drawings which should accompany the abstract:	1	**Language of filing** of the international application:	English

Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

/Jeffrey Van Myers, Reg. No. 27,362/

13-12-2013

For receiving Office use only

1. Date of actual receipt of the purported international application: 13 DEC 2013	2. Drawings: ☐ received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	☐ not received:
5. International Searching Authority (if two or more are competent): ISA / US	6. ☐ Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 269 of 656; IPR2025-00196

Sheet No. 6

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)

The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

Declaration of Inventorship (Rules 4.17(iv) and 51*bis*.1(a)(iv))
for the purposes of the designation of the United States of America:

I hereby declare that I believe I am the original inventor or an original joint inventor of a claimed invention in the application.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/ ..... (if furnishing declaration pursuant to Rule 26*ter*).

I hereby declare that the above-identified international application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Name: Boyd, Christopher L.

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 1309 Bonham Terrace, Austin, TX 78704, USA

Inventor's Signature: Christopher L. Boyd Date: 12-13-2013
(The signature must be that of the inventor, not that of the agent)

Name: James P. Koen

Residence: Round Rock, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2302 Falcon Drive, Round Rock, Texas 78681, USA

Inventor's Signature: James P. Koen Date: 12-13-2013
(The signature must be that of the inventor, not that of the agent)

Name: David Christopher Laguna

Residence: Austin, TX, USA
(city and either US state, if applicable, or country)

Mailing Address: 2011 E. 6th St., Austin, TX 78702, USA

Inventor's Signature: Date: 12/13/2013
(The signature must be that of the inventor, not that of the agent)

☒ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Continuation of Box No. VIII (i) to (v) DECLARATION

*If the space is insufficient in any of Boxes Nos. VIII (i) to (v) to furnish all the information, including in the case where **more than two inventors are to be named** in Box No. VIII (iv), in such case, write "Continuation of Box No. VIII ..." (indicate the item number of the Box) and furnish the information in the same manner as required for the purposes of the Box in which the space was insufficient. If additional space is needed in respect of two or more declarations, a separate continuation box must be used for each such declaration. If this Box is not used, this sheet should not be included in the request.*

Name: Thomas R. Turner
Residence: Georgetown, TX, USA
Mailing Address: 4210 Malaga Dr., Georgetown, TX 78628, USA

Signature:_____ Date: _____

Name: Kenneth D. Swinden
Residence: Hutto, TX, USA
Mailing Address: 132 Mustang Creek North Loop, Hutto, TX 78634, USA

Signature:_____ Date: _____

Name: Mario Conti Garcia
Residence: Austin, T, USA
Mailing Address: 9624 Woody Ridge View, Austin, TX 78730, USA

Signature: _____ Date: Dec. 19 2013

Name: John Charles Tribou
Residence: Austin, TX, USA
Mailing Address: 9109 Middlebie Dr., Austin, TX 78750, USA

Signature:_____ Date: _____

590233

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 01, 2014

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *61/737,200*
FILING DATE: *December 14, 2012*
RELATED PCT APPLICATION NUMBER: *PCT/US13/75126*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US61/737,200*

Certified by

David J. Kappos

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
John	H.	Miller Jr.	Austin	TX	US

Inventor 2 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
James	P.	Koen	Austin	TX	US

Inventor 3 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
John	C.	Tribou	Austin	TX	US

Inventor 4 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Mike		Rainone	Palestine	TX	US

Inventor 5 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Talbot		Presley	Palestine	TX	US

Inventor 6 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Jeffrey	Van	Myers	Driftwood	TX	US

Inventor 7 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Christopher	L	Boyd	Austin	TX	US

Inventor 8 — Remove

Given Name	Middle Name	Family Name	City	State	Country i
Kenneth	D	Tooke	Austin	TX	US

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
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Inventor 9					Remove
Given Name	Middle Name	Family Name	City	State	Country i
David	Christopher Thoma	Laguna	Austin	TX	US

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Title of Invention	Server Immersion Tank System
Attorney Docket Number (if applicable)	JMG001-00

Correspondence Address

Direct all correspondence to (select one):

◉ The address corresponding to Customer Number	○ Firm or Individual Name
Customer Number	44070

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
◉ No.
○ Yes, the name of the U.S. Government agency and the Government contract number are:

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 01/31/2014 OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

Entity Status

Applicant claims small entity status under 37 CFR 1.27

(●) Yes, applicant qualifies for small entity status under 37 CFR 1.27

( ) No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey Van Myers/			Date (YYYY-MM-DD)	2012-12-14
First Name	Jeffrey	Last Name	Myers	Registration Number (If appropriate)	27362

This collection of information is required by 37 CFR 1.51. 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. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours 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, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or paten. Accordingly, pursuant to the requirements of the Act, please be advised that : (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, t o a n other federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

[0001] Goal: substantially constant pressure at all Spray Heads (at bottom of Tank):

[0002] 1. For example, as in Fig. 1, 13 Spray Bars, each having, e.g., 10 Spray Heads (not shown) each of x-sectional area of 1 unit.

[0003] 1.1. Spray Bars 1 & #13 have x-sectional area of 5 units (Optional: 5 Spray Heads of 1 unit area, or 10 Spray Heads of 0.5 unit area).

[0004] 1.2. Spray Bars #2-#12 have x-sectional area of 10 units.

[0005] 1.3. Total x-sectional area of ALL Spray Bars is 120 units.

[0006] 2. Each (x2) Header Manifold has x-sectional area of 60 units, i.e., 1/2 total x-sectional area of all Spray Bars.

[0007] 3. Total x-sectional area of Supply Manifold is 120 units.

[0008] Result: relative pressure drop at Supply-to-Headers minimal; pressure drop at Header-to-Spray Bar is related to position, but inverse relationship wrt 'top' and 'bottom' Headers compensates (subject to frictional losses, slight differences from ideal x-sectional areas, etc.)

[0009] 1. Each Spray Bar has an area-efficient (e.g, ball, gate) shutoff valve at each end, adjacent the connection to the respective Header, all valves being set at system setup/change via an actuating rod manually inserted from above; when both closed, no fluid is delivered to the Spray Heads.

[0010] 2. The Spray Bars are spaced such that a Server may be suspended in each inter-Spray Bar gap, thus forming respective 'flow slots' the flow patterns of which project upward from the Spray Heads, through the inter-Server gaps, and, ultimately into open fluid return channel(s) (e.g., weirs) extending horizontally along the long side(s) of the tank.

[0011] 3. Servers are inserted starting from, e.g., the 'left' end of tank, each suspended in a respective 'Server-slot' between adjacent Spray Bars, with no Server-slot vacancies allowed.

[0012] 4. If any empty Server-slots remain, a full tank width/height flow barrier is inserted into the Server-slot immediately to the 'right' of the 'right-most' active

Server, and the shutoff valves at both ends of all 'idle' Spray Bars are closed, thus forming a stagnant fluid reservoir (with proportional system energy savings).

[0013] Operation: Heat developed on the 'left-facing' major surface of Server #1 is extracted by fluid flow developed in flow-slot #1 by Spray Bar #1, while heat developed on the 'right-facing' major surface is extracted by fluid flow developed in flow-slot #2 by Spray Bar #2. Similarly, heat developed on the 'left-facing' major surface of Server #2 is extracted by fluid flow developed in flow-slot #2 by Spray Bar #2, while heat developed on the 'right-facing' major surface is extracted by fluid flow developed in flow-slot #3 by Spray Bar #3; and so on.

[0014] (Optional) The shutoff valves of the Spray Bar servicing the 'right-most' active 'flow slot' (i.e., between the 'right-most' active Server and the flow barrier) may be partially closed to compensate for the reduced heat being radiated/conducted into this flow slot.

[0015] (Optional) Each shutoff valve is controlled by a respective servo, with the valve-pair of each Spray Bar being controlled by a single Valve Controller in response to temperature sensor(s) suspended in the respective flow-slot somewhat below the 'top' surfaces of the adjacent Servers (to more accurately measure the temperature of the fluid exiting the respective flow-slot before significant mixing with fluid flowing in adjacent flow-slots).

[0016] (Optional) A 'smart' Master Controller monitors a selected set of the flow-slot temp sensors, and coordinates the activities of all active flow-slot Valve Controllers. Due to the huge heat storage capacity of the entire fluid mass and concomitant system temperature lag, determining the energy saving contribution of this Master Controller will be problematic, but nonetheless this function contributes to the end goal of protecting the set of active Servers from sustained excessive heat excursions.

[0017] (Option) The gaps between the 'side' surfaces of each Server and the adjacent side(s) of the Tank may be blocked using appropriately sized flow baffles to facilitate more precise control of fluid flow in each flow-slot.

[0018] (Option) As in Fig. 2, dispose infra-red (IR) shields between adjacent blades to reflect/absorb IR radiation from one blade to the next adjacent blade.

Reflection can be achieved using highly polished metal/mirrored plates, e.g., gold-plated; absorption can be achieved using flat-black or black-anodized plates. Fins can be added to enhance effectiveness. Multiple layers may also be employed with an interlayer gap for vertical flow of the cooling fluid.

[0019] (Option) Also as in Fig. 2, orient the Spray Bar(s) longitudinally with Spray Head(s) aligned with inter-blade gaps. If more than one Spray Head per gap, arrange radially so as that the flow pattern resembles a fan, as in Fig. 3. Individual Spray Heads can be fan-shaped. Spray Heads can be fixed flow rate or variable flow rate or a mixture of both as required for specific applications. Variable flow rate can be adjusted manually or by servo-mechanism.

[0020] (Option) Also as shown in Fig. 3, Supplementary Spray Bars, oriented vertically but with horizontally-oriented 'aimable' Spray Head(s), can be provided to provide flow of cooling fluid directly onto local blade hotspots. Such Supplementary Spray Bars can be supplied either from the primary Spray Bars or via special Supplementary Manifolds disposed either at the bottom/top of the tank or adjacent the tank side(s).

[0021] (Option) Dispose within the tank a bladder to contain the fluid and all related structures. This allows the tank to be modular, bolt-together panels as the fluid sealing is accomplished via the bladder. Over time, as necessary, the bladder can be drained and replaced without any special expense or effort to clean the inside surfaces of the tank. Based on heuristic evaluation, the shape of the tank can be optimized to minimize hot spots, e.g., form a narrow "waist" in the long side walls to develop a Venturi-like region wherein fluid flow is accelerated past a specific horizontal zone of the blades.

[0022] (Option) Spray Head design can be selected to match heat signature of each blade. Spray Heads can be fixed flow rate or variable flow rate or a mixture of both as required for specific applications. Spray Heads can be mounted on short flex-tubes to provide directional distribution for augmented cooling. In some applications, selected Spray Bars/Heads can be supplied from an auxiliary cooling source operating independently of the main fluid source.

[0023] (Option) Attach a solid-state temperature sensor on or adjacent to each Supplemental Spray Head to provide closed-loop control of a servo-controlled valves supplying such Spray Head.

[0024] (Option) Provide servo-mechanical arrangement to dynamically reposition each Supplemental Spray Head. Attach an RFID tag on each Supplemental Spray Head to provide closed-loop control of the repositioning system.

[0025] (Option) Provide array of temperature sensors together with RFID tags on the Supplemental Spray Heads to allow software monitoring of local hot spots, with automatic repositioning of nearby Supplemental Spray Heads to detected hot spots. Same system can provide servo-control of Spray Head supply valves to resolve larger scale heat zone problems.

[0026] (Option) In addition to, or as a supplement to, the static weir fluid return system, provide active fluid extraction. To prevent loss of suction, provide fluid level sensor(s) to reduce or shut off active extraction before the fluid level drops below the suction point.

[0027] (Option) Design blades specifically for fluid immersion, e.g., with no enclosure, no fans. Orient component heatsinks so as to maximize heat transfer to the cooling fluid while minimizing vertical fluid flow resistance/turbulence. Relocate *essential* moving components, e.g., rotating disk devices, from blades to locations adjacent the respective blade but outside the cooling fluid. For multi-server blades (or blades with more than one significant local heat generating component), distribute the major heat generating components vertically/horizontally to spread the heat signature more evenly vertically/horizontally across the entire surface of the blade. When feasible, mount components on both sides of the blade to facilitate heat distribution to the fluid flow on both sides of the blade.

[0028] The cooling system can be any of several known types: vapor compression; water evaporative ("swamp cooler"); dessicant; ground water source; ambient air source, etc. Choice will be based on geographic location,

availability of energy resources, installation/operating costs, etc. Automatic switch-over to alternative systems can be provided to minimize operating cost.

Electronic Acknowledgement Receipt

EFS ID:	14469753
Application Number:	61737200
International Application Number:	
Confirmation Number:	5753
Title of Invention:	Server Immersion Tank System
First Named Inventor/Applicant Name:	John H. Miller, Jr.
Customer Number:	44070
Filer:	Jeffrey Van Myers
Filer Authorized By:	
Attorney Docket Number:	JMG001
Receipt Date:	14-DEC-2012
Filing Date:	
Time Stamp:	11:18:48
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	$125
RAM confirmation Number	9950
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Provisional Cover Sheet (SB16)	JMG001_PCS_121214.pdf	2071456 77a542714667e6c881b56706e80f86e0da8db39c	no	4
Warnings:					
Information:					
2	Specification	JMG001_p_121214.pdf	6854641 e2e8e7cf21f943b5db189d5445fc38c15c6cb78b	no	38
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	28824 a86ba99a0a56136eee5d1490eb28a2ff65e04e7d	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	8954921	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

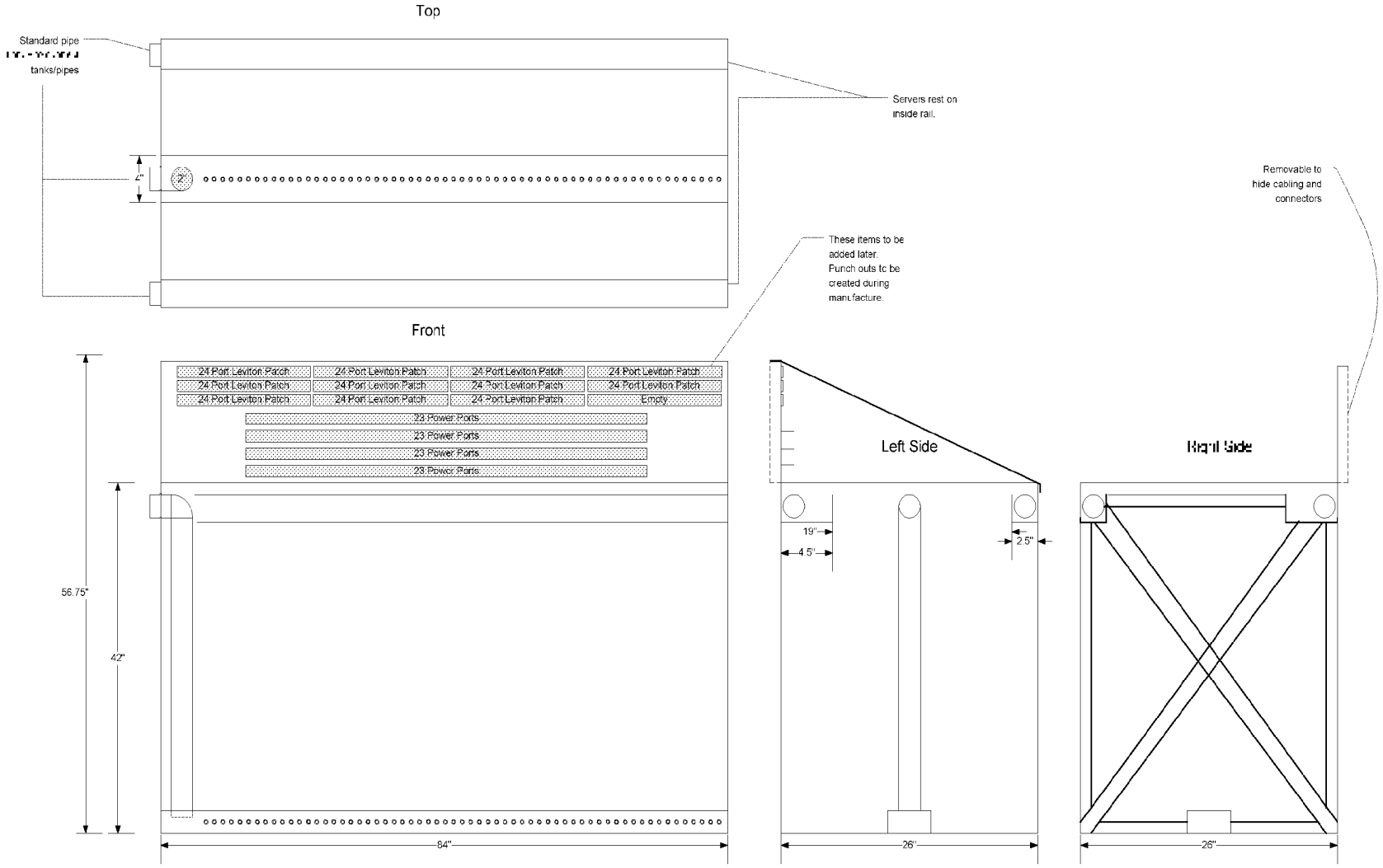
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

(Optional) The shutoff valves of the Spraybar servicing the 'right-most' active 'flow slot' (i.e., between the 'right-most' active Server and the flow barrier) may be partially closed to compensate for the reduced heat being radiated/conducted into this flow slot.

(Optional) Each shutoff valve is controlled by a respective servo, with the valve-pair of each Spraybar being controlled by a single Valve Controller in response to temperature sensor(s) suspended in the respective flow-slot somewhat below the 'top' surfaces of the adjacent Servers (to more accurately measure the temperature of the fluid exiting the respective flow-slot before significant mixing with fluid flowing in adjacent flow-slots).

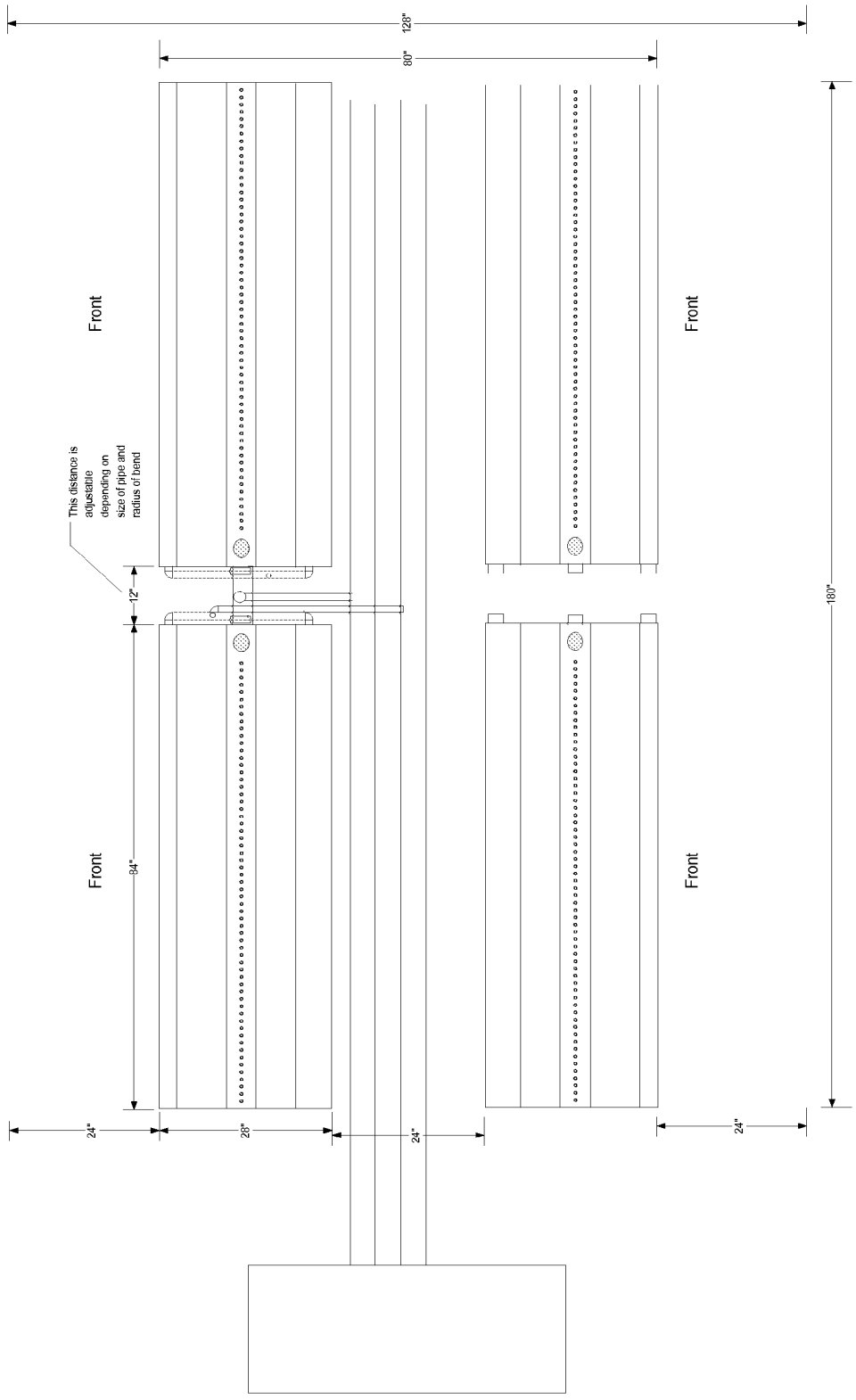
(Optional) A 'smart' Master Controller monitors a selected set of the flow-slot temp sensors, and coordinates the activities of all active flow-slot Valve Controllers. Due to the huge heat storage capacity of the entire fluid mass and concomitant system temperature lag, determining the energy saving contribution of this Master Controller will be problematic, but nonetheless this function contributes to the end goal of protecting the set of active Servers from sustained excessive heat excursions.

(Option) The gaps between the 'side' surfaces of each Server and the adjacent side(s) of the Tank may be blocked using appropriately sized flow baffles to facilitate more precise control of fluid flow in each flow-slot.



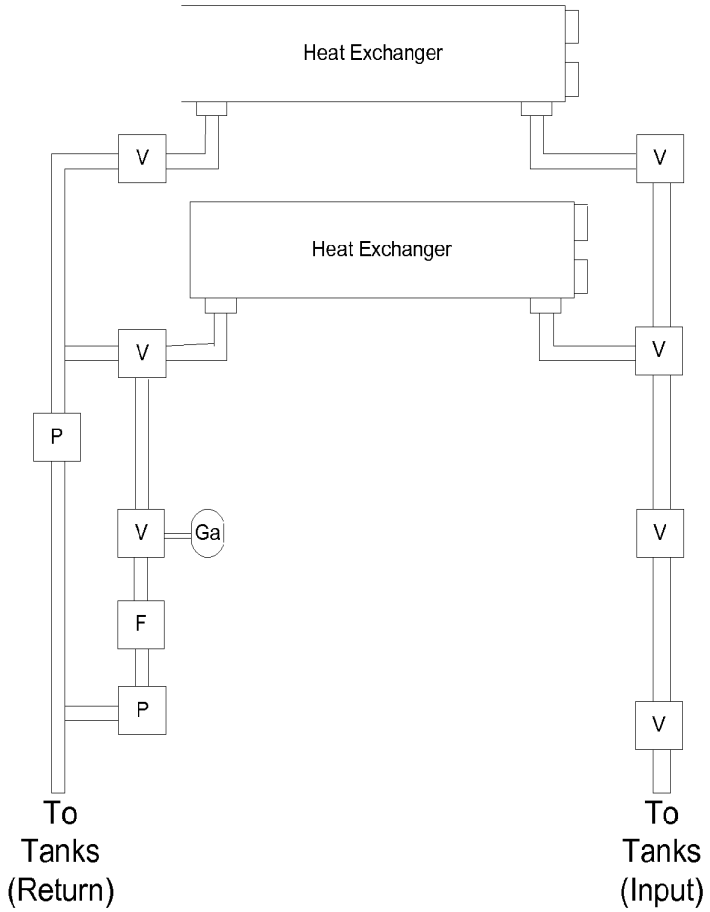
Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 285 of 656; IPR2025-00196

Top
2"
Front
24 Port Levitor Patch
24 Port Levitor Patch
24 Port Levitor Patch
8 Power Ports
8 Power Ports
8 Power Ports
25"
Left Side
2.5"
19"
4.5"
26"
Right Side
26"

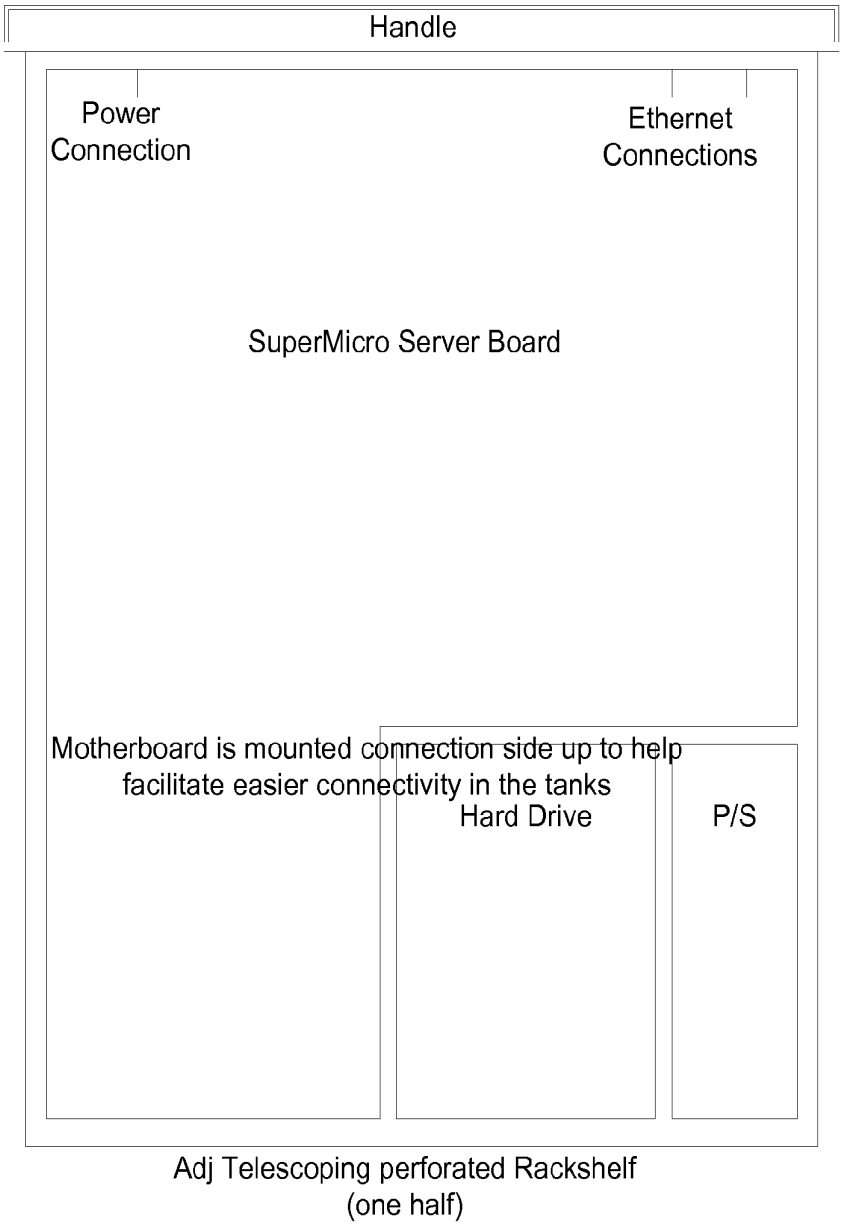

128"
80"
Front
Front
This distance is adjustable depending on size of pipe and radius of bend
12"
84"
180"
Front
Front
24"
20"
24"
24"

Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front
Front

Right Side
26"
Left Side
2.5"
19"
4.5"
26"
Front
24 Port Leviton Patch
24 Port Leviton Patch
24 Port Leviton Patch
8 Power Ports
8 Power Ports
8 Power Ports
26"
25"



Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 290 of 656; IPR2025-00196



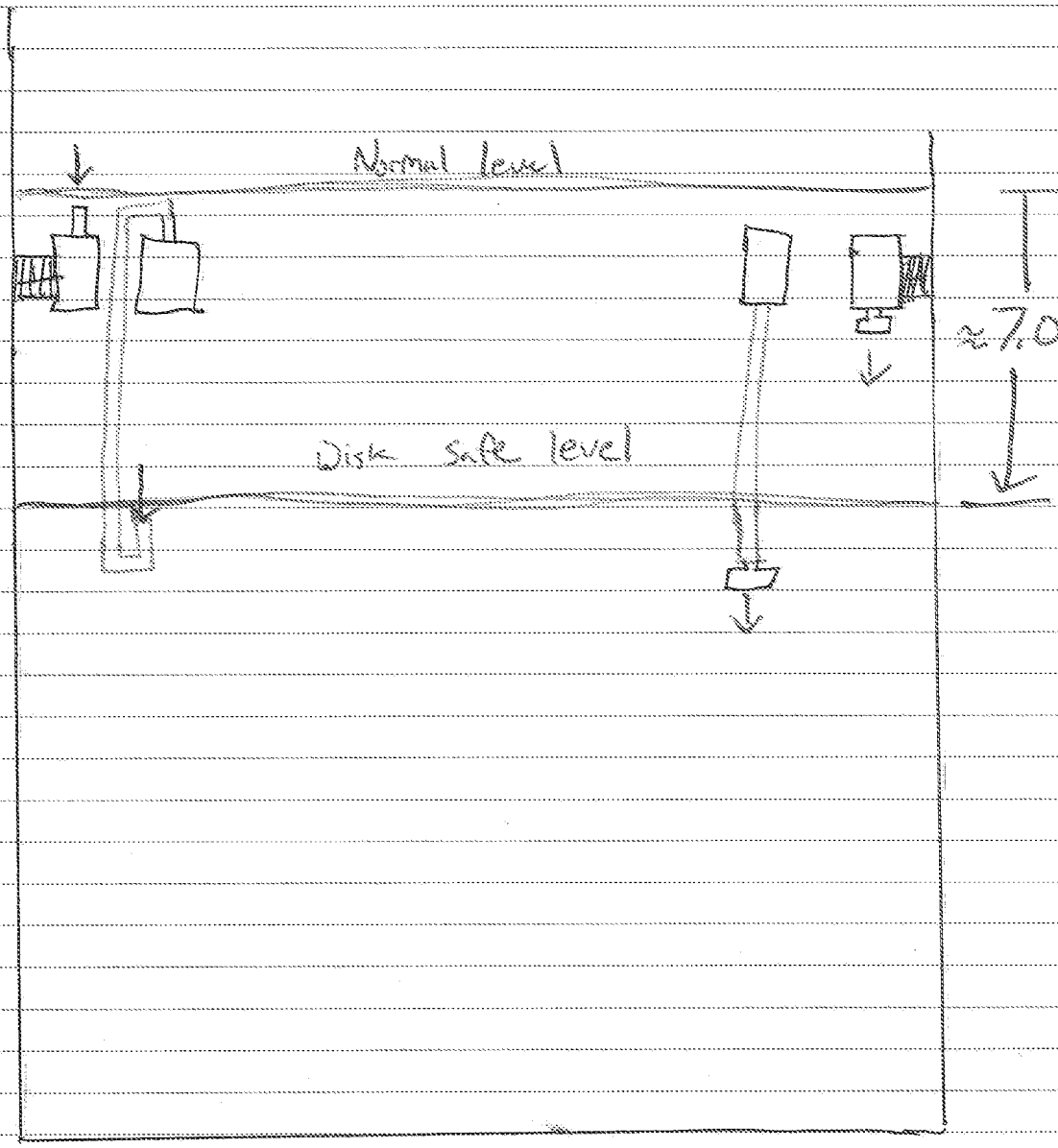
Petitioner Green Revolution Cooling, Inc., Ex-1002
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From Page No. ____ 10-2-2012

Dropped O.I level for sensors w/ unsealed disks.

O.I is about 7" lower and nozzles are lasered on threaded tube to sit a few inches below the oil level.

Intake is extended via tube/pipe to sit just below oil level with intake pointing up.



To Page No. ____

Witnessed & Understood by me,

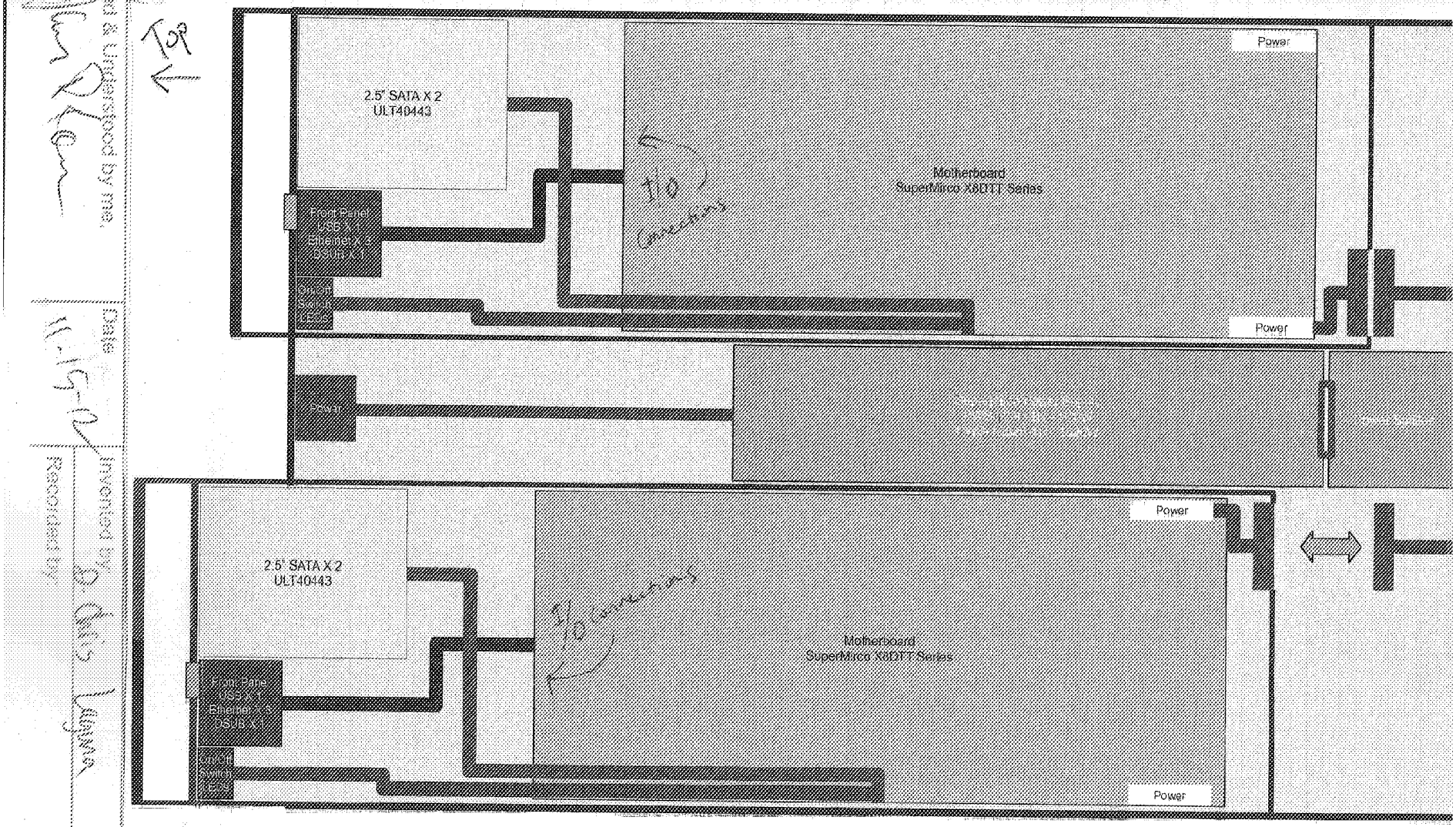
Date 11-15-12

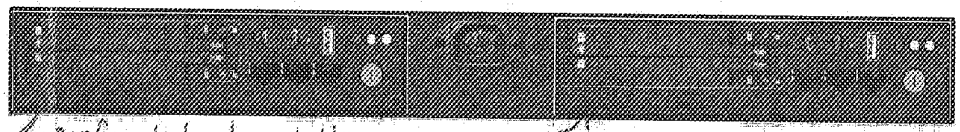
Invented by: D. Chris Laguna

Recorded by:

Date 10/2/12

Midas Green Tech – 1U Low Energy High Density Rack (LEHDR)





LEHDR 1U Style 1

Support for: (2) 16.7" x 7.0" Motherboard*, (1) 20.0" x 3.0" x 1.65" Power Suppl
(4) 2.5" Hard Drives

* = Maximum component dimmensions

Overall Dimmensions: 17.5" x 30" x 1.75"

Sled (Node) Dimmensions: (without handle) 7.5" x 21.75" x 1.7"

Chris Laguna – Midas Green Tech – July 2012

Read & Understood by me

Date 11-15-12

Invented by Chris Laguna

Recorded by

Date 11/15/12

Petitioner Green Revolution Cooling, Inc., Ex-1002
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SLED Assembly

SLED = Super Low Energy Device, Midas Green Tech's oil-ready and optimized server.

All steps should be done utilizing an ESD safe environment with the proper tools.

Planning

- Determine type of SLED from customer order details
- Single Server
    - Dual Server
    - Triple Server
    - Quad Server
    - Other

- Determine Form Factor
    - 1U
    - 2U
    - 3U
    - 4U
    - Other

- Establish Server(s) Specifications
- Select Processor(s)
    - Select Motherboard(s)
    - Select Power Supply(s)
    - Select Heat Sink(s)
    - Select Memory Configuration
    - Select Disk Configuration
    - Select Peripherals
    - Select Chassis
    - Select necessary cables, adapters, I/O ports, brackets, mounts, screws and materials

- Verify and Finalize SLED Layout
- Use component templates to plan layout with I/O ports facing the front (top) of the SLED
- Verify tolerances are in place for cabling and assembly
- Confirm component compatibility
- Finalize layout

- Order/Obtain Parts

Fabrication

- Clean and inspect chassis for defects
- Remove any unnecessary chassis components (fans, mounts, etc.)
- Use component templates to mark necessary modifications to chassis. Modifications can be the addition of mounting points, removal of chassis components, additional ventilation holes and brackets to secure server components
- Modify chassis for server components

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- Modify chassis for server components

- Remove any sharp corners or edges
- Clean and ensure modified chassis is clean and dry
- Verify chassis modifications with server component templates
- Dry-fit server components to verify clearances and tolerances

Assembly

- Install motherboard mounts and motherboard verifying proper mount alignment and making note of cable connection points
- Remove motherboard and return to protective sleeve
- Install power supply and power distribution (if applicable) components
- Make note of routing of power cabling, make every attempt to conceal power cables under motherboard mounts
- Install storage components, and run necessary cabling
- Install I/O cabling, including power switches, LED indicators, LAN, video and USB connections if necessary
- Before installing in chassis, install the processor and heat sink into the motherboard using indium foil instead of thermal grease. Any motherboard or peripheral components with a removable heat sink will need any thermal greases, compounds or tape removed and surfaces cleaned
- Mount motherboard on mounts and secure with the proper screws taking caution to the cabling being ran below the motherboard
- Connect all cabling
- Double check clearances and fit of components
- Install memory and any peripherals, including hard drives
- Clean up cabling and secure any loose cables and connections
- Finalize chassis assembly with mounting brackets and handles

Initial Testing

- Temporarily install fans on all processors
- Double check all cables are properly installed and secure, all components are installed and secured
- Connect monitor, keyboard and USB/CD/DVD-ROM containing testing software
- Connect power and power on the server
- Verify in server BIOS that all peripherals are recognized and working

If server does not power on, utilize the motherboard manual for troubleshooting

- Run memtest for at least 5 minutes to do a quick check of the installed memory
- Connect Ethernet
- Install OS of choice to verify proper server functionality including RAIDs, Networking, etc.

Burn-in and Stress Testing

- Only begin burn-in once testing is complete and you are satisfied with the function of the server
- With the server still out of the oil and fans installed continue:
- Boot form stress-test CD (stresslinux.org or similar)
- Run stress utilities at 50% utilization for at least 2 hours. Run at 100% utilization for 2 more
- Verify server passes stress test by analyzing software logs and reports

If a component fails, isolate the component, remove it and replace it, repeat the testing above

- Finalize server prep for oil submersion, removing fans and finishing chassis assembly
- Lift server so that it is oriented vertically as it will be installed in the tanks, check for loose components
- Submerge server in testing tank
- Restart the stress test and allow it to run at 50% utilization for another 2 hours, 100% utilization for at least 2 hours and time permitting, overnight at 50% utilization
- Analyze for failures and replace any failed components

Release to production

- Remove any testing equipment and media
- Format hard drives and run a DOD wipe to clear any stored data.
- Install OS and setup as indicated in order details

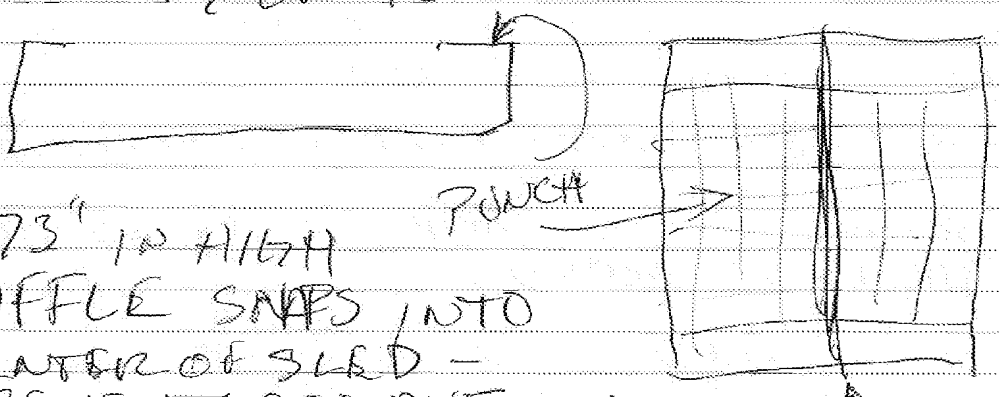
TITLE IMPROVED SLED PACKAGE Project No. Book No. 1

From Page No.

ISSUES WITH CURRENT SLED —
- LONG ASSEMBLY TIME
- NO PROTECTION AGAINST SHORTS WHILE INSERTING OR REMOVING SYSTEMS FROM TANK
- POSSIBLE POOR COOLANT FLOW DUE TO OPEN DESIGN

NEW SLED BASE
USE STAMPED STEEL FOR BOTTOM — PUNCH 5MM X 5MM (MAYBE SMALLER) ROUND HOLES IN A MATRIX ON BOTTOM — ALLOWS USE OF STAB-LOCKING NYLON MOUNTS FOR PC BOARDS

SIDES OF SLED COME UP 1.75", FOLD OVER — PUNCHED 1 ROW ON FOLDOVER FOR SNAP MOUNTING OF TOP



1.73" IN HIGH BAFFLE SNAPS INTO CENTER OF SLED — PREVENTS COOLANT MIXING BETWEEN BOARDS ON SLED.

SLED TOP IS MOLDED PLASTIC SHEET WITH SMALL POSTS ON EDGE TO INTERLOCK WITH SLED BASE EDGE. ALSO INCLUDES MOUNTPOINTS FOR SEVERAL SMALL PUSHBUTTON SWITCHES (POWER, RESET, ETC).

To Page No. 2

Explained & Understood by me.	Date	Invented by:	Date
Chris Boyd	3-14-12	CHRIS BOYD	3-12-2012
		Recorded by: CHRIS BOYD	

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 300 of 656; IPR2025-00196

Project No. _____
Book No. _____ TITLE IMPROVED SLED PACKAGE

Page No. 1

ASSEMBLY —

TECH PRINTS OUT MOUNTING TEMPLATE FOR MOTHERBOARD AND ALIGNS THEM IN UPPER RIGHT & LEFT OF SLED BASE.

TECH PUSHES STAB-LOCK POSTS INTO SLED BASE AT POINTS NOTED ON TEMPLATE

TECH INSTALLS CPU, RAM, HEATSINKS, INDIUM FOIL, ETC TO PREP BOARD FOR IMMERSION SERVICE

TECH PLACES MOTHERBOARD OVER TOP OF STAB-LOCK POSTS & PUSHES INTO PLACE

TECH INSTALLS BAFFLE - BAFFLE HAS MOLDED IN STAB-LOCKS AND CABLE CLIPS/TIE POINTS

TECH SNAPS BOOT DRIVE INTO MOLDED CARRIER WITH STAB LOCKS - SNAPS INTO SLED

TECH MOUNTS PSU ONTO SLED W STAB-LOCKING BRACKETS

TECH CONNECTS POWER, DISK, POWER SWITCH, RESET SWITCH CABLES TO BOARD

TECH SNAPS SLED TOP ONTO SLED

ASSEMBLY COMPLETE, READY FOR TEST / BURN IN.

To Page No. V

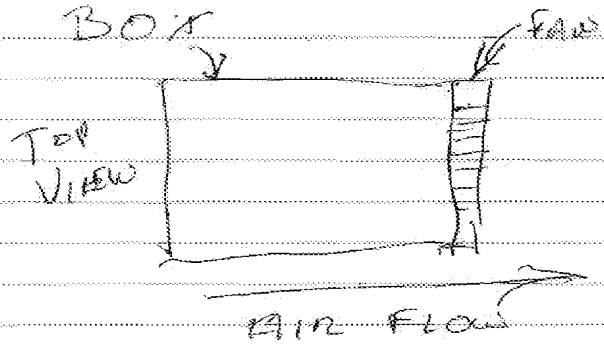
Read & Understood by me.	Date	Invented by:	Date
[signature]	3-14-12	Recorded by:	

Project No. _____

TITLE COOLING SYSTEM FOR IMMERSED SERVERS Book No. _____

From Page No. 1

MANUFACTURERS OF MOTHERBOARDS, SERVERS, ETC. ARE CURRENTLY RELUCTANT TO WARRANTY BOARDS IMMERSED IN MINERAL OIL. TO MINIMIZE OUR RISK DUE TO "INFANT MORTALITY," WE CAN BURN IN + TEST SYSTEMS DESTINED FOR IMMERSION IN AIR —

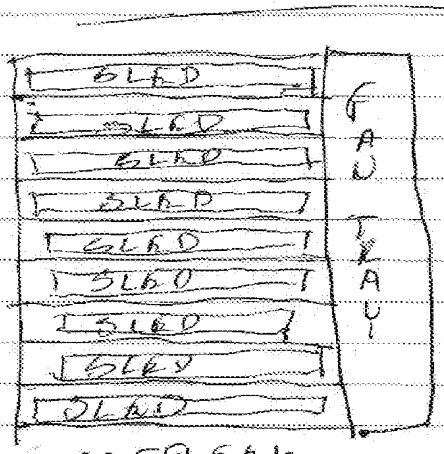


SLIDE FAN TRAY INTO BOX.

TURN ON FAN TRAY TO PULL AIR THROUGH BOX, OVER BOARDS OTHER COMPONENTS

RUN BURN-IN TESTS.

MULTIPLE BOARDS/SLEDS CAN BE TESTED @ SAME TIME



SOLID BAFFLES TO SIDES, TOP, BOTTOM TO FORCE COOLING AIR OVER BOARDS UNDER TEST

ADVANTAGES —

- SYSTEMS UNDER TEST ARE EASILY ACCESSED & HANDLED BY TECHS
- NO "VOIDED WARRANTY" EXCUSE FROM BOARD MANUFACTURERS FOR EARLY FAILURES
- ALLOWS US TO USE A VICE FOR SYSTEM ASSEMBLY
- NO OILY PARTS SHIPPED TO US TRIGGERING SECURITY INSPECTIONS OF PACKAGE

To Page No. 2

Witnessed & Understood by me,	Date	Invented by: CHRIS BOYD	Date
	3-14-12	Recorded by: CHRIS BOYD	3-12-2012

Project No. _____

Book No. _____ TITLE Green Notes

From Page No. X

3-12-2012 Store Rain Water Runoff for use in cooling towers

3-3-2012 - Deploy all systems @ 208/240V 2-3% Power Savings for free

To Page No. _____

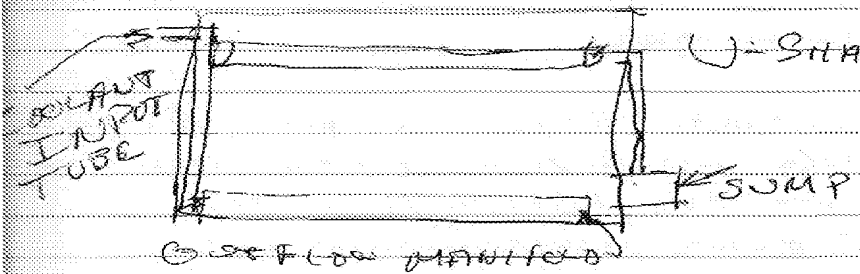
Witnessed & Understood by me,

Date 3-14-12

Invented by:

Recorded by:

Date



GOAL - IMPROVE FORCED CONVECTION COOLING EFFIENCY BY AVOIDING MIXING OF COOLANT.

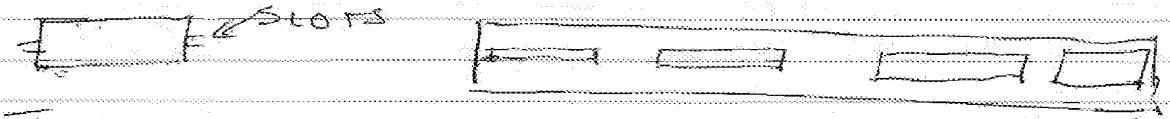
COLD FLUID FLOWS INTO TANK VIA TUBE CONNECTED TO A SLOTTED MANIFOLD. COLD FLUID DISPLACES WARM FROM BELOW. WARM FLUID OVERFLOWS U-SHAPED DRAINS ON ~~BOTH~~ BOTH SIDES OF TANK WALL.

(NOTE - A SPINE ON THE SIDE OF THE U-TUBE COULD ACT AS A CONVENIENT MOUNT POINT FOR SERVER EARS.)


U-TUBE PROFILE

U-TUBES DRAIN INTO A CLOSED SUMP CONTAINER FOR RECIRCULATION THRU HEAT EXCHANGER. NOTE THAT THE PUMP CANNOT DRAIN THE TANK.

POSSIBLE SLOTTED OUTFLOW MANIFOLD PROFILE:



I SUSPECT SLOTS WOULD NEED TO BE NARROW ON THE END CLOSEST TO THE POINT WHERE COOLANT IS INJECTED, AND GET PROGRESSIVELY WIDER TO ~~ACCOUNT~~ ACCOUNT FOR PRESSURE GETTING LOWER AS COOLANT FLOWS DOWN THE ~~TUBE~~ TUBE.

-COULD ALSO USE A SERIES OF PROGRESSIVELY LARGER ROUND HOLES.

To Page No. _____

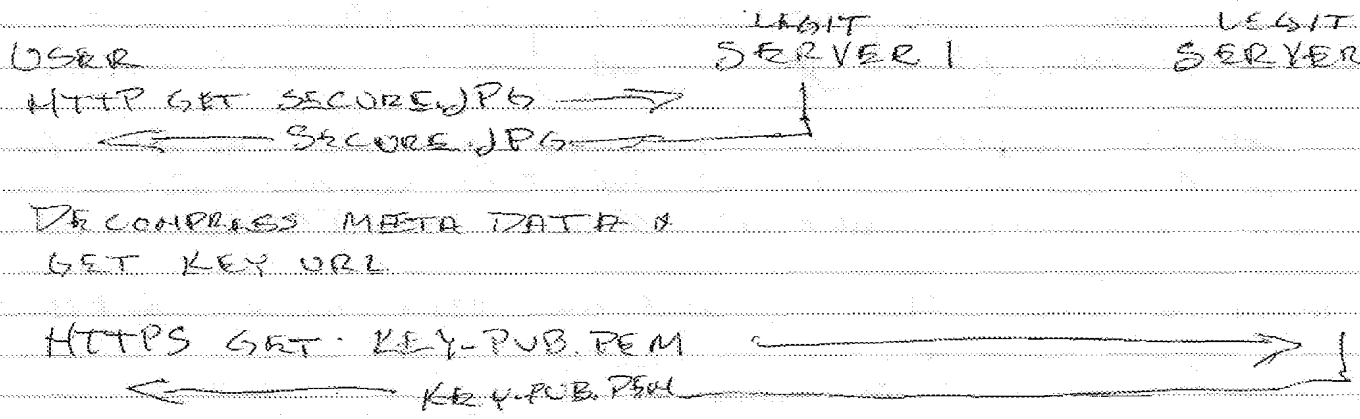
Witnessed & Understood by me,	Date	Invented by:	Date
[signature]	3-14-12	CHRIS BOYD	3-2-2012
		Recorded by: CHRIS BOYD	

Project No. _____
Book No. _____
From Page No. X

TITLE METHOD FOR AUTHENTICATING GRAPHICS SERVED BY A [illegible] OTHER SERVER TO PREVENT PHISHING, TRADEMARK [illegible]

— EXTEND CURRENT STANDARD OPEN FORMATS LIKE JPEG, JPEG2000, OR PNG TO INCLUDE META DATA ABOUT THE SERVER(S) THAT ARE AUTHORIZED TO SERVE THE GRAPHIC. THIS COULD INCLUDE, BUT IS NOT LIMITED TO:
IP SUBNET OR ADDRESS
PTR RECORD
REFERRING URL
REFERRING DOMAIN NAME
HTTPS URL WITH GRAPHIC OWNER'S PUBLIC KEY
THIS DATA IS COMPRESSED & CRYPTO SIGNED WITH THE GRAPHIC OWNER'S ~~PUBLIC KEY~~ PRIVATE KEY.

NORMAL TRANSACTION WORKS SOMETHING LIKE THIS



To Page No. _____

Witnessed & Understood by me.	Date	Invented by:	Date
	11-15-12	CHRIS BOYD	6-6-2012
		Recorded by: CHRIS BOYD	

THIS SCHEME HELPS PREVENT THINGS LIKE PHISHING —

USER	PHISH SERVER	LEGIT SERVER 2

HTTP GET STOLEN.JPG →
← STOLEN.JPG

DECRYPT META DATA & GET KEY URL

HTTPS GET KEY-PUB.PEM →
← KEY-PUB.PEM

META DATA MISMATCH! ALERT USER TO PROBABLE PHISH!

FOR BEST SECURITY, KEY URL SHOULD BE ON A DNSSEC SIGNED DOMAIN NAME.

NEEDS WIDE SUPPORT IN BROWSERS, EMAIL CLIENTS GRAPHICS ARTS PACKAGES, ETC.

POSSIBLE EXTENSION? DEVELOP A WAY FOR A DOMAIN NAME TO SIGNAL THEY ALWAYS USE THIS SCHEME — MAYBE AN ADDITIONAL TXT RECORD IN DNS?

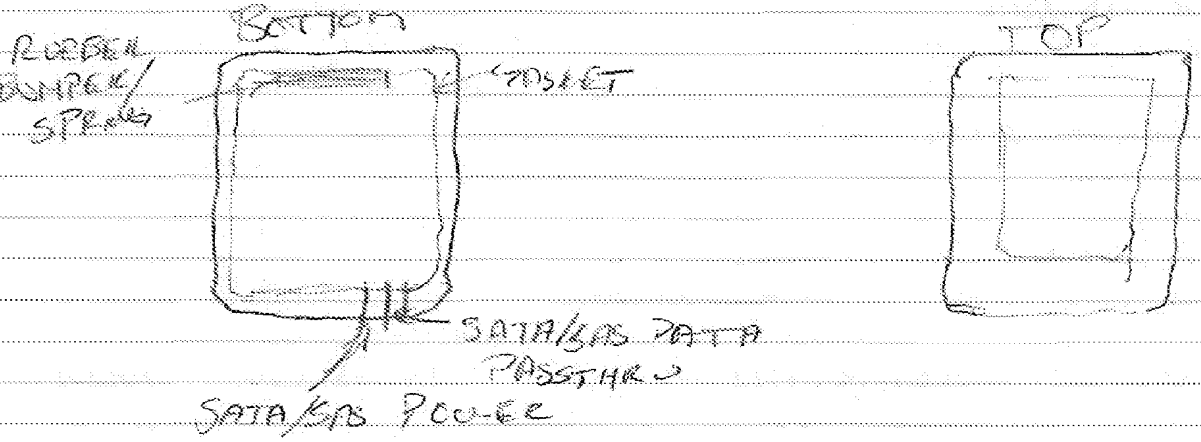
To Page No. 8

Witnessed & Understood by me, Date 11-15-17 Invented by: Chris Boyd Date 5-6-202
Recorded by: Chris Boyd

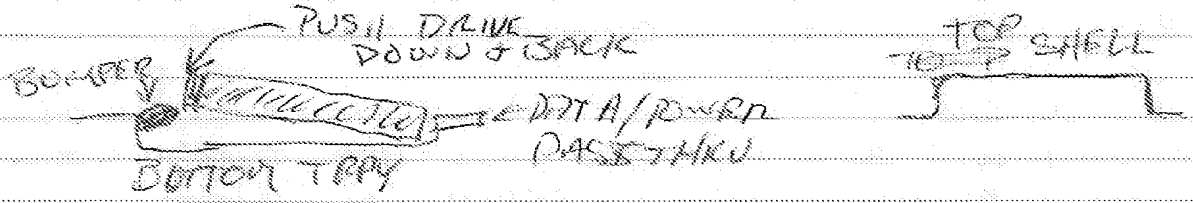
Project No.
Book No.
TITLE DISK DRIVE PACKAGING FOR IMMERSION

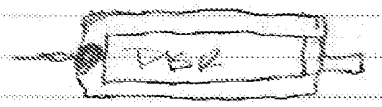
From Page No. X

SNAPPED ALUMINUM ENCLOSURE - CLAMSHELLS TOGETHER TO SEAL DISK DRIVE - WITH OIL RESISTANT GASKET



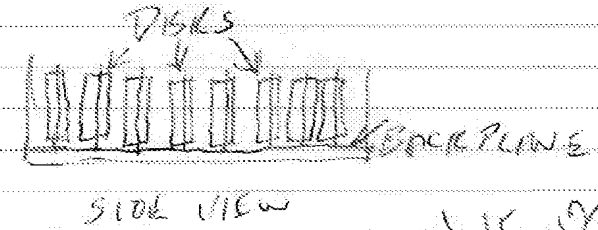
DISK DRIVE SNAPS INTO PLACE & IS SECURED BY DATA/POWER CONNECTORS & RUBBER BUMPER

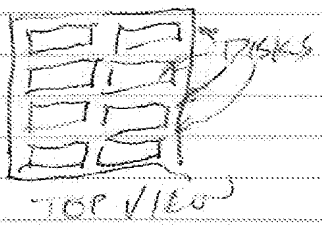




ASSEMBLED CASE

ASSEMBLED DISK CASES CAN BE MOUNTED EASILY IN A DISK ARRAY CABINET SIMILAR TO A BACKBLAZE OR EQUIVALENT.





To Page No. 9

Witnessed & Understood by me,

Invented by: CHRIS BOYD
Recorded by: CHRIS BOYD

Date: 6-21-2011

TITLE: DISC DRIVE PACKAGING FOR ARRAY

Project No.

Book No.

From Page No. 8

IMMERSION

EDGES OF DRIVE CASE ARE USED AS MOUNTING RAIL GUIDES TO HOLD DRIVE IN THE ARRAY.

CABINETS CAN BE LIFTED OUT PART WAY FOR DRIVE REPLACEMENT OR MAINTENANCE, LEAVING CONTROLLER SUBMERGED FOR COOLING.

CAN BE RETROFITTED TO RACK BLADE CABINET.

To Page No.

Witnessed & Understood by me.	Date	Invented by:	Date
	11-15-12	CHRIS BOYD	3-21-2002
		Recorded by: CHRIS BOYD	

10 Project No. _____
Book No. _____ TITLE IR SENSING FOR TANKS

From Page No. X

USE MULTIPLE IR SENSORS, POSSIBLY WITH WIDE ANGLE LENSES INSIDE TANK TO MONITOR COOLANT SURFACE TEMPERATURE - OR, USE A DIGITAL IMAGING SENSOR - POSSIBLY JUST A MODIFIED DIGITAL CAMERA SENSOR - WITH IMAGE PROCESSING SOFTWARE TO DETECT & COMPENSATE FOR TANK TEMPS & POSSIBLE HOT SPOTS

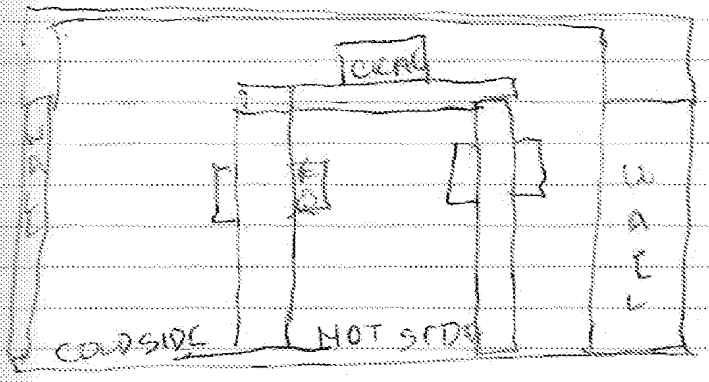
EITHER APPROACH COULD BE ADVANTAGEOUS, COMPARED TO SIMPLE TEMPERATURE SENSORS, FOR ADJUSTING COOLANT FLOW RATES, IR ENERGY SHOULD RADIATE THROUGH THE OIL/COOLANT FROM HOT COMPONENTS BEFORE WARMED COOLANT CONVECTS OR IS FORCED TO TOP TO TRIGGER SIMPLE TEMP SENSOR.

To Page No. _____

Witnessed & Understood by me.	Date	Invented by: CHRIS BOYD	Date
	11-15-12	Recorded by: CHRIS BOYD	12/7/12

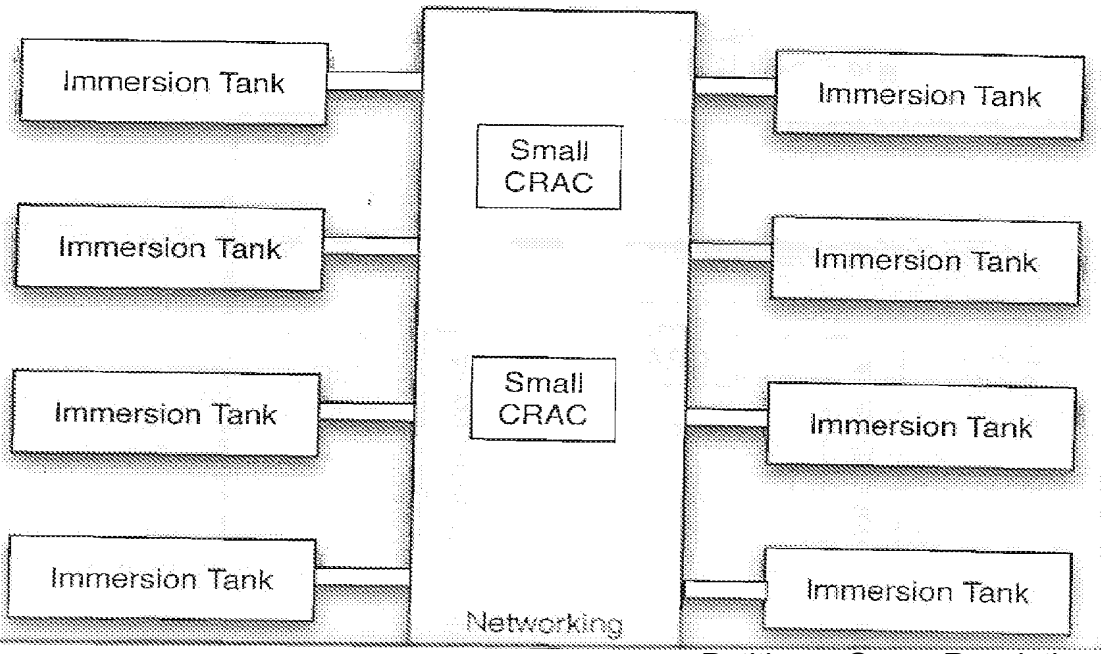
SINCE NOT ALL EQUIPMENT CAN BE IMMERSION COOLED, WE NEED TO PROVIDE AN EFFICIENT METHOD TO COOL THIS GEAR.

USING A SYSTEM TO DO TOTAL CONTAINMENT OF HOT & COLD AIR SHOULD PROVIDE AN ACCEPTABLY LOW PUE, EVEN IN CASES WHERE NO OUTSIDE AIR CAN BE USED.

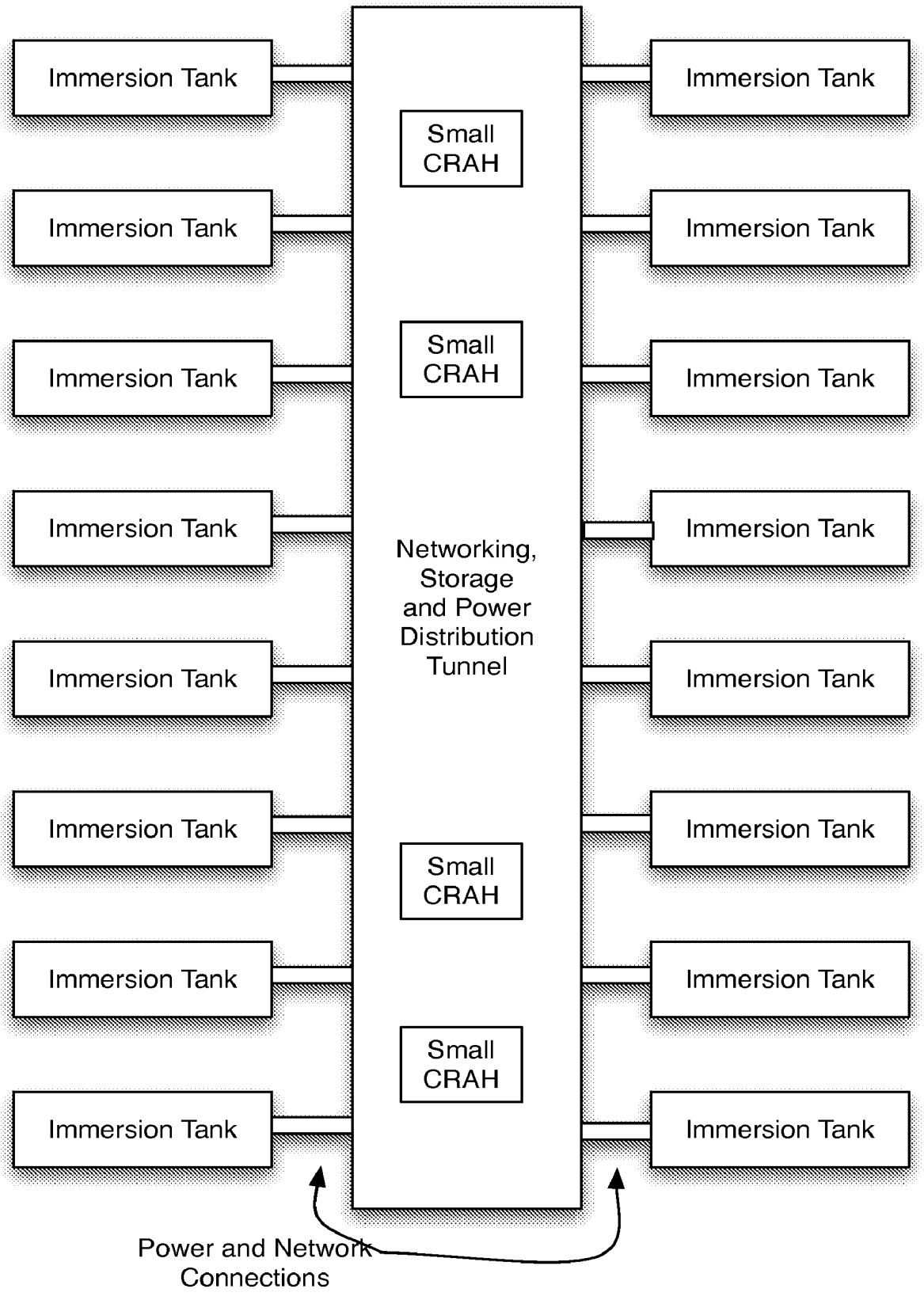


AIRFLOW → ← AIRFLOW

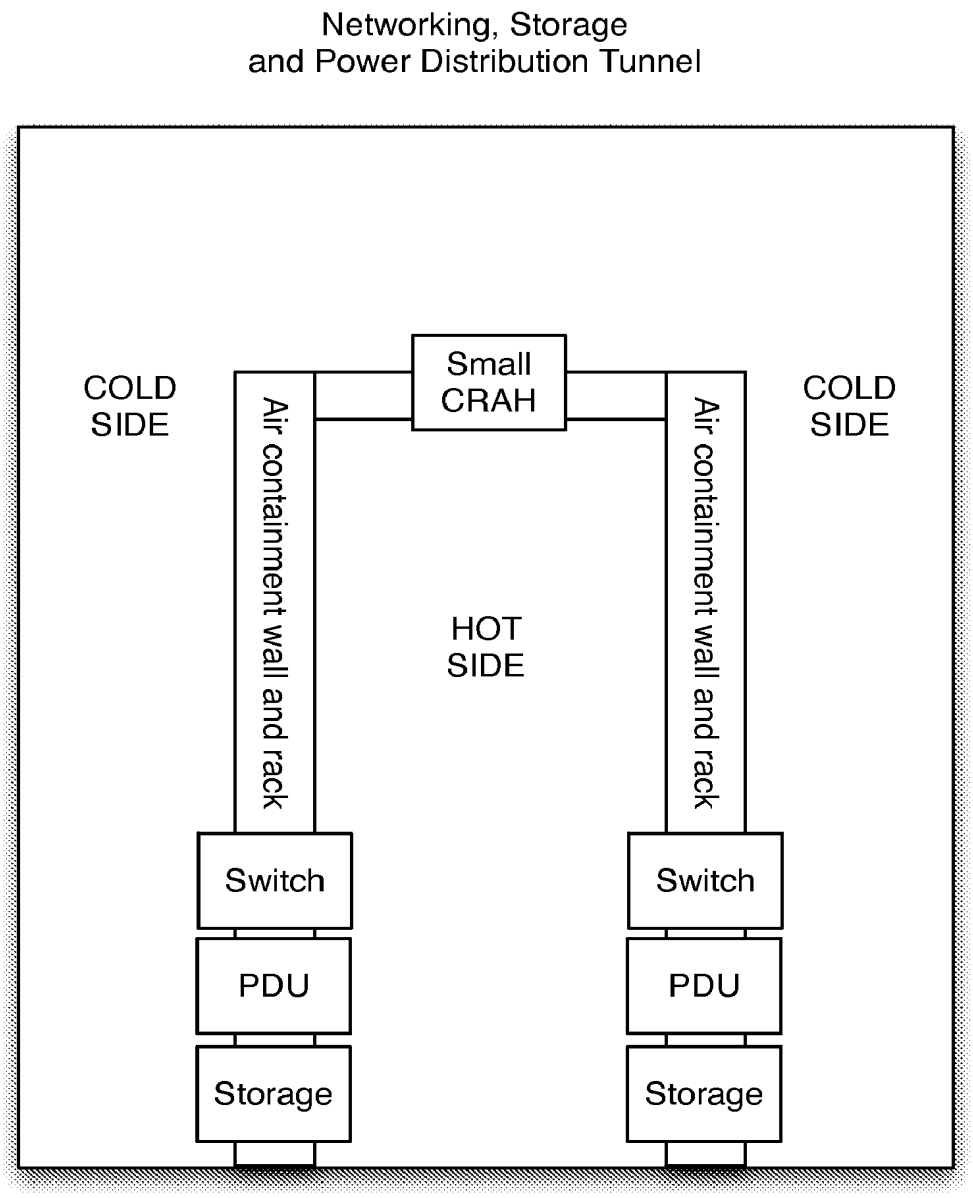
Top View



Top View


Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Immersion Tank
Small CRAH
Small CRAH
Small CRAH
Networking, Storage and Power Distribution Tunnel
Power and Network Connections

End View

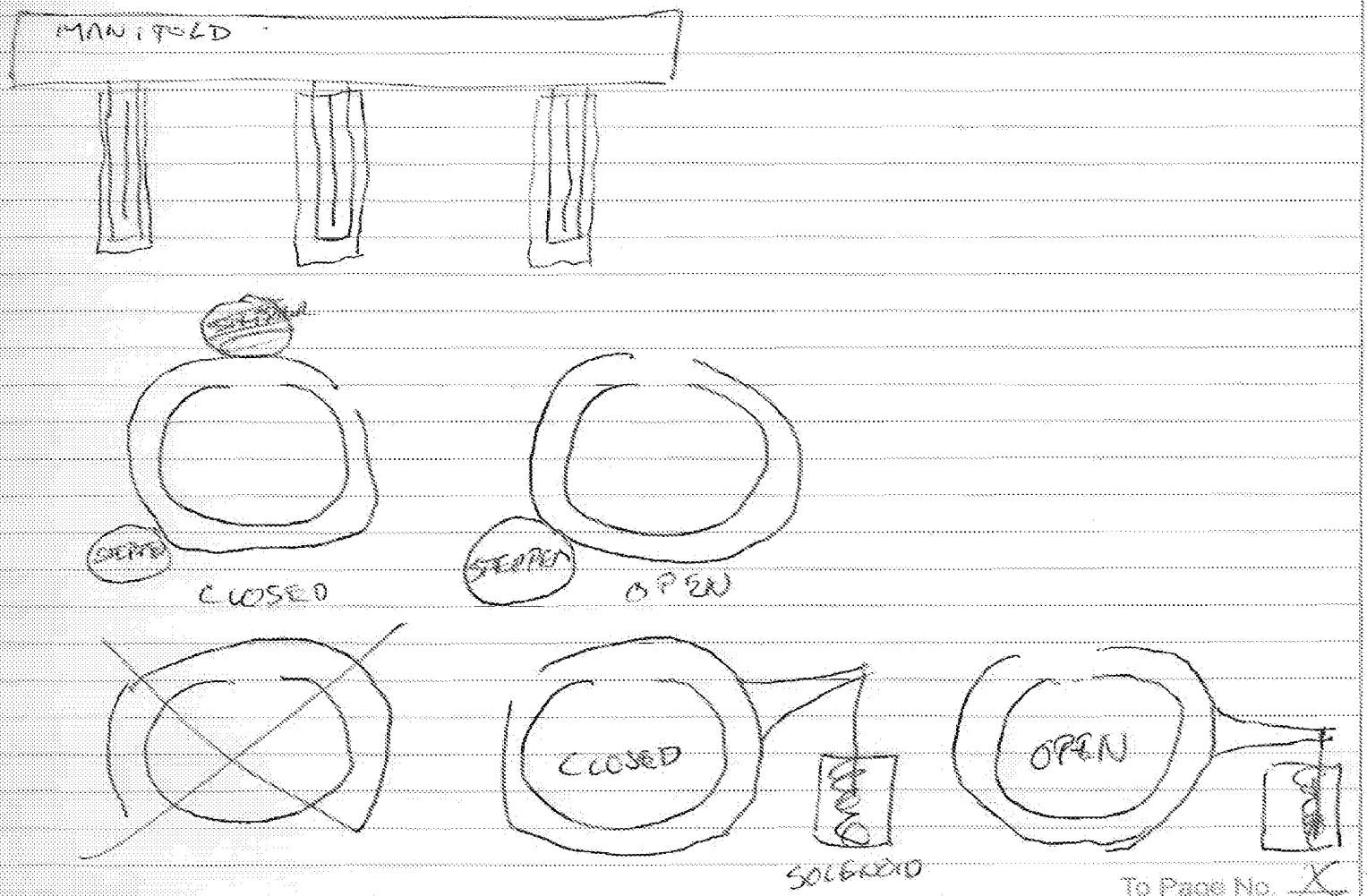

Networking, Storage
and Power Distribution Tunnel
COLD
SIDE
Small
CRAH
COLD
SIDE
Air containment wall and rack
Air containment wall and rack
HOT
SIDE
Switch
Switch
PDU
PDU
Storage
Storage

Project No. _____
Book No. _____ TITLE Flow Metering System

Page No. X

ONE WAY TO ADJUST COOLANT FLOW INTO TANK —

TWO TUBES — ONE LARGER & ONE SMALLER, AND SIZED SUCH THEY FIT ONE INSIDE THE OTHER. CUT SLOTS IN EACH TUBE. FEED COOLANT INTO SMALLER TUBE, AND ROTATE OUTER TUBE TO EXPOSE WIDER OR NARROWER SLOT FOR COOLANT TO FLOW OUT OF. ROTATE TUBE WITH STEPPER OR SOLENOID ACTING ON ARM ATTACHED TO TUBE. STEPPER PROBABLY BEST FOR DIGITAL CONTROL. SOLENOID MAYBE BEST FOR ANALOG CONTROL.



To Page No. X

Read & Understood by me.

Date 11-15-12

Invented by: CHRIS BOYD

Recorded by: CHRIS BOYD

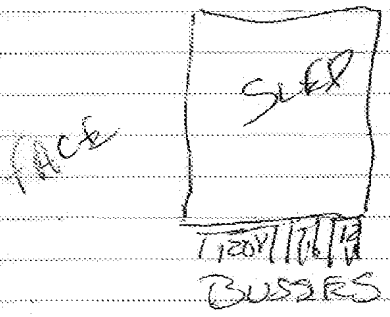
Date 10-18-2012

TITLE ENHANCED SLED

Project No.

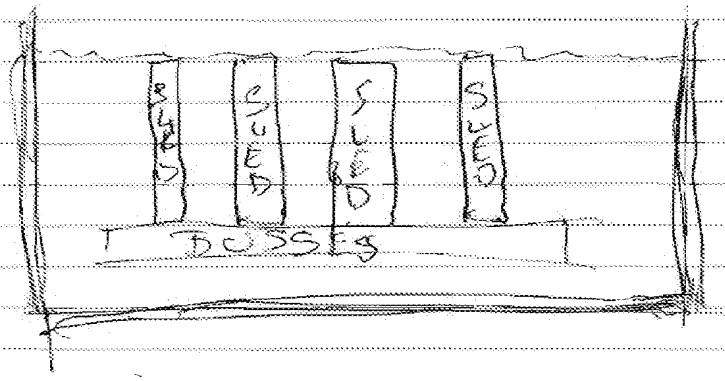
Book No.

From Page No. 1



ALTERNATE MEANS OF POWER DISTRIBUTION TO SLEDs — INSTALL A POWER BUSS IN TH TO DISTRIBUTE POWER TO SLED BOARDS.

SLEDS SNAP INTO POWER CONNECTO TO DRAW 120VAC (CONVENTIONAL PS OR DIRECT 5VDC/12VDC POWER DIRECTLY TO THE MOTHERBOARD.



To Page No. —

Witnessed & Understood by me)	Date	Invented by:	Date
C Boyd	10-26-2012	Ken Tooke	10/24/2012
		Recorded by: Chris Boyd	

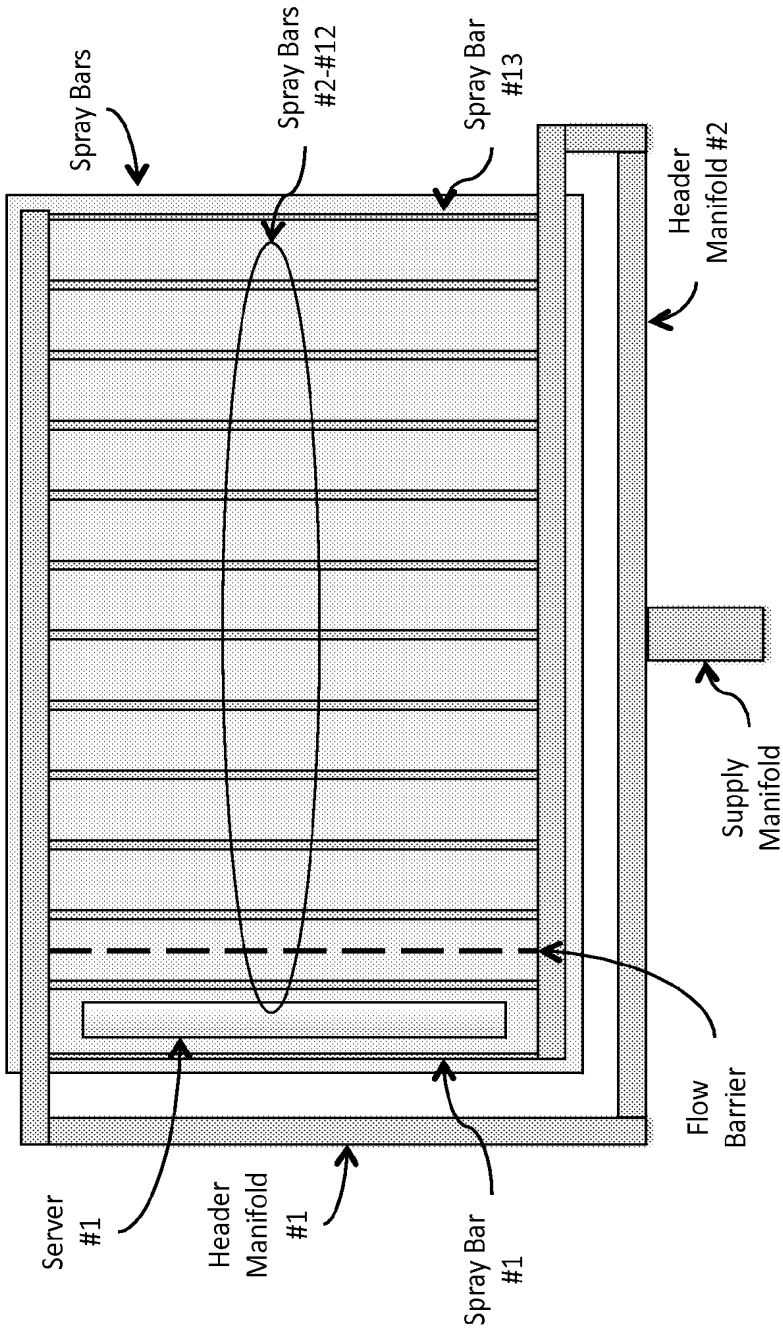

Spray Bars
Spray Bars #2-#12
Spray Bar #13
Header Manifold #2
Supply Manifold
Flow Barrier
Server #1
Header Manifold #1
Spray Bar #1

Fig. 1

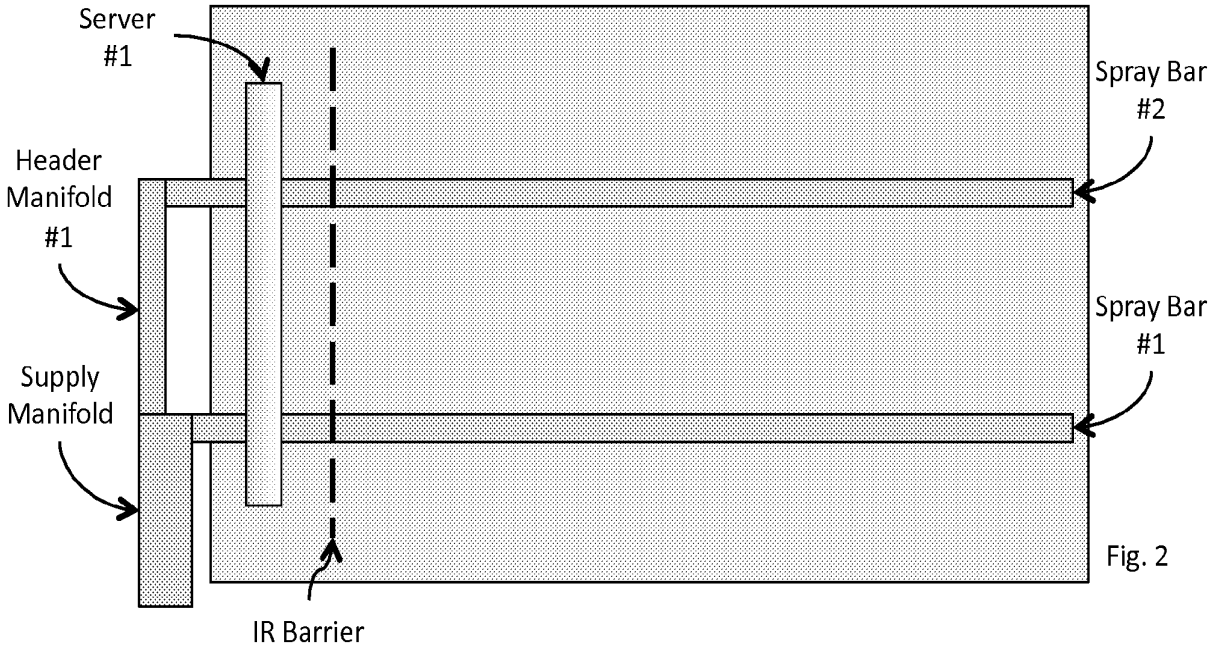


Fig. 2

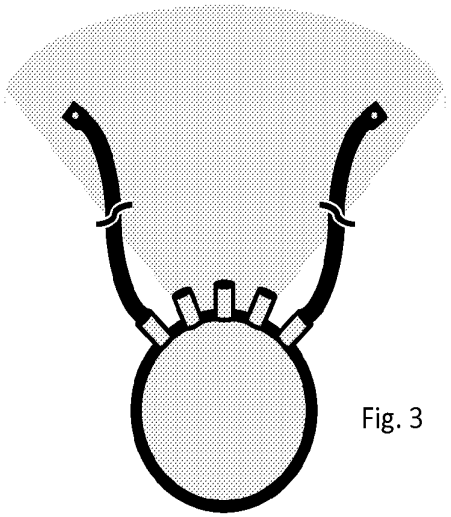


Fig. 3

Petitioner Green Revolution Cooling, Inc., Ex-1002
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WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/US2013/075126**
International filing date:		**13 December 2013 (13.12.2013)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**61/737,200**
	Filing date:	**14 December 2012 (14.12.2012)**
Date of receipt at the International Bureau:		**03 January 2014 (03.01.2014)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT/US13/75126
International Application No.

13 DEC 2013 (13.12.13)
International Filing Date

RO/US
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* JMG001-01

Box No. I TITLE OF INVENTION

APPLIANCE IMMERSION COOLING SYSTEM

Box No. II APPLICANT ☐ This person is also inventor

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Midas Green Technology, LLC
8500 Shoal Creek
Building 2, Suite K
Austin, TX 78757
USA

Telephone No.
512.420.8099

Facsimile No.

Applicant's registration No. with the Office

E-mail authorization: Marking one of the check-boxes below authorizes the receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority to use the e-mail address indicated in this Box to send, notifications issued in respect of this international application to that e-mail address if those offices are willing to do so.

☒ as advance copies followed by paper notifications; or ☒ exclusively in electronic form (no paper notifications will be sent).

E-mail address: jim@midasgreentech.com

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☒ all designated States ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MYERS, Jeffrey Van
J.V. Myers & Associates, PC
P.O. Box 130
Driftwood, TX 8619
USA

Telephone No.
512.858.7453

Facsimile No.

Agent's registration No. with the Office
27,362

E-mail authorization: Marking one of the check-boxes below authorizes the receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority to use the e-mail address indicated in this Box to send, notifications issued in respect of this international application to that e-mail address if those offices are willing to do so.

☒ as advance copies followed by paper notifications; or ☒ exclusively in electronic form (no paper notifications will be sent).

E-mail address: jvm@jvmyers.com

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

BOYD, Christopher L.
1309 Bonham Terrace
Austin, TX 78704
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

KOEN, James P.
2302 Falcon Drive
Round Rock, TX, 78681
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Laguna, David Christopher
2011 E. 6th Street
Austin, TX 78702
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

TURNER, Thomas R.
4210 Malaga Dr.
Georgetown, TX 78628
USA

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☒ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: USA

State *(that is, country)* of residence: USA

This person is applicant for the purposes of: ☐ all designated States ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Supplemental Box *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. If, in any of the Boxes, except Boxes Nos. VIII(i) to (v) for which a special continuation box is provided, ***the space is insufficient*** *to furnish all the information: in such case, write "Continuation of Box No...." (indicate the number of the Box) and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

(i) ***if more than one person is to be indicated as applicant and/or inventor*** *and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;*

(ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication ***"the States indicated in the Supplemental Box"*** *is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;*

(iii) if, in Box No. II or in any of the sub-boxes of Box No. III, ***the inventor or the inventor/applicant is not inventor for the purposes of all designated States****: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;*

(iv) if, in addition to the agent(s) indicated in Box No. IV, there are ***further agents****: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;*

(v) if, in Box No. VI, there are ***more than three earlier applications whose priority is claimed****: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI.*

*2. If the applicant intends to make an indication of the wish that the international application be treated, in certain designated States, as an application for a patent of addition, certificate of addition, inventor's certificate of addition or utility certificate of addition: in such case, write the name or two-letter code of each designated State concerned and the indication "****patent of addition,****" "****certificate of addition,****" "****inventor's certificate of addition****" or "****utility certificate of addition,****" the number of the parent application or parent patent or other parent grant and the date of grant of the parent patent or other parent grant or the date of filing of the parent application (Rules 4.11(a)(i) and 49bis.1(a) or (b)).*

*3. If the applicant intends to make an indication of the wish that the international application be treated, in the United States of America, as a continuation or continuation-in-part of an earlier application: in such case, write "United States of America" or "US" and the indication "****continuation****" or "****continuation-in-part****" and the number and the filing date of the parent application (Rules 4.11(a)(ii) and 49bis.1(d)).*

Continuation of Box No. III:

Kenneth D. Swinden
132 Mustang Creek North Loop
Hutto, TX 78634
USA
Inventor Only
Nationality: USA
Residence: USA

Mario Conti Garcia
9624 Woody Ridge View
Austin, TX 78730
USA
Inventor Only
Nationality: USA
Residence: USA

John Charles Tribou
9109 Middlebie Dr.
Austin, TX 78750
USA
Nationality: USA
Residence: USA

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Box No. V DESIGNATIONS

The filing of this request **constitutes under Rule 4.9(a) the designation** of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.

However,

☐ DE Germany **is not designated** for any kind of national protection

☐ JP Japan **is not designated** for any kind of national protection

☐ KR Republic of Korea **is not designated** for any kind of national protection

(The check-boxes above may only be used to exclude (irrevocably) the designations concerned if, at the time of filing or subsequently under Rule 26bis.1, the international application contains in Box No. VI a priority claim to an earlier national application filed in the particular State concerned, in order to avoid the ceasing of the effect, under the national law, of this earlier national application.)

Box No. VI PRIORITY CLAIM AND DOCUMENT

The priority of the following earlier application(s) is hereby claimed:

Filing date of earlier application *(day/month/year)*	Number of earlier application	Where earlier application is:		
		national application: country or Member of WTO	regional application: regional Office	international application: receiving Office
item (1) 14/12/2012	61/737,200	USA		
item (2) 7/6/2013	61/832,211	USA		
item (3)				

☐ Further priority claims are indicated in the Supplemental Box.

Furnishing the priority document(s):

☒ The **receiving Office** is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application(s) was filed with the receiving Office which, for the purposes of this international application, is the receiving Office)* identified above as:

☒ all items ☐ item (1) ☐ item (2) ☐ item (3) ☐ other, see Supplemental Box

☐ The **International Bureau** is requested to obtain from a digital library a certified copy of the earlier application(s) identified above, using, where applicable, the access code(s) indicated below *(if the earlier application(s) is available to it from a digital library)*:

☐ item (1) access code _____ ☐ item (2) access code _____ ☐ item (3) access code _____ ☐ other, see Supplemental Box

Restore the right of priority: the receiving Office is requested to restore the right of priority for the earlier application(s) identified above or in the Supplemental Box as item(s) (_____). *(See also the Notes to Box No. VI; further information **must** be provided to support a request to restore the right of priority.)*

Incorporation by reference: where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if more than one International Searching Authority is competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)*:

ISA/ US

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Continuation of Box No. VII USE OF RESULTS OF EARLIER SEARCH, REFERENCE TO THAT SEARCH

☐ The ISA indicated in Box No. VII is requested to take into account the results of the earlier search(es) indicated below (*see also Notes to Box VII; use of results of more than one earlier search*).

Filing date *(day/month/year)*	Application Number	Country *(or regional Office)*

☐ **Statement (Rule 4.12(ii))**: this international application is the same, or substantially the same, as the application in respect of which the earlier search was carried out except, where applicable, that it is filed in a different language.

☐ **Availability of documents**: the following documents are available to the ISA in a form and manner acceptable to it and therefore do not need to be submitted by the applicant to the ISA (Rule 12*bis*.1(f)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a translation of the earlier application into a language which is accepted by the ISA,
- ☐ a translation of the results of the earlier search into a language which is accepted by the ISA,
- ☐ a copy of any document cited in the results of the earlier search. *(If known, please indicate below the document(s) available to the ISA):*

☐ **Transmit copy of results of earlier search and other documents** *(where the earlier search **was not** carried out by the ISA indicated above but by the same Office as that which is acting as the receiving Office)*: the **receiving Office** is requested to prepare and transmit to the ISA (Rule 12*bis*.1(c)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a copy of any document cited in the results of the earlier search.

* Where the results of the earlier search are neither available from a digital library nor transmitted by the receiving Office, the applicant is required to submit them to the receiving Office (Rule 12*bis*.1(a)) (*See item 11. in the check-list and also Notes to Box No. VII*).

Filing date *(day/month/year)*	Application Number	Country *(or regional Office)*

☐ **Statement (Rule 4.12(ii))**: this international application is the same, or substantially the same, as the application in respect of which the earlier search was carried out except, where applicable, that it is filed in a different language.

☐ **Availability of documents**: the following documents are available to the ISA in a form and manner acceptable to it and therefore do not need to be submitted by the applicant to the ISA (Rule 12*bis*.1(f)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a translation of the earlier application into a language which is accepted by the ISA,
- ☐ a translation of the results of the earlier search into a language which is accepted by the ISA,
- ☐ a copy of any document cited in the results of the earlier search. *(If known, please indicate below the document(s) available to the ISA):*

☐ **Transmit copy of results of earlier search and other documents** *(where the earlier search **was not** carried out by the ISA indicated above but by the same Office as that which is acting as the receiving Office)*: the **receiving Office** is requested to prepare and transmit to the ISA (Rule 12*bis*.1(c)):

- ☐ a copy of the results of the earlier search,*
- ☐ a copy of the earlier application,
- ☐ a copy of any document cited in the results of the earlier search.

* Where the results of the earlier search are neither available from a digital library nor transmitted by the receiving Office, the applicant is required to submit them to the receiving Office (Rule 12*bis*.1(a)) (*See item 11. in the check-list and also Notes to Box No. VII*).

☐ Further earlier searches are indicated on a continuation sheet.

Box No. VIII DECLARATIONS

The following **declarations** are contained in Boxes Nos. VIII (i) to (v) *(mark the applicable check-boxes below and indicate in the right column the number of each type of declaration)*:			Number of declarations
☐	Box No. VIII (i)	Declaration as to the identity of the inventor :	
☐	Box No. VIII (ii)	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent :	
☐	Box No. VIII (iii)	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application :	
☒	Box No. VIII (iv)	Declaration of inventorship (only for the purposes of the designation of the United States of America) :	
☐	Box No. VIII (v)	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty :	

Petitioner Green Revolution Cooling, Inc., Ex-1002
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Box No. IX CHECK LIST for EFS-Web filings - this sheet is only to be used when filing an international application with RO/US via **EFS-Web**

This international application **contains** the following:	Number of sheets
(a) request form PCT/RO/101 (including any declarations and supplemental sheets)	8
(b) description (excluding any sequence listing part of the description, see (f), below)	14
(c) claims	4
(d) abstract	1
(e) drawings (if any)	7
(f) sequence listing part of the description in the form of an **image file** (e.g. PDF)	
Total number of sheets (including the sequence listing part of the description if **filed as an image file**)	34

(g) sequence listing part of the description

- ☐ filed in the form of an **Annex C/ST.25 text file**
- ☐ WILL BE filed separately on physical data carrier(s), on the same day and in the form of an **Annex C/ST.25 text file**

Indicate type and number of physical data carrier(s)

This international application is **accompanied by** the following item(s) *(mark the applicable check-boxes below and indicate in right column the number of each item):*	Number of items
1. ☒ fee calculation sheet	1
2. ☒ original separate power of attorney	1
3. ☐ original general power of attorney	
4. ☐ copy of general power of attorney; reference number:	
5. ☐ priority document(s) identified in Box No. VI as item(s)	
6. ☐ Translation of international application into *(language)*:	
7. ☐ separate indications concerning deposited microorganism or other biological material	
8. ☐ *(only where item (f) is marked in the left column)* copy of the sequence listing in electronic form (Annex C/ST.25 text file) not forming part of the international application but **furnished only for the purposes of international search** under Rule 13*ter*	
9. ☐ *(only where item (f) is marked in the left column)* a statement confirming that "the information recorded in electronic form submitted under Rule 13*ter* is identical to the sequence listing as contained in the international application" as filed via EFS-Web:	
10. ☐ copy of results of earlier search(es) (Rule 12*bis*.1(a))	
11. ☐ other *(specify)*:	

Figure of the drawings which should accompany the abstract:	1	**Language of filing** of the international application:	English

Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

/Jeffrey Van Myers, Reg. No. 27,362/

13-12-2013

For receiving Office use only

1. Date of actual receipt of the purported international application: 13 DEC 2013	2. Drawings: ☐ received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	☐ not received:
5. International Searching Authority (if two or more are competent): ISA / US	6. ☐ Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

Petitioner Green Revolution Cooling, Inc., Ex-1002
Page 323 of 656; IPR2025-00196

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference JMG001-01	**FOR FURTHER ACTION** See item 4 below	
International application No. PCT/US2013/075126	International filing date *(day/month/year)* 13 December 2013 (13.12.2013)	Priority date *(day/month/year)* 14 December 2012 (14.12.2012)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant MIDAS GREEN TECHNOLOGY, LLC		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 16 June 2015 (16.06.2015)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Nora Lindner e-mail: pt05.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: JEFFREY VAN MEYERS
J.V. MYERS & ASSOCIATES, PC
P.O. BOX 130
DRIFTWOOD, TX 78619

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	25 APR 2014
Applicant's or agent's file reference: JMG001-01	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/075126	13 December 2013	14 December 2012

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G06F 1/20 (2014.01)
USPC - 361/679.49

Applicant MIDAS GREEN TECHNOLOGY, LLC

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	08 April 2014	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/075126

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

      ☐ on paper

      ☐ in electronic form

   b. (time)

      ☐ in the international application as filed

      ☐ together with the international application in electronic form

      ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/075126

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	None	YES
	Claims	1-10	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-10	NO
Industrial applicability (IA)	Claims	1-10	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-10 lack novelty under PCT Article 33(2) as being anticipated by Best et al., (hereinafter referred to as Best).

Regarding claim 1, Best discloses an appliance immersion cooling system (800) comprising:
a tank (810) adapted to immerse in a dielectric fluid a plurality of electrical appliances (Para. [0099], regarding "the servers 820 can be inserted over the hard-drives prior to the submersion of the server into the dielectric liquid coolant"), each in a respective appliance slot distributed vertically along, and extending transverse to, a long wall of the tank (Para. [0097], regarding "the mounting members (not shown) may be fixedly attached along the length L of each longer side of the tank 810 and in the middle of the tank 810 between the two shorter ends of the tank to support the rack ears 836 of a standard rack-mountable server 820 shown in FIG. 12A."), the tank comprising:
a weir, integrated horizontally into the long wall of the tank adjacent all appliance slots (Para. [0102], regarding "in a common manifold area above each of the servers to improve the circulation of the liquid coolant through the plurality of servers"), adapted to facilitate substantially uniform recovery of the dielectric fluid flowing through each appliance slot (Para. [0102], regarding "in a common manifold area above each of the servers to improve the circulation of the liquid coolant through the plurality of servers"; said manifold being a common one improving circulation will be substantially uniform);
a primary circulation facility adapted to circulate the dielectric fluid through the tank (Para. [0107], regarding "multiple fans 880 may be mounted under each of the server racks 830 and 832 in the volume of liquid coolant between the plurality of servers in each respective rack and the bottom of the tank to increase the mixing of the dielectric liquid coolant within the tank"), comprising:
a plenum, positioned adjacent the bottom of the tank (Para. [0107], regarding "multiple fans 880 may be mounted under each of the server racks 830 and 832 in the volume of liquid coolant between the plurality of servers in each respective rack and the bottom of the tank to increase the mixing of the dielectric liquid coolant within the tank"; a plenum being defined as "a space in which a gas, usually air, is contained at a pressure greater than atmospheric pressure", makes the space below the racks and above the tank bottom the claim plenum), adapted to dispense the dielectric fluid substantially uniformly upwardly through each appliance slot (Para. [0107], regarding "multiple fans 880 may be mounted under each of the server racks 830 and 832 in the volume of liquid coolant between the plurality of servers in each respective rack and the bottom of the tank to increase the mixing of the dielectric liquid coolant within the tank");
a secondary fluid circulation facility adapted to extract heat from the dielectric fluid circulating in the primary circulation facility (Para. [0104], "A pump, such as the pump 330 of FIG. 2, may pump liquid coolant from the external heat exchanger through the piping system into the tank 810 to maintain the coolant fluid flow within the tank."; said pump 330 of Fig. 2 is associated with the cooling system 300), and to dissipate to the environment the heat so extracted (Para. [0081], regarding "alternative heat rejection or cooling apparatus 350, such as an outside air radiator 352 permitting cooling with outside ambient atmospheric air"); and
a control facility adapted to coordinate the operation of the primary and secondary fluid circulation facilities as a function of the temperature of the dielectric fluid in the tank (Para. [0082], regarding "The controller 380 may also monitor the flow of the liquid coolant through the tank and/or fluid circuit. Based upon such information, the computer controller may output signals to the pump 330 and heat rejection or cooling apparatus 350 to adjust the flow of the liquid coolant through the fluid circuit and the amount of the heat being rejected by the heat rejection or cooling apparatus 350 for sufficiently cooling each respective server when the tank 310 is sufficiently full of the liquid coolant").

Regarding claim 2, Best discloses the system of claim 1, and Best further discloses wherein the tank (810) and primary circulation facility (880) comprise a tightly co-located module (As in Fig. 11).

Regarding claim 3, Best discloses the system of claim 1, and Best further discloses wherein the tank further comprises:
an interconnect panel facility adapted to mount appliance support equipment (Para. [0099], regarding "a liquid-resistant or liquid-proof enclosure 892 for the movable hard-drive 890 in each of the servers 820 can be inserted over the hard-drives prior to the submersion of the server into the dielectric liquid coolant to protect moving components (e.g., a platen) from being damaged by the viscous liquid coolant").

(Continued in Supplemental Boxes)