Electronic Acknowledgement Receipt

EFS ID:	11639926
Application Number:	61576577
International Application Number:	
Confirmation Number:	4609
Title of Invention:	METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE
First Named Inventor/Applicant Name:	Paul F. Rembach
Customer Number:	29637
Filer:	Wendy Buskop/Sarah Gernhart
Filer Authorized By:	Wendy Buskop
Attorney Docket Number:	1997.001
Receipt Date:	16-DEC-2011
Filing Date:	
Time Stamp:	14:41:51
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$125
RAM confirmation Number	1114
Deposit Account	501313
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	1997-001_ADSFORM.pdf	1420842 41b0980dc1e25edfe22731badc009d6b1ef6b943	no	4
Warnings:					
Information:					
2	Provisional Cover Sheet (SB16)	1997-001_PROVCOVERSHEET.pdf	2071687 fcc53cc8225e0df5cda14a1e1ab23915cb46235b	no	3
Warnings:					
Information:					
3		1997-001_PROV_APPLICATION.pdf	133539 95efbe2b7257ac77284de5d106f582d986e9704e	yes	31

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	22
Claims	23	30
Abstract	31	31

Warnings:					
Information:					
4	Drawings-only black and white line drawings	1997-001_DRAWINGS.pdf	2057788 925da11f3b02e9ad754b7367021bd0027c4a4f52	no	11
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	29830 8f034e10f4743580054062493a1f318aa30c1d2e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	5713686		

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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.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE
First Named Inventor/Applicant Name:	Paul F. Rembach
Filer:	Wendy Buskop/Sarah Gernhart
Attorney Docket Number:	1997.001

Filed as Small Entity

Provisional Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Provisional Application filing fee	2005	1	125	125
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($)
Miscellaneous:				
			Total in USD ($)	**125**

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1997.001
	Application Number	
Title of Invention	METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE	

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

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
	Paul	F.	Rembach	

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

City	Houston	State/Province	TX	Country of Residence	US

Citizenship under 37 CFR 1.41(b) US

Mailing Address of Applicant:

Address 1	11503 Dakar Drive
Address 2	

City	Houston	State/Province	TX
Postal Code	77065	Country	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	29637		
Email Address	sarah.gernhart@buskoplaw.com	Add Email	Remove Email

Application Information:

Title of the Invention	METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE		
Attorney Docket Number	1997.001	Small Entity Status Claimed	☒
Application Type	Provisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	11	Suggested Figure for Publication (if any)	

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1997.001
	Application Number	
Title of Invention	METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE	

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	29637		

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)

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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[1]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			○ Yes ◉ No

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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

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1997.001
	Application Number	
Title of Invention	METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE	

If the Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information:

Address 1			
Address 2			
City		**State/Province**	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

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

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	/WBUSKOP/			Date (YYYY-MM-DD)	2011-12-14
First Name	Wendy	Last Name	Buskop	Registration Number	32202

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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 inspections or an issued patent.

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

PTO/SB/16 (11-08)
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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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
Paul	F.	Rembach	Houston	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	METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE
Attorney Docket Number (if applicable)	1997.001

Correspondence Address

Direct all correspondence to (select one):

◉ The address corresponding to Customer Number	○ Firm or Individual Name
Customer Number	29637

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)
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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	/WBUSKOP/			Date (YYYY-MM-DD)	2011-12-16
First Name	Wendy	Last Name	Buskop	Registration Number (If appropriate)	32202

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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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).
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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.

PROVISIONAL APPLICATION FOR PATENT

INVENTOR:

PAUL F. REMBACH

TITLE:

METHOD FOR COOLING AND MAINTAINING A HEAT GENERATING BUILDING WITHIN A PRESET TEMPERATURE RANGE

ATTORNEY DOCKET NO.: 1997.001

SPECIFICATION

FIELD

[0001] The present embodiments generally relate to method for cooling portable, liftable, and moveable facilities having heat generating electronics that enables a reduced dependency on air conditioning or chilled water systems relative to conventional methods.

BACKGROUND

[0002] A need exists for a method to cool facilities, such as a portable facility with heat generating electronics that can reduce electrical power usage, such as by an amount as much as 50 percent or more compared to current methods for cooling such facilities.

[0003] A further need exists for a method that is implementable on facilities that are portable and transportable.

[0004] A further need exists for a method that can manage temperatures in multiple facilities with heat generating electronics simultaneously from a single controller connected to a network.

[0005] A further need exists for a method for continuous and simultaneous monitoring and controlling of temperatures in facilities while using less power than conventional methods for cooling facilities, such as trailer mounted facilities with twenty servers racked together.

[0006] The present embodiments meet these needs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The detailed description will be better understood in conjunction with the accompanying drawings as follows:

[0008] Figure 1 depicts a perspective view of a system installed in a facility that can be used to implement the method according to one or more embodiments.

[0009] Figure 2 depicts a cut view of the system with an installed heat sink with accompanying equipment in the facility according to one or more embodiments.

[00010] Figures 3A-3B depict an embodiment of a controller that can be used to implement the method according to one or more embodiments.

[00011] Figure 4A depicts a detailed perspective view of the heat sink according to one or more embodiments.

[00012] Figure 4B depicts a detailed cut view of the heat sink according to one or more embodiments.

[00013] Figure 5 depicts a side view of the facility with the system installed therein with each heat sink having six outer heat pipe assemblies according to one or more embodiments.

[00014] Figure 6 depicts a perspective view of the system installed into multiple facilities connected together according to one or more embodiments.

[00015] Figure 7 depicts a cross sectional view of the system installed in the facility having outer top mounted heat sinks according to one or more embodiments.

[00016] Figure 8 depicts an embodiment of the system installed to a plurality of mobile and/or modular facility controlled by a single controller connected by a network.

[00017] Figure 9 depicts an embodiment of the method for cooling facilities.

[00018] The present embodiments are detailed below with reference to the listed Figures.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[00019] Before explaining the method in detail, it is to be understood that the method is not limited to the particular embodiments and that it can be practiced or carried out in various ways.

[00020] The present embodiments relate to a method for cooling a facility with heat generating electronics therein, which can enable heat removal with very low energy consumption. For example, the facility can be a portable building, mobile and/or modular facility, data center, or the like. The facility can range in length from about 10 feet to about 60 feet.

[00021] The method can be used on a facility that has a plurality of connected walls, an outer top connecting the walls, an inside ceiling connecting the walls, a base connecting to the walls opposite the inside ceiling, and a closable opening, such as a door or man way.

[00022] The facility can house telecommunications equipment, servers, and other heat generating electronics racked in vertical units.

[00023] The method can include mounting a heat sink in at least one wall or in the outer top of the facility. In embodiments, two or more heat sinks can be mounted in the walls and/or outer top of the facility. One or more heat sinks can be mounted to form part of the wall or outer top, such that the heat sink forms a non-load bearing integral portion of the wall or outer top. A typical heat sink can be about 72 inches in height, 18 inches in width, and 10 inches in thickness.

[00024] Each facility can have multiple vertical units containing heat generating electronics, and the method can include installing heat sinks in each vertical unit. In one or more embodiments, the method can be performed using multiple outer heat pipe assemblies in conjunction with a single heat sink.

[00025] The method can use a heat sink that has a finless heat collecting portion and a fin side

with fins. The fin side can be positioned to extend into an interior or chamber of the facility or vertical unit.

[00026] A first interior fan can be installed to flow air from an air flow space between the outer top and inside ceiling, such as out of a first opening in the inside ceiling and into a second segment of the chamber, which can have air at a low British thermal unit (BTU) therein.

[00027] A second interior fan can be installed within a first segment of the chamber to flow air with a high BTU from near the heat generating electronics to the heat sink; thereby allowing the air to quickly cool and then flow into the air flow space, creating an air flow circulation.

[00028] The method can include using an outer heat pipe assembly having an outer fluid filled heat collection portion, which can be mounted to the finless side of the heat sink.

[00029] The outer heat pipe assembly can have outer fins opposite the outer fluid filled heat collection portion. The outer fins can extend outwards from the facility. The outer heat pipe assembly can be in thermal communication with the heat sink.

[00030] The outer heat pipe assembly can contain a fluid that can be at a low temperature in the portion adjacent the heat sink. The fluid in the outer heat pipe assembly can be used to absorb heat from the heat sink; thereby forming a heated fluid that can then flow, thermally and without using electricity, to the outer fins of the outer heat pipe assembly. The fluid can be water or another heat transferring fluid.

[00031] A first exterior fan can be installed on the outside of the facility to flow external air over the outer fins, forming a heated air.

[00032] A second exterior fan can be installed on the outside of the facility to exhaust the heated air from around the outer fins to an area external to the facility.

[00033] A controller can be used to control the internal and exterior fans. The controller can include a processor with a data storage, and can be connected to a power supply and a

network.

[00034] A first powered transducer can be installed within the second segment and connected to the controller for monitoring a cooler chamber air, and comparing the temperature of the cooler chamber air in the second segment to preset limits in the data storage.

[00035] A second powered transducer can be secured to a portion of the outer heat pipe assembly for monitoring a temperature of at least one outer fin of the outer heat pipe assembly. The second powered transducer can be connected to the controller, and computer instructions in the data storage can compare the monitored temperatures from the second powered transducer to preset limits in the data storage.

[00036] A third powered transducer can be secured proximate to the fins of the heat sink for determining a temperature of inner heated air. The third powered transducer can be connected to the controller. Computer instructions in the data storage can be used to monitor and compare the temperatures from the third powered transducer to preset limits.

[00037] The controller can have computer instructions in the data storage for monitoring temperatures in the facility, monitoring heat transfer temperatures, monitoring fan status, actuating fans, regulating fan speeds, and stopping fans, such as when the monitored temperatures from the powered transducers meet or exceed the preset limits.

[00038] The method can include installing a small capacity air conditioning unit in one of the walls of the facility or in each vertical unit of the facility, and connecting the small capacity air conditioning unit to the controller. The small capacity air conditioner can have a capacity that can be less than 1/5 of a needed capacity to cool a vertical unit of the facility or the entire facility.

[00039] The small capacity air conditioner can be operated by the controller, and can be used to provide an assist to lower the temperature inside the second segment to a temperature less than a temperature outside of the facility.

[00040] The method can be used on a facility that has multiple racks of standard data servers, such as fourteen racks. Total processing power for such a facility can be approximately twenty petabytes depending on the arrangement of the servers. Waste heat generated in this type of typical facility can usually be generated in amounts of about 25 kilowatts (KW) per vertical unit or rack. For example, in a trailer mounted portable facility with fourteen racks, 350 KW in waste heat can be generated.

[00041] A typical cooling method for facilities uses chill water or standard air conditioning (AC) units, requiring approximately 99.609 tons of air conditioning per hour.

[00042] The electrical energy requirement by conventional methods can be approximately 211,990 KW/hour to effectively accomplish cooling, inclusive of the losses of heat.

[00043] The electrical energy costs using such conventional methods for cooling for a typical facility with fourteen racks at an arbitrary cost of $0.05 per KW/hour is $7,759.00 per month. The present method can reduce the costs of power usage for such a facility to only approximately $620.74 per month. As such, an energy savings of about $7000 per month can be provided by this dramatically improved method for cooling facilities with heat generating electronics.

[00044] The method can accomplish energy requirement reduction by not requiring large three phase compressors, sub-systems inclusive of circulating water pumps, large discharge blowers, and complicated connection piping in the facility.

[00045] The method can have a significant positive impact on carbon emissions into the environment, because less power can be required to operate the facility with heat generating electronics.

[00046] The method can improve the economy of the United States by reducing the costs to operate the facility, reducing the need for carbon based fuels to produce electrical energy, and enabling owners to employ more employees with the saved money.

[00047] The method can avoid the need to use toxic fluid, such as those used in heating,

ventilation, and air conditioning (HVAC) systems.

[00048] The method can also eliminate the need for a support skid, which can require more fuel to transport.

[00049] The method can reduce that quantity of raw materials, iron, and other metals required to build and cool the facility.

[00050] The method can eliminate the need for multiple top and/or multiple side mounted air conditioning units. For example, in one or more embodiments, the method can operate exclusively using low power air circulation fans to move ambient air over external heat sinks to dissipate heat into external air.

[00051] As such, one or more embodiments of the method can reduce electrical consumption by the facility containing heat generating electronics by an average of 92 percent. For example, the method can be used on a facility requiring 200 KW of continuous operation of heat removal to dramatically reduce electrical power requirements to cool that result in savings of as much as $85,000 per year; thereby relieving the energy demands on local utility systems and reducing pollution.

[00052] In operation, when the heat is dissipated into the external air from the heat sink, coolant inside the outer heat pipe assembly can be naturally forced back towards the heat sink by other coolant that has not had the heat removed, thereby causing a natural fluid circulation from hot to cold. The coolant can continue to circulate using the method without external energy input when an interior of the facility is hotter than the ambient external air.

[00053] Turning now to the Figures, Figure 1 depicts an embodiment of a facility 10, which can be an air cooled mobile and/or modular facility.

[00054] The facility 10 can have a plurality of walls, such as wall 11a and wall 11b. The facility 10 can have an inside ceiling 70 disposed in parallel and separated from an outside top to form an air flow space, a closable opening 14, and a base 16, which can

be connected to the walls 11a-11b.

[00055] The closable opening 14 can be a locking, water-tight, sealed opening, such as a door.

[00056] The facility 10 can be made of welded steel, creating an integral structure that can be lifted, such as by a crane. In one or more embodiments, the facility 10 can be made of plate steel having a thickness ranging from about 3/16 of an inch to about 3/4 of an inch.

[00057] The facility 10 can have a height ranging from about 8 feet to about 25 feet, width ranging from about 4 feet to 15 about feet, and depth ranging from about 10 feet to about 60 feet.

[00058] A small air conditioner 72 can be configured to be installed on a portion of the facility 10 to provide additional cooling when required.

[00059] Figure 2 depicts a cut view the facility 10 detailing portions of a system 8.

[00060] The facility 10 can have heat generating electronics 18 disposed within a chamber 17. For example, the heat generating electronics 18 can be computer equipment elements, telecommunications equipment, data archival equipment, processing equipment, testing equipment, event recording equipment, logging equipment, power electronics, or combinations thereof.

[00061] The heat generating electronics 18 can be racked within the chamber 17 of the facility 10 surrounding an interior portion of the walls 11a-11b of the facility 10.

[00062] The heat generating electronics 18 can separate the chamber 17 into a first segment 13 and a second segment 15. The first segment 13 can have air with a first British thermal unit (BTU) content, such as inner heated air 38. The second segment 15 can have air with a second BTU content, such as cooler chamber air 39. The first BTU content can be larger than the second BTU content. In operation, the heat generating electronics 18 can draw in the cooler chamber air 39, such as through a heat generating electronics fan 21, for cooling the heat generating electronics 18. The heat

generating electronics 18 can transfer heat to the cooler chamber air 39, thereby forming the inner heated air 38 for expulsion into the first segment 13.

[00063] The facility 10 can have the inside ceiling 70 disposed below the outside top 12 and above the base 16. The air flow space 19 can be formed between the inside ceiling 70 and the outside top 12.

[00064] A first interior fan 22 can be disposed on the inside ceiling 70, and can be used to cool the facility 10 without the need for heavy duty air conditioning systems that consume large amounts of power.

[00065] The first interior fan 22 can be a variable speed low voltage fan with one or more blades. For example, the first interior fan 22 can have a low voltage of 120 volts.

[00066] The first interior fan 22 can be connected to a power supply 24. The first interior fan 22 can blow air from the air flow space 19 towards the base 16, creating a first air flow 26. For example, the first air flow 26 can be at a speed of about 1,150 linear feet per minute.

[00067] The power supply 24 can be a 120 volt, 12 volt, 6 volt, 48 volt, or 220 volt power supply. The power supply 24 can be electricity from an electric municipality grid, a generator, a fuel cell, a battery, a solar cell, a hydroelectric power supply, a wind power generator, or combinations thereof.

[00068] A second interior fan 28 can be connected to the power supply 24 to assist in providing a general circulation of air 31 around the walls 11a-11b, the base 16, and between the outside top 12 and the inside ceiling 70. The second interior fan 28 can be disposed in a portion of the air flow space 19.

[00069] A heat sink 32, which can be a solid material, can be configured to be integrally mounted in one of the walls 11a-11b of the facility 10, such as the wall 11a.

[00070] The heat sink 32 can be an extruded metal block, which can be made of copper, aluminum, or alloys thereof. The heat sink 32 can be totally or partially anodized to

protect the heat sink 32 from environmental decay and to provide cathodic protection.

[00071] The heat sink 32 can have structural integrity, enabling the heat sink 32 to act as a portion of a non-load bearing wall or non-load bearing ceiling of the facility 10.

[00072] The heat sink 32 can have a length and height equal to or less than the length and height of the wall 11a, and a depth slightly shallower than the wall 11a, such that the heat sink 32 can be attached to a wall frame assembly of the wall 11a.

[00073] The heat sink 32 can have one or more fins connected to a finless heat collecting portion, which can be solid. The fins can contact the inner heated air 38 in the facility 10.

[00074] The fins of the heat sink 32 can transfer heat from the inner heated air 38 while the inner heated air 38 moves across the fins of the heat sink 32. In one or more embodiments, the heat sink 32 can have from about six fins to about four hundred fins.

[00075] The fins can be connected with an outer fluid filed finless heat collection portion of the heat sink 32, allowing for thermal dissipation of heat absorbed by the heat sink 32 into fluid of an outer heat pipe assembly 42 in thermal communication with the outer fluid filed finless heat collection portion. As such, the outer fluid filed finless heat collection portion can form a heated fluid.

[00076] The outer heat pipe assembly 42 can have outer fins for receiving the heated fluid from the outer fluid filed finless heat collection portion, and allowing for heat dissipation through the outer fins to form a cooled fluid.

[00077] The outer fins of the outer heat pipe assembly 42 can be affected by a first external fan 46, which can pull external air 48 over the outer fins of the outer heat pipe assembly 42 through a forced air duct; thereby transferring heat from the outer fins to form a heated air 50.

[00078] A second external fan 52 can exhaust the heated air 50 away from the facility 10. The

first external fan 46 and the second external fan 52 can be variable speed fans, and can be connected to the power supply 24.

[00079] The first interior fan 22, second interior fan 28, first external fan 46, and second external fan 52 can be controlled by a controller 62.

[00080] In embodiments, the controller 62 can be a variable speed controller for causing one or more of the first interior fan 22, second interior fan 28, first external fan 46, and second external fan 52 to operate at one or more speeds simultaneously.

[00081] For example, the controller 62 can include a program logic controller, which can allow the controller 62 to be configured for controlling one or more of the first interior fan 22, second interior fan 28, first external fan 46, and second external fan 52 based on preset limits that can be stored in the controller 62.

[00082] The controller 62 can receive temperature signals from a first powered transducer 54. The first powered transducer 54 can be configured for installation within the facility 10 for determining a first temperature within the facility 10.

[00083] The controller 62 can connect to a second powered transducer 58 secured to a portion of the outer heat pipe assembly 42 for determining a second temperature.

[00084] The controller 62 can connect to a third powered transducer 60, which can be secured proximate to the fins of the heat sink 32 for determining a third temperature, which can be a temperature of the inner heated air 38.

[00085] The first powered transducer 54, the second powered transducer 58, and the third powered transducer 60 can each be connected to both the controller 62 and the power supply 24. Each of the first powered transducer 54, the second powered transducer 58, and the third powered transducer 60 can be standard 100 ohm platinum transducers.

[00086] The controller 62 can communicate with a network 74. The network 74 can be the internet, a local area network, satellite network, or another communications network.

The network 74 can be in communication with a client device 77 of a user 79, allowing for remote monitoring and controlling of the system 8.

[00087] The facility 10 can also have a display 63 disposed therein and in communication with the controller 62, allowing for local monitoring and controlling of the system 8.

[00088] The controller 62 can also be connected to the first interior fan 22, the second interior fan 28, the first external fan 46, the second external fan 52, and the power supply 24.

[00089] The controller 62 can control the heat sink 32 by controlling air flow using the first interior fan 22, second interior fan 28, first external fan 46, and second external fan 52. In one or more embodiments, the controller 62 can be configured to control one or more of the heat sinks in parallel.

[00090] In embodiments, the controller 62 can be configured to dissipate thirty kilowatts of heat per vertical section in the facility 10. Each of the vertical sections can be one vertical portioned off section of the overall facility 10, which can have independent server blades, rackings, and power supplies.

[00091] The controller 62 can be configured to control the first interior fan 22, second interior fan 28, first external fan 46, and second external fan 52 to create a lateral airflow between the outside top 12 and the inside ceiling 70 simultaneously while creating an air flow from the heat sink 32 towards the inside ceiling 70 and into the air flow space 19.

[00092] The small air conditioner 72 can be mounted in the outside top 12 or one of the walls 11a-11b, such as the wall 11b, and can be connected to the power supply 24 and the controller 62. The small air conditioner 72 can have less than 1/5 of a cooling requirement for cooling the entirety of the facility 10. The small air conditioner 72 can be used when temperatures outside of the facility 10 are above seventy degrees Fahrenheit.

[00093] For example, a preset limit can be seventy degrees Fahrenheit for a low set point and

eighty degrees Fahrenheit for a high set point within the facility 10. The controller 62 can use computer instructions in a data storage thereof to keep the first temperature of the cooler chamber air 39 between these two set points, such as by turning on and off the first interior fan 22, second interior fan 28, first external fan 46, and second external fan 52; adjusting the speeds of the first interior fan 22, second interior fan 28, first external fan 46, and second external fan 52; or turning on and off the small air conditioner 72.

[00094] Figures 3A-3B depict an embodiment of the controller 62, which can include a processor 64 in communication with the data storage 65 and the display 63.

[00095] The data storage 65 can have various computer instructions for monitoring and controlling temperatures inside of one or more facilities.

[00096] For example, the data storage 65 can include computer instructions to monitor the temperature of the inner heated air in the facility 66a. The data storage 65 can include computer instructions to monitor the temperature of at least one of the outer fins 66b. The data storage 65 can include computer instructions to monitor the cooler chamber air 66c. The data storage 65 can include computer instructions to compare each monitored temperature to preset limits 66d.

[00097] The data storage 65 can include computer instructions to, when the monitored temperatures meet or exceed the preset limits, individually: actuate the first interior fan, second interior fan, first external fan, and second external fan; regulate fan speeds of the first interior fan, second interior fan, first external fan, and second external fan; or turn off the first interior fan, second interior fan, first external fan, and second external fan 66e.

[00098] For example, if the preset limits 69 require the temperature of the cooler chamber air to remain between 70 degrees Fahrenheit and 80 degrees Fahrenheit and the monitored temperature is determined, using one of the powered transducers, to be 85 degrees Fahrenheit, then the computer instructions can instruct the controller 62 to actuate the first interior fan, second interior fan, first external fan, and second external

fan, or to increase a speed of the first interior fan, second interior fan, first external fan, and second external fan.

[00099] The data storage 65 can include computer instructions to instruct the processor to compare the monitored temperatures to preset limits, and to control fan speeds individually or simultaneously to cause temperatures in the facility to remain within the preset limits 71.

[000100] The data storage 65 can include computer instructions to allow the processor to turn on and turn off and regulate air flow from the small air conditioner mounted in one of the walls or in the inside ceiling for use when outside air is over seventy degrees Fahrenheit or above another preset value 75.

[000101] The data storage 65 can include computer instructions to provide an alarm message when the monitored temperatures exceed or fall below the preset limits, wherein the alarm message is provided to: the client device, a computer, the display, or combinations thereof 78.

[000102] The data storage 65 can include computer instructions to ensure that air flowing across the inner heat sink remains in contact with each of the heat sinks to optimize heat transfer from the facility 81.

[000103] The data storage 65 can include computer instructions to enable the user with the client device to connect to the controller and view a status of temperatures of at least one facility over the network 90.

[000104] The data storage 65 can include computer instructions to form an executive dashboard on the client device enabling the user to simultaneously view the status of the multiple facilities 92.

[000105] The data storage 65 can include computer instructions for instructing the controller to control temperature and cooling of the vertical sections of the facility, wherein the temperature and cooling of the vertical sections is controlled individually, in priority

groupings, or simultaneously 93.

[000106] For example, if the facility has three vertical sections, and if only one of the vertical sections is outside of the preset limits 69, then the controller 62 can control one or more of the individual fans associated with that vertical section.

[000107] The data storage 65 can include computer instructions for instructing the controller to control temperature and cooling of the vertical sections of the facility using the network 95.

[000108] The alarm message 79, preset limits 69, and monitored temperatures 67 can be stored in the data storage 65.

[000109] Figure 4A depicts a perspective view of the heat sink 32, and Figure 4B depicts a side cut view of the heat sink 32 and outer heat pipe assembly 42.

[000110] The heat sink 32 can be connected with the outer heat pipe assembly 42. The heat sink 32 can include one or more fins 33 and a coating 68, which can be a non-electrically conductive coating. The coating 68 can be anodized gold, anodized silver, titanium, platinum, iridium, or a similar secondary heat conductive surface for preventing degradation from oxidation or other environmental factors.

[000111] In embodiments, the outer heat pipe assembly 42 can be coated, such as with an anodized aluminum, alloy of aluminum, copper, anodized copper, or combinations of these materials.

[000112] The outer heat pipe assembly 42 can be made of a metal pipe and can have an inner diameter that varies depending on a designed heat load. For example, the inner diameter of the outer heat pipe assembly 42 can include thousands of small pipes or capillaries therein, with each small pipe or capillary having an inner diameter of less than two mm. The outer heat pipe assembly 42 can have a pipe base with small pipes and fins, such as those made by ACT in Pennsylvania.

[000113] The fins 33 can be connected to a finless heat collecting portion 36, which can be

solid.

[000114] An outer fluid filled finless heat collection portion 43 of the outer heat pipe assembly 42 can be disposed adjacent one or more outer fins 44, and between the outer fins 44 and the finless heat collecting portion 36. The outer fluid filled finless heat collection portion 43 can be in thermal communication with the finless heat collecting portion 36.

[000115] The outer fluid filed finless heat collection portion 43 can allow for thermal dissipation of heat absorbed by the heat sink 32 into fluid of the outer fins 44 of the outer heat pipe assembly 42.

[000116] The outer heat pipe assembly 42 can have a fan assembly, including the first external fan 46 and the second external fan 52 for forced air cooling.

[000117] In operation, heat from the inner heated air can be transferred to the fins 33, heat from the fins 33 can be transferred to the finless heat collecting portion 36, heat from the finless heat collecting portion 36 can be transferred to the outer fluid filed finless heat collection portion 43, and heat from the outer fluid filed finless heat collection portion 43 can be transferred to the outer fins 44.

[000118] For example, the outer fluid filed finless heat collection portion 43 can transfer heat from the finless heat collecting portion 36 into a fluid to form a heated fluid 40. The outer fins 44 can receive the heated fluid 40 from the outer fluid filed finless heat collection portion 43. Heat from the heated fluid 40 can be dissipated through the outer fins 44, thereby forming a cooled fluid 45, which can flow back to the outer fluid filed finless heat collection portion 43.

[000119] For example, the first external fan 46 can draw in the external air 48 into a forced air duct 83, which can receive the external air 48 and flow the external air 48 across the outer fins 44, thereby causing a heat exchange and forming the heated air 50.

[000120] The second external fan 52 can draw the heated air 50 out away from the outer fins

44. The second external fan 52 can operate at a higher suction to draw the external air 48 through the outer heat pipe assembly 42.

[000121] In one or more embodiments, the outer fins 44 can be very thin and short microstructures. A large quantity of the very thin and short microstructures can provide for fast and lightweight thermal dissipation.

[000122] In one or more embodiments, the outer heat pipe assembly 42 can have several hundred of the outer fins 44.

[000123] Figure 5 depicts a side view of an outside of the facility 10 with one heat sink having six outer heat pipe assemblies 42a-42f.

[000124] The facility 10 can have the vertical sections 76a-76g. Each of the vertical section 76a-76g can contain racks with servers that generate heat or other heat generating electronics.

[000125] The facility 10 can have the first external fans 46a-46n for drawing in the exterior air, and the second external fans 52a-52n for expelling the heated air.

[000126] Each of the first external fans 46a-46n and the second external fans 52a-52n for each of the vertical sections 76a-76g can be operated independently, simultaneously, or in priority groupings.

[000127] The facility 10 can have the small air conditioner 72, which can be a 15 ton A/C unit, such as one made by TRANE™.

[000128] The facility 10 can be installed in a transportable container 73, such as a shipping container for easy transport by land or sea. In one or more embodiments, the transportable container 73 can contain multiple facilities.

[000129] The transportable container 73 can be a vertical lift container, skid mounted container, or a container that is transportable by rail, boat, or truck.

[000130] In one or more embodiments, the transportable container 73 can be a moveable

custom made container, which can provide additional protection and additional space for the facility 10.

[000131] Figure 6 depicts an embodiment of the system installed into multiple facilities 10a-10b that are connected together.

[000132] The walls 11a-11c of the facilities 10a-10b can be removed and/or connected together, such that the facilities share the means for flowing air. For example, the wall 11a of the facility 10a can be connected with the wall 11c of the facility 10b.

[000133] The facilities 10a-10b can have one or more of the heat sinks 32a-32b for transferring heat from within the facilities 10a-10b, as well as the outer heat pipe assemblies 42 for transferring the heat to the external air.

[000134] Figure 7 depicts an embodiment of the facility 10 with the closable opening 14, as well as the inside ceiling 70 and the outside top 12 forming the air flow space 19.

[000135] The inside ceiling 70 can have a first opening 23. The first interior fan 22 can blow air from within the air flow space 19 into the chamber 17 through the first opening 23.

[000136] The second interior fan 28 can blow air from a second opening 25 of the inside ceiling 70 into the air flow space 19, thereby creating a cross air flow 80.

[000137] The facility 10 can have the heat sink 32a, which can be wall mounted into one of the walls 11a-11b, such as the wall 11a. For example, the heat sink 32a can be disposed adjacent the heat generating electronics 18.

[000138] The facility 10 can have the heat sink 32b and the heat sink 32c, which can both be configured to be installed on the outside top 12. For example, the heat sink 32b and the heat sink 32c can be used when the heat generating electronics 18 vent upwards into the air flow space 19.

[000139] Each of the heat sinks 32a-32c can be associated with the outer heat pipe assemblies

42a, 42b, and 42c, which can each have two pairs of circulating fans to provide for faster thermal heat transfer from the chamber 17 of the facility 10 to an outside of the facility 10.

[000140] Each of the heat sinks 32a-32c associated with the outer heat pipe assemblies 42a-42c can be connected to the controller 62.

[000141] Figure 8 depicts a plurality of facilities 10a-10b controlled by one of the controllers 62.

[000142] The plurality of facilities 10a-10b can be connected to the controller 62, and the controller 62 can be connected to the network 74.

[000143] The client device 77 can be connected to the controller 62 and facilities 10a-10b through the network 74, allowing the user 79 to remotely monitor temperatures and receive alarm messages. The client device 77 can be a cell phone, computer, or other communications device.

[000144] The controller 62 can simultaneously operate the plurality of facilities 10a-10b. The facilities 10a-10b can have thermal partitions 35a-35h formed by the heat generating electronics 18a-18d that extend from the bases 16a-16b to the inside ceilings 70a-70b.

[000145] The thermal partitions 35a-35h can form the chambers 17a and 17b, thereby separating the inner heated air 38a-38d from the cooler chamber air 39a-39d.

[000146] Each of the facilities 10a-10b can have the display 63a-63b for locally displaying temperatures and information on the system.

[000147] Each of the facilities 10a-10b can have one or more of the heat sinks 32a-32d, which can contact the inner heated air 38a-38d for cooling thereof. Each of the facilities 10a-10b can have one or more outer heat pipe assemblies 42a-42d, which can transfer heat to the external air.

[000148] Each of the chambers 17a-17b can have one or more of the first interior fans 22a-22d.

For example, the chamber 17a can have the first interior fan 22a and the first interior fan 22b, and the chamber 17b can have the first interior fan 22c and the first interior fan 22d.

[000149] The first interior fans 22a-22d can receive air from the second interior fans 28a-28d through the air flow space 19a-19b, and can provide the cooler chamber air 39a-39d to the chambers 17a-17b.

[000150] Each of the facilities 10a-10b can have the walls 11a-11d and outside tops 12a-12b.

[000151] Figure 9 depicts a diagram of an embodiment of the method for cooling a facility, such as a facility.

[000152] The method can include mounting the heat sink in at least one wall or outside top of the facility containing the heat generating electronics, forming a non-load bearing integral portion of the wall or outside top, as illustrated by box 100.

[000153] The method can include mounting the outer heat pipe assembly to the finless heat collecting portion of the heat sink, as illustrated by box 102.

[000154] The method can include installing the forced air ducts around the outer heat pipe assembly to contain air flow around the heat pipes, as illustrated by box 104.

[000155] The method can include installing the first external fan to force air into the forced air duct from outside of the facility, as illustrated by box 106.

[000156] The method can include installing the second external fan to pull air from the forced air duct to outside of the facility, as illustrated by box 108.

[000157] The method can include installing the first interior fan to flow air from a ceiling air duct into the facility, as illustrated by box 110.

[000158] The method can include installing the second interior fan to pull air from the facility into the ceiling air duct, as illustrated by box 112.

[000159] The method can include installing the first powered transducer in the facility proximate to a section of the facility having the lowest temperature, as illustrated by box 114.

[000160] The method can include installing the second powered transducer in the facility in the air flow proximate to the fins of the outer heat pipe assembly, as illustrated by box 116.

[000161] The method can include installing the third powered transducer proximate to the fins of the heat sink, as illustrated by box 118.

[000162] The method can include connecting the first powered transducer, second powered transducer, third powered transducer, first external fan, second external fan, first interior fan, and second interior fan to the controller, wherein the controller has the processor and the data storage, as illustrated by box 120.

[000163] The method can include using computer instructions in the data storage to monitor temperature in the facility, actuate the fans, regulate the fan speeds, and stop the fans when monitored temperatures of the facility meet or exceed preset limits, as illustrated by box 122.

[000164] The method can include installing a small capacity air conditioning unit, connecting the small capacity air conditioning unit to the controller, and providing an assist to lower the temperature of air in the facility to a temperature less than the temperature outside of the facility, as illustrated by box 124.

[000165] While these embodiments have been described with emphasis on the embodiments, it should be understood that within the scope of the appended claims, the embodiments might be practiced other than as specifically described herein.

CLAIMS

What is claimed is:

1. A method for cooling a facility with heat generating electronics, wherein the facility has a plurality of walls, an outside top connecting the walls, a closable opening, an inside ceiling spaced apart and in parallel to the outside top forming an air flow space, and a base connecting to the walls opposite the inside ceiling forming a chamber with a first segment having air with a first BTU and a second segment having air with a second BTU, wherein the first BTU is larger than the second BTU, the method comprising:

   a. mounting a heat sink in at least one of the walls or in the outside top, wherein the heat sink forms a non-load bearing integral portion of the at least one wall or the outside top, and wherein the heat sink has a finless heat collecting portion and fins;

   b. mounting at least one outer heat pipe assembly to the finless heat collecting portion, wherein the at least one outer heat pipe assembly engages the heat sink with an outer fluid filled finless heat collecting portion, and wherein the at least one outer heat pipe assembly has outer fins opposite the outer fluid filled heat collecting portion;

   c. installing a forced air duct around the at least one outer heat pipe assembly to contain air flow around the at least one outer heat pipe assembly;

   d. installing a first interior fan to force air from the air flow space into the second segment, and connecting the first interior fan to a power supply;

   e. installing a second interior fan to direct inner heated air from the first segment through the inside ceiling and into the air flow space, and connecting the second interior fan to the power supply;

   f. installing a first exterior fan to flow external air into the forced air duct, and connecting the third exterior fan to the power supply;

g. installing a second exterior fan to exhaust heated air to an outside of the facility from the forced air duct, and connecting the second exterior fan to the power supply;

h. installing a first powered transducer in the second segment to determine a first temperature of a cooler chamber air;

i. installing a second powered transducer to at least one of the outer fins to determine a second temperature;

j. installing a third powered transducer proximate to the fins of the heat sink to determine a third temperature of the inner heated air;

k. allowing the inner heated air to contact the fins of the heat sink to transfer heat from the fins of the heat sink to the finless heat collecting portion;

l. contacting the outer fluid filled finless heat collecting portion with the finless heat collecting portion for transferring heat to fluid in the outer fluid filled finless heat collecting portion, forming a heated fluid;

m. circulating the heated fluid to the outer fins of the outer heat pipe assembly;

n. forcing air over the outer fins to dissipate heat and remove heat from the heated fluid, forming a cooled fluid;

o. circulating the cooled fluid to the outer fluid filled finless heat collecting portion without using a pump or a motor;

p. connecting the first powered transducer, the second powered transducer, the third powered transducer, the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan to a controller comprising a processor and a data storage;

q. connecting the controller to the power supply; and

r. using computer instructions in the data storage to:

(i) instruct the processor to monitor temperatures from the first powered transducer, the second powered transducer, and the third powered transducer;

(ii) compare the monitored temperatures to preset limits; and

(iii) when the monitored temperatures exceed or fall below the preset limits, maintain temperatures within the facility within the preset limits by:

1. actuating the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

2. regulating fan speeds of the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

3. stopping the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan; or

4. combinations thereof.

2. The method of claim 1, further comprising:

a. installing a small 1/5 capacity air conditioning unit in one of the walls of the facility;

b. connecting the small 1/5 capacity air conditioning unit to the controller; and

c. using computer instructions in the data storage to allow the controller to provide cooling to lower the temperature of air in the second segment of the facility to a temperature less than a temperature outside the facility.

3. The method of claim 1, further comprising using a variable speed controller to cause one or more of the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan to operate at one or more speeds simultaneously.

4. The method of claim 1, further comprising using low voltage fans that operate at 120 volts, 12 volts, 6 volts, 48 volts, or 220 volts as the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan.

5. The method of claim 1, further comprising using an extruded metal block with sixty fins to four hundred fins as the heat sink.

6. The method of claim 5, further comprising using a hollow metal block as the extruded metal block.

7. The method of claim 6, further comprising using copper, aluminum, or alloys thereof as the extruded metal block.

8. The method of claim 1, further comprising disposing a non-electrically conductive coating on the heat sink.

9. The method of claim 1, further comprising using from six outer fins to four hundred outer fins with the outer heat pipe assembly.

10. The method of claim 1, wherein the heat generating electronics comprise: computer equipment elements, telecommunications equipment, data archival equipment, processing equipment, testing equipment, event recording equipment, logging equipment, power electronics, or combinations thereof.

11. The method of claim 1, wherein the power supply is a generator, a fuel cell, a battery, a solar cell, a hydroelectric power supply, a coal power supply, power from an electric power grid, or a wind power generator.

12. The method of claim 1, further comprising using computer instructions to control vertical sections of the facility individually, in priority groupings, or simultaneously.

13. The method of claim 12, further comprising simultaneously controlling from two vertical sections to twenty five vertical sections.

14. The method of claim 1, further comprising using computer instructions in the data storage

to connect to a network with a member of the group comprising: a client device, a computer, a display, or combinations thereof, thereby enabling monitoring of a status of cooling in the facility.

15. The method of claim 1, further comprising using computer instructions in the data storage to generate an alarm message when temperatures exceed or fall below the preset limits.

16. The method of claim 1, further comprising using a transportable container to allow move the facility by rail, boat, or truck.

17. The method of claim 1, further comprising using the heat generating electronics to form thermal partitions in the facility, wherein the heat generating electronics extend from the base to the inside ceiling to form the first segment and the second segment.

18. A method for cooling a facility with heat generating electronics, the method comprising:

a. mounting a heat sink in a wall or an outside top of the facility, wherein the heat sink comprises a finless heat collecting portion and fins;

b. mounting an outer heat pipe assembly to the heat sink, wherein the outer heat pipe assembly comprises an outer fluid filled finless heat collecting portion in thermal communication with the finless heat collecting portion, and wherein the outer heat pipe assembly comprises outer fins opposite the outer fluid filled heat collecting portion;

c. installing a forced air duct around the outer heat pipe assembly to contain air flow around the outer heat pipe assembly;

d. installing a first interior fan in the facility to force air from an air flow space of the facility into a second segment of the facility;

e. installing a second interior fan in the facility to direct an inner heated air from a first segment of the facility into the air flow space and in contact with the fins of the heat sink, wherein heat from the inner heated air is transferred to the fins of

the heat sink, wherein heat from the fins of the heat sink is transferred to the finless heat collecting portion, wherein heat from the finless heat collecting portion is transferred to fluid in the outer fluid filled heat collecting portion forming a heated fluid, and wherein the heated fluid flows into the outer fins;

f. installing a first exterior fan to flow the external air into the forced air duct to contact the outer fins, wherein heat from the heated fluid in the outer fins is transferred to the external air, forming a heated air;

g. installing a second exterior fan to exhaust the heated air to an outside of the facility from the forced air duct;

h. installing a first powered transducer in the second segment to determine a first temperature of a cooler chamber air;

i. installing a second powered transducer to at least one of the outer fins to determine a second temperature;

j. installing a third powered transducer proximate to the fins of the heat sink to determine a third temperature of the inner heated air; and

k. using computer instructions in a data storage of a controller to:

(i) instruct a processor of the controller to monitor temperatures from the first powered transducer, the second powered transducer, and the third powered transducer;

(ii) compare the monitored temperatures to preset limits; and

(iii) when the monitored temperatures exceed or fall below the preset limits, maintain temperatures within the facility within the preset limits by:

1. actuating the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

2. regulating fan speeds of the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

3. stopping the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan; or

4. combinations thereof.

19. A method for cooling a facility with heat generating electronics, wherein the facility has a first segment with inner heated air, a second segment, and an air flow space, the method comprising:

a. mounting a heat sink in a wall or an outside top of the facility, wherein the heat sink comprises a finless heat collecting portion and fins, and wherein the heat sink is in contact with the inner heated air;

b. mounting an outer heat pipe assembly to the heat sink, wherein the outer heat pipe assembly comprises an outer fluid filled finless heat collecting portion in thermal communication with the finless heat collecting portion, and wherein the outer heat pipe assembly comprises outer fins opposite the outer fluid filled heat collecting portion, and a forced air duct around the outer heat pipe assembly to contain air flow around the outer heat pipe assembly;

c. flowing air from the air flow space into the second segment using a first interior fan to provide cooler chamber air to the second segment;

d. flowing the inner heated air from the first segment into the air flow space and across the fins of the heat sink using a second interior fan, wherein heat from the inner heated air is transferred to the fins of the heat sink, wherein heat from the fins of the heat sink is transferred to the finless heat collecting portion, wherein heat from the finless heat collecting portion is transferred to fluid in the outer fluid filled heat collecting portion forming a heated fluid, and wherein the heated fluid flows into the outer fins;

e. flowing external air into the forced air duct to contact the outer fins using a first exterior fan, wherein heat from the heated fluid in the outer fins is transferred to the external air, forming a heated air;

f. exhausting the heated air to an outside of the facility from the forced air duct using a second exterior fan;

g. determining a first temperature of the cooler chamber air using a first powered transducer in the second segment;

h. determining a second temperature using a second powered transducer on at least one of the outer fins;

i. determining a third temperature of the inner heated air using a third powered transducer proximate to the fins of the heat sink; and

j. using a controller to:

(i) monitor temperatures from the first powered transducer, the second powered transducer, and the third powered transducer;

(ii) compare the monitored temperatures to preset limits; and

(iii) when the monitored temperatures exceed or fall below the preset limits, maintain temperatures within the facility within the preset limits by:

1. actuating the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

2. regulating fan speeds of the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

3. stopping the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan; or

4. combinations thereof.

e. flowing external air into the forced air duct to contact the outer fins using a first exterior fan, wherein heat from the heated fluid in the outer fins is transferred to the external air, forming a heated air;

f. exhausting the heated air to an outside of the facility from the forced air duct using a second exterior fan;

g. determining a first temperature of the cooler chamber air using a first powered transducer in the second segment;

h. determining a second temperature using a second powered transducer on at least one of the outer fins;

i. determining a third temperature of the inner heated air using a third powered transducer proximate to the fins of the heat sink; and

j. using a controller to:

(i) monitor temperatures from the first powered transducer, the second powered transducer, and the third powered transducer;

(ii) compare the monitored temperatures to preset limits; and

(iii) when the monitored temperatures exceed or fall below the preset limits, maintain temperatures within the facility within the preset limits by:

1. actuating the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

2. regulating fan speeds of the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan;

3. stopping the first interior fan, the second interior fan, the first exterior fan, and the second exterior fan; or

4. combinations thereof.

ABSTRACT OF DISCLOSURE

A method to cool a portable facility with heat generating electronics can include using interior fans, a heat sink integrally serving as part of a wall or ceiling, and an outer heat pipe assembly in thermal communication with the heat sink to allow for heat dissipation. The method can use external fans to pull external air over the outer heat pipe assembly, and a plurality of transducers to monitor temperatures of the facility connected to a controller. The controller can operate the fans. Computer instructions can be used to monitor temperatures from the transducers, compare the temperatures to preset limits, and individually or simultaneously actuate, regulate, or turn off the fans when monitored temperatures meet or exceed preset limits.

FIGURE 1

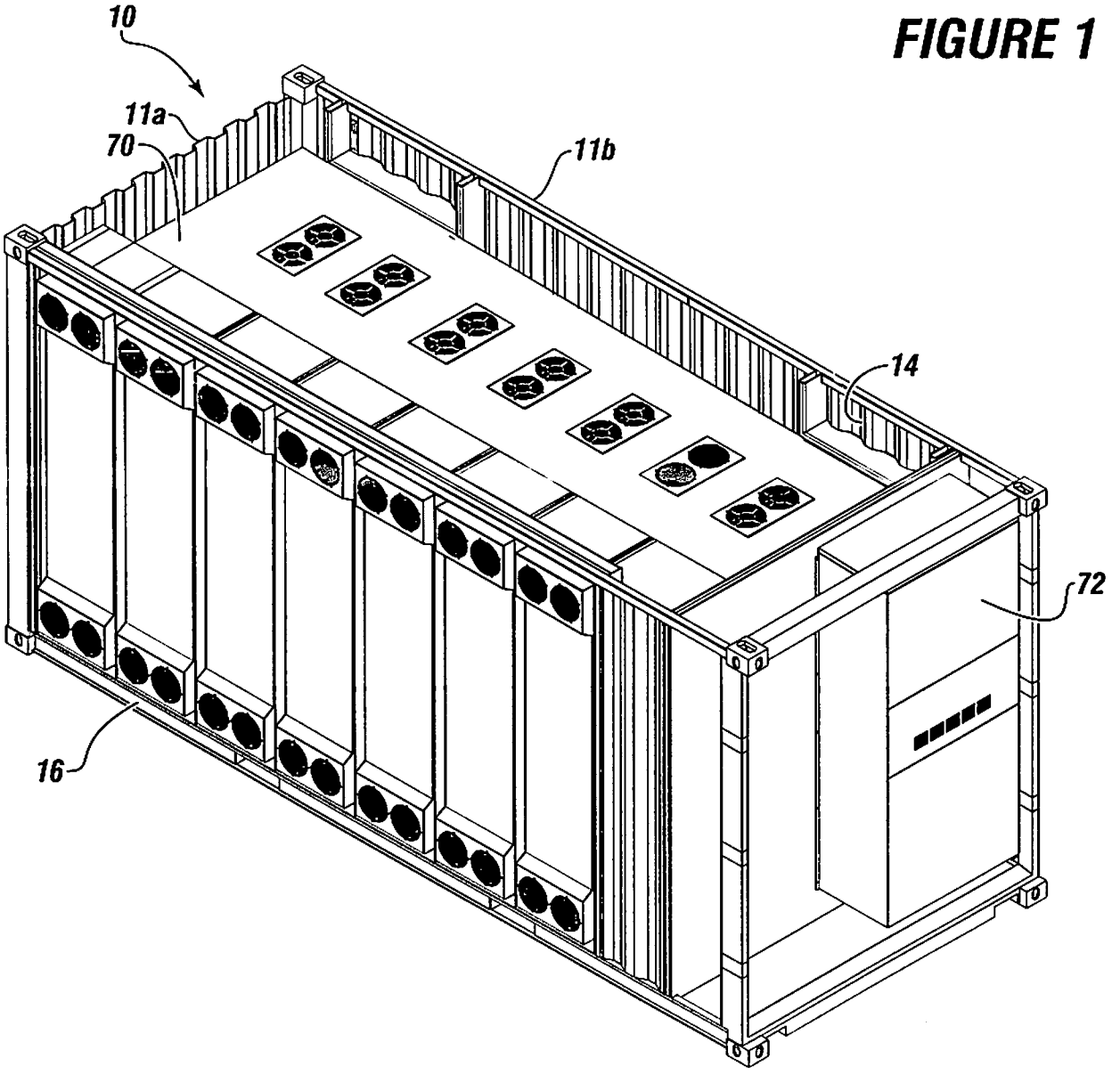
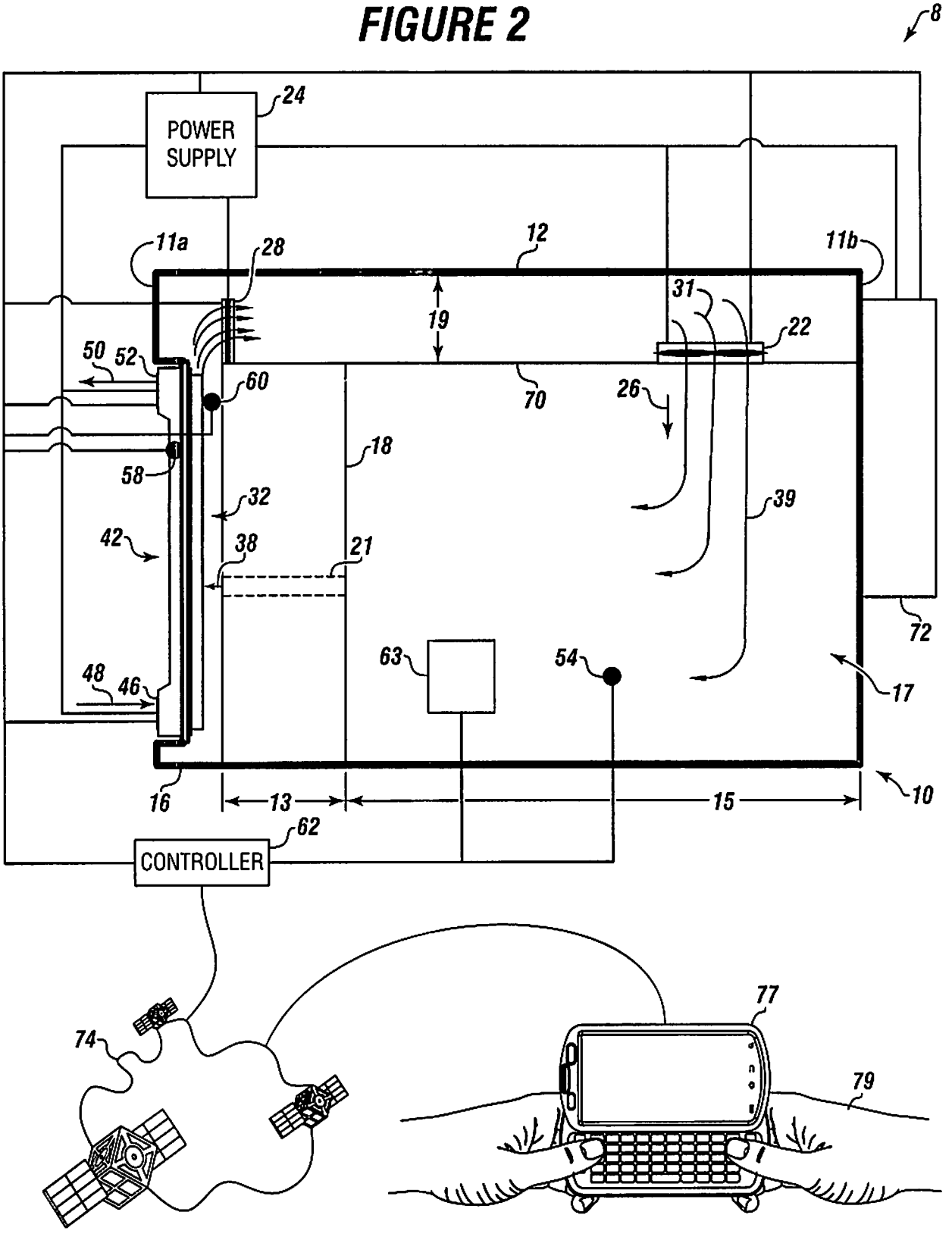


FIGURE 2


8
POWER SUPPLY
24
11a
28
12
11b
19
31
22
50
52
60
70
26
18
58
32
39
42
38
21
72
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CONTROLLER
62
74
77
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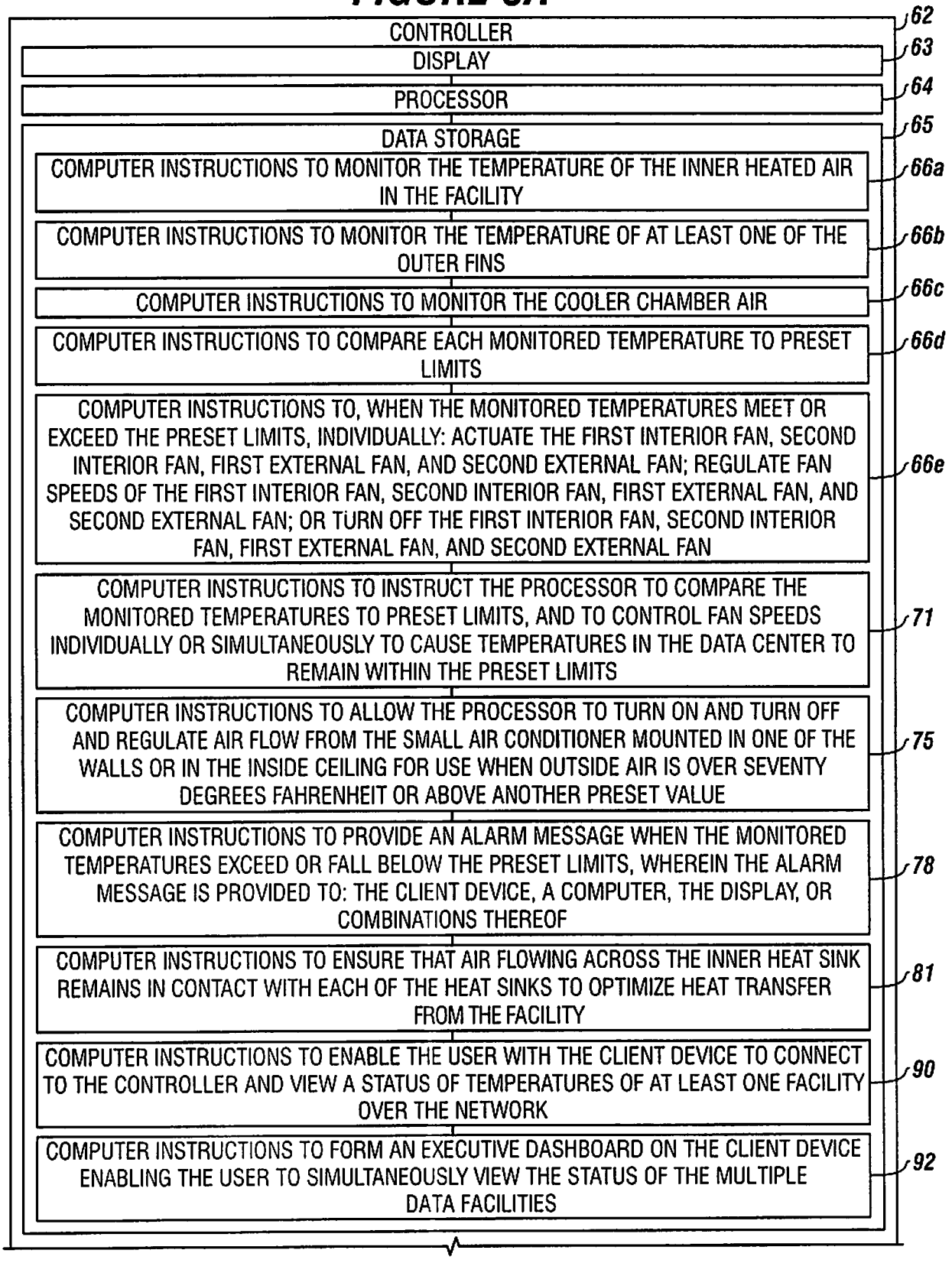
FIGURE 3A


CONTROLLER
62
DISPLAY
63
PROCESSOR
64
DATA STORAGE
65
COMPUTER INSTRUCTIONS TO MONITOR THE TEMPERATURE OF THE INNER HEATED AIR IN THE FACILITY
66a
COMPUTER INSTRUCTIONS TO MONITOR THE TEMPERATURE OF AT LEAST ONE OF THE OUTER FINS
66b
COMPUTER INSTRUCTIONS TO MONITOR THE COOLER CHAMBER AIR
66c
COMPUTER INSTRUCTIONS TO COMPARE EACH MONITORED TEMPERATURE TO PRESET LIMITS
66d
COMPUTER INSTRUCTIONS TO, WHEN THE MONITORED TEMPERATURES MEET OR EXCEED THE PRESET LIMITS, INDIVIDUALLY: ACTUATE THE FIRST INTERIOR FAN, SECOND INTERIOR FAN, FIRST EXTERNAL FAN, AND SECOND EXTERNAL FAN; REGULATE FAN SPEEDS OF THE FIRST INTERIOR FAN, SECOND INTERIOR FAN, FIRST EXTERNAL FAN, AND SECOND EXTERNAL FAN; OR TURN OFF THE FIRST INTERIOR FAN, SECOND INTERIOR FAN, FIRST EXTERNAL FAN, AND SECOND EXTERNAL FAN
66e
COMPUTER INSTRUCTIONS TO INSTRUCT THE PROCESSOR TO COMPARE THE MONITORED TEMPERATURES TO PRESET LIMITS, AND TO CONTROL FAN SPEEDS INDIVIDUALLY OR SIMULTANEOUSLY TO CAUSE TEMPERATURES IN THE DATA CENTER TO REMAIN WITHIN THE PRESET LIMITS
71
COMPUTER INSTRUCTIONS TO ALLOW THE PROCESSOR TO TURN ON AND TURN OFF AND REGULATE AIR FLOW FROM THE SMALL AIR CONDITIONER MOUNTED IN ONE OF THE WALLS OR IN THE INSIDE CEILING FOR USE WHEN OUTSIDE AIR IS OVER SEVENTY DEGREES FAHRENHEIT OR ABOVE ANOTHER PRESET VALUE
75
COMPUTER INSTRUCTIONS TO PROVIDE AN ALARM MESSAGE WHEN THE MONITORED TEMPERATURES EXCEED OR FALL BELOW THE PRESET LIMITS, WHEREIN THE ALARM MESSAGE IS PROVIDED TO: THE CLIENT DEVICE, A COMPUTER, THE DISPLAY, OR COMBINATIONS THEREOF
78
COMPUTER INSTRUCTIONS TO ENSURE THAT AIR FLOWING ACROSS THE INNER HEAT SINK REMAINS IN CONTACT WITH EACH OF THE HEAT SINKS TO OPTIMIZE HEAT TRANSFER FROM THE FACILITY
81
COMPUTER INSTRUCTIONS TO ENABLE THE USER WITH THE CLIENT DEVICE TO CONNECT TO THE CONTROLLER AND VIEW A STATUS OF TEMPERATURES OF AT LEAST ONE FACILITY OVER THE NETWORK
90
COMPUTER INSTRUCTIONS TO FORM AN EXECUTIVE DASHBOARD ON THE CLIENT DEVICE ENABLING THE USER TO SIMULTANEOUSLY VIEW THE STATUS OF THE MULTIPLE DATA FACILITIES
92

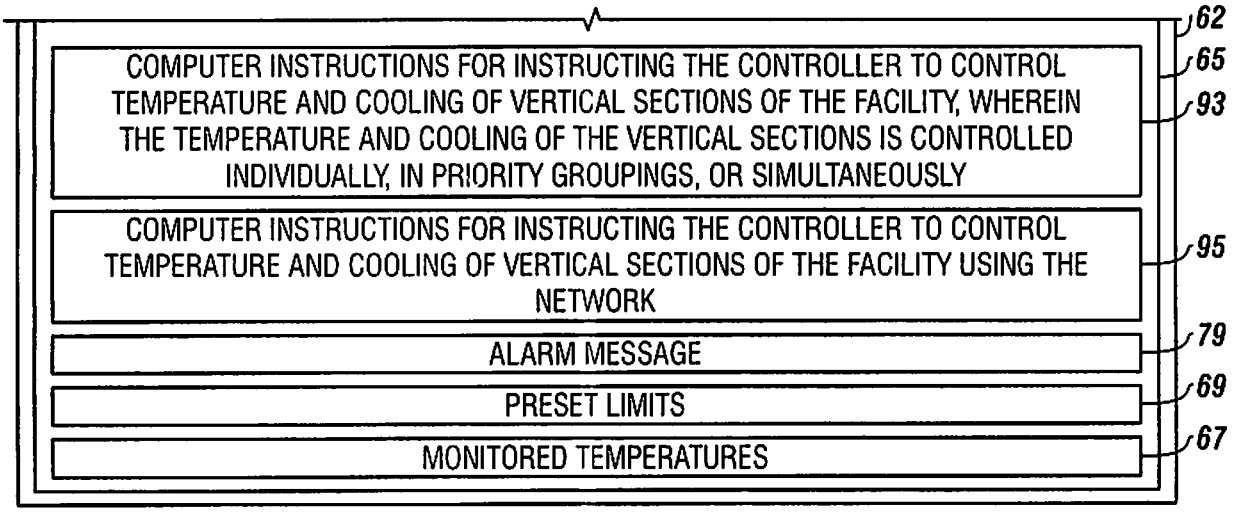

62
COMPUTER INSTRUCTIONS FOR INSTRUCTING THE CONTROLLER TO CONTROL TEMPERATURE AND COOLING OF VERTICAL SECTIONS OF THE FACILITY, WHEREIN THE TEMPERATURE AND COOLING OF THE VERTICAL SECTIONS IS CONTROLLED INDIVIDUALLY, IN PRIORITY GROUPINGS, OR SIMULTANEOUSLY
65
93
COMPUTER INSTRUCTIONS FOR INSTRUCTING THE CONTROLLER TO CONTROL TEMPERATURE AND COOLING OF VERTICAL SECTIONS OF THE FACILITY USING THE NETWORK
95
ALARM MESSAGE
79
PRESET LIMITS
69
MONITORED TEMPERATURES
67

FIGURE 3B

FIGURE 4A

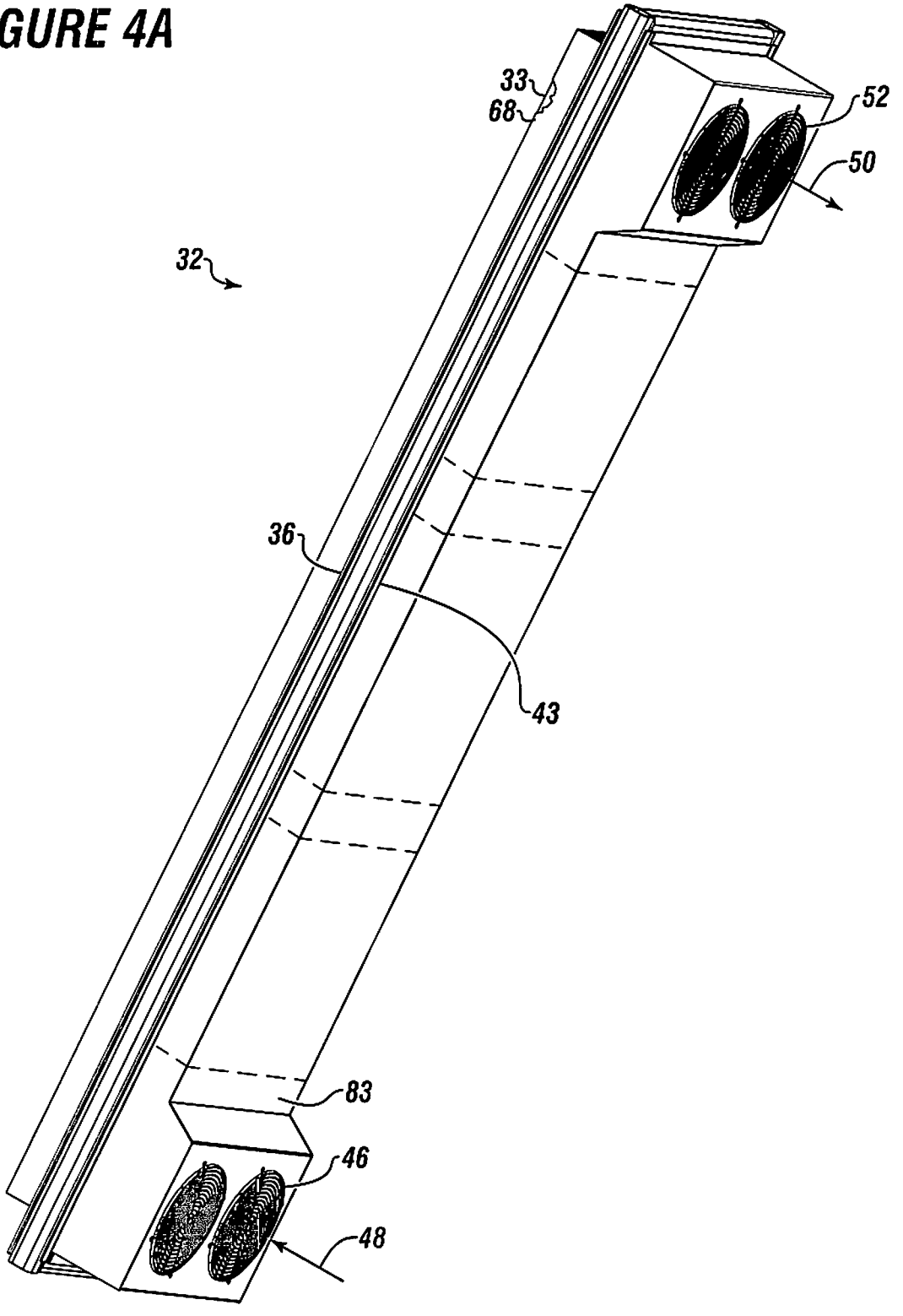


FIGURE 4B

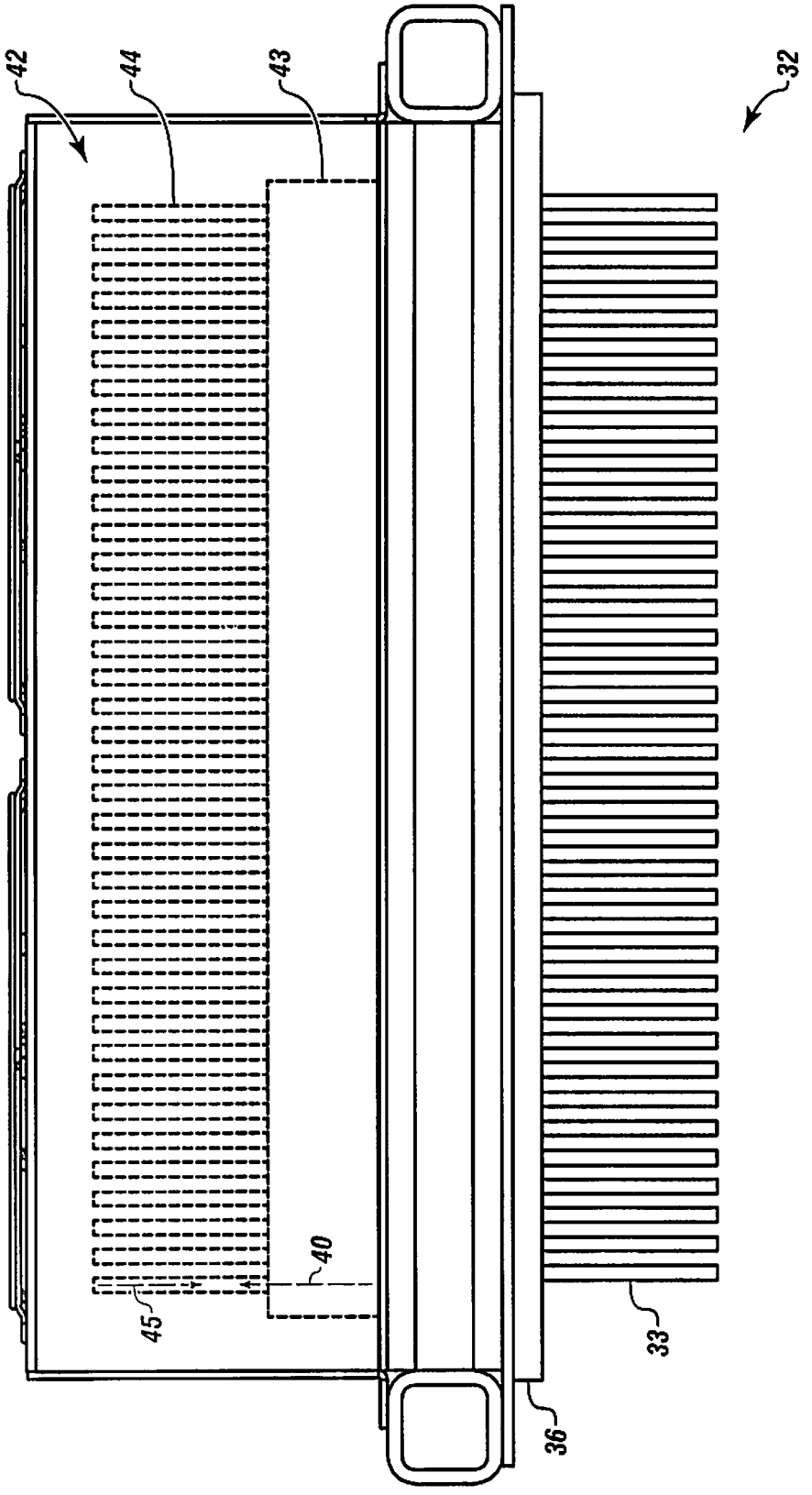
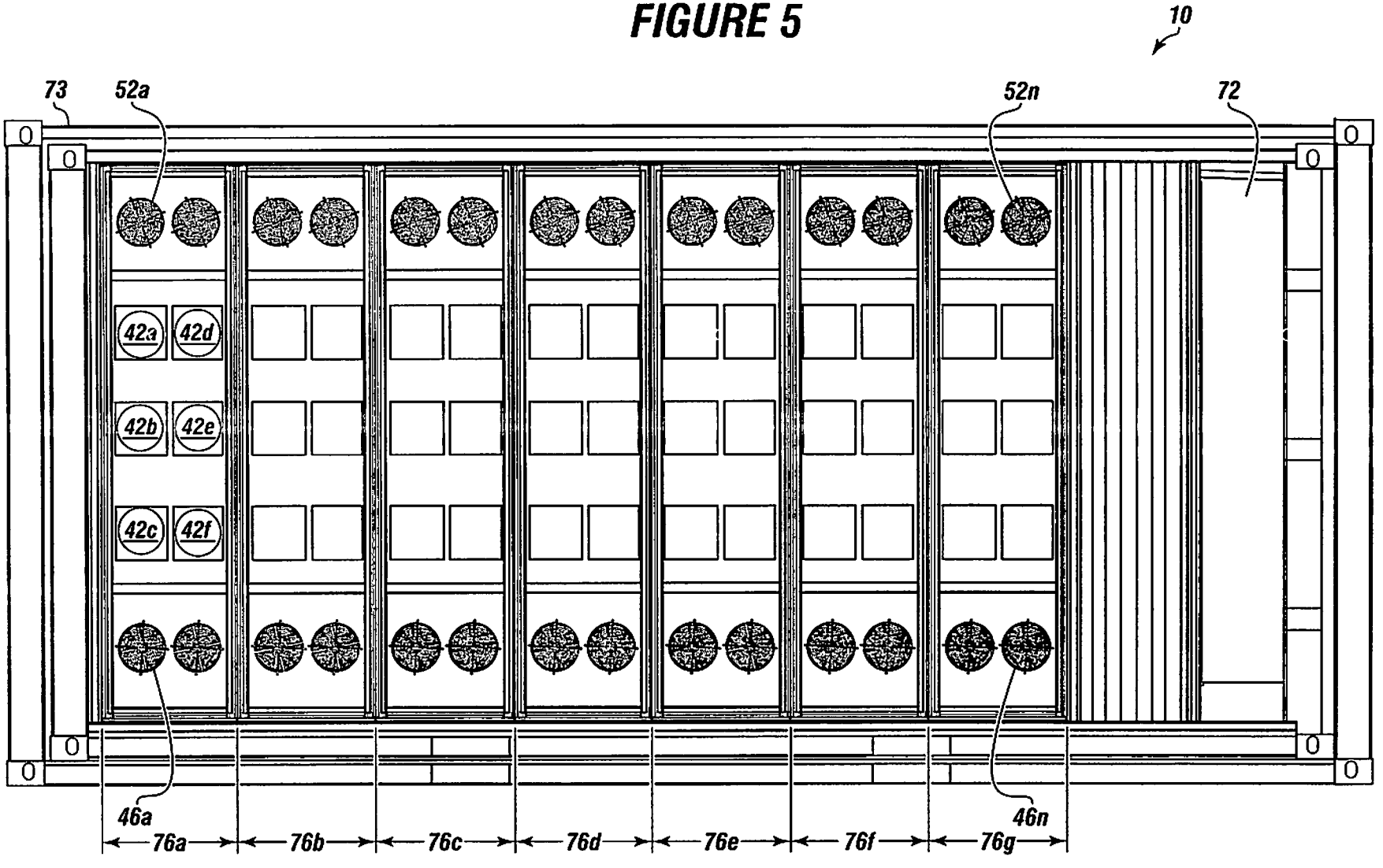


FIGURE 5


10
73
52a
52n
72
42a
42d
42b
42e
42c
42f
46a
46n
76a
76b
76c
76d
76e
76f
76g

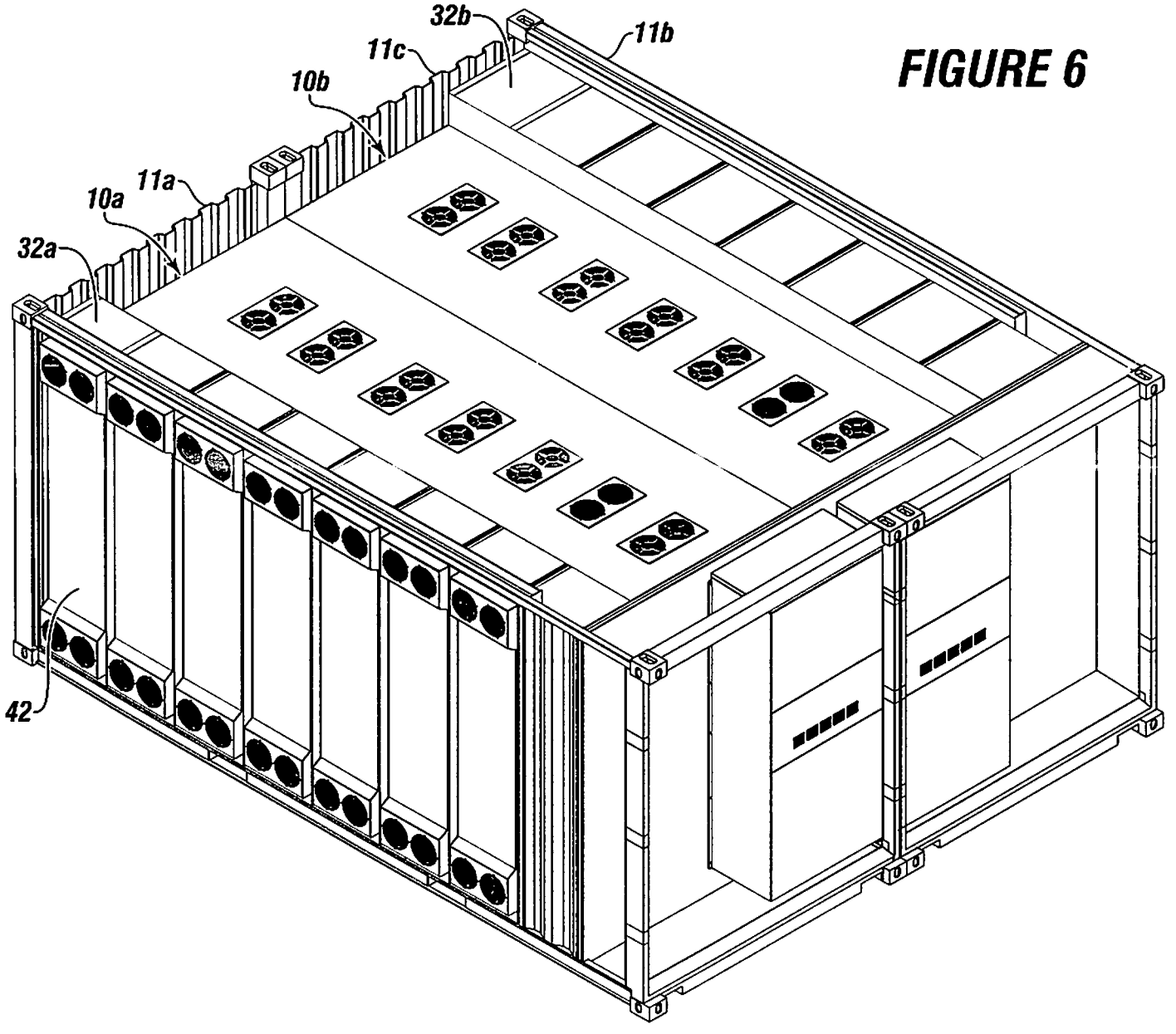


FIGURE 6

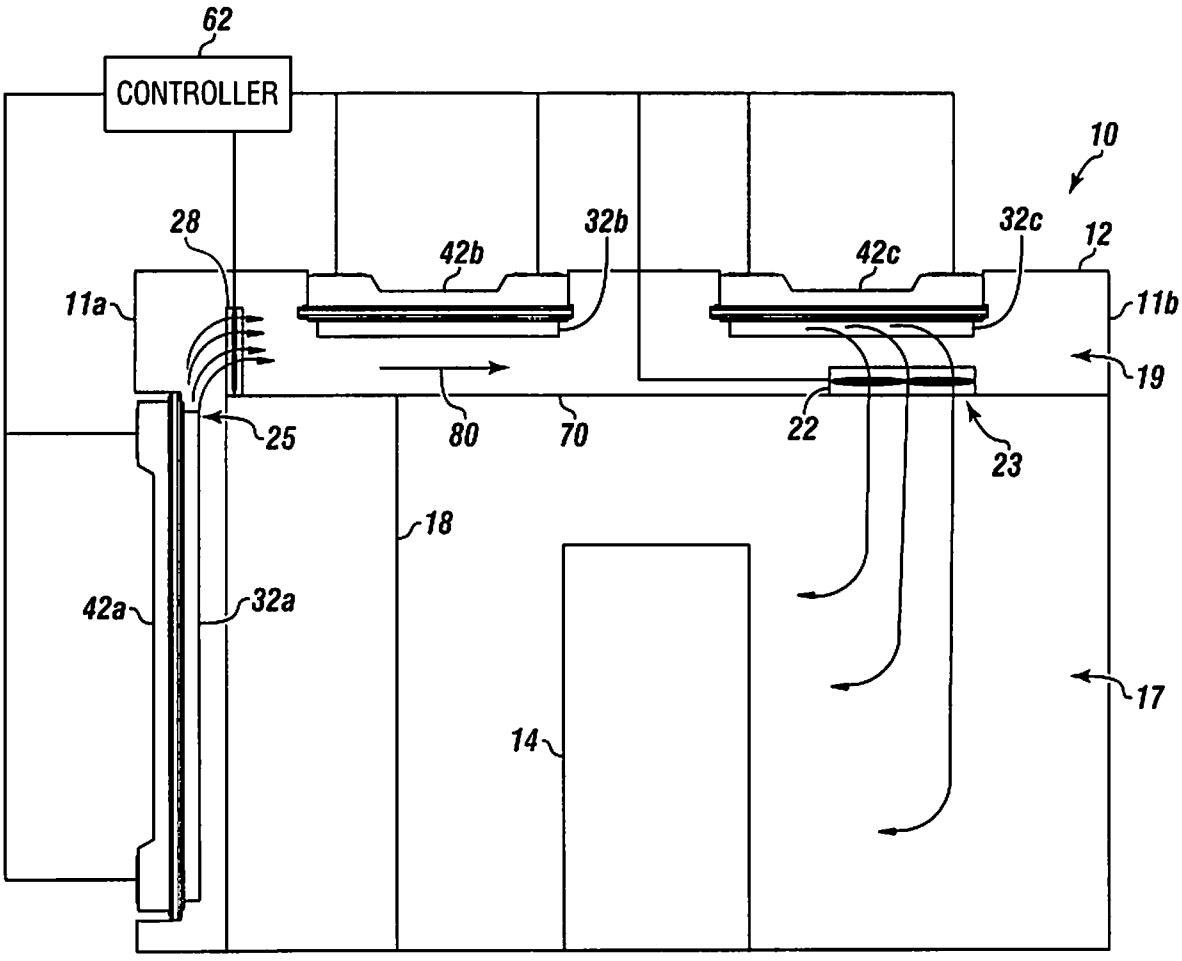

62
CONTROLLER
10
28
42b
32b
42c
32c
12
11a
11b
19
25
80
70
22
23
18
42a
32a
17
14

FIGURE 7

FIGURE 8

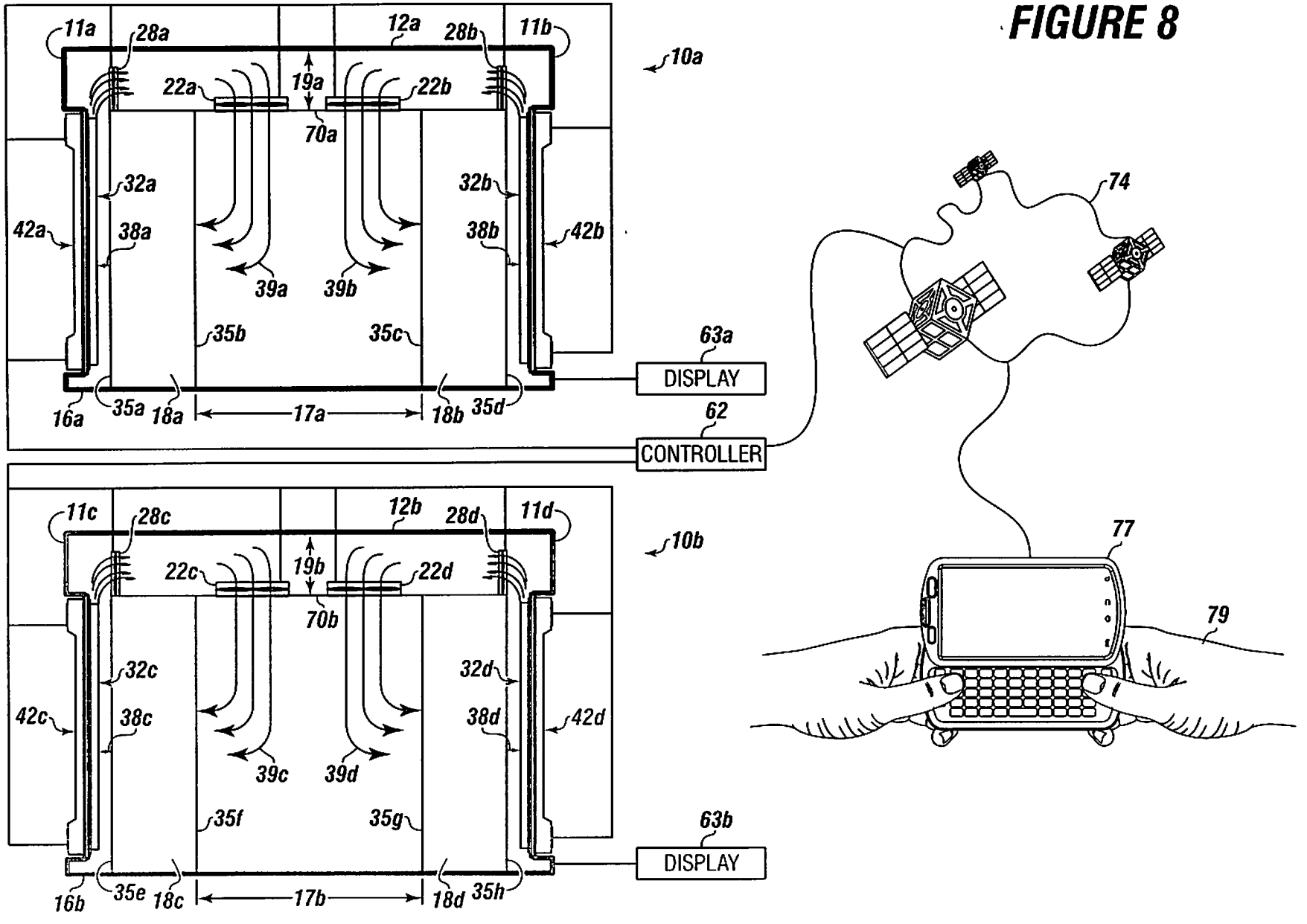
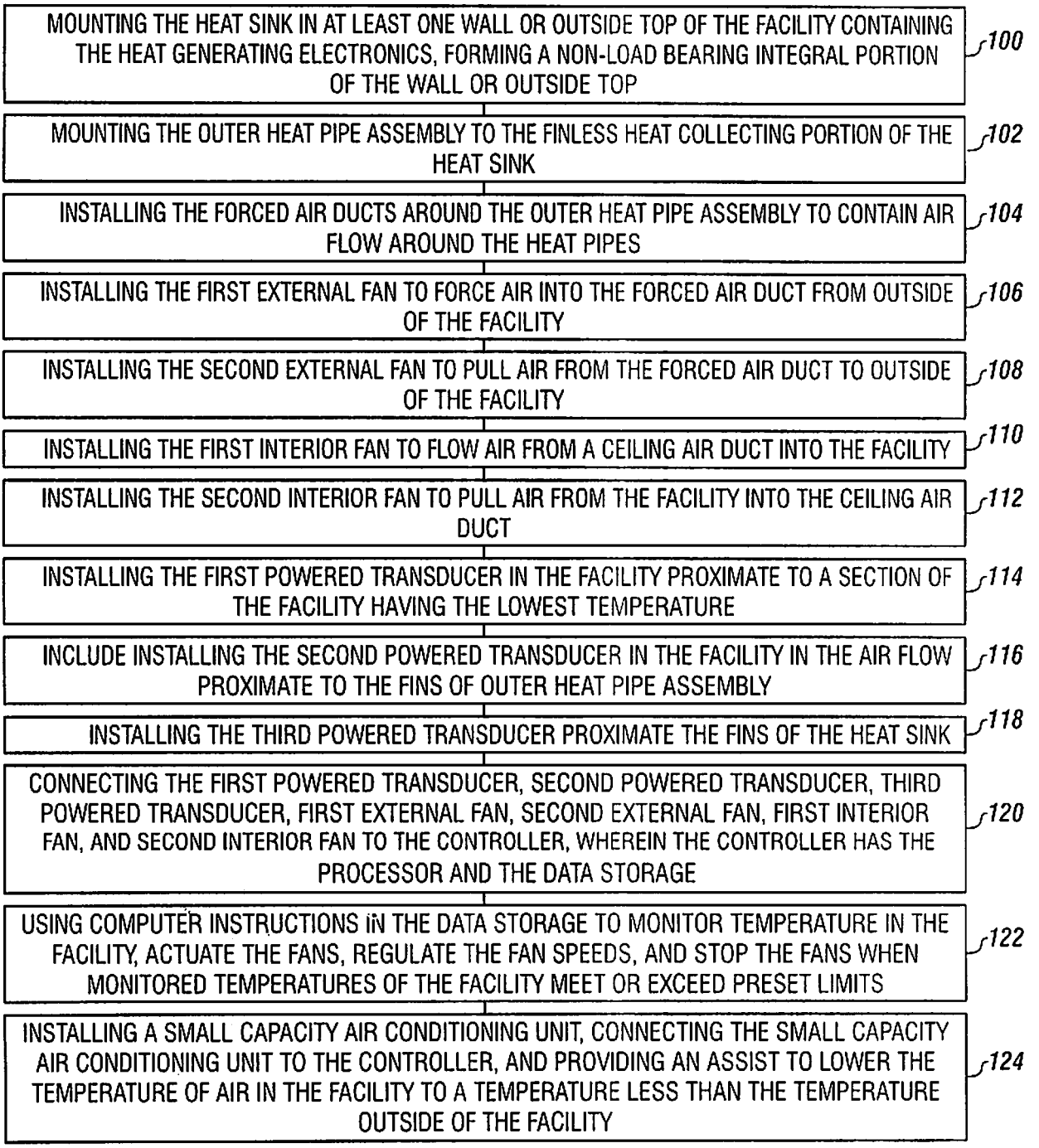

11a
28a
12a
28b
11b
10a
22a
19a
22b
70a
32a
32b
42a
38a
38b
42b
39a
39b
35b
35c
63a
DISPLAY
62
CONTROLLER
16a
35a
18a
17a
18b
35d
74
77
79
11c
28c
12b
28d
11d
10b
22c
19b
22d
70b
32c
32d
42c
38c
38d
42d
39c
39d
35f
35g
63b
DISPLAY
16b
35e
18c
17b
18d
35h

FIGURE 9


MOUNTING THE HEAT SINK IN AT LEAST ONE WALL OR OUTSIDE TOP OF THE FACILITY CONTAINING THE HEAT GENERATING ELECTRONICS, FORMING A NON-LOAD BEARING INTEGRAL PORTION OF THE WALL OR OUTSIDE TOP
100
MOUNTING THE OUTER HEAT PIPE ASSEMBLY TO THE FINLESS HEAT COLLECTING PORTION OF THE HEAT SINK
102
INSTALLING THE FORCED AIR DUCTS AROUND THE OUTER HEAT PIPE ASSEMBLY TO CONTAIN AIR FLOW AROUND THE HEAT PIPES
104
INSTALLING THE FIRST EXTERNAL FAN TO FORCE AIR INTO THE FORCED AIR DUCT FROM OUTSIDE OF THE FACILITY
106
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108
INSTALLING THE FIRST INTERIOR FAN TO FLOW AIR FROM A CEILING AIR DUCT INTO THE FACILITY
110
INSTALLING THE SECOND INTERIOR FAN TO PULL AIR FROM THE FACILITY INTO THE CEILING AIR DUCT
112
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114
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116
INSTALLING THE THIRD POWERED TRANSDUCER PROXIMATE THE FINS OF THE HEAT SINK
118
CONNECTING THE FIRST POWERED TRANSDUCER, SECOND POWERED TRANSDUCER, THIRD POWERED TRANSDUCER, FIRST EXTERNAL FAN, SECOND EXTERNAL FAN, FIRST INTERIOR FAN, AND SECOND INTERIOR FAN TO THE CONTROLLER, WHEREIN THE CONTROLLER HAS THE PROCESSOR AND THE DATA STORAGE
120
USING COMPUTER INSTRUCTIONS IN THE DATA STORAGE TO MONITOR TEMPERATURE IN THE FACILITY, ACTUATE THE FANS, REGULATE THE FAN SPEEDS, AND STOP THE FANS WHEN MONITORED TEMPERATURES OF THE FACILITY MEET OR EXCEED PRESET LIMITS
122
INSTALLING A SMALL CAPACITY AIR CONDITIONING UNIT, CONNECTING THE SMALL CAPACITY AIR CONDITIONING UNIT TO THE CONTROLLER, AND PROVIDING AN ASSIST TO LOWER THE TEMPERATURE OF AIR IN THE FACILITY TO A TEMPERATURE LESS THAN THE TEMPERATURE OUTSIDE OF THE FACILITY
124