

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John E. Seem et al.

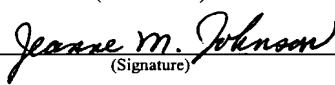
Title: METHOD AND APPARATUS
FOR ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL CONTROL
SYSTEM

Appl. No.: Unknown

Filing Date: Herewith

Examiner: Unknown

Art Unit: Unknown

CERTIFICATE OF EXPRESS MAILING	
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EV431598885US	May 7, 2004
(Express Mail Label Number)	(Date of Deposit)
Jeanne M. Johnson	
(Printed Name)	
	
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UTILITY PATENT APPLICATION
TRANSMITTAL

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

Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is the nonprovisional utility patent application of:

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☐ Applicant claims small entity status under 37 CFR 1.27.

Enclosed are:

- ☒ Specification, Claim(s), and Abstract (27 pages).
- ☒ Informal drawings (13 sheets, Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14).
- ☒ Declaration and Power of Attorney (5 pages).
- ☒ Assignment of the invention to Johnson Controls Technology Company (4 pages).
- ☒ Assignment Recordation Cover Sheet (1 page).
- ☐ Small Entity statement.
- ☒ Request for application not to be published with certification under 35 USC 122(b)(2)(B)(i) (1 page).
- ☐ Information Disclosure Statement.
- ☐ Form PTO/SB/08 with copies of ____ listed reference(s).
- ☒ Application Data Sheet (37 CFR 1.76) (6 pages).
- ☐ Claim for Convention Priority.

The filing fee is calculated below:

	Claims as Filed		Included in Basic Fee		Extra Claims		Rate		Fee Totals
Basic Fee							\$770.00	=	\$770.00
Total	65	-	20	=	45	x	\$18.00	=	\$810.00
Claims:									
Independents	4	-	3	=	1	x	\$86.00	=	\$86.00
:									
If any Multiple Dependent Claim(s) present:					+		\$290.00	=	\$0.00
							SUBTOTAL:	=	\$1666.00
[]							Small Entity Fees Apply (subtract ½ of above):	=	\$0.00
							TOTAL FILING FEE:	=	\$1,666.00
Assignment Recordation Fee:					+		\$40.00	=	\$40.00
TOTAL FEE								=	\$1,706.00

☒ A check in the amount of \$1,706.00 to cover the filing fee and fee for recordation of Assignment is enclosed.

☐ The required filing fees are not enclosed but will be submitted in response to the Notice to File Missing Parts of Application.

☒ The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

Date May 7, 2004

By David J. Bates

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 (Signature)	

REQUEST AND CERTIFICATION UNDER 35 U.S.C. 122(b)(2)(B)(i)

Commissioner for Patents
P.O. Box 1450
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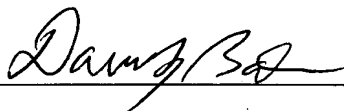
Sir:

Applicants hereby 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 agreement, that requires publication at eighteen months after filing. Applicants hereby request that the attached application not be published under 35 U.S.C. 122(b).

Respectfully submitted,

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U.S. PATENT APPLICATION

for

**METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF
AN ENVIRONMENTAL CONTROL SYSTEM**

Inventors: John E. Seem
William A. Huth
Robert J. Fraune
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METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN ENVIRONMENTAL CONTROL SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates to an environmental control
5 system. More particularly, the present invention relates to a method and
apparatus for assessing performance of environmental control networks. The
present invention also relates to a method and apparatus for diagnosing
performance problems in environmental control networks.

BACKGROUND OF THE INVENTION

[0002] Environmental control networks or facility management
10 systems are employed in office buildings, manufacturing facilities, and the like, for
controlling the internal environment of the facility. The environmental control
network may be employed to control temperature, fluid flow, humidity, lighting,
boilers, chillers, power, security and similar systems in the internal environment.

[0003] For example, in environmental control networks configured
15 to control temperature and air flow, controlled air units such as variable air volume
(VAV) boxes and unitary devices (UNT) are located throughout the facility to
provide environmentally controlled air to the internal environment. The controlled
air is provided at a particular temperature or humidity so that a comfortable
20 internal environment is established and maintained.

[0004] The VAV boxes and unitary devices are coupled via duct
work to a source of conditioned air, known as an air handling unit (AHU). VAV
boxes and unitary devices may include a fan or other device for blowing the
controlled air. VAV boxes and unitary devices may also include a damper for
25 regulating the amount of the controlled air provided to the internal environment.
The damper is coupled to an actuator, which preferably positions the damper so
that appropriate air flow is provided to the internal environment.

[0005] In modern systems, a digital controller is typically
associated with at least one of the actuator and the damper. The controller

receives information related to the air flow and temperature (known as “controlled variables”) in the internal environment and appropriately positions the actuator so that the appropriate air flow is provided to the internal environment.

5 **[0006]** The AHU also includes a digital controller which may control the supply of cooled air by regulating the flow of chilled water through a cooling coil. The controller regulates the flow of chilled water to the cooling coil by adjusting the position of a valve based on a feedback signal indicative of the temperature of the air discharged from the coil (another “controlled variable”). The feedback signal is generated by a sensor disposed to monitor the controlled
10 variable.

[0007] The AHU and VAV controllers use the feedback signals to maintain the controlled variables within certain tolerances of desired levels (known as “setpoints”). For example, the AHU controller attempts to maintain the temperature of the air discharged from the system at a specific level. When the
15 actual temperature of the discharged air deviates from the desired temperature, the controller must appropriately adjust the flow of the chilled water to bring the actual air temperature back in line with the desired air temperature. Thus, if the feedback signal indicates that the actual air temperature is colder than the desired temperature, the controller decreases the flow rate of chilled water to cause the
20 actual temperature of the discharged air to increase. Likewise, if the feedback signal indicates that the actual air temperature is warmer than the desired temperature, the controller increases the flow rate of chilled water to cause the actual temperature of the discharged air to decrease.

[0008] An ideal feedback control system would be able to maintain
25 the controlled variable at the setpoint based only on the feedback signal. However, actual feedback control systems require additional inputs known as control parameters that are used by the controller to determine how to control the system based on the feedback signal and the setpoint. Common control algorithms that make use of such control parameters are proportional (P) control, proportional integral (PI) control, and proportional-integral derivative (PID) control.
30 More recently, a pattern recognition adaptive control (PRAC) method has been utilized to automatically determine the values of the control parameters after

significant setpoint changes or load disturbances have occurred. One example of an improved PRAC method is disclosed in commonly owned U.S. Patent Application No. 10/612,621 (currently pending).

[0009] With any of the forgoing feedback control strategies, however, it can be difficult to maintain the controlled variable precisely at the desired set point for various reasons, including that the appropriate values for the control parameters may change over time as the system is used. For example, the dynamics of a process may be altered by heat exchanger fouling, inherent nonlinear behavior, ambient variations, flow rate changes, large and frequent disturbances, and unusual operations status such as failures, startup and shutdown. The process of adjusting the control parameters of a controller to compensate for such system changes is called retuning. If a controller is not periodically retuned, the control response may become poor. For example, the controlled variable may become unstable or oscillate widely with respect to the setpoint. This can result in inefficient operation as well as increase the maintenance costs due to unnecessary wear of the components.

[0010] Significant advances in the art of monitoring the performance of environmental control systems and diagnosing problems therewith have been disclosed in commonly owned U.S. Patent Nos. 5,555,195 and 5,682,329 ("the '195 and '329 patents"), the entire contents of which are hereby incorporated by reference herein. The '195 and '329 patents disclose diagnostic systems that may be utilized to analyze the performance of devices in an environmental control system such as an HVAC or VAV box. The diagnostic systems disclosed in these two patents advantageously record temperature, air flow, actuator position and other data used in the VAV controllers and generate associated performance indices such as exponentially weighted moving averages (EWMAs). The performance indices may be related to error values, process output values, actuator positions, changes in actuator positions, duty cycles of the actuators, or starts, stops and reversals of the actuators. The calculated and stored performance indices allow building operators to analyze the VAV boxes and controller performance during particular time periods (e.g., commissioning) as well as during the useful lifetimes of the systems.

[0011] In addition to monitoring and diagnostic systems such as described above, it is also known to provide alarm/warning systems and data visualization programs to assist building operators with deriving meaningful information from the data that is gathered. However, human operators must typically select the thresholds for alarms and warnings, which can be a daunting task. If the thresholds are too tight, numerous false alarms may be issued. Conversely, if the thresholds are too loose, equipment or system failures can go undetected.

[0012] In view of the forgoing, it would be desirable to provide an improved method and apparatus for conveying measured performance indices to building operators. It would be further be desirable to convey performance indicators to building operators for analyzing system performance and diagnosing problems without requiring manual setting of alarm and warning thresholds.

SUMMARY OF THE INVENTION

[0013] The present invention relates to a method and apparatus for assessing performance of an environmental control network. The present invention also relates to a method and apparatus for diagnosing performance problems in environmental control networks.

[0014] According to a first aspect of an embodiment of the present invention, a method is provided for analyzing performance of control applications in an environmental control network. The method includes receiving at least one performance indicator for each control application, and identifying at least one control application experiencing degraded performance using a first view of the performance indicators. The method further includes obtaining additional information regarding the at least one control application using a second view of the performance indicators.

[0015] According to another aspect of an embodiment of the present invention, a program product is provided for analyzing performance of control applications in an environmental control network. The program product comprises machine-readable program code for causing, when executed, one or more machines to implement a method. The method includes displaying

performance indicators for the control applications using a first view that allows at least one control application exhibiting degraded performance to be identified. The method further includes displaying performance indicators using a second view that provides additional details regarding the performance of the at least one control application.

[0016] According to another aspect of an embodiment of the present invention, a method is provided for diagnosing performance of control applications in an environmental control network. The method includes receiving at least one performance indicator for each control application, and identifying at least one control application exhibiting degraded performance using a first view of the performance indicators. The method further includes obtaining additional information regarding the at least one control application using a second view of the performance indicators. The second view provides additional information on the at least one control application to permit a diagnosis of a possible cause of the degraded performance.

[0017] According to another aspect of an embodiment of the present invention, a method is provided for assessing performance of control applications associated with an environmental control network. The method includes receiving a plurality of performance indicators for the control applications, and performing a statistical scaling on the performance indicators. The method further includes displaying the scaled performance indicators on a common scale.

[0018] These and other benefits and features of embodiments of the invention will be apparent upon consideration of the following detailed description of exemplary embodiments thereof, presented in connection with the following drawings in which like reference numerals are used to identify like elements throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Figure 1 is a schematic block diagram of an environmental control network.

[0020] Figure 2 is an enlarged schematic block diagram of a controller and associated air handling unit shown in Figure 1.

[0021] Figure 3 is simplified schematic block diagram of an environmental control network and a remote computer in communication therewith.

[0022] Figures 4 – 7 illustrate a first embodiment of a performance assessment and diagnostics display showing varying levels of detail of performance indicators associated with controlled devices in an environmental control network.

[0023] Figures 8 – 10 illustrate different reports displaying varying levels of detail of performance indicators associated with controlled devices in an environmental control network.

[0024] Figures 11 and 12 illustrate tools that may be used to inspect and alter values and control logic associated with controlled devices in an environmental control network.

[0025] Figure 13 illustrates a flowchart of an exemplary embodiment of a method for generating a normalized/scaled performance graph.

[0026] Figure 14 illustrates a standardized/normalized/scaled performance graph.

[0027] Before explaining several exemplary embodiments of the present invention in detail it is noted that the invention is not limited to the details of construction or the arrangement of components set forth below or illustrated in the drawings. The invention is capable of other embodiments and being practiced or carried out in various ways. It is also noted that the phraseology and terminology employed herein is for purposes of description only and should not be regarded as limiting.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0028] The particulars shown herein are by way of example and for purposes of illustrative discussion of the embodiments of the present invention only and are presented in a manner that is believed to provide the most useful and readily understood description of the principles and concepts of the present invention. In this regard, no attempt is made to show structural details of the present invention in more detail than is necessary to provide a fundamental

understanding of the present invention. The description of the invention taken with the drawings is believed sufficient to make it apparent to those skilled in the art how several forms of the present invention may be embodied in practice.

[0029] Turning now to the drawings and referring initially to Figure 1, an environment control system or network 10 includes a plurality of field controllers 12, 14 and 16, a pair of supervisory controllers 18 and 20, and a work station 22. Field controllers 12, 14 and 16 may be coupled to each other and to supervisory controller 18 for communication via a communication bus 24. Supervisory controller 18 may also be coupled to work station 22 as well as to controller 20 or other controllers in environment control network 10 via a communications trunk 26. As shown in Figure 3, a portable or remote computer 28 may also be coupled to supervisory controller 18, to another controller or server on network 10, and/or to one or more devices on the subnetworks of network 10, via a session connection 30. Session connection 30 may be provided via a local area network (LAN) connection, a remote Internet, VPN connection, etc.

[0030] Referring again to Figure 1, environment control network 10 may be a facilities management system such as the MetasysTM system as manufactured by Johnson Controls, Inc. (JCI). In the illustrated embodiment, field controllers 12 and 14 are associated with VAV boxes 32 and 34 and field controller 16 is associated with an air handler unit (not shown) that provides forced air for the facility. Examples of field bus controllers that may be suitable for use in network 10 include FEC, AHU, VAV, UNT and VMA controllers manufactured by JCI. Examples of supervisory controllers that may be suitable for use in network 10 include NCE, NAE, NIE and NCM controllers manufactured by JCI. Examples of communications buses or trunks that may be suitable for use in network 10 include Ethernet, LON, N1, N2 and MSTP. Persons skilled in the art will recognize that many other types of controllers and communication buses could be utilized in the exemplary embodiments.

[0031] According to one exemplary embodiment, each of field controllers 12, 14 and 16 gathers and stores information associated with operation of the controlled devices. Each field controller 12, 14 and 16 may also calculate

performance indices (or indicators) for the controlled devices and/or the applications controlling such devices. Performance indicators are attributes of facility components (e.g. buildings, systems, and devices) that measure some aspect of the quality of operation of these components. In general, performance indicators have the following properties:

1. Provide a measure of the quality of the operation of a component, process or system.
2. Capable of being summarized or aggregated in some way.
3. Allow for comparison and summarization among disparate components.
4. May be compared against past performance or benchmarks.

[0032] Thus, a performance indicator provides some measure of whether a control application is performing as required. For example, an HVAC control loop controlling some HVAC process variable such as temperature or pressure is designed to maintain the process variable at a setpoint with minimal effort. Good performance indicators for this process might measure the deviation of input (i.e., the process variable) from setpoint (i.e., accuracy) as well as the size (i.e., magnitude, amount or degree) of control effort, which may be indicative of efficiency and/or mechanical wear.

[0033] With reference now to Figure 2, additional details are provided for an exemplary controller and associated VAV box (e.g., controller 12 VAV box 32) that are suitable for use in the exemplary embodiments. In the illustrated embodiment, controller 12 includes a communication port 36 coupled with communication bus 24 (Figure 1). Controller 12 also includes an air flow input 38, a temperature input 40, and an actuator output 42. Instead of VAV box 32, the controlled device could be an AHU including fans, heating or cooling units, exhaust dampers, and return dampers for treating an air flow 44.

[0034] In the illustrated embodiment, VAV control box 32 includes a damper 46, an air flow sensor 48, and an actuator 50. Actuator 50 positions damper 46 based on control signals from controller 12 provided via actuator output 42. The position of damper 46 controls the amount of air flow 44 provided to the environment being controlled. The controlled environment may be a room, hallway, building, a portion thereof, or any other internal environment. Air flow

sensor 48 provides a parameter such as an air flow measurement to air flow input 38 of controller 12. The air flow measurement represents an estimate of the amount of air flow 44 provided through damper 46 to the controlled environment. A temperature sensor 52 located in the controlled environment provides another
5 parameter to controller 12 via temperature input 40.

[0035] Additional details regarding controller 12 and its manner of operation are provided in commonly owned U.S. Patent No. 5,682,329, which was incorporated by reference above. However, a brief summary of certain aspects of the operation of controller 12 are repeated below for convenience. Further details
10 regarding the operation of network 10 are also provided in the '329 patent.

[0036] In the embodiment of Figures 1 and 2, controller 12 is configured to appropriately position actuator 50 in accordance with a control algorithm. The control algorithm may be a type that is well known to persons skilled in the art such as P, PI, PID based algorithms. The control algorithm may
15 also be a PRAC based algorithm such as disclosed in commonly owned U.S. Patent Application No. 10/612,621 (currently pending). In accordance with any of these types of algorithms, controller 12 may receive air flow and temperature feedback values at inputs 38 and 40, respectively. The control algorithm may also receive other data (e.g., temperature set point from a thermostat) from
20 communications port 36 or some other input. Controller 12 provides an actuator output signal at actuator output 42 to accurately position damper 46 in an effort to maintain the controlled environment within a specified tolerance of the desired temperature with minimal effort.

[0037] In accordance with the foregoing control algorithms,
25 controller 12 may also calculate and store one or more diagnostic and/or performance indices. The calculation of exemplary performance indices by controller 12 is described in the '329 patent, which was incorporated by reference above. Exemplary performance indices may include parameters such as the absolute value error for temperature, pressure, airflow or humidity. Exemplary
30 performance indices may also include the actual temperature measured by temperature sensor 52 or air flow measured by sensor 48, the change in the actuator position signal, the temperature setpoint provided by the thermostat, the

duty cycle or run time of actuator 50, or the number of starts, stops and reversals of actuator 50. In addition to the foregoing, many other types of performance indicators could be generated by controller 12, depending on the type of equipment being controlled, the environment being controlled and other factors.

5 **[0038]** In the embodiment illustrated in Figure 3, controller 12 may calculate weighted averages of control effort and accuracy performance indicators 54 and 56. Performance indicators 54 and 56 may be exponentially weighted moving averages (EWMAs) such as described in the '329 patent. The calculated EWMA values 54 and 56 may be utilized in a variety of control and diagnostic
10 systems including chemical applications, flight control, energy systems, lighting systems, and other environments. The use of EWMA values (as opposed to only the raw sensor readings) provides certain advantages including that only one previous value must be stored for each performance indicator. Additional advantages of using EWMA values include that they are based on all of the values
15 in the time series, while at the same time being computationally efficient and giving greater weight to more recent values compared to older values.

[0039] Controller 12 may store the summary data, the performance indicators and/or the EWMA values in a local memory. Alternatively, or in addition, controller 12 may provide such information to supervisory controller
20 18 and/or to one or more remote computers 28 (or to any other computer or device on network 10 or that is capable of connecting to network 10) on a continuous, periodic, or on request only basis. This may be done for various purposes such as report generation, data logging, performance monitoring, diagnostics, and the like.

25 **[0040]** With reference now to Figures 4 - 7, a performance assessment and diagnostics display 58 for a facility management system is provided according to a first exemplary embodiment. Performance display 58 allows an operator to view the summary data, performance indices, EWMA values, and other types of operational data. As explained in detail below, the
30 display of such information may be used to assess the current performance of the facility management system, to detect problems with performance, to diagnose the root causes of the problems, and so on. Significantly, such performance

assessment and diagnosis may be accomplished according to the exemplary embodiments without requiring the operator to set any alarm or warning thresholds.

[0041] As shown in Figure 4, performance display 58 comprises three main sections or windows including a facility navigation window 60 (in the upper left), a systems navigation window 62 (in the lower left), and a performance/diagnostics window 64 (on the right). Facility navigation window 60 displays a facility navigation tree 66 that allows an operator to select which of the different facilities and/or subfacilities (e.g., buildings or groups of buildings) of an organization will have its performance assessed and/or diagnosed. In the illustrated embodiment, a root node 68 (labeled "ACME Facility") of facility tree 66 has been selected. As a result of this selection, all of the facilities and subfacilities of ACME Facility 68 are available in systems navigation window 62.

[0042] Systems navigation window 62 includes a systems navigation tree 70 that allows an operator to select which of the different systems or subsystems (e.g., equipment, controlled devices, control applications, etc.) of the selected facilities or subfacilities are included in performance/diagnostics window 64. In the embodiment of Figure 4, a node 94 (labeled "HVAC") of systems tree 70 has been selected. The act of selecting of HVAC node 94 in window 62 causes an HVAC performance view 96 to appear in performance/diagnostics window 64.

[0043] In Figure 4, HVAC performance view 96 provides a high level (i.e., summarized or "rolled-up") view of the performance indicators associated with the selected HVAC systems. According to an exemplary embodiment, HVAC performance view 96 comprises a plurality of "dot plots" graphs of the performance indices for the selected HVAC systems. For example, HVAC performance view 96 may include a dot plot graph for each type of control loop used in the HVAC systems of ACME Facility 68. In the illustrated example, view 96 displays an air distribution dot plot 98, a chilled water distribution dot plot 100, and a hot water distribution dot plot 102. That is, dot plots 98, 100 and 102 in Figure 4 display performance indicators associated with the current level of

performance for the air distribution, chilled water distribution and hot water distribution control loops in the HVAC systems of ACME Facility 68.

[0044] Instead of dot plot graphs, HVAC performance view 96 could display the performance indices for the selected HVAC systems using other types of graphics such as histograms, box plots, and the like. Moreover, the performance indicators could be displayed using a textual based display such as a table with rows and columns of numbers or percentages, or by a combination of graphics and text.

[0045] In the illustrated example, dot plot 98 in view 96 indicates that two of the air distribution control loops (indicated by data plots 104 and 106) are currently experiencing something less than good performance, with data plot 104 indicating a control loop considered to be operating at a "poor" level. By contrast, dot plots 100 and 102 show that all of the chilled water distribution control loops and all but one of the hot water distribution control loops are currently exhibiting good performance. In dot plot 102, one hot water distribution control loop shown in summary view 96 appears to be experiencing somewhat degraded system performance (see data point 108).

[0046] According to an exemplary embodiment, summary view 96 is created by rolling-up the performance indicators for only the worst performing control loop or subsystem of the selected system. Thus, the performance indicators for control loops or subsystems that are performing better than the worst performing control loops or subsystems may not be shown in summary view 96. As persons skilled in the art will appreciate, this summary view allows building operators to quickly identify control loops or subsystems that are exhibiting degraded performance levels without being distracted by control loops or subsystems that are performing properly. Instead of displaying performance indicators for only the worst performing control loops or subsystems, a weighting function or some other technique may be utilized.

[0047] Whenever a control loop or subsystem is identified using summary view 96 as performing at a degraded level, system tree 70 can be used to delve further into the performance indices associated with the poorly performing

control loop or subsystem to obtain additional information which may help to diagnose the root cause of the degraded performance.

[0048] In view 96, a building operator responsible for diagnosing problems in the HVAC systems of ACME Facility 68 will notice that the air handling unit represented by data plot 104 appears to be experiencing degraded performance. To find the reason for this poor performance, the building operator may select a node 110 (labeled "Air Distribution") in system tree 70 to obtain additional information on the air distribution units.

[0049] As shown in Figure 5, the selection of node 110 in tree 70 causes an air distribution performance view 112 to appear in performance/diagnostics window 64. View 112 displays performance indices for all of the air distribution systems in ACME Facility 68 using dot plots graphs, one for each of type of air distribution system. For example, view 112 may display performance indices for air handling units, packaged units and terminal units in dot plots 114, 116 and 118, respectively.

[0050] From the performance indicators displayed in view 112, and particularly data points 120, 121 and 122 in dot plot 114, it can be seen that the poor air distribution performance first observed in summary view 96 (see data point 104 in Figure 4) is associated with the terminal units rather than the air handling units or packaged units of the HVAC systems of in ACME Facility 68. Additional information for diagnosing the poor performance of the terminal unit(s) may be obtained by selecting a node 124 (labeled "Terminal Units") in system tree 70 of window 62.

[0051] When node 124 is selected, a terminal units performance view 126 appears in performance/diagnostics window 64 as shown in Figure 6. View 126 shows performance indicators for all of the terminal units in ACME Facility 68 using dot plots, one for each type of terminal unit in ACME Facility 68. In the illustrated embodiment, view 126 displays performance indices in dot plots 128, 130, 132, 134 and 136 corresponding to variable air volume units, fan coil units, unit heaters, baseboard heaters and heat pumps, respectively.

[0052] From the performance indicators displayed in view 126, and particularly dot plot 128, it can be seen that one of the variable air volume

units (represented by data point 138) is experiencing particularly poor performance. Additional information regarding the degraded performance of this variable air volume unit indicated by data point 138 may be obtained by selecting a node 144 (labeled "Variable Air Volume Units") in system tree 70 of window 62 as shown in Figure 7. Although not shown, nodes 146 and/or 148 can be selected to obtain additional information regarding the degraded fan coil unit performance and baseboard heater performance indicated by data plots 140 and 142, respectively.

[0053] As persons skilled in the art will appreciate, the above-described embodiment of the present invention provides a new methodology for fault detection and diagnosis that overcomes many of the problems with traditional methods. Currently, fault detection is typically accomplished using alarm and event management systems that are based on limit sensing. Limit sensing raises alarms when observations cross predefined thresholds. After the alarm draws the operator's attention, the operator must typically find the root cause of the alarm without any further assistance from the alarm and event management system. Limit sensing is prevalent in current systems because it is easy to implement and understand, however, it has limitations. For example, it can be difficult to set thresholds that minimize false alarms while still being sensitive to real faults. Moreover, certain kinds of faults tend to cascade alarms, making it more difficult for the operator to focus on the true root cause.

[0054] To further explain the methodology associated with the present invention, it is useful to identify the various stages in fault detection and diagnosis in building automation system monitoring. In general, there are three stages to fault detection and diagnosis in engineering systems:

1. Fault detection – determine that something has or is going wrong in the monitored system.
2. Fault isolation – determine the exact location of the fault (i.e., the faulty component(s) such as valve, damper, etc.).
3. Fault identification – determine the magnitude of the fault.

The isolation and identification tasks together are referred to as fault diagnosis.

[0055] The methodology and framework of the exemplary embodiments described herein assists with the first four stages. In particular, the use of performance indicators automates stages 1 and 2. In addition, the standard user interface for organizations, navigations, performance indicator alarm reporting, and views provided by display 58 assists users with stages 3 and 4.

[0056] With reference now to Figures 8 - 12, a typical scenario for using another exemplary embodiment of the present invention for performance based commissioning and/or long term monitoring of an HVAC system will be described. Performance based commissioning and/or long term monitoring begins with an overview report 150 (see Figure 8) that shows all of the systems that have been or are currently being assessed. That is, report 150 summarizes the performance of all systems that are being commissioned or monitored. Note that only certain systems are identified as poor performers (as indicated by data points 152 and 154).

[0057] When poorly performing systems are identified, the user is able to drill down on the poorly performing systems using the illustrated apparatus to discover additional details that may assist the user with diagnosing the root cause of the poor performance. For example, Figure 9 shows a first level of drill down by system type in a report 156. Report 156 shows the performance of HVAC control loops within each of the systems types. This level of drill down allows the user to identify the specific kind of problem a system is having.

[0058] After the control loop having the problem is identified (e.g., the temperature control loop indicated by data point 158 in Figure 10), the user is able to zoom in on the performance of the individual control loop using a report 160 (see Figure 10). According to an exemplary embodiment, report 160 displays enough trend data or historical sensor information to allow problems with the performance to be diagnosed. In the illustrated embodiment, report 160 includes tables 162 and 164 which display performance data for the control loops. According to an exemplary embodiment, the user can select a row in table 162 to cause table 164 to provide the detailed information for the control loop associated with the air handling unit of the selected row in table 162 and a drop down menu

166. At the same time, a pair of graphs 168 and 170 display actual values (both historical and current) from a trend buffer for the selected control loop which may allow the user to visually identify performance problems. For example, in a temperature control loop for AHU-3 there is an input, a set point, and an output. Thus, all three of such values can be plotted in graphs 168 and 170 to help the user diagnose the problem.

[0059] According to an exemplary embodiment, the data in the trend buffer along with any other gathered historical data and/or performance indicators may be stored for future reference in a database or other memory by clicking on a session management tab 172 and activating a save feature. In addition, a snapshot session checkbox 174 may be provided to allow any previously saved session data to be redisplayed in tables 162 and 164 and in graphs 168 and 170.

[0060] Turning now to Figures 11 and 12, two final tools for assessing performance and diagnosing problems in a facility management system are provided. Figure 11 displays a hardware (or mechanical) system layout view 176 for the selected system. View 176 provides a simplified view of the selected system (at a device level detail) and the values presently on that system based on the graphic. Using view 176, it is possible to not only inspect values in the system but also to override and change the values. This can be invaluable in assisting building operators with diagnosing problems noted in higher level performance views of the system.

[0061] Figure 12 shows a control diagram view 178 which illustrates the control strategy used for the selected system (e.g., volume matching vs. building static pressure control for the return fan). View 178 may be used for many purposes that might benefit building operators such as verifying sequence of operation, creating building wide control strategies (e.g., optimal start, power-fail, motor restart), and the like. View 178 may also be used to override values (either temporarily or permanently) to perform testing and/diagnosis of problems.

[0062] Turning now to Figure 13, an exemplary embodiment of a method 180 for creating a normalized/scaled performance view 184 (see Figure

14) is illustrated and described. According to method 180, performance indicators ("PI") are received in a step 186 for one or more control applications.

[0063] After the performance indicators are received, the performance indicators are converted in a step 188 into consistent units for each type of control application. For example, the airflow through one VAV box may be measured in cubic feet per minute (CFM) while in another VAV box it is measured in cubic feet per second.

[0064] Next, the standardized performance indicators may be normalized based on the equipment size in a step 190. Normalization step 190 need only be performed in certain instances, e.g., for volumetric or mass flow rates. For example, it may be necessary to normalize flow errors in a VAV box because an error of 100 CFM is a large error for a box with a maximum capacity of 200 CFM but a small error for a box with a maximum capacity of 100,000 CFM. Examples of volumetric flow rates performance indices that might benefit from normalization include (1) the absolute value of flow error through a VAV box and (2) the absolute value of return flow error for volume matching. An exemplary method for normalizing such flow rates for volumetric flow rate is to divide the performance index by the design or maximum capacity. For example, if a VAV box has a control performance index for the absolute value of the flow error of 100 CFM and the maximum capacity of the box is 1,000 CFM, then a normalized performance index may be 0.1 (i.e., 100 CFM / 1,000 CFM). Other types of performance indices besides volumetric or mass flow rates may also require and/or benefit from normalization. Examples of performance indices that typically need not be normalized include pressure, temperature, humidity, velocity, and the like.

[0065] After obtaining standardizing and normalizing (where necessary or helpful) the performance indices, a statistical scaling is performed in a step 192. An exemplary method for performing such statistical scaling involves determining the standard deviation (z-value) for each performance index. The standard deviation score is a measure in standard deviations of how far a sample is from the mean. The standard deviation score is determined from the following equation:

$$z_x = \frac{X - \bar{X}}{s}$$

where X is the performance index, $\bar{X}$ is the mean of the performance index for fault-free systems, and s is the sample standard deviation for fault-free systems.

[0066] In the illustrated embodiment, method 180 concludes with a
 5 final step 194 of displaying each standardized/normalized/scaled PI on a common scale. One example of a common scale is shown in Figure 14. In this scale, the standard deviation score for each performance index is plotted as a dot on a continuum between -3 and 12. In this example, the scale ranges from -3 standard deviations (representing extremely good performance) and 12 standard deviations
 10 (representing exceptionally poor performance). Other types of common scales are well known to persons skilled in the art and could also be utilized.

[0067] As persons skilled in the art will appreciate, the forgoing methods, apparatuses and tools enable multi-site organizations to centrally manage the performance of their building systems and equipment across the
 15 breadths of their enterprises. Moreover, the foregoing methods and apparatuses apply to not only to HVAC systems (e.g., chillers, boilers, air handlers), but also to other types of controlled systems.

[0068] It is understood that, while the detailed drawings and specific examples given describe exemplary embodiments of the present
 20 invention, they are for the purpose of illustration only. The invention is not limited to the precise details and conditions disclosed. For example, although the forgoing exemplary embodiments were described more thoroughly in the context of an HVAC system than other types of environmental control systems, the concepts of the present invention are equally applicable to numerous other types of systems
 25 including but not limited to lighting, utilities, spaces, fire and safety, power and the like. Also, although particular facility management systems and components are suggested, the performance monitoring and diagnostic system may be configured for various other HVAC systems. In addition, the system may easily be configured to analyze other performance indicators than those specifically described or
 30 mentioned above. Accordingly, these and all other such modifications are intended to be included within the scope of the present invention. Other

substitutions, modifications, changes and omissions may be made in the design, operating conditions and arrangement of the exemplary embodiments without departing from the spirit of the present invention.

WHAT IS CLAIMED IS:

1 1. A method for analyzing performance of control applications in an
2 environmental control network, comprising:
3 receiving at least one performance indicator for each control
4 application;
5 identifying at least one control application experiencing degraded
6 performance using a first view of the performance indicators; and
7 obtaining additional information regarding the at least one control
8 application using a second view of the performance indicators.

1 2. The method of claim 1, wherein first and second views each include
2 a plurality of continuums ranging from good to poor performance with the
3 performance indicators plotted on the continuums.

1 3. The method of claim 2, wherein a different continuum is provided for
2 each type of control application.

1 4. The method of claim 1, wherein the first view is a summary view of
2 the performance indicators and the second view is a more detailed view of the
3 performance indicators.

1 5. The method of claim 4, wherein the summary view displays the
2 performance indicators for only a worst performing control application among a
3 group of control applications.

1 6. The method of claim 1, wherein the identifying and obtaining steps
2 are performed by navigating at least one tree structure.

1 7. The method of claim 1, wherein the control applications are
2 associated with an HVAC system.

1 8. The method of claim 1, wherein the performance indicators
2 represent control effort and accuracy.

1 9. The method of claim 8, wherein the performance indicators are
2 exponentially weighted moving averages.

1 10. The method of claim 1, wherein the first and second views each
2 include a plurality of dot plots ranging from good to poor performance.

1 11. The method of claim 10, wherein a separate dot plot is provided for
2 each type of control application in the first view.

1 12. The method of claim 10, wherein a separate dot plot is provided for
2 each type of control loop in the control applications in the second view.

1 13. The method of claim 1, further including displaying trend buffer data
2 for the at least on control application.

1 14. The method of claim 13, further including saving the trend buffer
2 data for display at a later time.

1 15. The method of claim 1, further including displaying a mechanical
2 view of the environmental control network.

1 16. The method of claim 15, wherein the mechanical view allows a user
2 to inspect and alter values in the at least one control application.

1 17. The method of claim 1, further including displaying a control diagram
2 view of the environmental control network.

1 18. The method of claim 17, wherein the control diagram view allows a
2 user to inspect and alter a control strategy used for the at least one control
3 application.

1 19. The method of claim 1, further including using statistical analysis to
2 identify a mean and standard deviation for each performance indicator.

1 20. The method of claim 19, wherein the mean and standard deviation
2 for each performance indicator are used to plot each performance indicator on a
3 continuum ranging from good to poor.

1 21. A program product for analyzing performance of control applications
2 in an environmental control network, the program product comprising machine-
3 readable program code for causing, when executed, one or more machines to
4 perform the following method steps:

5 displaying performance indicators for the control applications using a
6 first view that allows at least one control application exhibiting degraded
7 performance to be identified; and

8 displaying performance indicators using a second view that provides
9 additional details regarding the performance of the at least one control application.

1 22. The program product of claim 21, wherein first and second views
2 each include a plurality of continuums ranging from good to poor performance with
3 the performance indicators plotted on the continuums.

1 23. The program product of claim 22, wherein a different continuum is
2 provided for each type of control application.

1 24. The program product of claim 21, wherein the first view is a
2 summary view of the performance indicators and the second view is a more
3 detailed view of the performance indicators.

1 25. The program product of claim 24, wherein the summary view shows
2 the performance indicators for only a worst performing control loop for each
3 control application.

1 26. The program product of claim 21, wherein the program code causes
2 at least one tree structure to be displayed for selecting the first view and the
3 second view.

1 27. The program product of claim 21, wherein the control applications
2 are associated with an HVAC system.

1 28. The program product of claim 21, wherein the performance
2 indicators represent control effort and accuracy.

1 29. The program product of claim 28, wherein the performance
2 indicators are exponentially weighted moving averages.

1 30. The program product of claim 21, wherein the first and second views
2 each include a plurality of dot plots ranging from good to poor performance.

1 31. The program product of claim 30, wherein a separate dot plot is
2 provided for type of control application in the first view.

1 32. The program product of claim 30, wherein a separate dot plot is
2 provided for each type of control loop in the control applications in the second
3 view.

1 33. The program product of claim 21, wherein the program code causes
2 trend buffer data to be displayed for the at least one control application.

1 34. The program product of claim 33, wherein the program code causes
2 trend buffer data to be saved for display at a later time.

1 35. The program product of claim 21, wherein the program code causes
2 a mechanical view of the environmental control network to be displayed.

1 36. The program product of claim 35, wherein the mechanical view
2 allows a user to inspect and alter values in the at least one control application.

1 37. The program product of claim 21, the program code causes a control
2 diagram view of the environmental control network to be displayed.

1 38. The program product of claim 37, wherein the control diagram view
2 allows a user to inspect and alter a control strategy used for the at least one
3 control application.

1 39. A method for diagnosing performance of control applications in an
2 environmental control network, comprising:
3 receiving at least one performance indicator for each control
4 application;
5 identifying at least one control application exhibiting degraded
6 performance using a first view of the performance indicators; and
7 obtaining additional information regarding the at least one control
8 application using a second view of the performance indicators, the second view
9 providing additional information on the at least one control application to permit a
10 diagnosis of a possible cause of the degraded performance.

1 40. The method of claim 39, wherein first and second views each
2 include a plurality of continuums ranging from good to poor performance with the
3 performance indicators plotted on the continuums.

1 41. The method of claim 40, wherein a different continuum is provided
2 for each type of control application.

1 42. The method of claim 39, wherein the first view is a summary view of
2 the performance indicators and the second view is a more detailed view of the
3 performance indicators.

1 43. The method of claim 42, wherein the summary view displays the
2 performance indicators for only a worst performing control loop for each control
3 application.

1 44. The method of claim 39, wherein the identifying and obtaining steps
2 are performed by navigating at least one tree structure.

1 45. The method of claim 39, wherein the control applications are
2 associated with an HVAC system.

1 46. The method of claim 39, wherein the performance indicators
2 represent control effort and accuracy.

1 47. The method of claim 46, wherein the performance indicators are
2 exponentially weighted moving averages.

1 48. The method of claim 39, wherein the first and second views each
2 include a plurality of dot plots ranging from good to poor performance.

1 49. The method of claim 48, wherein a separate dot plot is provided for
2 type of control application in the first view.

1 50. The method of claim 48, wherein a separate dot plot is provided for
2 each type of control loop in the control applications in the second view.

1 51. The method of claim 39, further including displaying trend buffer
2 data for the at least one control application.

1 52. The method of claim 51, further including saving the trend buffer
2 data for display at a later time.

1 53. The method of claim 39, further including displaying a mechanical
2 view of the environmental control network.

1 54. The method of claim 53, wherein the mechanical view allows a user
2 to inspect and alter values in the at least one control application.

1 55. The method of claim 39, further including displaying a control
2 diagram view of the environmental control network.

1 56. The method of claim 55, wherein the control diagram view allows a
2 user to inspect and alter a control strategy used for the at least one control
3 application.

1 57. The method of claim 39, further including using statistical analysis to
2 identify a mean and standard deviation for each performance indicator.

1 58. The method of claim 57, wherein the mean and standard deviation
2 for each performance indicator are used to plot each performance indicator on a
3 continuum ranging from good to poor.

1 59. A method for assessing performance of control applications
2 associated with an environmental control network, comprising:
3 receiving a plurality of performance indicators for the control
4 applications;
5 performing a statistical scaling on the performance indicators; and
6 displaying the scaled performance indicators on a common scale.

1 60. The method of claim 59, further including standardizing the
2 performance indicators for consistent units.

1 61. The method of claim 59, further including normalizing the
2 performance indicators based on equipment size.

1 62. The method of claim 59, wherein the control applications are
2 associated with at least two distinct types of devices.

1 63. The method of claim 59, wherein the control applications are
2 associated with an HVAC system.

1 64. The method of claim 59, wherein the common scale is a dot plot
2 corresponding to a range of standard deviations.

1 65. The method of claim 64, further including calculating a z-score for
2 each performance indicator and plotting the z-score on the dot plot.

ABSTRACT

A method and apparatus is disclosed for assessing performance of control applications in an environmental control network and for diagnosing performance problems. The apparatus includes a performance assessment and diagnostic display comprising a facility navigation tree, a system navigation tree and a performance/diagnostics window. The facility navigation tree and system navigation tree may be used to select the facilities and systems that are to have their associated control applications assessed and/or diagnosed. The performance/diagnostics window includes graphs of performance indicators that are indicative of performance levels for the included control applications. The system tree may be used to delve to more detailed views of the performance indicators to obtain additional information that may help to diagnose problems noted in performance of the selected control applications.

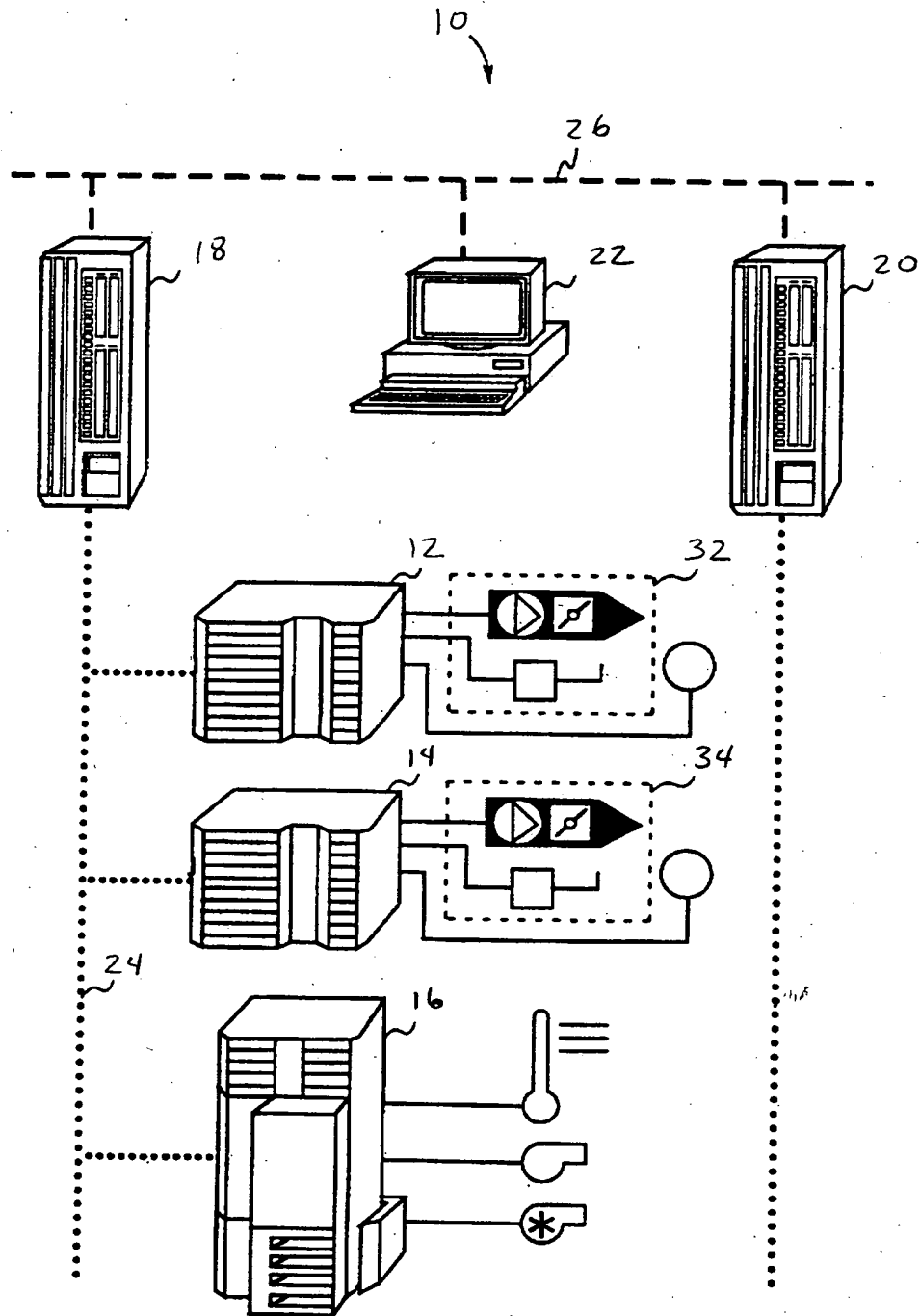


FIG. 1

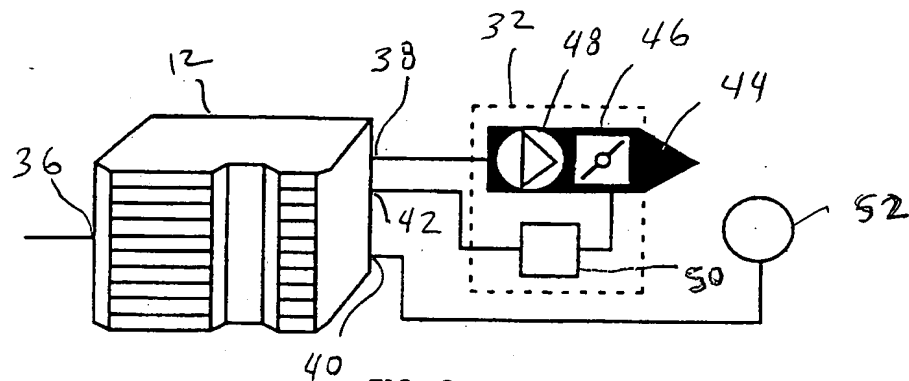


FIG. 2

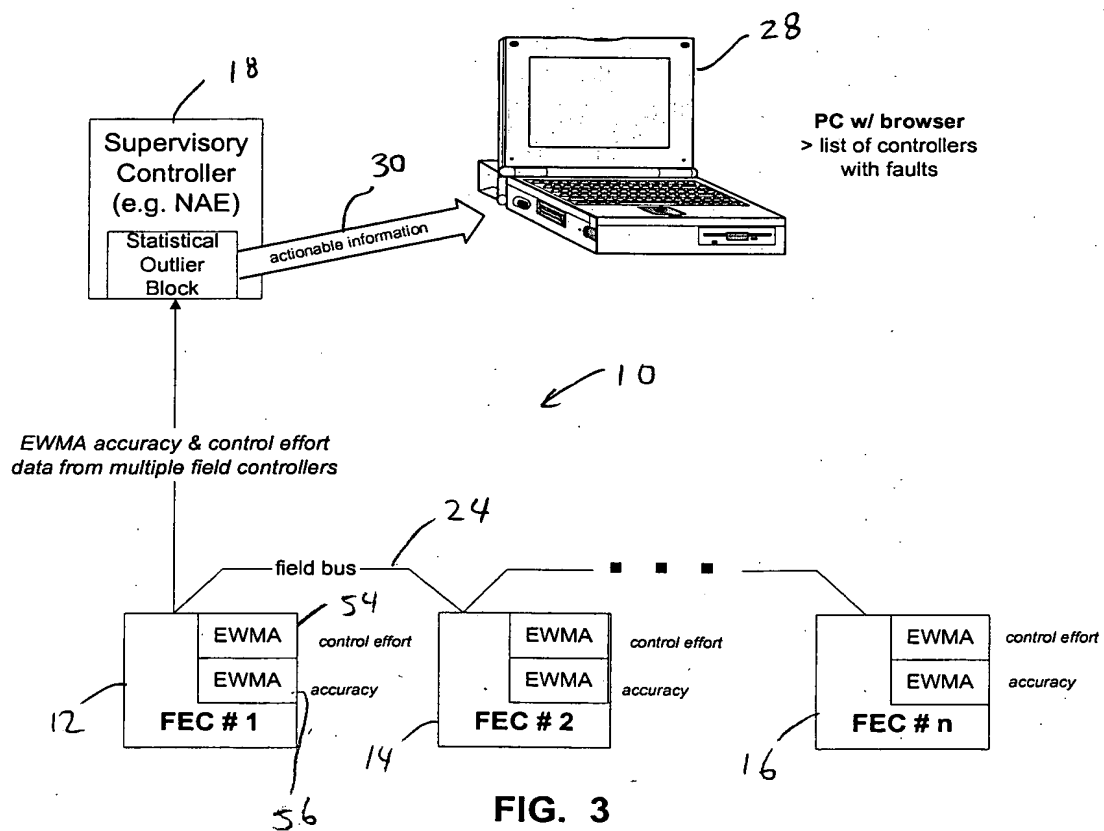


FIG. 3

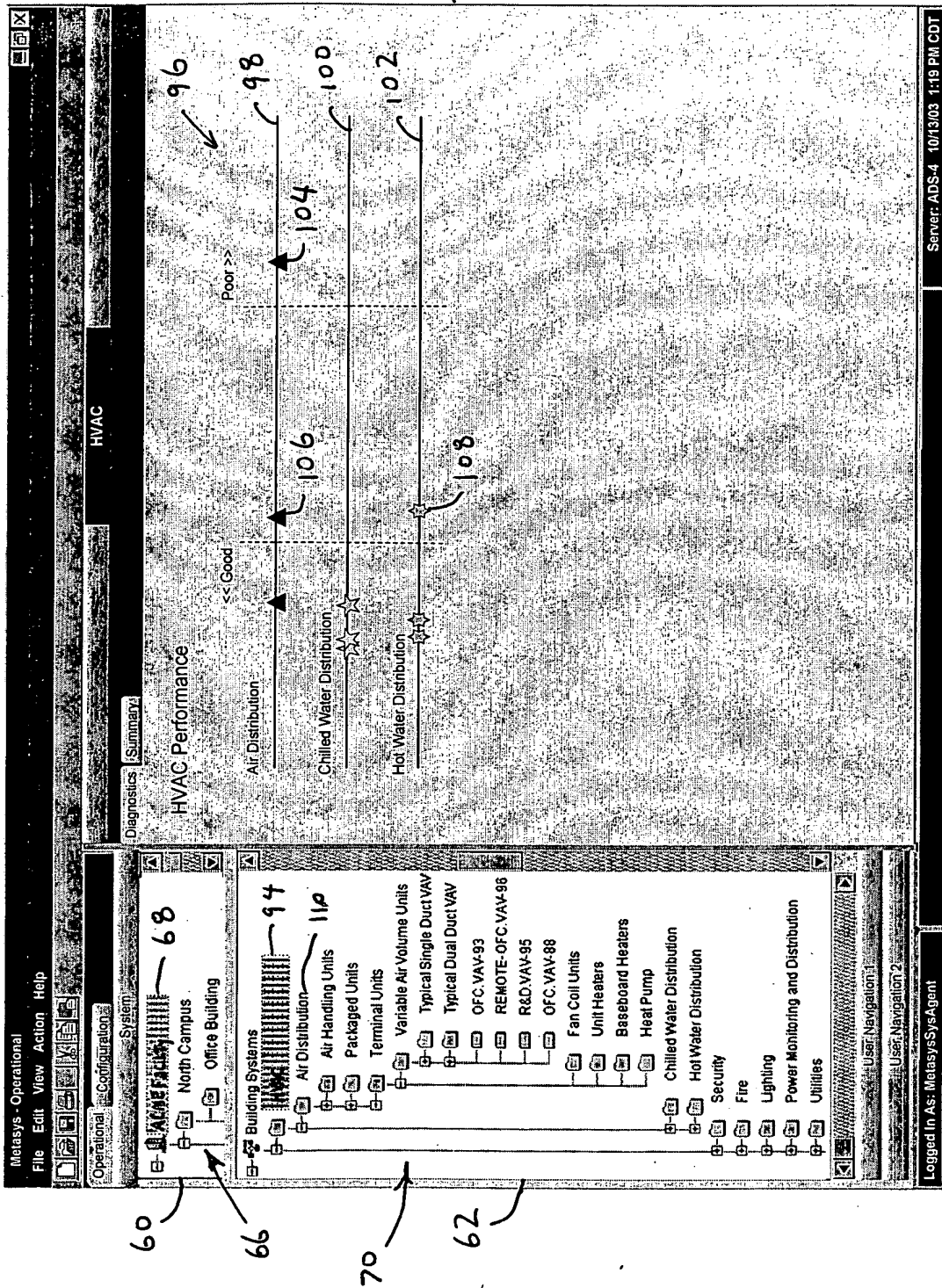


FIG. 4

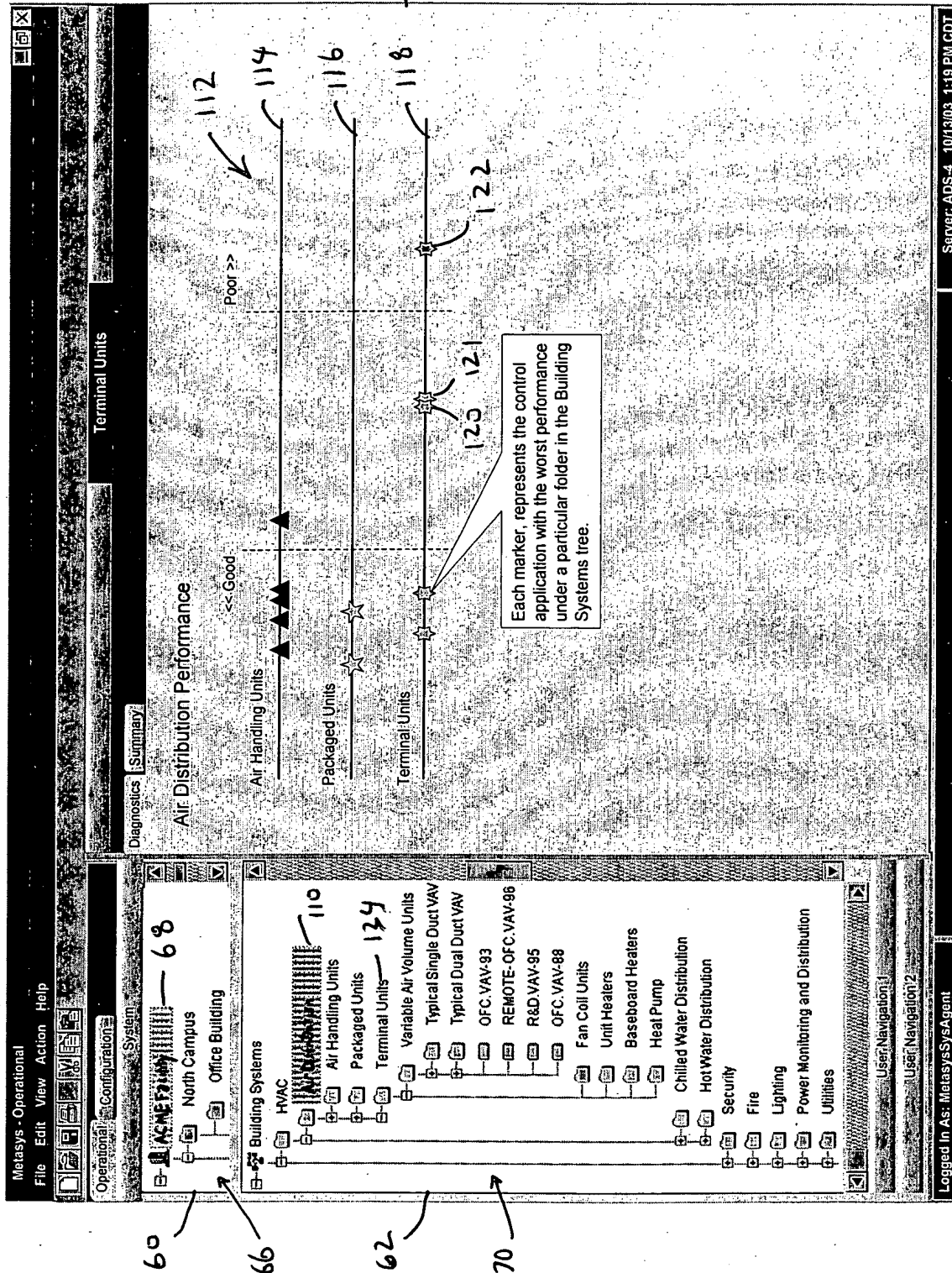


FIG. 5

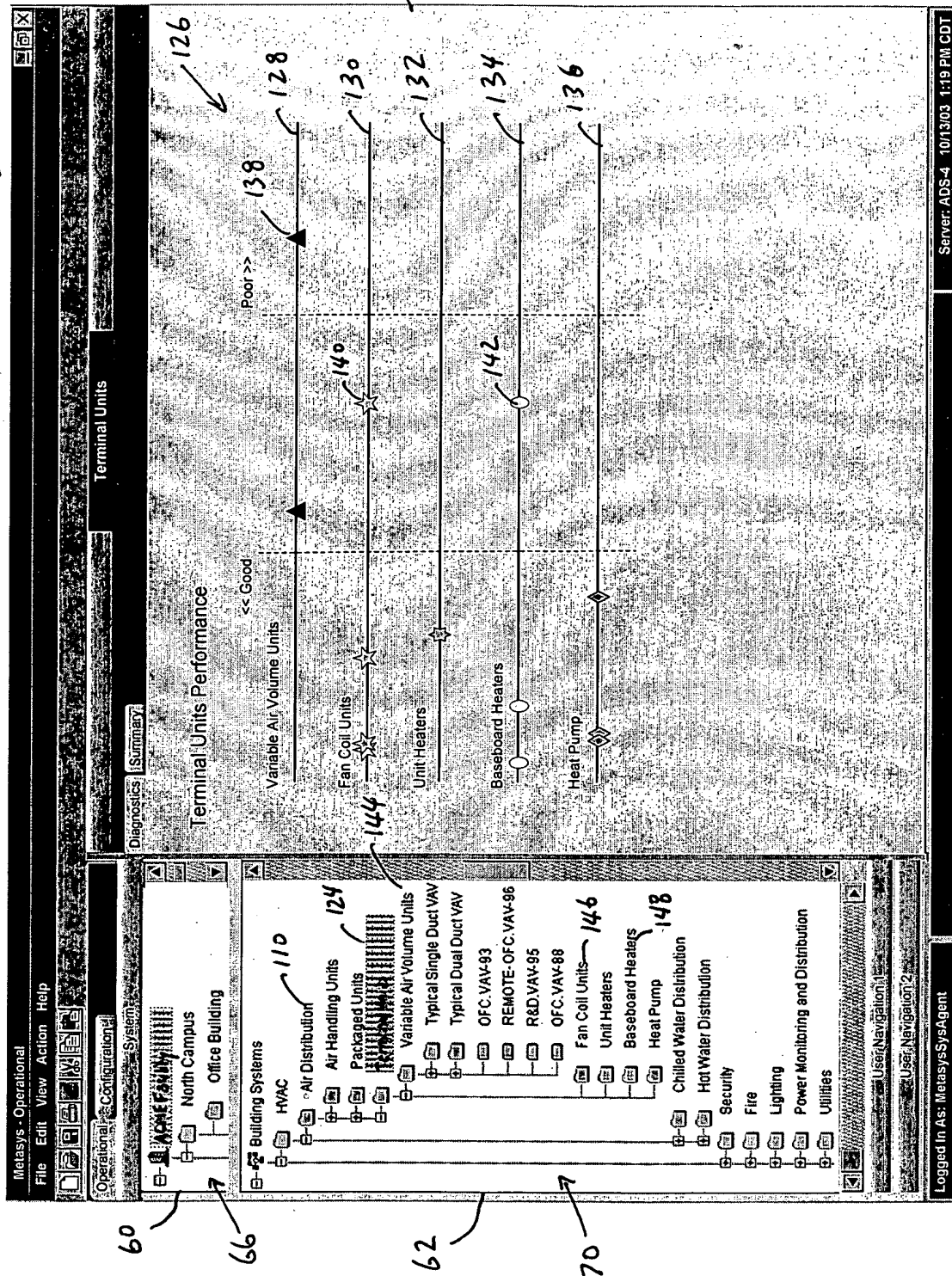


FIG. 6

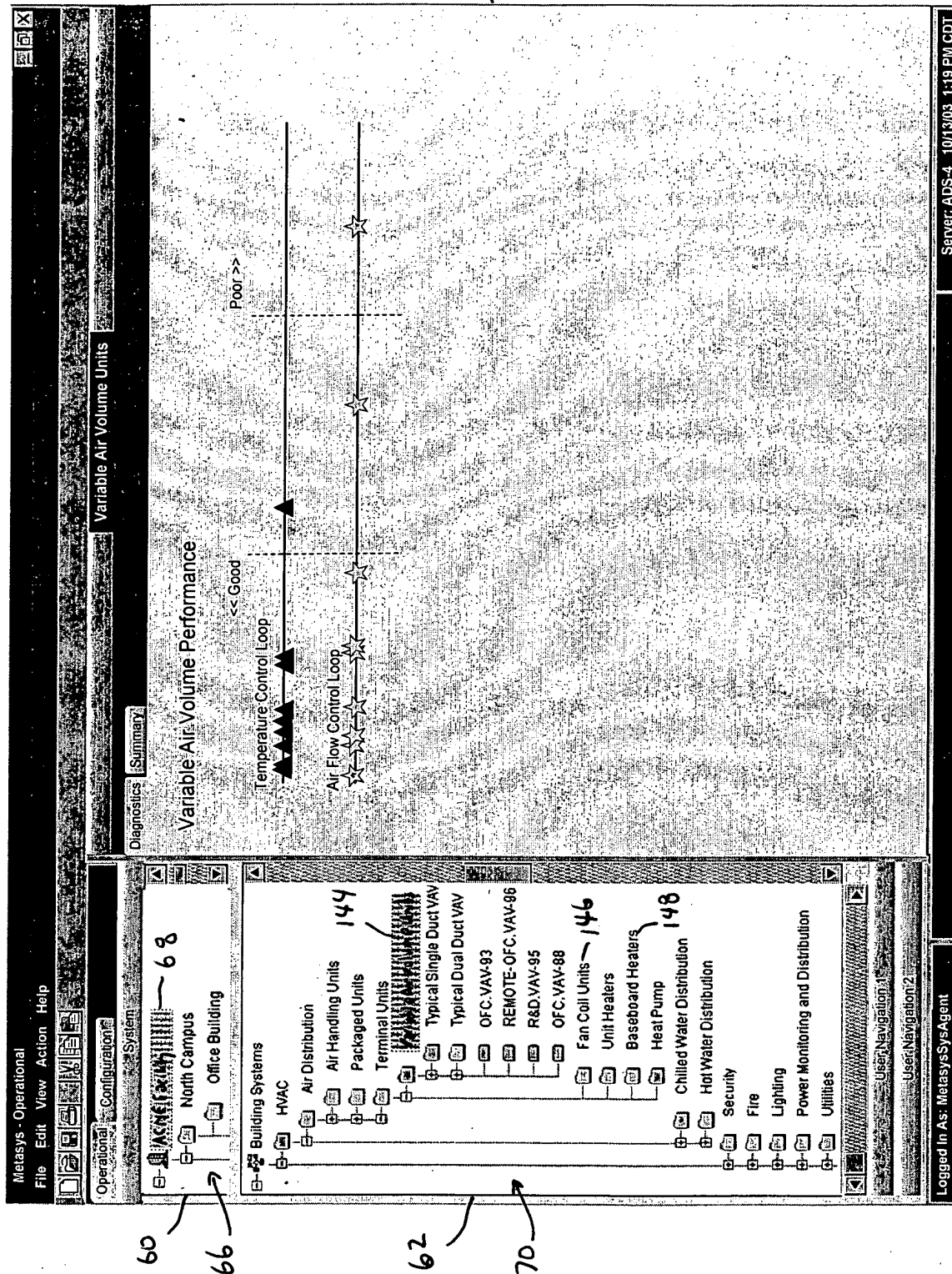


FIG. 7

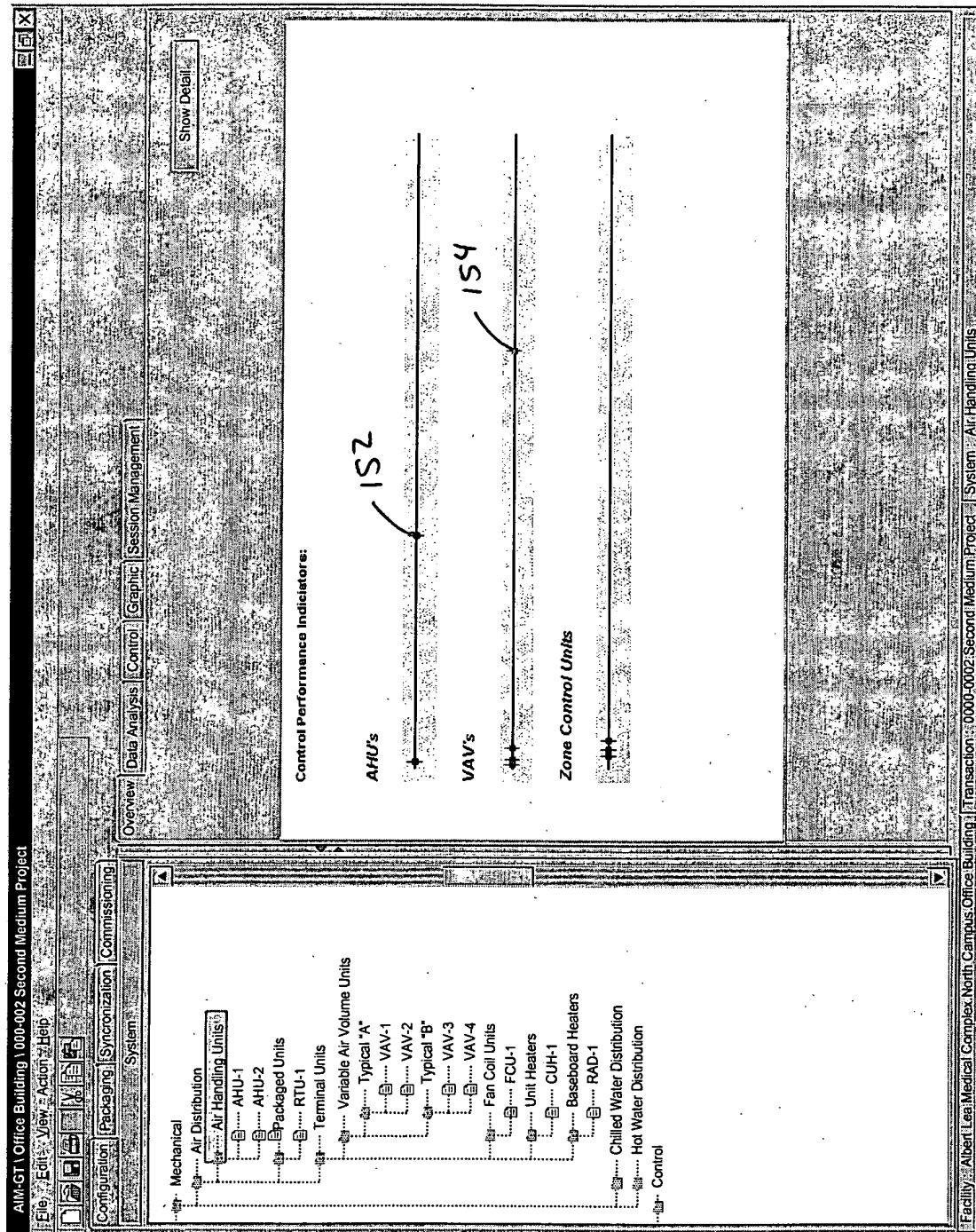


FIG. 8

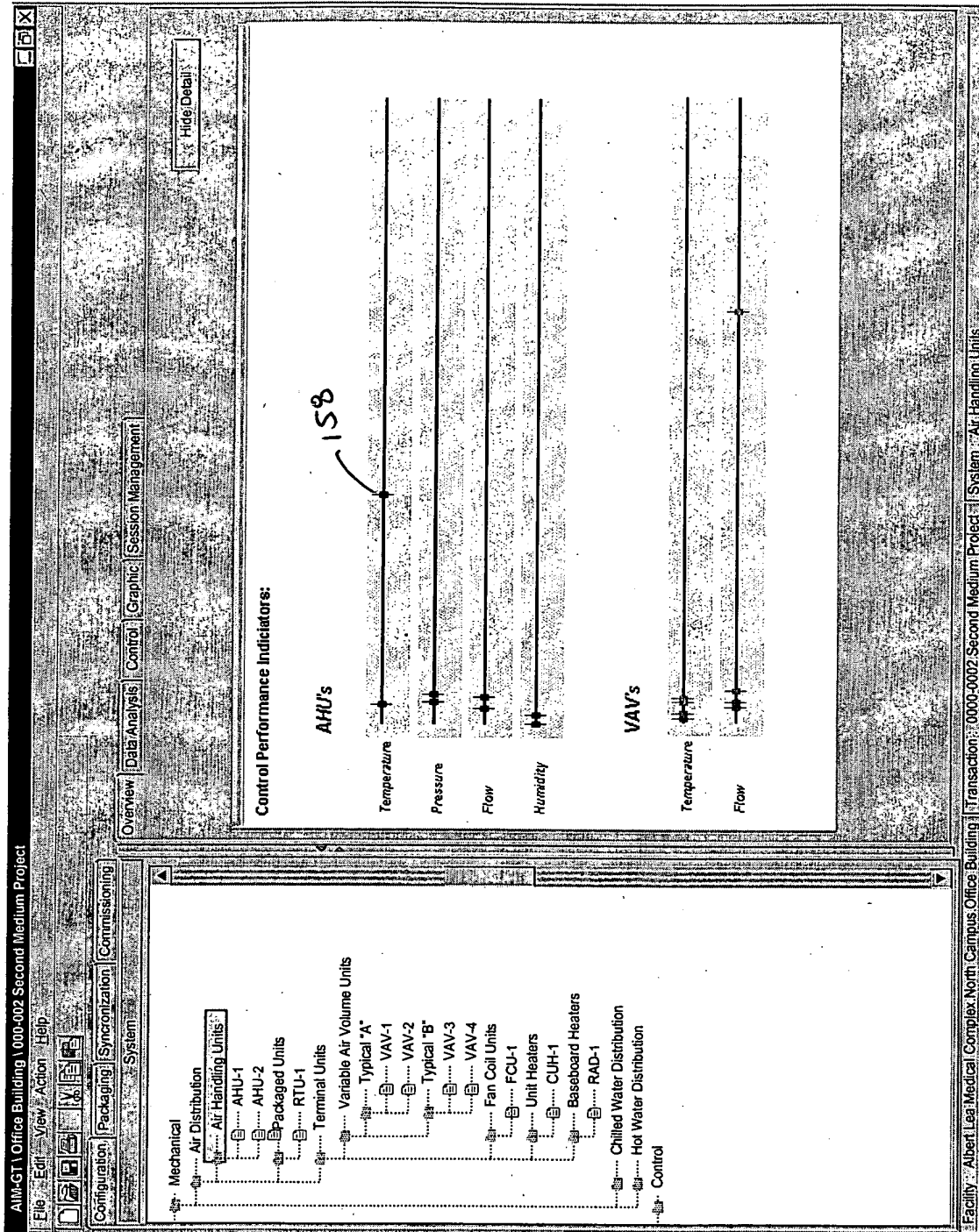


FIG. 9

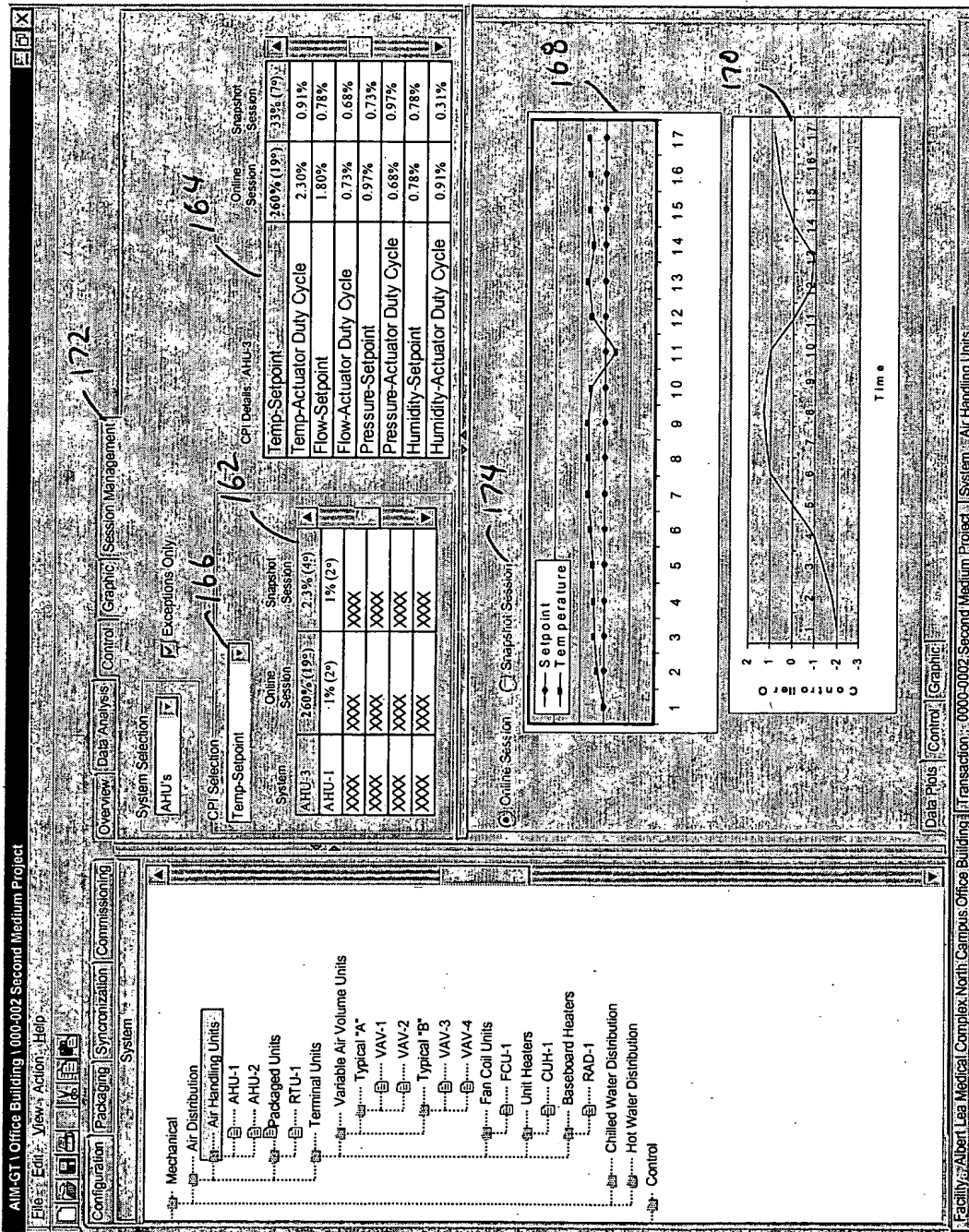


FIG. 10

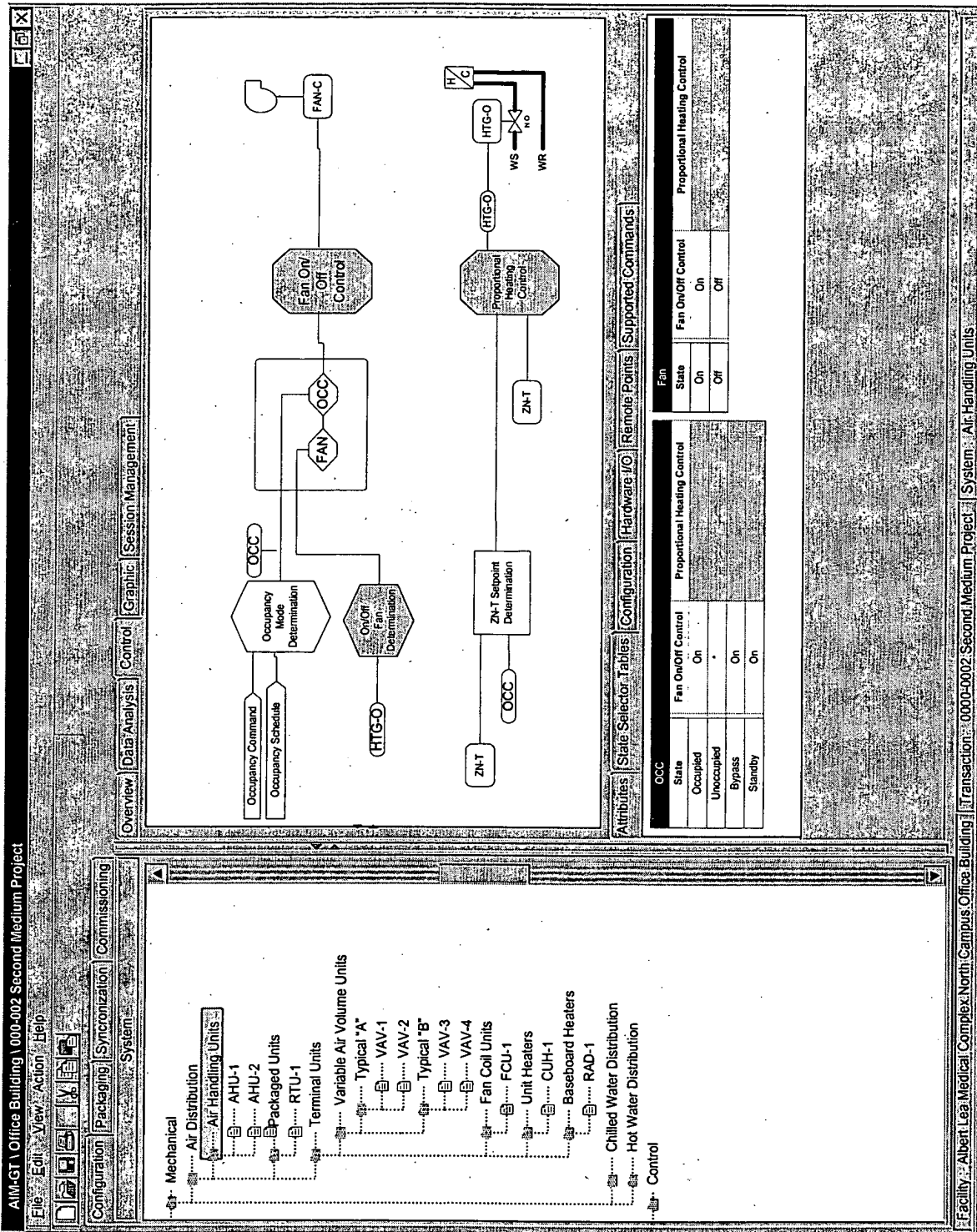


FIG. 12

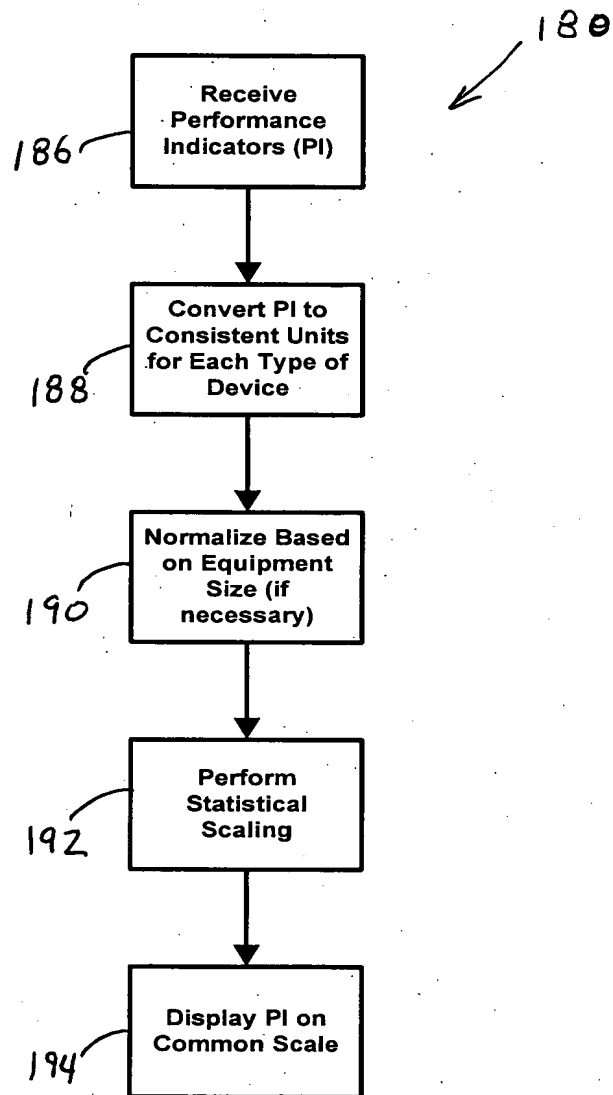


FIG. 13

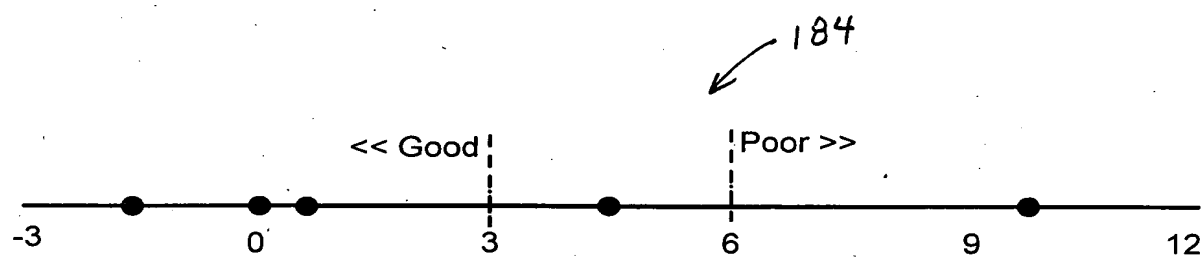


FIG. 14

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN
ENVIRONMENTAL CONTROL SYSTEM**

(Attorney Docket No. 081445-0324)

the specification of which (check one)

 X is attached hereto.

 was filed on as United States Application Number or PCT
International Application Number and was amended on
(if applicable).

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear,

concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number

I HEREBY APPOINT the following registered attorneys and agents of the law firm of
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to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

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I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

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

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Date

5/6/04


5/6/2004

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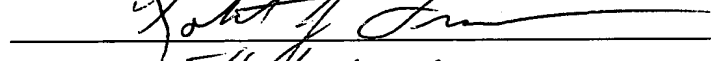
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Inventor's signature



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5/6/04 10:10 am

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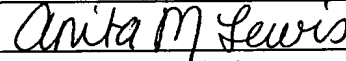
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Residence

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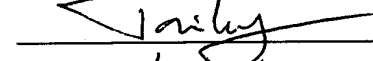
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Inventor's signature



Date

5/6/04

Application Data Sheet

Application Information

Application Type::	Regular
Subject Matter::	Utility
Suggested classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Computer Readable Form (CRF)?::	No
Title::	METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN ENVIRONMENTAL CONTROL SYSTEM
Attorney Docket Number::	081445-0324
Request for Early Publication?::	No
Request for Non-Publication?::	Yes
Suggested Drawing Figure::	4
Total Drawing Sheets::	13
Small Entity?::	No
Petition included?::	No
Secrecy Order in Parent Appl.?::	No

Applicant Information

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	John E.
Family Name::	Seem

City of Residence:: Glendale
State or Province of Residence:: Wisconsin
Country of Residence:: US
Street of mailing address:: 1800 West Woodbury Lane
City of mailing address:: Glendale
State or Province of mailing address:: WI
Postal or Zip Code of mailing address:: 53209

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: William A.
Family Name:: Huth
City of Residence:: Hartland
State or Province of Residence:: Wisconsin
Country of Residence:: US
Street of mailing address:: 1201 East Sweetbriar Lane
City of mailing address:: Hartland
State or Province of mailing address:: WI
Postal or Zip Code of mailing address:: 53029

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Robert J.

Family Name:: Fraune
City of Residence:: Waukesha
State or Province of Residence:: Wisconsin
Country of Residence:: US
Street of mailing address:: S52 W23505 Partridge Lane
City of mailing address:: Waukesha
State or Province of mailing address:: WI
Postal or Zip Code of mailing address:: 53189

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Anita M.
Family Name:: Lewis
City of Residence:: Cedarburg
State or Province of Residence:: Wisconsin
Country of Residence:: US
Street of mailing address:: 7515 Devonshire Drive
City of mailing address:: Cedarburg
State or Province of mailing address:: WI
Postal or Zip Code of mailing address:: 53012

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity

Given Name:: Tri V.
Family Name:: Ky
City of Residence:: Waukesha
State or Province of Residence:: Wisconsin
Country of Residence:: US
Street of mailing address:: 1941 Rustic Way
City of mailing address:: Waukesha
State or Province of mailing address:: WI
Postal or Zip Code of mailing address:: 53186

Correspondence Information

Correspondence Customer Number:: 26371
E-Mail address:: PTOMailMilwaukee@Foley.com

Representative Information

Representative Designation::	Registration Number::	Representative Name::
Primary	54,589	MATHEW P. ANDERSON
Primary	46,521	SCOTT D. ANDERSON
Primary	29,512	RUSSELL J. BARRON
Primary	39,902	DAVID J. BATES
Primary	42,308	STEVEN C. BECKER
Primary	54,991	CHAD E. BEMENT

Primary	51,495	MICHAEL S. BRAYER
Primary	52,673	MARCUS A. BURCH
Primary	35,093	CHARLES G. CARTER
Primary	44,603	ALISTAIR K. CHAN
Primary	26,416	JOHN C. COOPER III
Primary	34,144	JEFFREY N. COSTAKOS
Primary	52,801	SCOTT M. DAY
Primary	30,844	BARRY L. GROSSMAN
Primary	47,619	JEFFREY S. GUNDERSEN
Primary	54,601	ADAM M. GUSTAFSON
Primary	48,367	JOHN M. LAZARUS
Primary	40,365	KEITH D. LINDENBAUM
Primary	39,282	DAVID G. LUETTGEN
Primary	52,008	M. SCOTT MC BRIDE
Primary	35,610	RICHARD J. MC KENNA
Primary	32,505	JAMES G. MORROW
Primary	50,755	SCOTT C. NIELSON
Primary	45,651	JASON E. PAULS
Primary	38,276	TODD A. RATHE
Primary	30,128	MICHAEL D. RECHTIN
Primary	48,580	MARCUS W. SPROW
Primary	47,959	M. REED STAHELI
Primary	43,193	JEAN M. TIBBETTS
Primary	38,646	JOHN A. VANOPHEM
Primary	34,279	JAMES A. WILKE

Primary	35,421	JOSEPH N. ZIEBERT
Primary	40,883	WALTER E. ZIMMERMAN

Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::

Foreign Priority Information

Country::	Application number::	Filing Date::	Priority Claimed::

Assignee Information

Assignee name:: Johnson Controls Technology Company

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 2003

Application or Docket Number

10841107

CLAIMS AS FILED - PART I

(Column 1) (Column 2)

TOTAL CLAIMS	65	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	65 minus 20 =	45
INDEPENDENT CLAIMS	4 minus 3 =	1
MULTIPLE DEPENDENT CLAIM PRESENT ☐		

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

CLAIMS AS AMENDED - PART II

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

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

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

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

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

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
 ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
 *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
 The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

SMALL ENTITY TYPE ☐

OR OTHER THAN SMALL ENTITY

RATE	FEE
BASIC FEE	385.00
XS 9=	
X43=	
+145=	
TOTAL	

RATE	FEE
BASIC FEE	770.00
XS18=	810
X86=	82
+290=	
TOTAL	1666.00

SMALL ENTITY OR

OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE
XS 9=	
X43=	
+145=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
XS18=	
X86=	
+290=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
XS 9=	
X43=	
+145=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
XS18=	
X86=	
+290=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
XS 9=	
X43=	
+145=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
XS18=	
X86=	
+290=	
TOTAL ADDIT. FEE	

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

05/11/2004 MGE BREM1 00000010 10841107

01 FC:1001	770.00 OP
02 FC:1201	86.00 OP
03 FC:1202	810.00 OP

PTO-1556
(5/87)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John E. Seem et al.

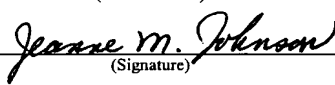
Title: METHOD AND APPARATUS
FOR ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL CONTROL
SYSTEM

Appl. No.: Unknown

Filing Date: Herewith

Examiner: Unknown

Art Unit: Unknown

CERTIFICATE OF EXPRESS MAILING	
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.	
EV431598885US	May 7, 2004
(Express Mail Label Number)	(Date of Deposit)
Jeanne M. Johnson	
(Printed Name)	
	
(Signature)	

UTILITY PATENT APPLICATION
TRANSMITTAL

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

Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is the nonprovisional utility patent application of:

John E. Seem
1800 West Woodbury Lane
Glendale, Wisconsin 53209

William A. Huth
1201 East Sweetbriar Lane
Hartland, Wisconsin 53029

Robert J. Fraune
S52 W23505 Partridge Lane
Waukesha, Wisconsin 53189

Anita M. Lewis
7515 Devonshire Drive
Cedarburg, Wisconsin 53012

Tri V. Ky
1941 Rustic Way
Waukesha, Wisconsin 53186

☐ Applicant claims small entity status under 37 CFR 1.27.

Enclosed are:

- ☒ Specification, Claim(s), and Abstract (27 pages).
- ☒ Informal drawings (13 sheets, Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14).
- ☒ Declaration and Power of Attorney (5 pages).
- ☒ Assignment of the invention to Johnson Controls Technology Company (4 pages).
- ☒ Assignment Recordation Cover Sheet (1 page).
- ☐ Small Entity statement.
- ☒ Request for application not to be published with certification under 35 USC 122(b)(2)(B)(i) (1 page).
- ☐ Information Disclosure Statement.
- ☐ Form PTO/SB/08 with copies of ____ listed reference(s).
- ☒ Application Data Sheet (37 CFR 1.76) (6 pages).
- ☐ Claim for Convention Priority.

The filing fee is calculated below:

	Claims as Filed		Included in Basic Fee		Extra Claims		Rate		Fee Totals
Basic Fee							\$770.00	=	\$770.00
Total	65	-	20	=	45	x	\$18.00	=	\$810.00
Claims:									
Independents	4	-	3	=	1	x	\$86.00	=	\$86.00
:									
If any Multiple Dependent Claim(s) present:						+	\$290.00	=	\$0.00
							SUBTOTAL:	=	\$1666.00
[]							Small Entity Fees Apply (subtract ½ of above):	=	\$0.00
							TOTAL FILING FEE:	=	\$1,666.00
Assignment Recordation Fee:						+	\$40.00	=	\$40.00
TOTAL FEE								=	\$1,706.00

☒ A check in the amount of \$1,706.00 to cover the filing fee and fee for recordation of Assignment is enclosed.

☐ The required filing fees are not enclosed but will be submitted in response to the Notice to File Missing Parts of Application.

☒ The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

Date May 7, 2004

By David J. Bates

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5760
Facsimile: (414) 297-4900

David J. Bates
Attorney for Applicant
Registration No. 39,902

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John E. Seem et al.
Title: METHOD AND APPARATUS
FOR ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL CONTROL
SYSTEM
Appl. No.: Unknown
Filing Date: Herewith
Examiner: Unknown
Art Unit: Unknown

CERTIFICATE OF EXPRESS MAILING	
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.	
EV431598885US (Express Mail Label Number)	May 7, 2004 (Date of Deposit)
Jeanne M. Johnson (Printed Name)	
 (Signature)	

REQUEST AND CERTIFICATION UNDER 35 U.S.C. 122(b)(2)(B)(i)

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

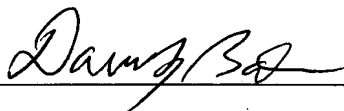
Sir:

Applicants hereby 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 agreement, that requires publication at eighteen months after filing. Applicants hereby request that the attached application not be published under 35 U.S.C. 122(b).

Respectfully submitted,

Date May 7, 2004

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5760
Facsimile: (414) 297-4900

By 

David J. Bates
Attorney for Applicant
Registration No. 39,902



07-15-04

JFW

Atty. Dkt. No. 081445-0324

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John E. Seem et al.
Title: METHOD AND APPARATUS
FOR ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL CONTROL
SYSTEM
Appl. No.: 10/841,107
Filing Date: 05/07/2004
Examiner: Unknown
Art Unit: Unknown

CERTIFICATE OF EXPRESS MAILING	
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.	
EV431586286US (Express Mail Label Number)	July 14, 2004 (Date of Deposit)
Jeanne M. Johnson (Printed Name)	
 (Signature)	

TRANSMITTAL OF FORMAL DRAWINGS

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

ATTENTION: DRAWING REVIEW BRANCH

Sir:

Transmitted herewith are the formal drawings (13 sheets, Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14) for the above-identified application. The Official Draftsperson is respectfully requested to approve these drawings for entry into the application.

Respectfully submitted,

Date July 14, 2004

By David J. Bates

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5760
Facsimile: (414) 297-4900

David J. Bates
Attorney for Applicant
Registration No. 39,902



1 / 13

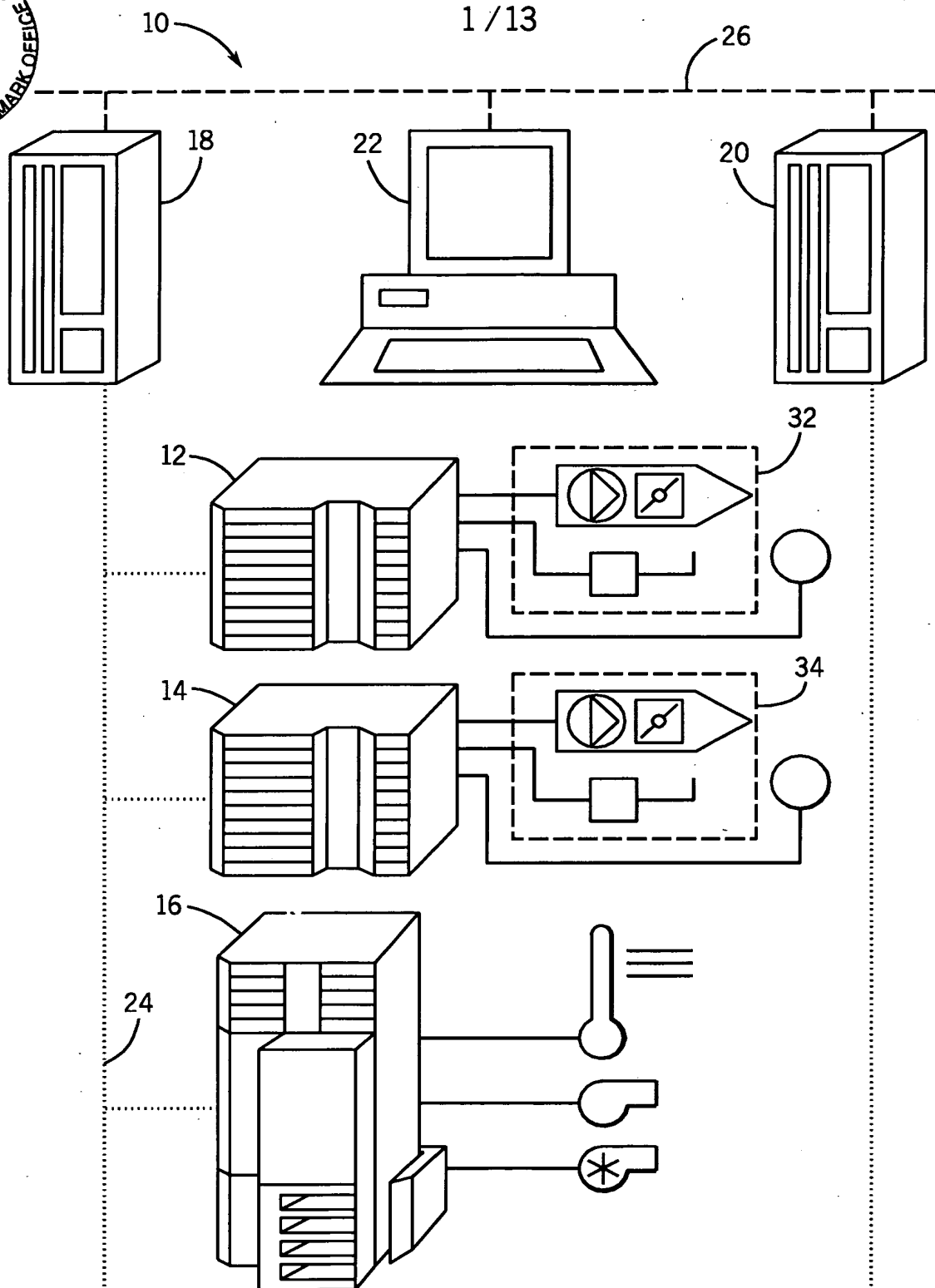


FIG. 1

Title: METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN ENVIRONMENTAL
CONTROL SYSTEM

Inventor(s): John E. Seem et al.

Appl. No.: 10/841,107

2 / 13

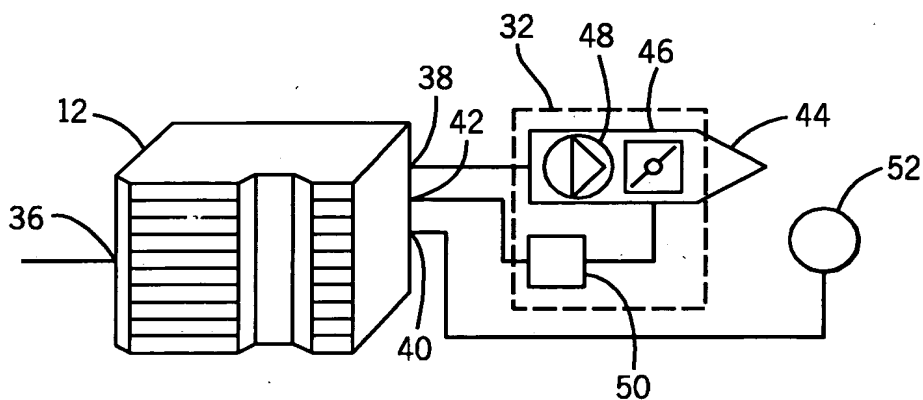


FIG. 2

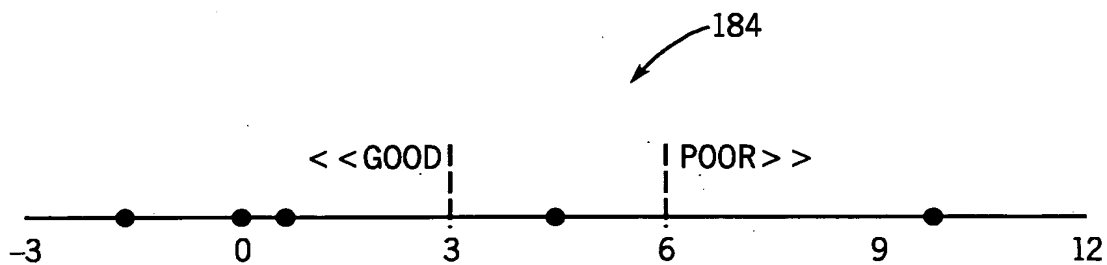


FIG. 14

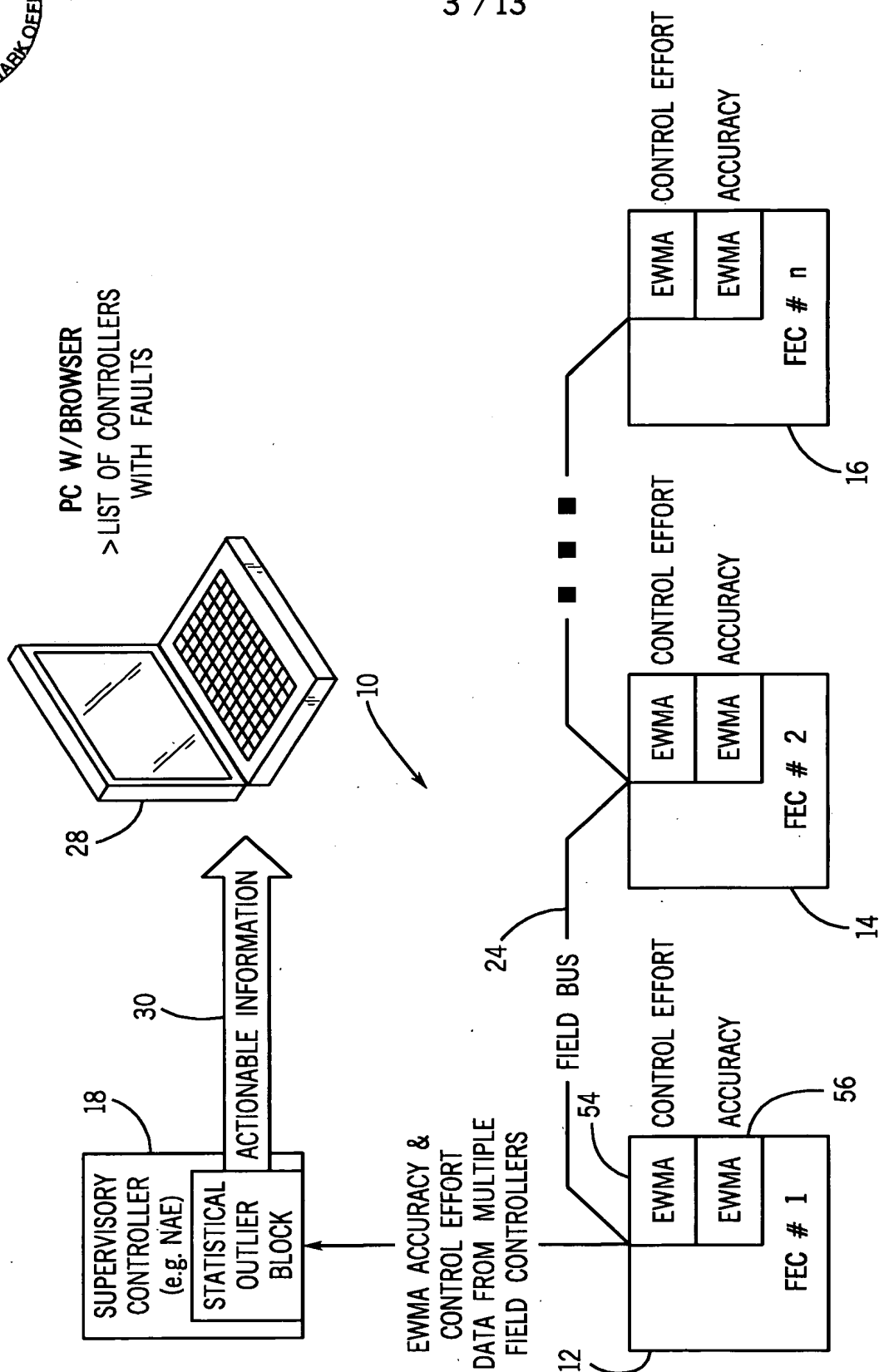


FIG. 3



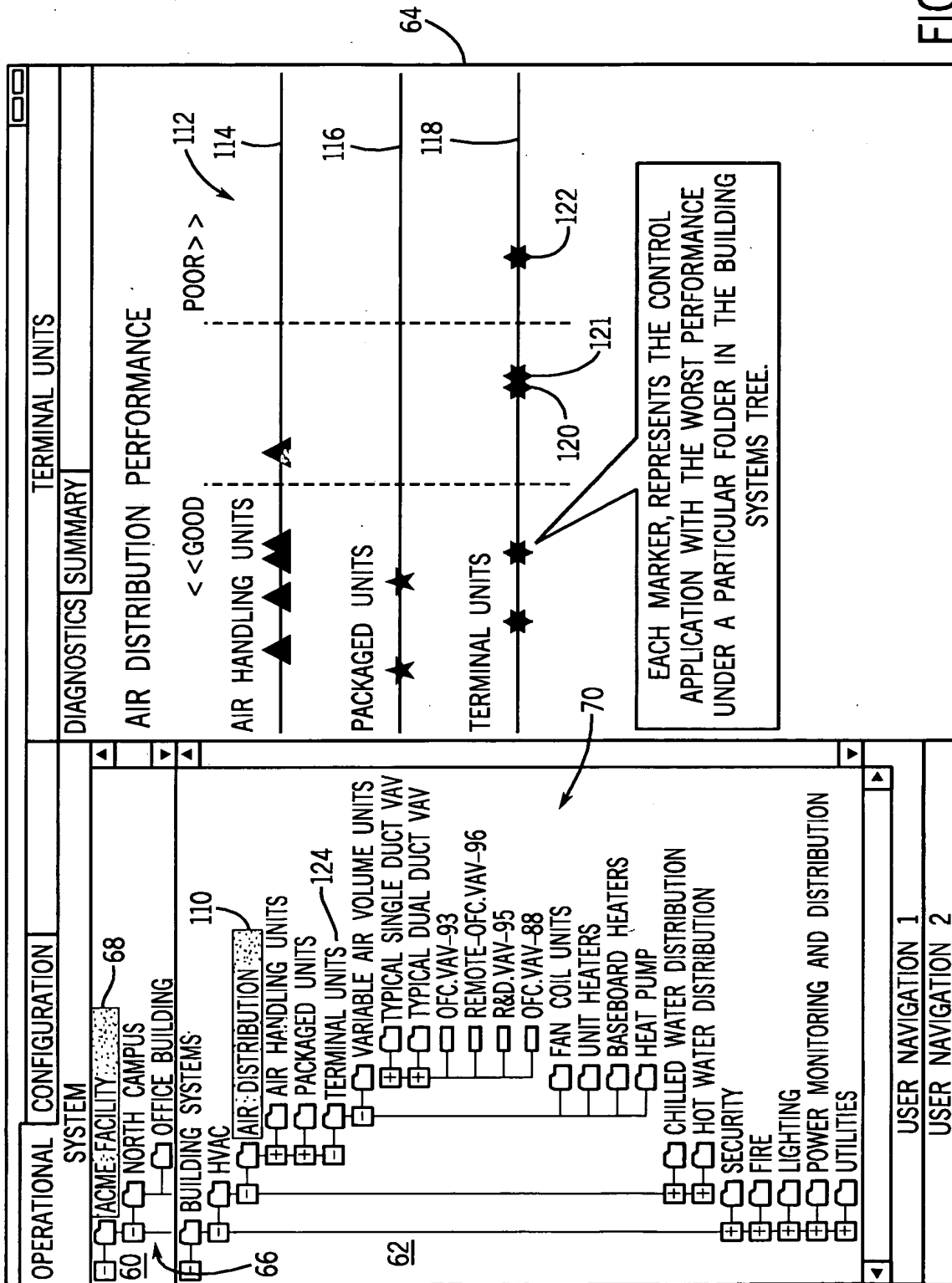
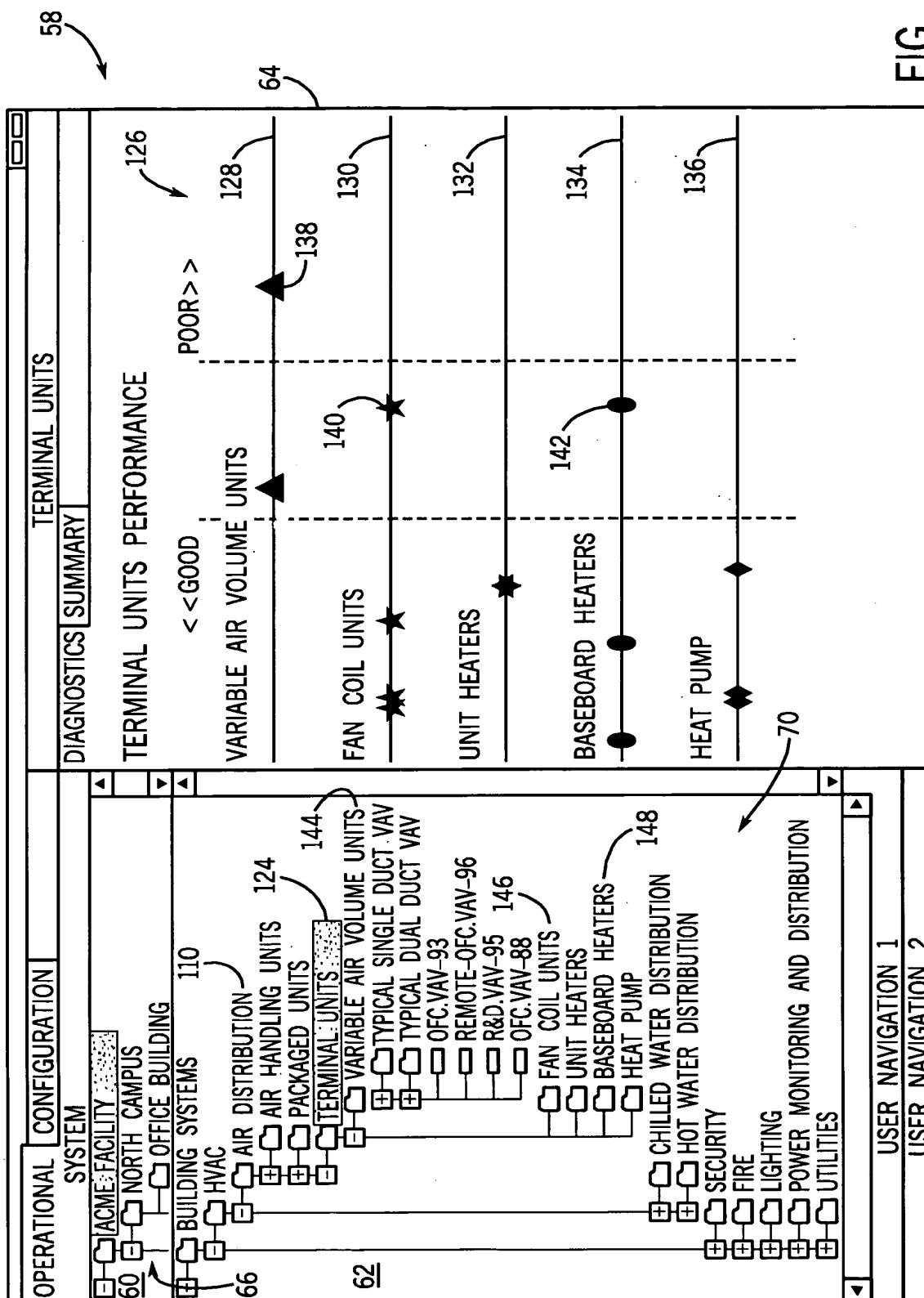


FIG. 5

Appl. No.: 10/841,107

6 / 13

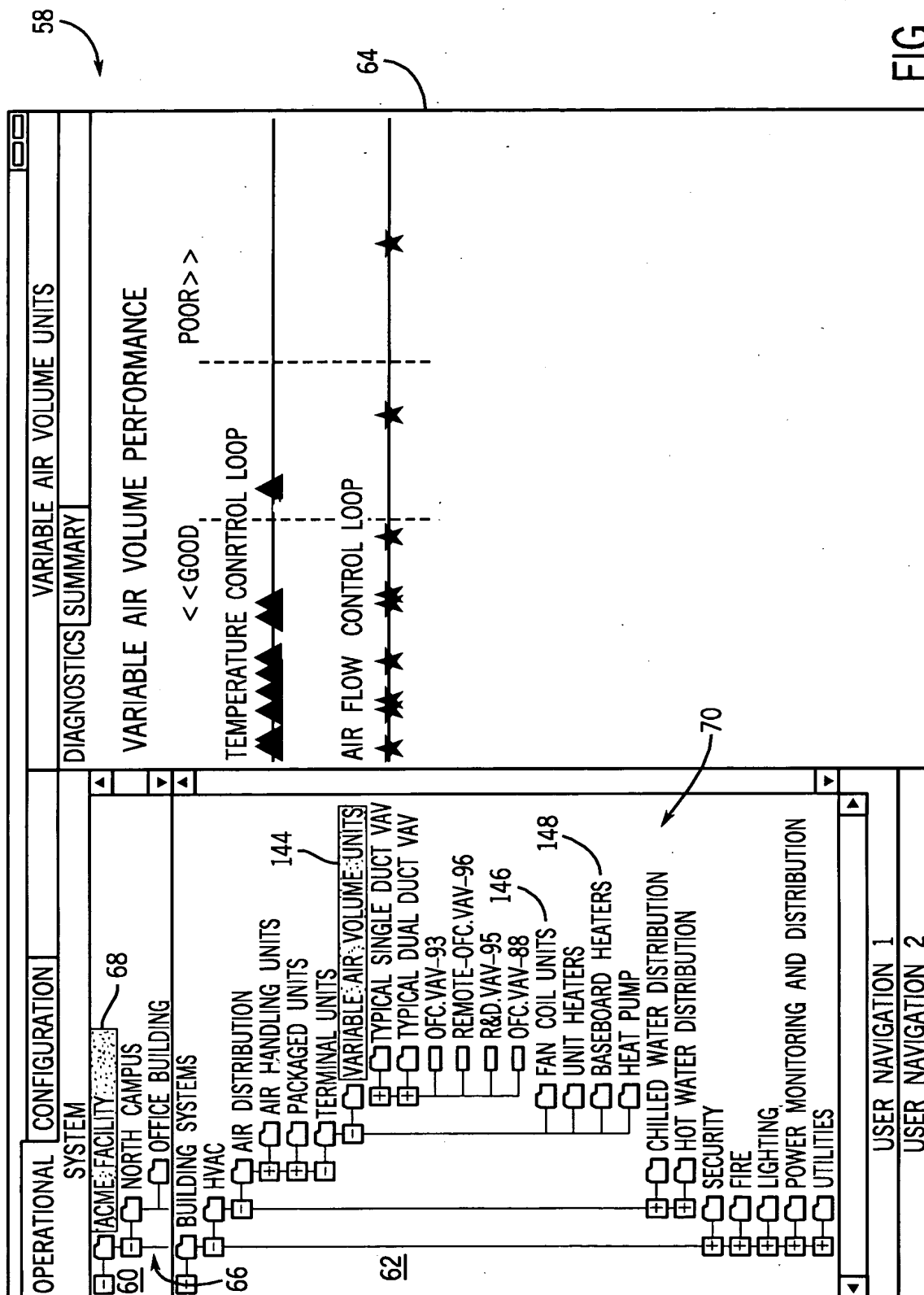
FIG. 6

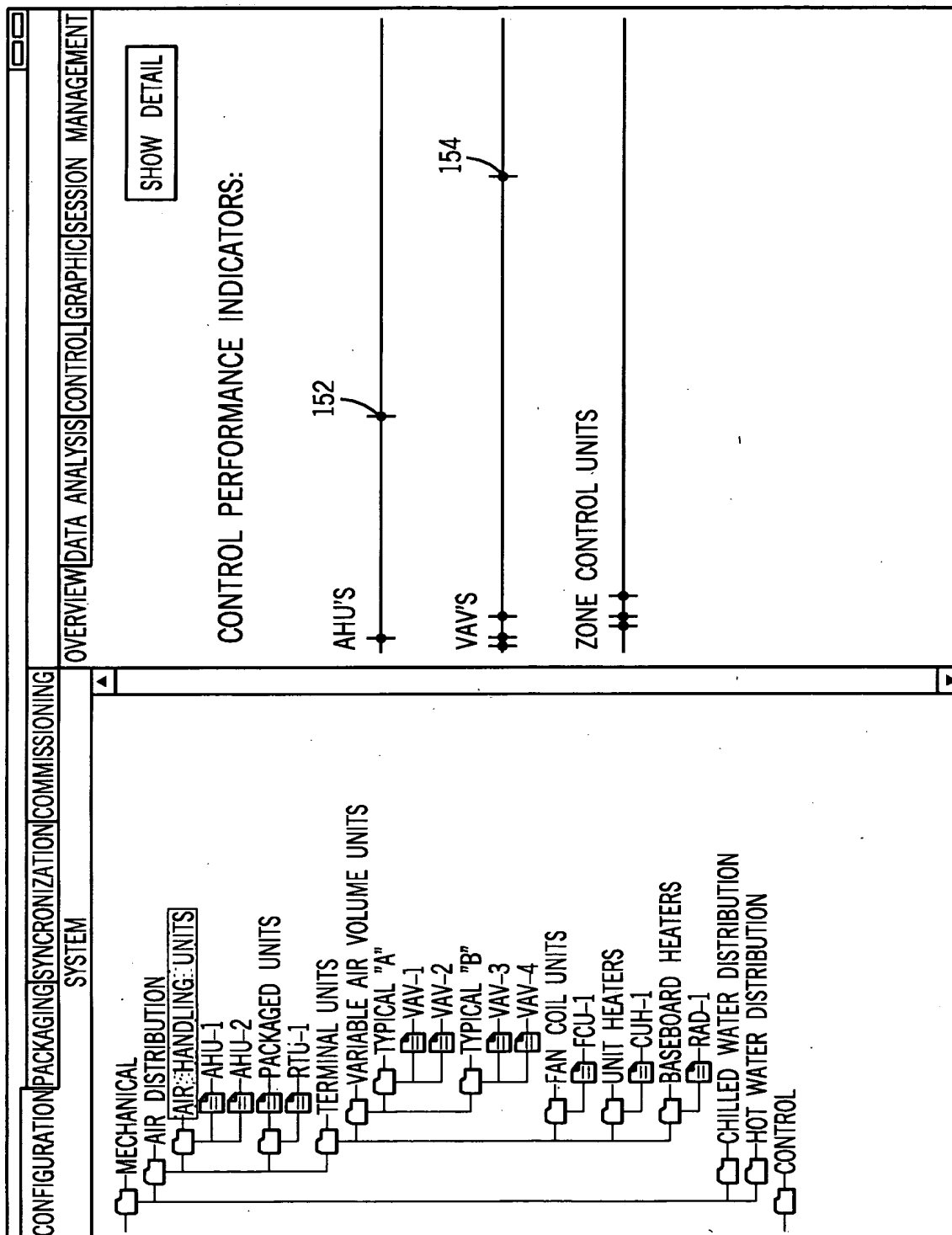


Appl. No.: 10/841,107

7 / 13

FIG. 7





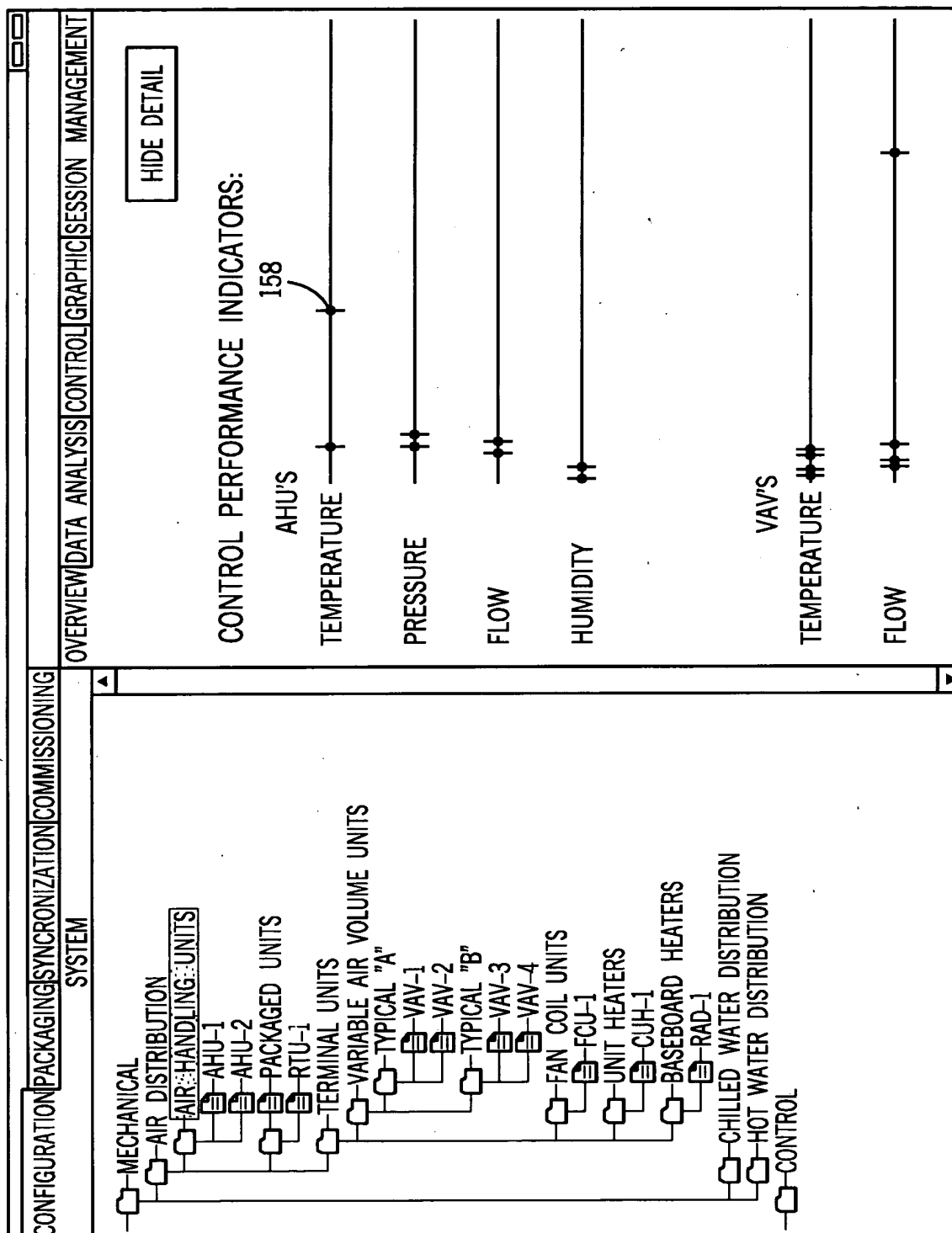
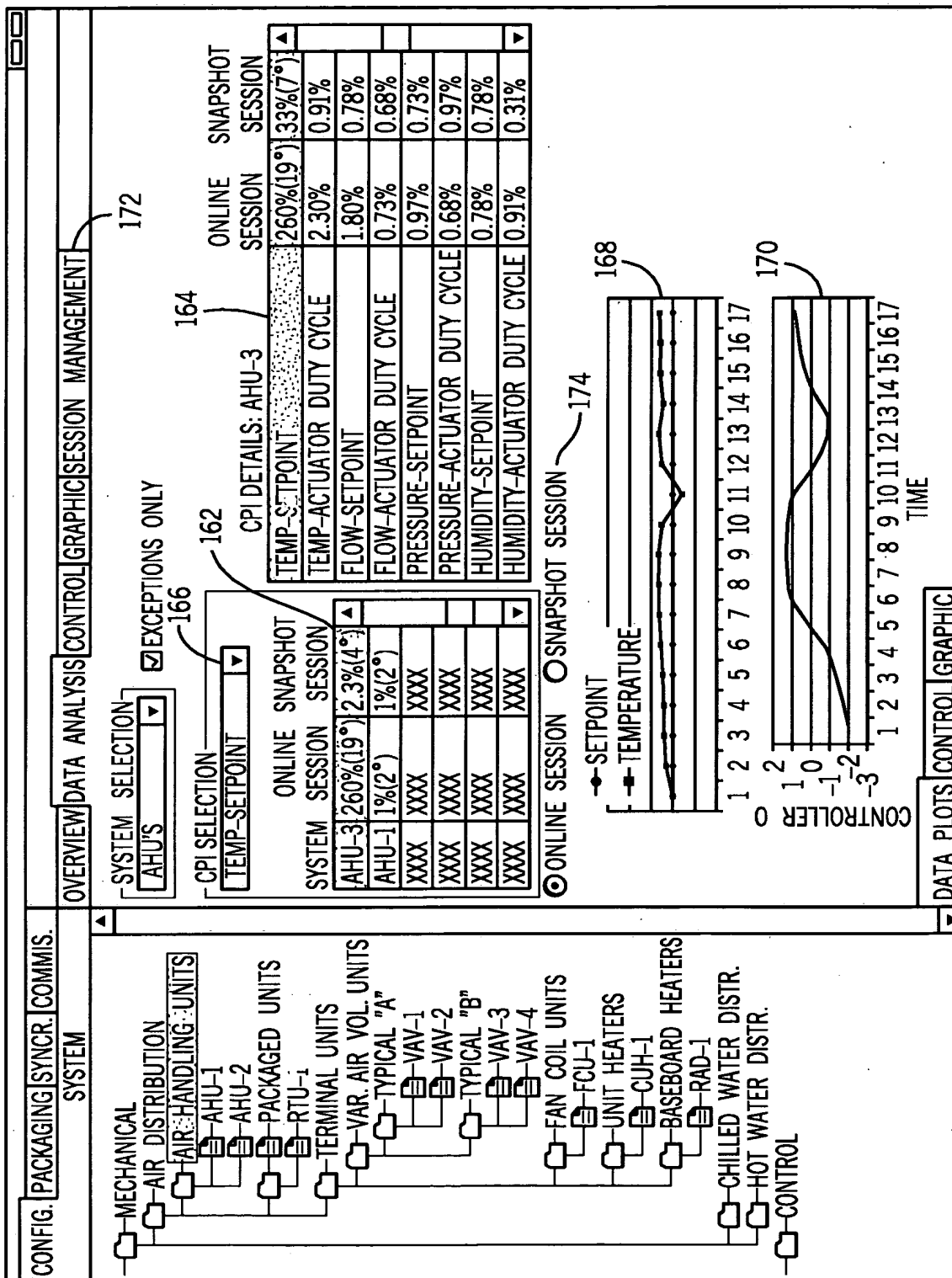


FIG. 9



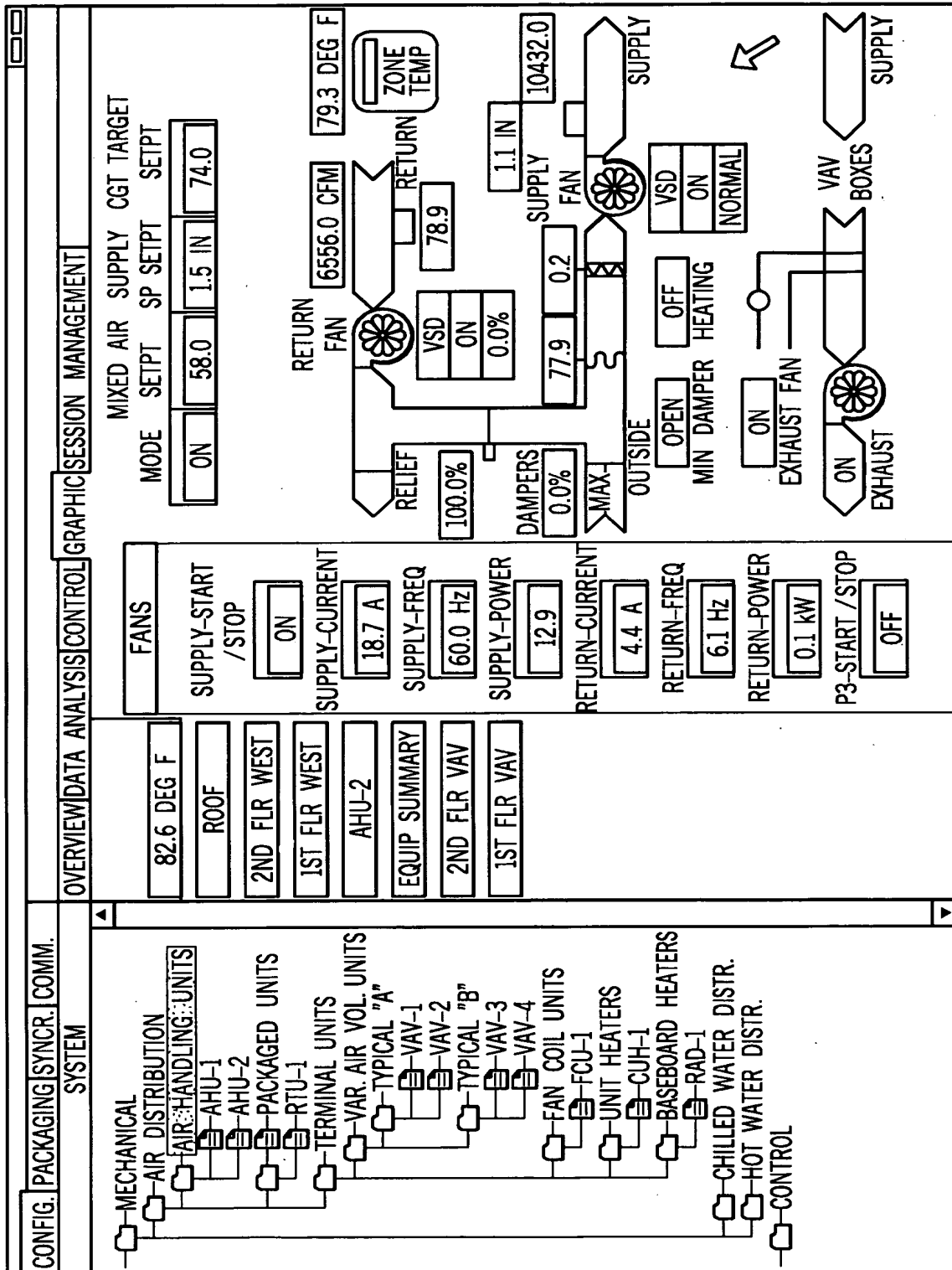
Title: METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN ENVIRONMENTAL CONTROL SYSTEM

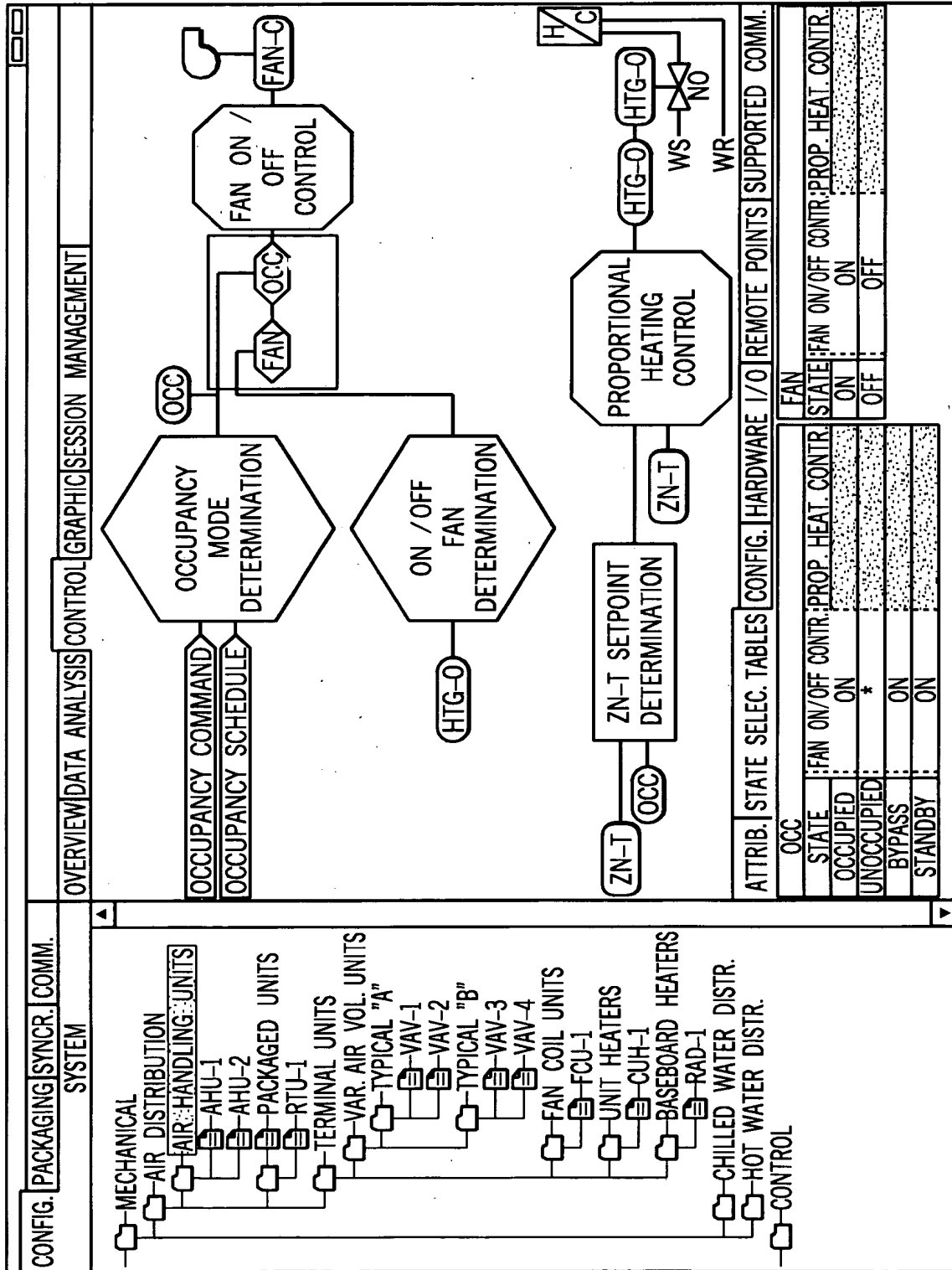
Inventor(s): John E. Seem et al.

Appl. No.: 10/841,107

11 / 13

FIG. 11





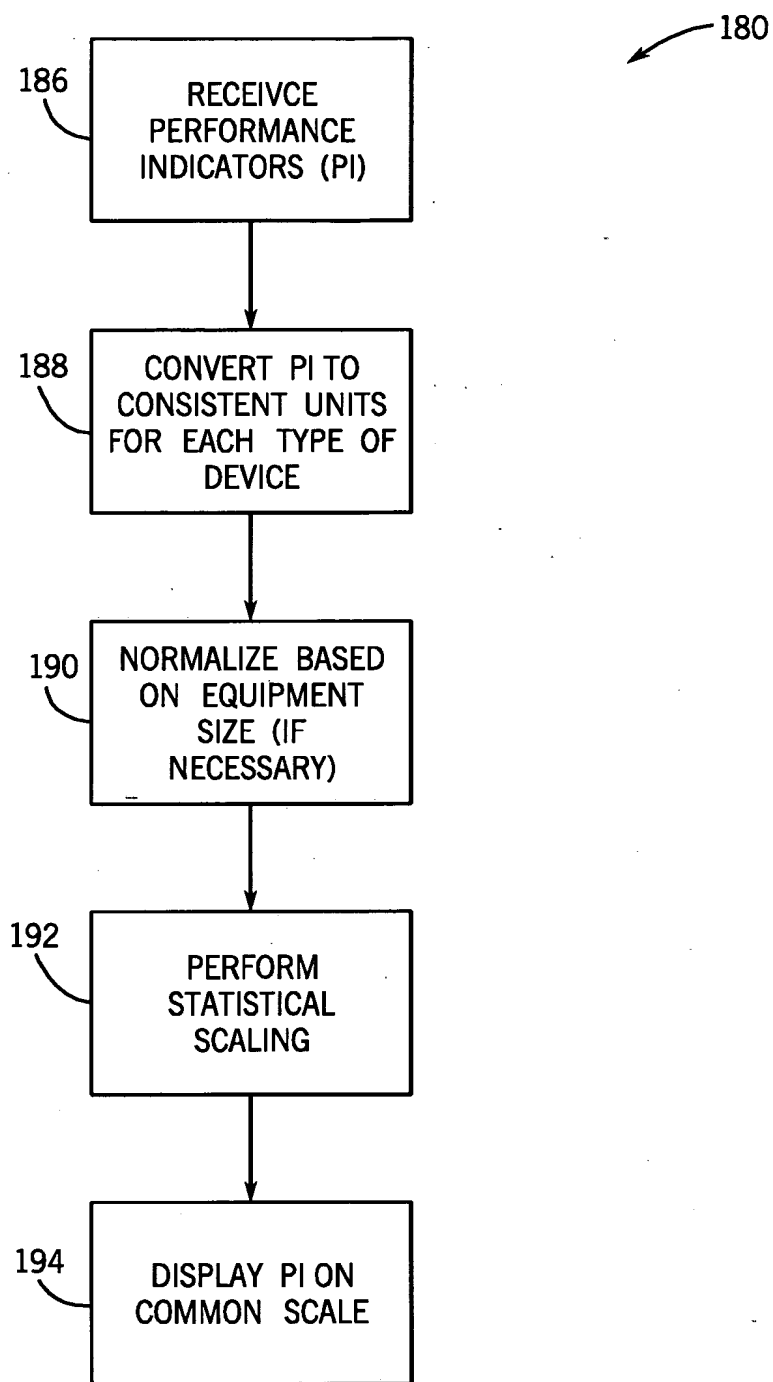


FIG. 13



8-6-04

Ifw

Atty. Dkt. No. 081445-0324

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John E. Seem et al.
Title: METHOD AND APPARATUS
FOR ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL CONTROL
SYSTEM
Appl. No.: 10/841,107
Filing Date: 05/07/2004
Examiner: To Be Determined
Art Unit: 2857

CERTIFICATE OF EXPRESS MAILING	
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.	
EV431586238US (Express Mail Label Number)	August 5, 2004 (Date of Deposit)
Jeanne M. Johnson (Printed Name)	
 (Signature)	

INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

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

Sir:

Submitted herewith on Form PTO-1449 is a listing of documents known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR §1.56. A copy of each listed document, except as noted below, is being submitted to comply with the provisions of 37 CFR §1.97 and §1.98.

The USPTO has waived the requirement under 37 CFR 1.98(a)(2)(i) to submit copies of U.S. patents and U.S. patent application publications when citing and submitting an Information Disclosure Statement in a patent application filed after June 30, 2003, and in an international application that has entered the national stage under 37 USC §371 after June 30, 2003. Accordingly, copies of these types of documents are not being supplied in connection with this application. Reference is being made to Pre-OG Notice from Office of Patent Legal Administration dated July 25, 2003, *Information Disclosure Statements May Be Filed*

Without Copies of U.S. Patents and Published Applications in Patent Applications filed after June 30, 2003.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b), within three (3) months of the filing date of the application.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

Applicants respectfully request that any listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO-1449 be returned in accordance with MPEP §609.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 CFR §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

Respectfully submitted,

Date August 5, 2004

By David J. Bates

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5760
Facsimile: (414) 297-4900

David J. Bates
Attorney for Applicant
Registration No. 39,902

Form PTO-1449 (MODIFIED)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTY. DOCKET NO. 081445-0324		SERIAL NO. 10/841,107	
INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)				APPLICANT John E. Seem et al.			
				FILING DATE 05/07/2004		GROUP ART UNIT 2857	
U.S. PATENT DOCUMENTS							
EXAMINER H. J. JENSEN	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUB- CLASS	FILING DATE IF APPROPRIATE
		5,682,329	10/28/1997	Seem et al.			
		5,555,195	09/10/1996	Jensen et al.			
FOREIGN PATENT DOCUMENTS							
	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB- CLASS	TRANSLATION YES NO
OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)							
EXAMINER				DATE CONSIDERED			
* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include any copy of this form with next communication to applicant.							

PLUS Search Results for S/N 10841107, Searched July 22, 2005

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present. PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

5847530
5872434
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10841107_CLS1.txt
Most Frequently Occurring Classifications of Patents Returned
From A Search of 10841107 on July 22, 2005

5/7/07

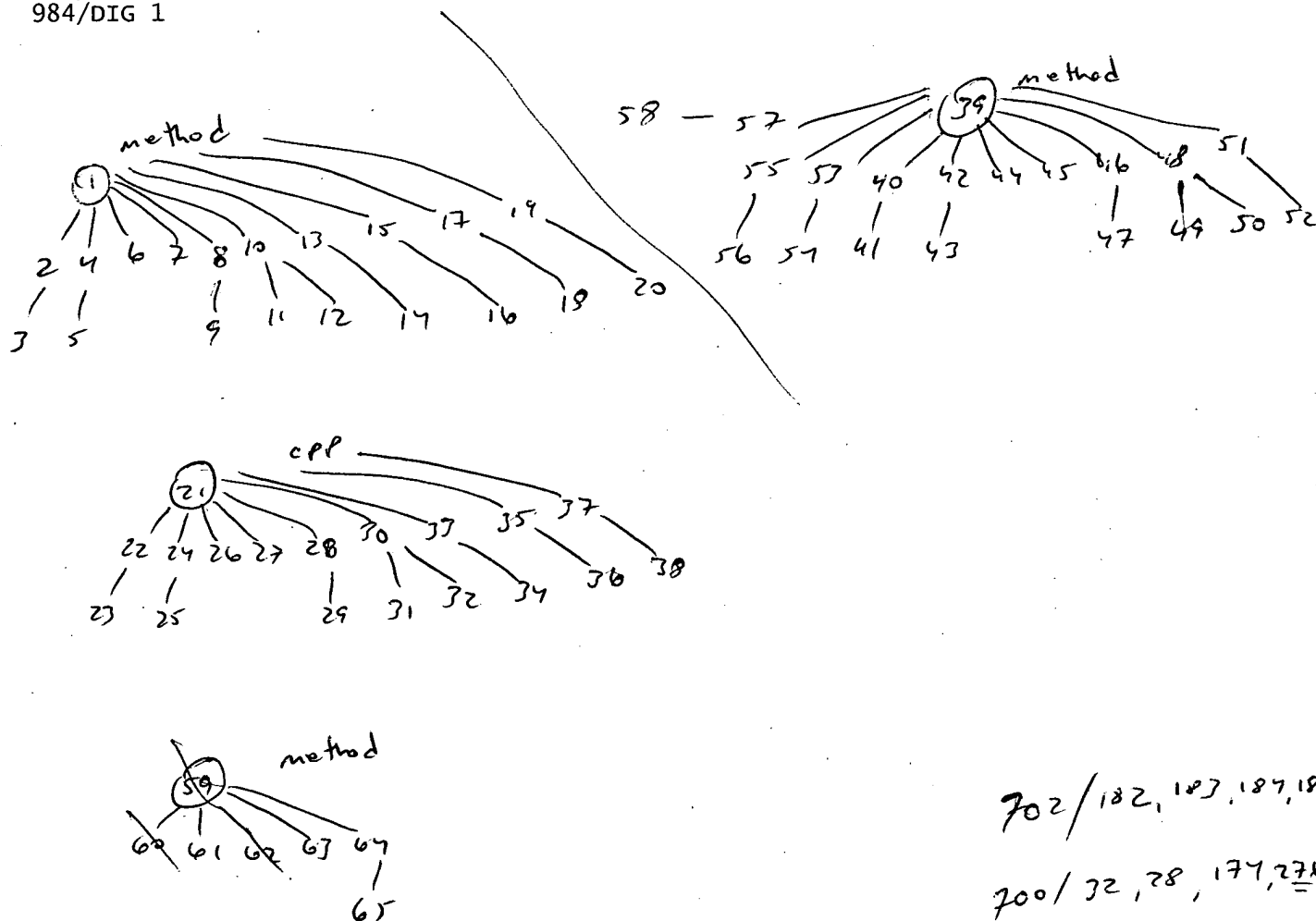
Original Classifications

Cross-Reference Classifications

2 123/179.21
2 984/DIG 1

Combined Classifications

2 123/179.21
2 219/69.16
2 984/DIG 1



702/182, 183, 187, 185

700/32, 28, 177, 271

340/870.01, 870.16
500, 3.1
815.7

345/660, 440, 440.1
440.2

Titles of Most Frequently Occurring Classifications of Patents Returned
From A Search of 10841107 on July 22, 2005

- 2 123/179.21 (0 OR, 2 XR)
 - Class 123 : INTERNAL-COMBUSTION ENGINES
 - 123/179.1 STARTING DEVICE
 - 123/179.21 .With charge or cylinder heating
- 2 219/69.16 (1 OR, 1 XR)
 - Class 219 : ELECTRIC HEATING
 - 219/50 METAL HEATING (E.G., RESISTANCE HEATING)
 - 219/68 .Cutting or disintegrating (e.g., machining engraving)
 - 219/69.11 ..Electric spark machining
 - 219/69.16 ...Gap spacing control
- 2 984/DIG 1 (0 OR, 2 XR)
 - Class 984 : MUSICAL INSTRUMENTS
 - 984/DIG 1 PAPER COPIES IN NUMERICAL ORDER OF ALL U.S. PATENTS IN SUBCLASSES 1-398

PLUS Search Results for S/N 10841107, Searched July 22, 2005

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present. PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

5847530
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Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	20325	control\$4 same performance same display\$4	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/08/18 13:49
L3	2391	702/182,183,184,185.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/08/18 13:49
L4	1803	700/32,28,174,276.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/08/18 13:49
L5	3312	340/870.01,870.16,500,3.1,815.4.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/08/18 13:49
L6	1835	345/660,440,440.1,440.2.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/08/18 13:49
L7	9250	3 or 4 or 5 or 6	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/08/18 14:37
L8	263	2 and 7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/08/18 13:50



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/841,107	05/07/2004	John E. Seem	081445-0324	1135
26371	7590	08/22/2005		
FOLEY & LARDNER 777 EAST WISCONSIN AVENUE SUITE 3800 MILWAUKEE, WI 53202-5308			EXAMINER ASSOUAD, PATRICK J	
			ART UNIT	PAPER NUMBER
			2857	

DATE MAILED: 08/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No. 10/841,107	Applicant(s) SEEM ET AL.	
	Examiner Patrick J. Assouad	Art Unit 2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-65 is/are pending in the application.
 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-20 and 39-58 is/are allowed.
- 6) ☒ Claim(s) 59,60 and 62 is/are rejected.
- 7) ☒ Claim(s) 21-38,61 and 63-65 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 July 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) ☒ Notice of References Cited (PTO-892) | 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) ☐ Notice of Informal Patent Application (PTO-152) |
| 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>8/5/04</u> . | 6) ☐ Other: ____ |

DETAILED ACTION

Drawings

1. Figure 1-2 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See at least Figs. 1-2 of US Patents 5,682,329, 5,446,677, and 5,555,195. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities: the status of US Application serial No. 10/612,621 should be updated appropriately.

Appropriate correction is required.

Claim Objections

3. Claims 21-38 are objected to because of the following informalities: to fully comply with MPEP 2106, Applicant is strongly suggested to incorporate the following language (or similar language) into all of the "program product" claims: "A computer

program product, in combination with and embodied on a computer-readable medium, for analyzing performance..." Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 59-60 and 62 are rejected under 35 U.S.C. 102(e) as being anticipated by Frerichs et al. (US 6,865,511).

6. Note: the preamble of independent claim 59 refers to an environmental control network; the body of the claim does not. Pursuant to MPEP 2111.02, the preamble is given little or no patentable weight.

7. The correspondence between the instant claimed invention (claim 59) and that of Frerichs et al. is seen most clearly from Fig. 5 of Frerichs et al. (reproduced below) and is as follows: receiving a plurality of performance indicators... is step 52 of Fig. 5; performing a statistical scaling on the performance indicators is the combination of one

Art Unit: 2857

or more of steps 54-60 of Fig. 5; displaying the scaled performance indicators on a common scale is step 62 of Fig. 5 of Frerichs et al.

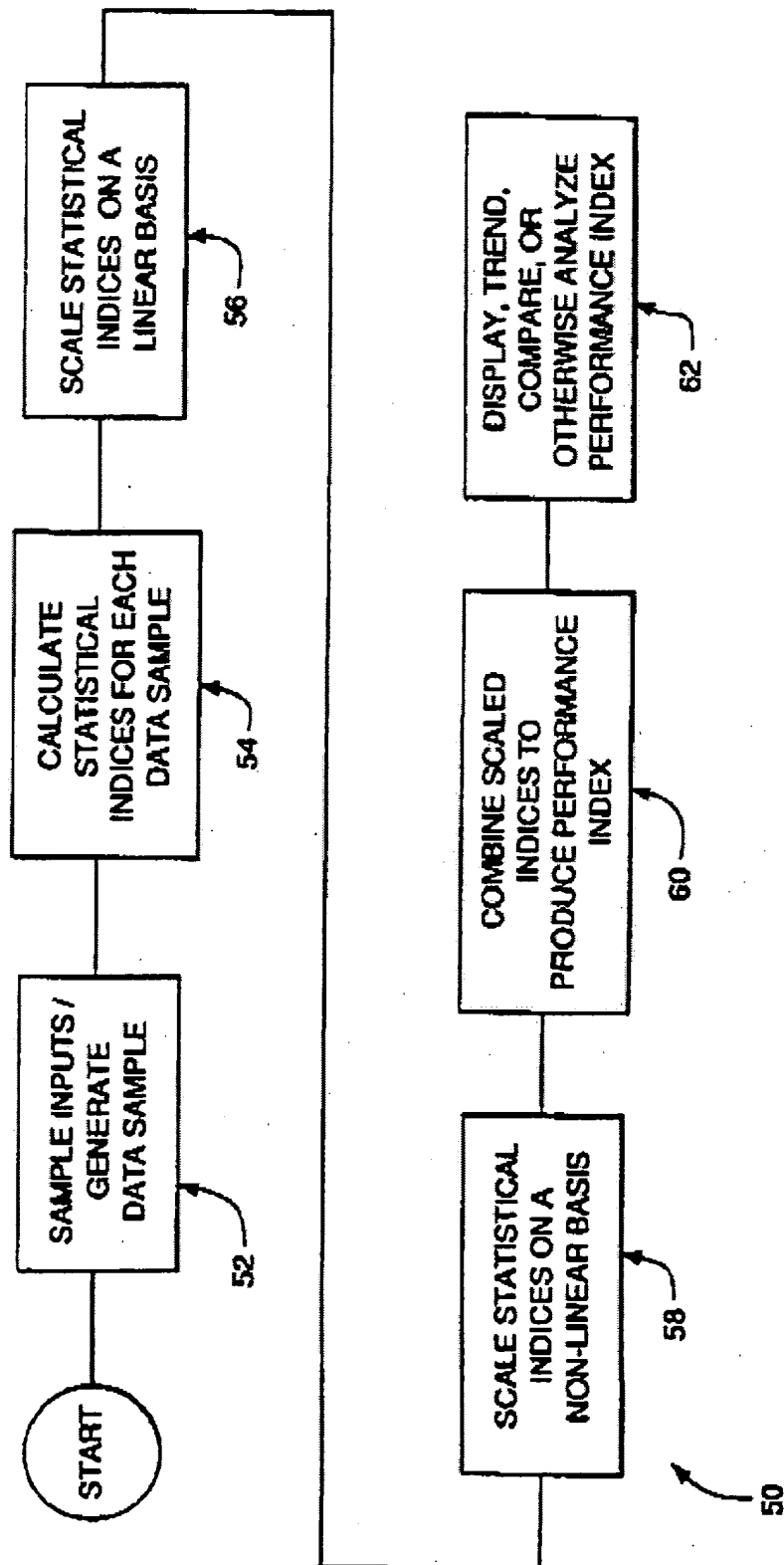


FIG. 5

8. As per dependent claim 60, the Examiner associates the claimed "standardizing the performance indicators for consistent units" with the combination of scaled indices which produce a performance index of Frerichs et al.

9. As per dependent claim 62 which refers to "two distinct types of devices", see at least the numerous distinct devices of Figs. 3-4.

Allowable Subject Matter

10. Claims 1-20 and 39-58 are allowed.

11. Claims 61 and 63-65 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See the attached PTO-892.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick J. Assouad whose telephone number is 571-272-2210. The examiner can normally be reached on Tuesday-Friday, 6:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc Hoff can be reached on 571-272-2216. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Patrick J Assouad
Primary Examiner
Art Unit 2857

pja

Form PTO-1449 (MODIFIED)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTY. DOCKET NO. 081445-0324		SERIAL NO. 10/841,107		
INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)				APPLICANT John E. Seem et al.				
				FILING DATE 05/07/2004		GROUP ART UNIT 2857		
O I P E AUG 05 2004 EXAMINER PTO TRADEMARK OFFICE U.S. PATENT DOCUMENTS								
EXAMINER POM	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUB- CLASS	FILING DATE IF APPROPRIATE	
		5,682,329	10/28/1997	Seem et al.				
		5,555,195	09/10/1996	Jensen et al.				
FOREIGN PATENT DOCUMENTS								
	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB- CLASS	TRANSLATION YES NO	
OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)								
EXAMINER POM		DATE CONSIDERED 8/18/05						
* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include any copy of this form with next communication to applicant.								

Notice of References Cited	Application/Control No. 10/841,107	Applicant(s)/Patent Under Reexamination SEEM ET AL.	
	Examiner Patrick J. Assouad	Art Unit 2857	Page 1 of 3

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,446,677	08-1995	Jensen et al.	700/277
	B	US-5,973,662 A	10-1999	Singers et al.	345/418
	C	US-6,014,612 A	01-2000	Larson et al.	702/183
	D	US-6,031,547 A	02-2000	Kennedy, Robert D.	345/440
	E	US-6,363,422 B1	03-2002	Hunter et al.	709/224
	F	US-6,385,510 B1	05-2002	Hoog et al.	700/276
	G	US-6,389,331 B1	05-2002	Jensen et al.	700/275
	H	US-6,626,366 B2	09-2003	Kayahara et al.	236/94
	I	US-6,704,016 B1	03-2004	Oliver et al.	345/440.2
	J	US-6,764,019 B1	07-2004	Kayahara et al.	236/51
	K	US-6,826,454 B2	11-2004	Sulfstede, Louis E.	700/276
	L	US-6,816,811 B2	11-2004	Seem, John E.	702/179
	M	US-6,823,680 B2	11-2004	Jayanth, Nagaraj	62/127

FOREIGN PATENT DOCUMENTS

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NON-PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 10/841,107	Applicant(s)/Patent Under Reexamination SEEM ET AL.	
	Examiner Patrick J. Assouad	Art Unit 2857	Page 2 of 3

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,134,511	10-2000	Subbarao, Krishnappa	703/6
	B	US-2002/0059229 a1	05-2002	Natsumeda et al.	707/6
	C	US-6,437,691	08-2002	Sandelman et al.	340/506
	D	US-6,477,518	11-2002	Li et al.	706/45
	E	US-2003/0014130 A1	01-2003	Grumelart, Alain	700/28
	F	US-2003/0158704 a1	08-2003	Triginai et al.	702/182
	G	US-2004/0068390 a1	04-2004	Saunders, Michael A.	702/182
	H	US-2004/0133314 a1	07-2004	Ehlers et al.	700/276
	I	US-6,782,385	08-2004	Natsumeda et al.	707/6
	J	US-2004/0199360 A1	10-2004	Friman et al.	702/182
	K	US-6,813,532	11-2004	Eryurek et al.	700/108
	L	US-6,813,532 B2	11-2004	Eryurek et al.	700/108
	M	US-6,925,338 B2	08-2005	Eryurek et al.	700/30

FOREIGN PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 10/841,107	Applicant(s)/Patent Under Reexamination SEEM ET AL.	
	Examiner Patrick J. Assouad	Art Unit 2857	Page 3 of 3

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,285,966 B1	09-2001	Brown et al.	702/188
	B	US-2002/0010562 A1	01-2002	Schleiss et al.	702/183
	C	US-6,389,331 B1	05-2002	Jensen et al.	700/275
	D	US-2002/0147506 A1	10-2002	Eryurek et al.	700/28
	E	US-2002/0177909 A1	11-2002	Fu et al.	700/28
	F	US-6,577,323 B1	06-2003	Jamieson et al.	715/700
	G	US-6,646,660 B1	11-2003	Patty, Richard B.	700/108
	H	US-6,732,540 B2	05-2004	Sugihara et al.	62/177
	I	US-6,865,511 B2	03-2005	Frerichs et al.	702/182
	J	US-			
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FOREIGN PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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INTERFERENCE SEARCHED			
Class	Subclass	Date,	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
PLUS report reviewed and attached.	8/18/05	POB
EAST searched. See attached.	8/18/05	POB
Limited classified search:	8/18/05	POB
702/182, 183, 184, 185 700/32, 28, 174 276		
340/870.01, 870.16 500, 3, 1 815.4		
345/660, 440, 440.1, 44.2		

Index of Claims



Application/Control No.

10/841,107

Examiner

Patrick J. Assouad

Applicant(s)/Patent under Reexamination

SEEM ET AL.

Art Unit

2857

✓	Rejected
=	Allowed

—	(Through numeral) Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

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11-21-05

IFW

Attorney Docket No. 081445-0324

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Seem et al.

Title: METHOD AND
APPARATUS FOR
ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL
CONTROL SYSTEM

Application No.: 10/841,107

Filing Date: 05/07/2004

Examiner: Assouad, Patrick J.

Art Unit: 2857

CERTIFICATE OF EXPRESS MAILING	
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.	
EV 625662085 US (Express Mail Label Number)	November 18, 2005 (Date of Deposit)
Deborah A. Kocorowski (Printed Name)	
 (Signature)	

Mail Stop **AMENDMENT**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AND REPLY TRANSMITTAL

Transmitted herewith is an Amendment and Reply in the above-identified patent application.

☒ [X] Amendment and Reply Under 37 C.F.R. § 1.111 (14 pages).

☒ [X] The fee required for additional claims is calculated below:

	Claims As Amended		Previously Paid For		Extra Claims Present		Rate		Additional Claims Fee
Total Claims:	58	-	65	=	0	x	\$50.00	=	\$0.00
Independent Claims:	3	-	4	=	0	x	\$200.00	=	\$0.00
First presentation of any Multiple Dependent Claims:							+	\$360.00	= \$0.00
CLAIMS FEE TOTAL									= \$0.00

☐ The Applicants hereby petition for an extension of time under 37 C.F.R. § 1.136(a) for the total number of months checked below:

☐	Extension for response filed within the first month:	\$120.00	\$0.00
☐	Extension for response filed within the second month:	\$450.00	\$0.00
☐	Extension for response filed within the third month:	\$1,020.00	\$0.00
☐	Extension for response filed within the fourth month:	\$1,590.00	\$0.00
☐	Extension for response filed within the fifth month:	\$2,160.00	\$0.00
EXTENSION FEE TOTAL:			\$0.00
☐	Statutory Disclaimer Fee under 37 C.F.R. § 1.20(d):	\$130.00	\$0.00
CLAIMS, EXTENSION AND DISCLAIMER FEE TOTAL:			\$0.00
☐	Small Entity Fees Apply (subtract ½ of above):		\$0.00
TOTAL FEE:			\$0.00

☒ The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447. If any extensions of time are needed for timely acceptance of papers submitted herewith, the Applicants hereby petition for such extension under 37 C.F.R. § 1.136 and authorizes payment of any such extensions fees to Deposit Account No. 06-1447.

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

Date

11/17/2005

By

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Attorney Docket No. 081445-0324

THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Seem et al.

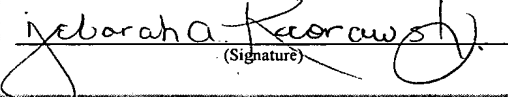
Title: METHOD AND
APPARATUS FOR
ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL
CONTROL SYSTEM

Application No.: 10/841,107

Filing Date: 05/07/2004

Examiner: Assouad, Patrick J.

Art Unit: 2857

CERTIFICATE OF EXPRESS MAILING	
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EV 625662085 US	November 18, 2005
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AMENDMENT AND REPLY UNDER 37 C.F.R. § 1.111

This communication is responsive to the Non-Final Office Action dated August 22, 2005 concerning the above-referenced patent application.

Amendments to the Specification begin on page 2 of this document.

Amendments to the Claims are reflected in the Listing of Claims which begins on page 4 of this document.

Remarks/Arguments begin on page 11 of this document.

Please amend the application as follows:

Amendments to the Specification:

Please amend the specification as follows:

Please replace paragraph [0008] starting on page 3 of the specification with the following rewritten paragraph:

[0008] An ideal feedback control system would be able to maintain the controlled variable at the setpoint based only on the feedback signal. However, actual feedback control systems require additional inputs known as control parameters that are used by the controller to determine how to control the system based on the feedback signal and the setpoint. Common control algorithms that make use of such control parameters are proportional (P) control, proportional integral (PI) control, and proportional-integral derivative (PID) control. More recently, a pattern recognition adaptive control (PRAC) method has been utilized to automatically determine the values of the control parameters after significant setpoint changes or load disturbances have occurred. One example of an improved PRAC method is disclosed in commonly owned U.S. Patent Application No. 10/612,621 (now U.S. Patent No. 6,937,909) (~~currently pending~~).

Please replace paragraph [0036] starting on page 9 of the specification with the following rewritten paragraph:

[0036] In the embodiment of Figures 1 and 2, controller 12 is configured to appropriately position actuator 50 in accordance with a control algorithm. The control algorithm may be a type that is well known to persons skilled in the art such as P, PI, PID based algorithms. The control algorithm may also be a PRAC based algorithm such as disclosed in commonly owned U.S. Patent Application No. 10/612,621 (now U.S. Patent No. 6,937,909) (~~currently pending~~). In accordance with any of these types of algorithms, controller 12 may receive air flow and temperature feedback values at inputs 38 and 40, respectively. The control algorithm may also receive other data (e.g., temperature set point from a thermostat) from communications port 36 or some other input. Controller 12 provides an actuator output signal at actuator output 42 to accurately position damper 46 in an effort to maintain the controlled environment within a specified tolerance of the desired temperature with minimal effort.

Amendments to the Claims:

This Listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A method for analyzing performance of control applications in an environmental control network, comprising:
 - receiving at least one performance indicator for each control application;
 - identifying at least one control application experiencing degraded performance using a first view of the performance indicators; and
 - obtaining additional information regarding the at least one control application using a second view of the performance indicators.
2. (Original) The method of claim 1, wherein first and second views each include a plurality of continuums ranging from good to poor performance with the performance indicators plotted on the continuums.
3. (Original) The method of claim 2, wherein a different continuum is provided for each type of control application.
4. (Original) The method of claim 1, wherein the first view is a summary view of the performance indicators and the second view is a more detailed view of the performance indicators.
5. (Original) The method of claim 4, wherein the summary view displays the performance indicators for only a worst performing control application among a group of control applications.
6. (Original) The method of claim 1, wherein the identifying and obtaining steps are performed by navigating at least one tree structure.
7. (Original) The method of claim 1, wherein the control applications are associated with an HVAC system.

8. (Original) The method of claim 1, wherein the performance indicators represent control effort and accuracy.
9. (Original) The method of claim 8, wherein the performance indicators are exponentially weighted moving averages.
10. (Original) The method of claim 1, wherein the first and second views each include a plurality of dot plots ranging from good to poor performance.
11. (Original) The method of claim 10, wherein a separate dot plot is provided for each type of control application in the first view.
12. (Original) The method of claim 10, wherein a separate dot plot is provided for each type of control loop in the control applications in the second view.
13. (Original) The method of claim 1, further including displaying trend buffer data for the at least on control application.
14. (Original) The method of claim 13, further including saving the trend buffer data for display at a later time.
15. (Original) The method of claim 1, further including displaying a mechanical view of the environmental control network.
16. (Original) The method of claim 15, wherein the mechanical view allows a user to inspect and alter values in the at least one control application.
17. (Original) The method of claim 1, further including displaying a control diagram view of the environmental control network.
18. (Original) The method of claim 17, wherein the control diagram view allows a user to inspect and alter a control strategy used for the at least one control application.
19. (Original) The method of claim 1, further including using statistical analysis to identify a mean and standard deviation for each performance indicator.

20. (Original) The method of claim 19, wherein the mean and standard deviation for each performance indicator are used to plot each performance indicator on a continuum ranging from good to poor.

21. (Currently Amended) A computer program product for analyzing performance of control applications in an environmental control network, the program product in combination with and embodied on a computer-readable medium and comprising machine-readable program code for causing, when executed, one or more machines to perform the following method steps:

displaying performance indicators for the control applications using a first view that allows at least one control application exhibiting degraded performance to be identified; and

displaying performance indicators using a second view that provides additional details regarding the performance of the at least one control application.

22. (Original) The program product of claim 21, wherein first and second views each include a plurality of continuums ranging from good to poor performance with the performance indicators plotted on the continuums.

23. (Original) The program product of claim 22, wherein a different continuum is provided for each type of control application.

24. (Original) The program product of claim 21, wherein the first view is a summary view of the performance indicators and the second view is a more detailed view of the performance indicators.

25. (Original) The program product of claim 24, wherein the summary view shows the performance indicators for only a worst performing control loop for each control application.

26. (Original) The program product of claim 21, wherein the program code causes at least one tree structure to be displayed for selecting the first view and the second view.

27. (Original) The program product of claim 21, wherein the control applications are associated with an HVAC system.

28. (Original) The program product of claim 21, wherein the performance indicators represent control effort and accuracy.

29. (Original) The program product of claim 28, wherein the performance indicators are exponentially weighted moving averages.

30. (Original) The program product of claim 21, wherein the first and second views each include a plurality of dot plots ranging from good to poor performance.

31. (Original) The program product of claim 30, wherein a separate dot plot is provided for type of control application in the first view.

32. (Original) The program product of claim 30, wherein a separate dot plot is provided for each type of control loop in the control applications in the second view.

33. (Original) The program product of claim 21, wherein the program code causes trend buffer data to be displayed for the at least one control application.

34. (Original) The program product of claim 33, wherein the program code causes trend buffer data to be saved for display at a later time.

35. (Original) The program product of claim 21, wherein the program code causes a mechanical view of the environmental control network to be displayed.

36. (Original) The program product of claim 35, wherein the mechanical view allows a user to inspect and alter values in the at least one control application.

37. (Original) The program product of claim 21, the program code causes a control diagram view of the environmental control network to be displayed.

38. (Original) The program product of claim 37, wherein the control diagram view allows a user to inspect and alter a control strategy used for the at least one control application.

39. (Original) A method for diagnosing performance of control applications in an environmental control network, comprising:

receiving at least one performance indicator for each control application;
identifying at least one control application exhibiting degraded performance using a first view of the performance indicators; and
obtaining additional information regarding the at least one control application using a second view of the performance indicators, the second view providing additional information on the at least one control application to permit a diagnosis of a possible cause of the degraded performance.

40. (Original) The method of claim 39, wherein first and second views each include a plurality of continuums ranging from good to poor performance with the performance indicators plotted on the continuums.

41. (Original) The method of claim 40, wherein a different continuum is provided for each type of control application.

42. (Original) The method of claim 39, wherein the first view is a summary view of the performance indicators and the second view is a more detailed view of the performance indicators.

43. (Original) The method of claim 42, wherein the summary view displays the performance indicators for only a worst performing control loop for each control application.

44. (Original) The method of claim 39, wherein the identifying and obtaining steps are performed by navigating at least one tree structure.

45. (Original) The method of claim 39, wherein the control applications are associated with an HVAC system.

46. (Original) The method of claim 39, wherein the performance indicators represent control effort and accuracy.

47. (Original) The method of claim 46, wherein the performance indicators are exponentially weighted moving averages.

48. (Original) The method of claim 39, wherein the first and second views each include a plurality of dot plots ranging from good to poor performance.

49. (Original) The method of claim 48, wherein a separate dot plot is provided for type of control application in the first view.

50. (Original) The method of claim 48, wherein a separate dot plot is provided for each type of control loop in the control applications in the second view.

51. (Original) The method of claim 39, further including displaying trend buffer data for the at least one control application.

52. (Original) The method of claim 51, further including saving the trend buffer data for display at a later time.

53. (Original) The method of claim 39, further including displaying a mechanical view of the environmental control network.

54. (Original) The method of claim 53, wherein the mechanical view allows a user to inspect and alter values in the at least one control application.

55. (Original) The method of claim 39, further including displaying a control diagram view of the environmental control network.

56. (Original) The method of claim 55, wherein the control diagram view allows a user to inspect and alter a control strategy used for the at least one control application.

57. (Original) The method of claim 39, further including using statistical analysis to identify a mean and standard deviation for each performance indicator.

58. (Original) The method of claim 57, wherein the mean and standard deviation for each performance indicator are used to plot each performance indicator on a continuum ranging from good to poor.

59.-65. (Cancelled).

REMARKS

The Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 59-65 are cancelled without prejudice.

Claim 21 is currently being amended.

This amendment changes and deletes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate status identifier for each.

After amending the claims as set forth above, claims 1-58 are now pending in this application.

Drawings

In section 1 of the Office Action, Figs. 1 and 2 are objected to as requiring the legend such as "Prior Art" based on Figs. 1 and 2 of U.S. Patent Nos. 5,682,329, 5,446,677, and 5,555,195. The Applicants respectfully submit that Figs. 1 and 2 of the present application are not intended to illustrate the prior art. Figs. 1 and 2 of the present application illustrate a system in which the components therein are configured to perform additional or differing functionality as clearly set forth in the specification of the current application. See, for example, the description set forth in the present application associated with controller 12 shown in Figs. 1 and 2. Accordingly, the Applicants respectfully request that the objections to Figs. 1 and 2 be withdrawn.

Specification

In section 2 of the Office Action, the disclosure is objected to based on informalities. Paragraphs [0008] and [0036] are amended to refer to “commonly owned U.S. Patent Application No. 10/612,621 (now U.S. Patent No. 6,937,909)” in order to update the status of U.S. Patent Application No. 10/612,621. No new matter has been added. Accordingly, the Applicants respectfully request that the objection to the specification be withdrawn.

Claim Objections

In section 3 of the Office Action, claims 21-38 are objected to based on informalities. Claim 21 has been amended to recite in part “a computer program product for analyzing performance of control applications in an environmental control network, the program product in combination with and embodied on a computer-readable medium.” Accordingly, the Applicants respectfully request that the objection to claim 21, as well as the objections to claims 22-38 which depend from claim 21 be withdrawn. The Applicants respectfully submit that the afore-mentioned amendment to claim 21 is presented only to advance prosecution and is not intended to narrow the original intended scope of claims 21-38, and is not intended to overcome rejections based on the cited references.

Claim Rejections – 35 U.S.C. § 102(e)

In section 5 of the Office Action, claims 59-60 and 62 are rejected under 35 U.S.C. § 102(e) as being anticipated by Frerichs et al. (U.S. Patent No. 6,865,511). While the Applicants do not necessarily agree with the rejections of claims 59-60 and 62 or the associated reasoning as set forth in the Office Action, the Applicants hereby cancel claims 59-60 and 62 without prejudice in order to advance prosecution. The Applicants reserve the right to present the subject matter of claims 59-60 and 62 in a later application.

Allowable Subject Matter

In section 10 of the Office Action, claims 1-20 and 39-58 are allowed. The Applicants thank the Examiner for the indication of allowance for claims 1-20 and 39-58.

In section 11 of the Office Action, claims 61 and 63-65 are objected to as being allowable except for their dependency on a rejected base claim. Claims 61 and 63-65 variously depend from claim 59. Again, while the Applicants do not necessarily agree with the rejection of claim 59 or the associated reasoning as set forth in the Office Action, the Applicants hereby cancel claims 61 and 63-65 without prejudice in order to advance prosecution. The Applicants reserve the right to present the subject matter of claims 61 and 63-65 in a later application.

Conclusion

The Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447. If any extensions of time are needed for timely acceptance of papers submitted herewith, the Applicants hereby petition for such extension under 37 C.F.R. § 1.136 and authorizes payment of any such extensions fees to Deposit Account No. 06-1447.

Respectfully submitted,

Date 11/17/2005

By Chad E. Bement

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Customer Number: 26371
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Chad E. Bement
Attorney for the Applicants
Registration No. 54,991

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 101841107	
CLAIMS AS FILED – PART I (Column 1) (Column 2)							
FOR	NUMBER FILED	NUMBER EXTRA					
BASIC FEE (37 CFR 1.16(a))							
TOTAL CLAIMS (37 CFR 1.16(c))	minus 20 =	*					
INDEPENDENT CLAIMS (37 CFR 1.16(b))	minus 3 =	*					
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))							
* If the difference in column 1 is less than zero, enter "0" in column 2.							
CLAIMS AS AMENDED – PART II (Column 1) (Column 2) (Column 3)							
AMENDMENT A	11/18/05	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		
	Total (37 CFR 1.16(c))	58	Minus	** 65	=		
	Independent (37 CFR 1.16(b))	3	Minus	*** 4	=		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))						
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		
	Total (37 CFR 1.16(c))	*	Minus	**	=		
	Independent (37 CFR 1.16(b))	*	Minus	***	=		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))						
AMENDMENT C		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		
	Total (37 CFR 1.16(c))	*	Minus	**	=		
	Independent (37 CFR 1.16(b))	*	Minus	***	=		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))						
			SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
			RATE	FEE		RATE	FEE
			X \$ _____ =		OR	X \$ _____ =	
			X \$ _____ =		OR	X \$ _____ =	
			+ \$ _____ =		OR	+ \$ _____ =	
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* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

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

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L2	31	(702/182 or 700/32,174,276).ccls. and control.clm. and performance.clm.	US-PGPUB	OR	ON	2005/11/29 09:15



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26371 7590 12/05/2005

FOLEY & LARDNER LLP
777 EAST WISCONSIN AVENUE
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MILWAUKEE, WI 53202-5308

EXAMINER

ASSOUAD, PATRICK J

ART UNIT

PAPER NUMBER

2857

DATE MAILED: 12/05/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/841,107	05/07/2004	John E. Seem	081445-0324	1135

TITLE OF INVENTION: METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN ENVIRONMENTAL CONTROL SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$0	\$1400	03/06/2006

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THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

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A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

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26371 7590 12/05/2005

**FOLEY & LARDNER LLP
777 EAST WISCONSIN AVENUE
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(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/841,107	05/07/2004	John E. Seem	081445-0324	1135

TITLE OF INVENTION: METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN ENVIRONMENTAL CONTROL SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$0	\$1400	03/06/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
ASSOUD, PATRICK J	2857	702-182000

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☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
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 2 _____
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:

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5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above. NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

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Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. 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 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/841,107	05/07/2004	John E. Seem	081445-0324	1135
26371	7590	12/05/2005	EXAMINER	
FOLEY & LARDNER LLP 777 EAST WISCONSIN AVENUE SUITE 3800 MILWAUKEE, WI 53202-5308			ASSOUAD, PATRICK J	
			ART UNIT	PAPER NUMBER
			2857	

DATE MAILED: 12/05/2005

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 46 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 46 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

37

Notice of Allowability	Application No.	Applicant(s)	
	10/841,107	SEEM ET AL.	
	Examiner	Art Unit	
	Patrick J. Assouad	2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Amdt filed 11/18/05.
2. ☒ The allowed claim(s) is/are 1-58.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

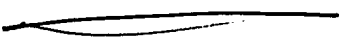
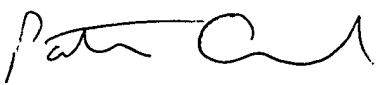
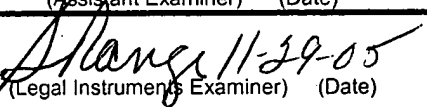
- | | |
|---|---|
| <ol style="list-style-type: none"> 1. ☐ Notice of References Cited (PTO-892) 2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____ 4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | <ol style="list-style-type: none"> 5. ☐ Notice of Informal Patent Application (PTO-152) 6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____ 7. ☐ Examiner's Amendment/Comment 8. ☐ Examiner's Statement of Reasons for Allowance 9. ☐ Other _____ |
|---|---|



Patrick J Assouad
 Primary Examiner
 Art Unit: 2857

Issue Classification 	Application/Control No.		Applicant(s)/Patent under Reexamination	
	10/841,107		SEEM ET AL.	
	Examiner		Art Unit	
	Patrick J. Assouad		2857	

ISSUE CLASSIFICATION										
ORIGINAL					CROSS REFERENCE(S)					
CLASS	SUBCLASS				CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
702	182				700	32	174	276		
INTERNATIONAL CLASSIFICATION										
G	0	6	F	19/00						
				/						
				/						
				/						
				/						

 (Assistant Examiner) (Date)		 Patrick J. Assouad 11/29/05 (Primary Examiner) (Date)		Total Claims Allowed: 58	
 (Legal Instruments Examiner) (Date)				O.G. Print Claim(s) 1	O.G. Print Fig. 13

☐ Claims renumbered in the same order as presented by applicant										☐ CPA		☐ T.D.		☐ R.1.47	
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	31	31		61		91		121		151		181		
2	2	32	32		62		92		122		152		182		
3	3	33	33		63		93		123		153		183		
4	4	34	34		64		94		124		154		184		
5	5	35	35		65		95		125		155		185		
6	6	36	36		66		96		126		156		186		
7	7	37	37		67		97		127		157		187		
8	8	38	38		68		98		128		158		188		
9	9	39	39		69		99		129		159		189		
10	10	40	40		70		100		130		160		190		
11	11	41	41		71		101		131		161		191		
12	12	42	42		72		102		132		162		192		
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21	21	51	51		81		111		141		171		201		
22	22	52	52		82		112		142		172		202		
23	23	53	53		83		113		143		173		203		
24	24	54	54		84		114		144		174		204		
25	25	55	55		85		115		145		175		205		
26	26	56	56		86		116		146		176		206		
27	27	57	57		87		117		147		177		207		
28	28	58	58		88		118		148		178		208		
29	29		59		89		119		149		179		209		
30	30		60		90		120		150		180		210		

[illegible]

Patrick J. Assouad

2857

[illegible]

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
SEE	EAST		
	attached	11/29/05	pm

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
✓ PLVS report reviewed and attached	8/18/05	PMB
EXT searched. See attached.	8/18/05	PMB
Limited classified search:	8/18/05	PMB
702 / 182, 183, 184, 185 700 / 32, 28, 174 276	✓	L
340 / 870.01, 870.16 500, 3, 1 815.4		
345 / 660, 440, 440.1, 44.2		

Complete and send this form together with applicable fee(s), to: **Mail**

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FEB 02 2006

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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

26371 7590 12/05/2005

FOLEY & LARDNER LLP
777 EAST WISCONSIN AVENUE
SUITE 3800
MILWAUKEE, WI 53202-5308

02/06/2006 MBERHE1 00000005 10841107

01 FC:1501 1400.00 DP

Certificate of Mailing or Transmission [EV625659550US]
 I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for express mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Deborah A. Kocorowski (Depositor's name)
 Deborah A. Kocorowski (Signature)
 February 2, 2006 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/841,107	05/07/2004	John E. Seem	081445-0324	1135

TITLE OF INVENTION: METHOD AND APPARATUS FOR ASSESSING PERFORMANCE OF AN ENVIRONMENTAL CONTROL SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$0	\$1400	03/06/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
ASSOUAD, PATRICK J	2857	702-182000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
 (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Foley & Lardner LLP
 2 _____
 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Johnson Controls Technology Company

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Holland, MI

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:

☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):

☐ A check in the amount of the fee(s) is enclosed.
☒ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 06-1447 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above. NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature

Chad E. Bement

Date

2/2/2006

Typed or printed name

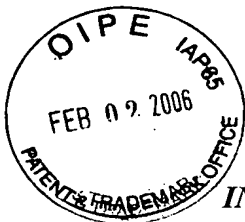
Chad E. Bement

Registration No.

54,991

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Seem et al.
Title: METHOD AND
APPARATUS FOR
ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL
CONTROL SYSTEM

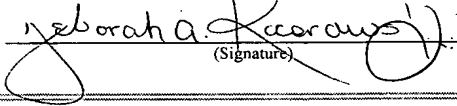
Application No.: 10/841,107

Filing Date: 05/07/2004

Examiner: Assouad, Patrick J.

Art Unit: 2857

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Commissioner for Patents
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EV 625659550 US (Express Mail Label Number)	February 2, 2006 (Date of Deposit)
Deborah A. Kocorowski (Printed Name)	
 (Signature)	

ISSUE FEE TRANSMITTAL

Enclosed herewith please find Issue Fee Transmittal Form PTOL-85(B).

A credit card payment form in the amount of **\$1,400.00** for payment of the Issue Fee is also enclosed.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by the credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

Respectfully submitted,

Date 2/2/2006

By Chad E. Bement

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5554
Facsimile: (414) 297-4900

Chad E. Bement
Attorney for the Applicants
Registration No. 54,991



Attorney Docket No. 081445-0324

THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Seem et al.

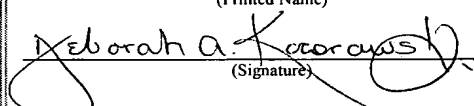
Title: METHOD AND
APPARATUS FOR
ASSESSING
PERFORMANCE OF AN
ENVIRONMENTAL
CONTROL SYSTEM

Application No.: 10/841,107

Filing Date: 05/07/2004

Examiner: Assouad, Patrick J.

Art Unit: 2857

CERTIFICATE OF EXPRESS MAILING	
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EV 625659550 US (Express Mail Label Number)	February 2, 2006 (Date of Deposit)
Deborah A. Kocorowski (Printed Name)	
 (Signature)	

Mail Stop **ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Transmitted herewith please find the following documents for the above-identified patent application.

- ☒ [X] Issue Fee Transmittal (1 page).
- ☒ [X] Issue Fee Transmittal Form PTOL-85(B) (1 page).
- ☒ [X] Credit Card Payment Form in the amount of **\$1,400.00** for payment of the Issue Fee (1 page).

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by the credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

Respectfully submitted,

Date 2/2/2006

By Chad E. Bement

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5554
Facsimile: (414) 297-4900

Chad E. Bement
Attorney for the Applicants
Registration No. 54,991

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
 filed in the U.S. District Court _____ for the District of Delaware _____ on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO.	DATE FILED 12/22/2021	U.S. DISTRICT COURT for the District of Delaware
PLAINTIFF JOHNSON CONTROLS TECHNOLOGY COMPANY		DEFENDANT WILLOW TECHNOLOGY CORPORATION PTY LIMITED, WILLOW TECHNOLOGIES, LLC, and WILLOW TECHNOLOGY USA, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 7,031,880 B1	4/18/2006	Johnson Controls Technology Company
2 US 10,055,114 B2	8/21/2018	Johnson Controls Technology Company
3 US 10,921,972 B2	2/16/2021	Johnson Controls Technology Company
4 US 11,073,976 B2	7/27/2021	Johnson Controls Technology Company
5 US 10,515,098 B2	12/24/2019	Johnson Controls Technology Company

* see attached additional patents

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
-------	-------------------	------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

WILLOW TECH. EX. 1006

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

JOHNSON CONTROLS TECHNOLOGY
COMPANY,

Plaintiff,

v.

WILLOW TECHNOLOGY
CORPORATION PTY LIMITED, WILLOW
TECHNOLOGIES, LLC, and WILLOW
TECHNOLOGY USA, INC.,

Defendants.

C.A. No.

JURY TRIAL DEMANDED

**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A
PATENT OR TRADEMARK (continued)**

PATENT OR TRADEMARK NO	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
6 US 11,038,709 B2	6/15/2021	Johnson Controls Technology Company
7 US 11,108,587 B2	8/31/2021	Johnson Controls Technology Company
8 US 10,534,326 B2	1/14/2020	Johnson Controls Technology Company
9 US 11,024,292 B2	6/1/2021	Johnson Controls Technology Company