ecobee Technologies, ULC
v.
EcoFactor, Inc.

U.S. Patent No. 8,596,550

IPR2022-00969 and IPR2022-00983

EcoFactor's Hearing Demonstratives

August 18, 2023

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Instituted Grounds – ‘983 IPR

» **Ground 1: Claims 1-16**
Allegedly Obvious over Ehlers ‘330 in view of Wruck

» **Ground 1: Claims 9-16**
Allegedly Obvious over Ehlers ‘330 in view of Wruck and Harter

Instituted Grounds – ‘969 IPR

- **Ground 1: Claims 17-23**
  Allegedly Obvious over Ehlers ‘330 in view of Wruck

- **Ground 1: Claims 17-23**
  Allegedly Obvious over Ols in view of Boait and Wruck

Overview of Argument

- **Petitioner Mischaracterizes Wruck.**
  - The "Delta Value" Is Not Explained In Wruck
  - Petitioner's Evidence is Merely Conclusory Statements
- **Because of this Mischaracterization:**
  - Wruck (with Ehlers or Ols and Boait) Does Not Disclose a Comparison of an Automated Setpoint with a Scheduled Setpoint
  - There is No Motivation to Combine Wruck with Ehlers or with Ols and Boait

Overview of Argument

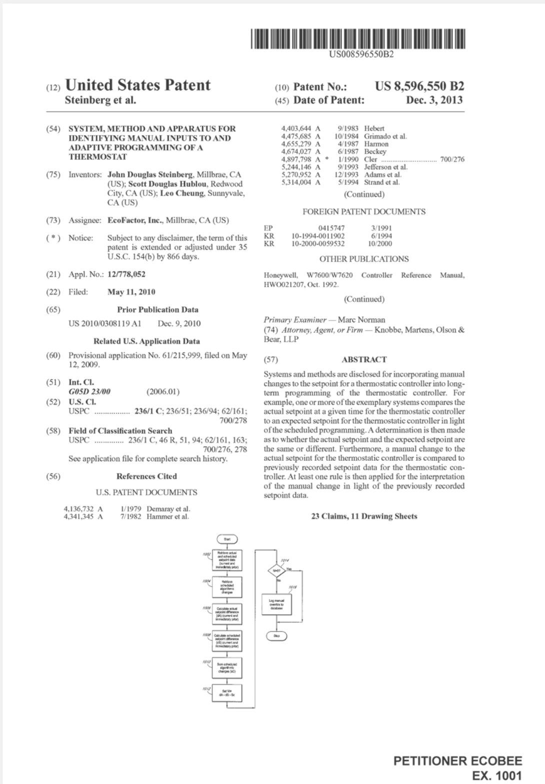
- **Petitioner Fundamentally Misunderstands the Teachings of Ehlers ’330**
- **Claims 1, 9, and 17 Are Not Invalid**
  - Ehlers and Wruck Do Not Disclose “using the stored data to predict a rate of change of temperatures inside the structure in response to at least changes in outside temperatures.”
  - Ehlers and Wruck Do Not Disclose “calculating with one or more computer processors, scheduled programming of the thermostatic controller for one or more times based on the predicted rate of change, the scheduled programming comprising at least a first automated setpoint at a first time.”

Overview of Argument

- **Ols, Boait, and Wruck Do Not Invalidate Claims 17-23**
  - No Motivation to Combine Ols and Boait
  - Ols and Boait Do Not Disclose "using the stored data to predict a rate of change of temperatures inside the structure in response to at least changes in outside temperatures."

‘550 Patent

‘550 Patent



US008596550B2

(12) United States Patent
Steinberg et al.

(10) Patent No.: US 8,596,550 B2
(45) Date of Patent: Dec. 3, 2013

(54) SYSTEM, METHOD AND APPARATUS FOR IDENTIFYING MANUAL INPUTS TO AND ADAPTIVE PROGRAMMING OF A THERMOSTAT

(75) Inventors: **John Douglas Steinberg**, Millbrae, CA (US); **Scott Douglas Hublou**, Redwood City, CA (US); **Leo Cheung**, Sunnyvale, CA (US)

(73) Assignee: **EcoFactor, Inc.**, Millbrae, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 866 days.

(21) Appl. No.: **12/778,052**

(22) Filed: **May 11, 2010**

(65) **Prior Publication Data**

US 2010/0308119 A1 Dec. 9, 2010

Related U.S. Application Data

(60) Provisional application No. 61/215,999, filed on May 12, 2009.

(51) **Int. Cl.**
G05D 23/00 (2006.01)

(52) **U.S. Cl.**
USPC .... **236/1 C**; 236/51; 236/94; 62/161; 700/278

(58) **Field of Classification Search**
USPC .... 236/1 C, 46 R, 51, 94; 62/161, 163; 700/276, 278
See application file for complete search history.

(56) **References Cited**

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(Continued)

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KR	10-1994-0011902	6/1994
KR	10-2000-0059532	10/2000

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(Continued)

Primary Examiner — Marc Norman
(74) *Attorney, Agent, or Firm* — Knobbe, Martens, Olson & Bear, LLP

(57) **ABSTRACT**

Systems and methods are disclosed for incorporating manual changes to the setpoint for a thermostatic controller into long-term programming of the thermostatic controller. For example, one or more of the exemplary systems compares the actual setpoint at a given time for the thermostatic controller to an expected setpoint for the thermostatic controller in light of the scheduled programming. A determination is then made as to whether the actual setpoint and the expected setpoint are the same or different. Furthermore, a manual change to the actual setpoint for the thermostatic controller is compared to previously recorded setpoint data for the thermostatic controller. At least one rule is then applied for the interpretation of the manual change in light of the previously recorded setpoint data.

23 Claims, 11 Drawing Sheets

PETITIONER ECOBEE
EX. 1001

Ex. 1001

U.S. Patent No. 8,596,550 (“’550 Patent”)

Title:
“System, Method and Apparatus for Identifying Manual Inputs to and Adaptive Programming for a Thermostat”

Issue Date:
December 3, 2013

Challenged Independent Claim 1

1. A method for detecting manual changes to the setpoint for a thermostatic controller comprising:

accessing stored data comprising a plurality of internal temperature measurements taken within a structure and a plurality of outside temperature measurements relating to temperatures outside the structure;

using the stored data to predict a rate of change of temperatures inside the structure in response to at least changes in outside temperatures;

calculating with one or more computer processors, scheduled programming of the thermostatic controller for one or more times based on the predicted rate of change, the scheduled programming comprising at least a first automated setpoint at a first time;

generating with one or more computer processors, a difference value based on comparing an actual setpoint at the first time for said thermostatic controller to the first automated setpoint for said thermostatic controller;

detecting a manual change to the first automated setpoint by determining whether said actual setpoint and said first automated setpoint are the same or different based on said difference value; and

logging said manual change to a database associated with the thermostatic controller.

* * *

Ex. 1001, col. 8:7-30

Challenged Independent Claim 9

9. A method for incorporating manual changes to the setpoint for a thermostatic controller into long-term programming of said thermostatic controller comprising:

accessing stored data comprising a plurality of internal temperature measurements taken within a structure and a plurality of outside temperature measurements relating to temperatures outside the structure;

using the stored data to predict a rate of change of temperatures inside the structure in response to at least changes in outside temperatures;

calculating scheduled programming of setpoints in the thermostatic controller based on the predicted rate of change, the scheduled programming comprising at least a first automated setpoint at a first time and a second automated setpoint at a second time;

* * *

comparing the actual setpoint at the first time for said thermostatic controller to the first automated setpoint for said thermostatic controller;

detecting a manual change to the first automated setpoint by determining whether said actual setpoint and said first automated setpoint are the same or different;

changing the second automated setpoint at the second time based on at least one rule for the interpretation of said manual change.

Ex. 1001, col. 8:50-9:6

Challenged Independent Claim 17

17. An apparatus for detecting manual changes to the setpoint for a thermostatic controller comprising:

at least a programmable communicating thermostat;

at least a remote processor;

at least a network connecting said remote processor and said communicating;

at least a database comprising a plurality of internal temperature measurements taken within a structure and a plurality of outside temperature measurements relating to temperatures outside the structure;

computer hardware comprising one or more computer processors configured to use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures;

* * *

the one or more computer processors configured to calculate scheduled setpoint programming of the programmable communicating thermostat for one or more times based on the predicted rate of change, the scheduled programming comprising one or more automated setpoints;

at least a database that stores the one or more automated setpoints associated with the scheduled programming for said programmable communicating thermostat;

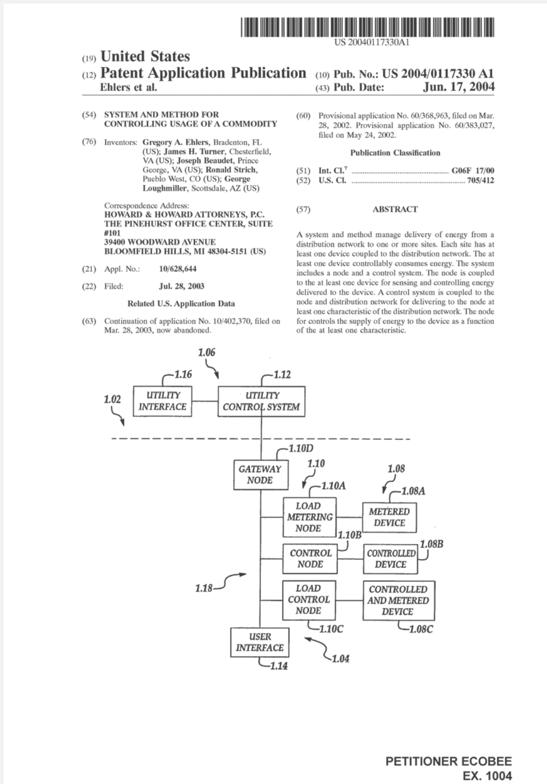
at least a database that stores actual setpoint programming of said programmable communicating thermostat; and

the one or more computer processors configured to compare the one or more automated setpoints associated with said scheduled setpoint programming with said actual setpoint programming.

Ex. 1001, col. 9:26-10:18

Cited Prior Art

Ehlers ‘330



US 20040117330A1

(19) United States
(12) Patent Application Publication
Ehlers et al.

(10) Pub. No.: US 2004/0117330 A1
(43) Pub. Date: Jun. 17, 2004

(54) SYSTEM AND METHOD FOR CONTROLLING USAGE OF A COMMODITY

(76) Inventors: **Gregory A. Ehlers**, Bradenton, FL (US); **James H. Turner**, Chesterfield, VA (US); **Joseph Beaudet**, Prince George, VA (US); **Ronald Strich**, Pueblo West, CO (US); **George Loughmiller**, Scottsdale, AZ (US)

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(21) Appl. No.: 10/628,644

(22) Filed: Jul. 28, 2003

Related U.S. Application Data

(63) Continuation of application No. 10/402,370, filed on Mar. 28, 2003, now abandoned.

(60) Provisional application No. 60/368,963, filed on Mar. 28, 2002. Provisional application No. 60/383,027, filed on May 24, 2002.

Publication Classification

(51) Int. Cl.[7] G06F 17/00
(52) U.S. Cl. 705/412

(57) ABSTRACT

A system and method manage delivery of energy from a distribution network to one or more sites. Each site has at least one device coupled to the distribution network. The at least one device controllably consumes energy. The system includes a node and a control system. The node is coupled to the at least one device for sensing and controlling energy delivered to the device. A control system is coupled to the node and distribution network for delivering to the node at least one characteristic of the distribution network. The node for controls the supply of energy to the device as a function of the at least one characteristic.

PETITIONER ECOBEE
EX. 1004

Ex. 1004

U.S. Patent App. Pub. No. 2004/0117330 (“Ehlers ‘330”)

Title:
“System and for Controlling Usage of a Commodity”

Pub. Date:
June 17, 2004

Wruck

US 20050040250A1

(19) United States
(12) Patent Application Publication
Wruck

(10) Pub. No.: US 2005/0040250 A1
(43) Pub. Date: Feb. 24, 2005

(54) TRANSFER OF CONTROLLER CUSTOMIZATIONS

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(21) Appl. No.: 10/859,665

(22) Filed: Jun. 3, 2004

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/643,395, filed on Aug. 18, 2003. Continuation-in-part of application No. 10/643,430, filed on Aug. 18, 2003.

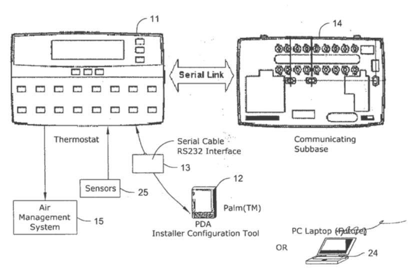
Publication Classification

(51) Int. Cl.[7] F23N 5/20; G05D 23/00

(52) U.S. Cl. 236/51

(57) ABSTRACT

A device and method that may be used at nearly any place to set and adjust a control system such as a thermostat, controller or computer having numerous parameters and options that may be selected for desired operation of an air management system. One may remotely, via a personal digital assistant or computer, configure, commission, select, set or adjust the parameters and options of a control system. The configuration information may be shared with other personal digital assistants in a wireless or non-wireless manner. Further, enhanced diagnostics and repair may be achieved with the sending of configuration information from one PDA or computer to a PDA or computer at a diagnostic and repair facility. New modifications and calibration may be provided for the configuration. Such added information and configuring may be sent back to the originating PDA or computer for the providing to the controller or thermostat.



PETITIONER ECOBEE
EX. 1005

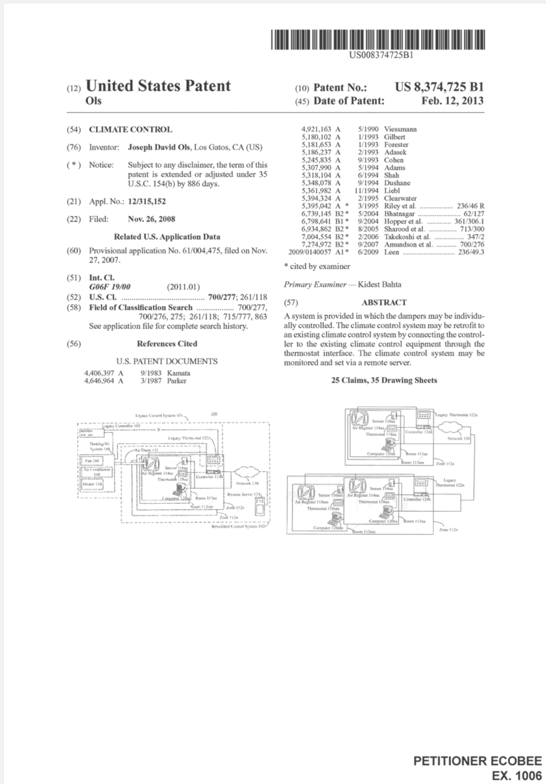
Ex. 1005

U.S. Patent App. Pub. No. 2005/0040250 (“Wruck”)

Title:
“Transfer of Controller Customizations”

Date:
February 24, 2005

Ols



US008374725B1

(12) **United States Patent**
Ols

(10) **Patent No.:** **US 8,374,725 B1**
(45) **Date of Patent:** **Feb. 12, 2013**

(54) **CLIMATE CONTROL**

(76) Inventor: **Joseph David Ols**, Los Gatos, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 886 days.

(21) Appl. No.: **12/315,152**

(22) Filed: **Nov. 26, 2008**

Related U.S. Application Data

(60) Provisional application No. 61/004,475, filed on Nov. 27, 2007.

(51) **Int. Cl.**
G06F 19/00 (2011.01)

(52) **U.S. Cl.** **700/277**; 261/118

(58) **Field of Classification Search** 700/277, 700/276, 275; 261/118; 715/777, 863
See application file for complete search history.

(56) **References Cited**

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2009/0140057	A1 *	6/2009	Leen	236/49.3

* cited by examiner

Primary Examiner — Kidest Bahta

(57) **ABSTRACT**

A system is provided in which the dampers may be individually controlled. The climate control system may be retrofit to an existing climate control system by connecting the controller to the existing climate control equipment through the thermostat interface. The climate control system may be monitored and set via a remote server.

25 Claims, 35 Drawing Sheets

PETITIONER ECOBEE
EX. 1006

Ex. 1006

U.S. Patent No. 8,374,725 (“Ols”)

Title:
“Climate Control”

Date:
February 12, 2013

Boait

(12) UK Patent Application (19) GB (11) 2 432 016 (13) A

(43) Date of A Publication 09.05.2007

(21) Application No: **0522544.6**

(22) Date of Filing: **04.11.2005**

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(51) INT CL:
G05D 23/19 (2006.01) ***G05B 13/04*** (2006.01)

(52) UK CL (Edition X):
G3N NGLA N262 N373 N374 N387
U1S S1978

(56) Documents Cited:
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EP 0736826 A2 **EP 0444308 A1**
JP 2005283028 A **US 5790437 A**
US 4217646 A **US 20030050737 A**

(58) Field of Search:
UK CL (Edition X) **G3N**
INT CL **G05B, G05D**
Other:

(54) Abstract Title**: electronic control units for central heating systems.**

(57) An automatic electronic control unit for controlling the operation of a central heating system where the time settings are determined automatically from a detection of the user's activity and lifestyle habits. An apparatus includes an electrical load sensor 22 for measuring the electrical load of one or more electrical appliances within the building and providing an output signal indicative of the electrical load of the one of more electrical appliances, and an electronic control unit that uses the output signal from the electrical load sensor to control an operation of the central heating system.

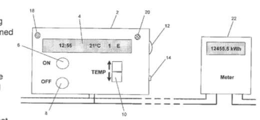


Figure 3

GB 2 432 016 A

Original Printed on Recycled Paper

PETITIONER ECOBEE
EX. 1007

Ex. 1007

U.K. Patent App. Pub. No. 2432016 ("Boait")

Title:
"Transfer of Controller Customizations"

Date:
February 24, 2005

Petitioner Mischaracterizes the Teachings of Wruck

Petitioner Mischaracterizes the Teachings of Wruck

Petitioner states that:

> Indeed, Wruck teaches that it was known to compare a user desired setpoint with a calculated setpoint in order to determine if the user has overridden the setpoint programming, and if the difference in setpoints is not equal to zero, display the temporary setpoint. (Ex. 1005, ¶0110)(Ex. 1002, ¶126). Wruck teaches to check whether the "Delta value" between the actual temporary setpoint and the scheduled setpoint is not equal to zero, and if so, to display the temporary setpoint, as shown in table 28, the relevant part of which is shown below, with highlighting added:

983 IPR – Pet at 39.
969 IPR – Pet. at 44.

“Delta value” is Only Disclosed in Table 28

Highlighted portion is the only reference to “Delta Value” in the entire Wruck disclosure.

- Wruck has 48 Figures and 260 paragraphs across over 35 pages
- No discussion about what “Delta value” means or how it is calculated.

TABLE 28

Thermostat Data	Display	Display Dependency	Report Text Description	Comments
version.major	A		FirmwareVersion: 0.0.19	
version.minor				
version.bug				
version.commVer	V		ComVersion: 1	
version.rePgmrVer	V		ReProgrammerVersion:	
status3.subBaseType	A		SubBaseID: T7350D, 3H3C	
subBase.connected	V		CommunicatingSubBase: Yes	
statusAnalog.spaceTemp	A		RoomTemperature: 75 F.	
statusAnalog.dischTemp	D	configured	DischargeAirTemp: 105 F.	config.dischAirSensor
statusAnalog.spaceHumidity	D	configured	Room RH: 33%	config.humiditySensor
statusAnalog.oDTemp	D	configured	OutdoorAir: 25 F.	config.oDAirSensor
statusAnalog.remoteStPtOffset	D	configured	RemoteSetPtOffset: 2 F.	config.remoteSetPoint
statusAnalog.temporarySetPt	D	value < > 0	TemporarySetPt: 76 F.	Display actual temporary setpoint if Delta value < > 0

Ex. 1005, Table 28 ¶110.
IPR 983 – POR at 39.
969 IPR – POR at 42

"Delta value" is Only Disclosed in Table 28

Wruck at ¶110:

Thermostat operating data may be monitored. A table 28 may provide data values with display dependency indications.

TABLE 28

Thermostat Data	Display	Display Dependency	Report Text Description	Comments
version.major	A		FirmwareVersion: 0.0.19	
version.minor				
version.bug				
version.commVer	V		ComVersion: 1	
version.rePgmrVer	V		ReProgrammerVersion:	
status3.subBaseType	A		SubBaseID: T7350D, 3H3C	
subBase.connected	V		CommunicatingSubBase: Yes	
statusAnalog.spaceTemp	A		RoomTemperature: 75 F.	
statusAnalog.dischTemp	D	configured	DischargeAirTemp: 105 F.	config.dischAirSensor
statusAnalog.spaceHumidity	D	configured	Room RH: 33%	config.humiditySensor
statusAnalog.oDTemp	D	configured	OutdoorAir: 25 F.	config.oDAirSensor
statusAnalog.remoteStPtOffset	D	configured	RemoteSetPtOffset: 2 F.	config.remoteSetPoint
statusAnalog.temporarySetPt	D	value < > 0	TemporarySetPt: 76 F.	Display actual temporary setpoint if Delta value < > 0
status1.totalError	N			Total error reported by the control loop.
status1.bypassTime	D	value > 0	BypassTime: 180 min	
status1.tuncos	N			Time until next scheduled change of occupancy state:
status1.DaysLeftKeypadHoliday	D	value > 0	HolidayDaysRemaining: 7	
status1.currentState	A		TimeSchedule: OCC	Current scheduled occupancy state 0: OCC 1: UNOCC 2: BYPASS 3: STANDBY 7: OCCNUL
status1.nextState	N			
status1.occSensor	D	configured	OccSensor: 0	config.occSensor = 1
status1.holiday	N			
status2.heatStgsOn	A	configured	HeatingStagesActive: 2	
	D	configured	AuxHeatingStagesActive: 2	Control = HeatPump
status2.coolStgsOn	A	configured	CoolingStagesActive: 1	
status2.percentCmdHeat	D	configured	HeatingOutput: 57%	SubBaseID = M
status2.percentCmdCool	D	configured	CoolingOutput: 33%	SubBaseID = M
status2.outFan	N			
status2.outCool1	N			
status2.outCool2	N			
status2.outCool3	N			
status2.outAux	A			
status2.outHeat1	D	configured	O/BChangeoverOver: ON	Control = heatpump config.heatPump
status2.outHeat2	N			
status2.outHeat3	N			
status2.effMode	A		EffectiveMode: Cool	Effective operating mode: 0: OFF__MODE 1: COOL__MODE 2: HEAT__MODE 3: EMERG__HEAT__MODE 4: REHEAT 5: MANUAL 6: FACTORY__TEST
status2.fan	A		FanStatus: ON	
status2.auxRelay	D	configured	Economizer: ON	NotHeatPmp AND Subbase > 1 config.auxOpMode = 1
	D	configured	HotGasDehumidification: ON	config.auxOpMode = 2

TABLE 28-continued

Thermostat Data	Display	Display Dependency	Report Text Description	Comments
	D	configured	SimpleDehumidification: ON	config.auxOpMode = 3
	D	configured	TimeOfDayContact: ON	config.auxOpMode = 0
status2.unused1	N			
status2.stagesActive	N	configured		
status2.noAuxHeat1	N			
status2.noAuxHeat2	N			
status2.dehumidActive	N	configured	Dehumidification: ON	RH sensor configured
status2.DALimit	D	configured	DishargeAirLimiting: ON	config.enableDALoLimit = 1 OR config.enableDAHiLimit = 1
status2.unused2	N			
status3.effOccTuncos	N			
status3.effSetPt__s6	A		EffectiveSetPoint: 72 F.	
status3.effOccCurrentState	A		EffectiveOccupancy: OCC	
status3.unused1	N			
status3.effOccNextState	N			
status3.unused2	N			
status4.terminalLoad	V			

Display Key: A - Always display
D - Display based on context Dependency
N - Never displayed
V - Verbose mode only

Ex. 1005, Table 28, ¶110

Petitioner Mischaracterizes the Teachings of Wruck

- Petitioner's Expert, Dr. Auslander, could not identify any support from the Wruck specification to support his position. Ex. 2008, 23:1-9
- EcoFactor's expert, Dr. Palmer, made clear "Delta value" could be any number of things.

Q Is there another interpretation that you'd like to share?

A There are lots of different interpretations. I mean, it could be if there's been a change to occupancy -- one occupancy mode to another occupancy mode. If there's been a change from heating to cooling. If there's been a change from temperature -- or from the active -- or HVAC equipment on versus HVAC equipment off. Wruck does not say what delta value is intended to mean in this context, and does not give anything in the body of his specification that elucidates that question.

Ex. 1022, 135:18-136:6

Prior Art Does Not Disclose "compar[ing] the one or more automated setpoints associated with said scheduled setpoint programming with said actual setpoint programming"

- **Claim 1e; Claim 9e; Claim 17j:**

  "the one or more computer processors configured to compare the one or more automated setpoints associated with said scheduled setpoint programming with said actual setpoint programming"

Ex. 1001, col. 8:21-24, 57-59; col. 9:36-10:2.

Wruck and Ehlers Do Not Disclose "compar[ing] the one or more automated setpoints associated with said scheduled setpoint programming with said actual setpoint programming"

- **There is no automated setpoint in Wruck**
- **Only evidence is "Delta value" is Table 28**
  - Wruck has 48 Figures, 260 paragraphs across over 35 pages
  - Only one single reference to "Delta value"
  - Not one discussion of what "Delta value" is or how it is obtained
  - Only Dr. Auslander's conclusory opinions with the benefit of the claims of the '550 patent in front of him

983 IPR – POR at 38-42; Sur-reply at 17-21.
969 IPR – POR at 41-45; Sur-reply at 17-21.

“Delta value” is Only Disclosed in Table 28

Highlighted portion is the only reference to “Delta Value” in the entire Wruck disclosure.

- Wruck has 48 Figures, 260 paragraphs across over 35 pages
- No discussion about what it means or how it is calculated.

TABLE 28

Thermostat Data	Display	Display Dependency	Report Text Description	Comments
version.major	A		FirmwareVersion: 0.0.19	
version.minor				
version.bug				
version.commVer	V		ComVersion: 1	
version.rePgmrVer	V		ReProgrammerVersion:	
status3.subBaseType	A		SubBaseID: T7350D, 3H3C	
subBase.connected	V		CommunicatingSubBase: Yes	
statusAnalog.spaceTemp	A		RoomTemperature: 75 F.	
statusAnalog.dischTemp	D	configured	DischargeAirTemp: 105 F.	config.dischAirSensor
statusAnalog.spaceHumidity	D	configured	Room RH: 33%	config.humiditySensor
statusAnalog.oDTemp	D	configured	OutdoorAir: 25 F.	config.oDAirSensor
statusAnalog.remoteStPtOffset	D	configured	RemoteSetPtOffset: 2 F.	config.remoteSetPoint
statusAnalog.temporarySetPt	D	value < > 0	TemporarySetPt: 76 F.	Display actual temporary setpoint if Delta value < > 0

Ex. 1005, Table 28 ¶110.
983 IPR – POR at 39.
969 IPR – POR at 42.

No Motivation to Combine Ehlers and Wruck Or Ols, Boait and Wruck

No Motivation to Combine Ehlers and Wruck

But Wruck Does Not Do This.

- No teaching in Wruck of Comparing Two Setpoints
- No teaching in Wruck of What "Delta value" means or how it is calculated
- No teaching in Wruck of calculating a setpoint

- Tellingly, Petitioner' Reply Does Not Address EcoFactor's Arguments Regarding No Motivation to Combine Wruck with either Ehlers or Ols and Boait

Petitioner states that:

A POSITA would have understood from Ehlers that comparing entered and automated setpoints would be beneficial to the described "learning from the user's inputs or adjustments to the system 3.08 to change or modify indoor air temperature." (Ex. 1004, ¶0242)(Ex. 1002, ¶63).

Dr. Auslander states that "Wruck does just that."

65. Wruck does just that. Specifically, Wruck provides an example of how the manually entered setpoint override may be determined—by comparing a user desired setpoint with a calculated setpoint—such that if the difference in setpoints is not equal to zero, the system may display the new setpoint. (Ex. 1005, Table 28, ¶0110). Further, to determine whether a value is not equal to zero, it would have been obvious to first determine what value is being compared to zero.

983 IPR – Pet. at 20-21, Ex. 1002, ¶ 65.
969 IPR – Pet. at 19; Ex. 1002, ¶ 64.

Ehlers ‘330 and Wruck (and Harter) Do Not Render Obvious Claims 1-23

- 969 IPR Ground 1
- 983 IPR Grounds 1 and 2

Petitioner Misunderstands the Teachings of Ehlers '330

"Thermal Gain Rate" ≠ "Rate of Change in Temperature"

- The "Thermal Gain Rate" Is Not The Same as a "Rate of Change in Temperature"
  - The phrase "thermal gain rate" is well understood by a POSITA as the rate at which energy is absorbed.
  - The phrase "rate of change of temperature" is well understood to mean the specific change of temperature over a specific time period.

983 IPR - POR at 12; Sur-reply at 4-5.
969 IPR – POR at 14; Sur-reply at 4.

Petitioner Misunderstands the Teachings of Ehlers '330 Takes Fig. 3D Out of Context

- Left Hand Label Indicates "Indoor Setpoint"
- Requires 128 minutes for Readings
- If read literally, Ehlers '330's description would indicate that the thermal gain rate would be a continuously increasing value between 72 and 80 (units unspecified).

But this is not consistent with other discussions in Ehlers '330.

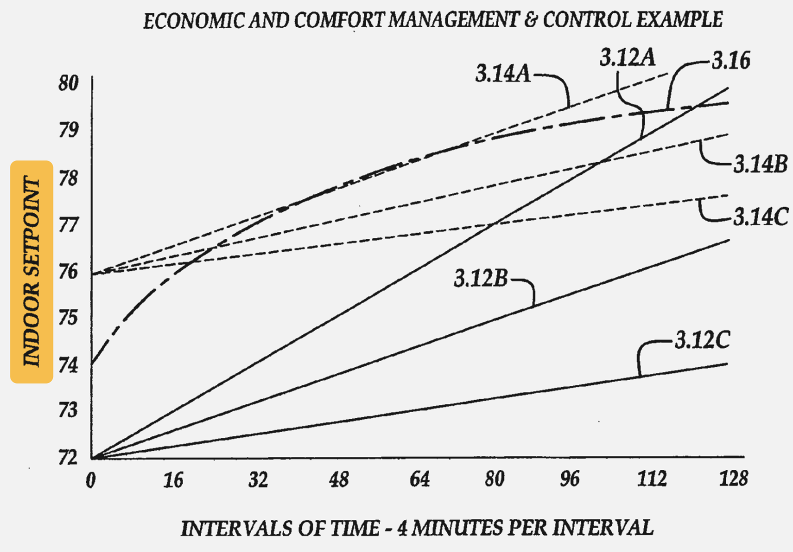


Figure 3D

983 IPR - POR at 13-14; Sur-reply at 5-6.
969 IPR – POR at 14-15; Sur-reply at 6-7.
Ex. 1004, Fig. 3D.

Petitioner Misunderstands the Teachings of Ehlers '330 Fig. 3E Provides Necessary Context

- Left Axis labeled "HVAC Runtime"
- Right Axis labeled "Thermal Gain Rate Per Hour"
- Horizontal Axis labeled "Intervals of Time–Hour Intervals"

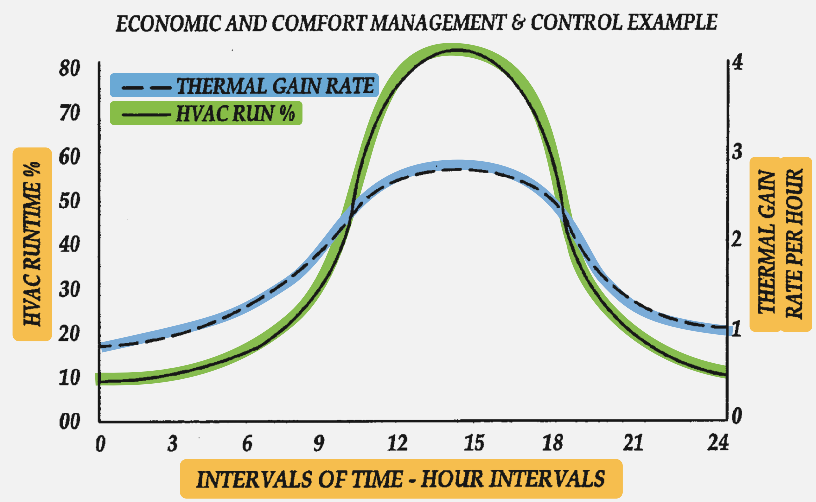


Figure 3E

983 IPR - POR at 14-16; Sur-reply at 6-8.
969 IPR – POR at 15-17; Sur-reply at 7-9.
Ex. 1004, Fig. 3E.

Petitioner Misunderstands the Teachings of Ehlers '330
Fig. 3G Provides Necessary Context

- *Same labels as Fig. 3E*
- Fig. 3G has nearly the same thermal gain plot as Fig. 3E, but allows indoor temperature to change by up to 3 Degrees F.

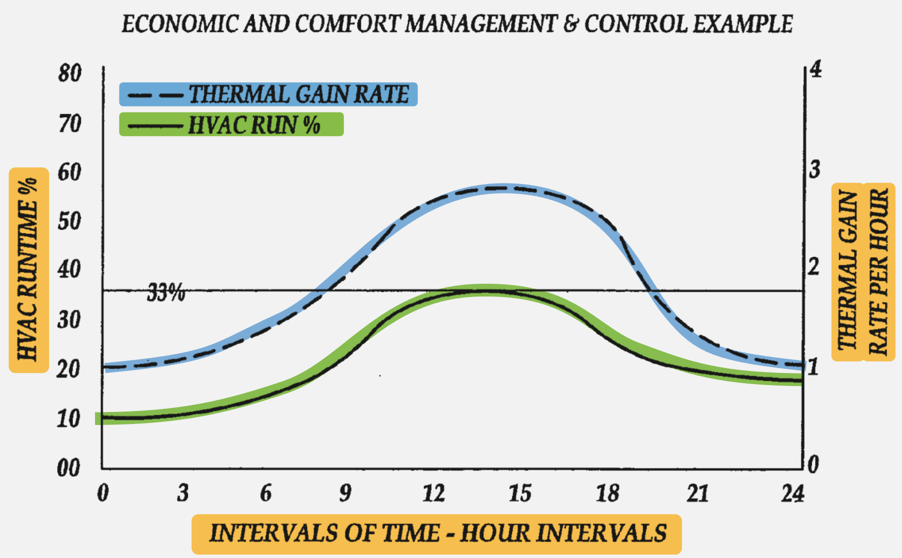
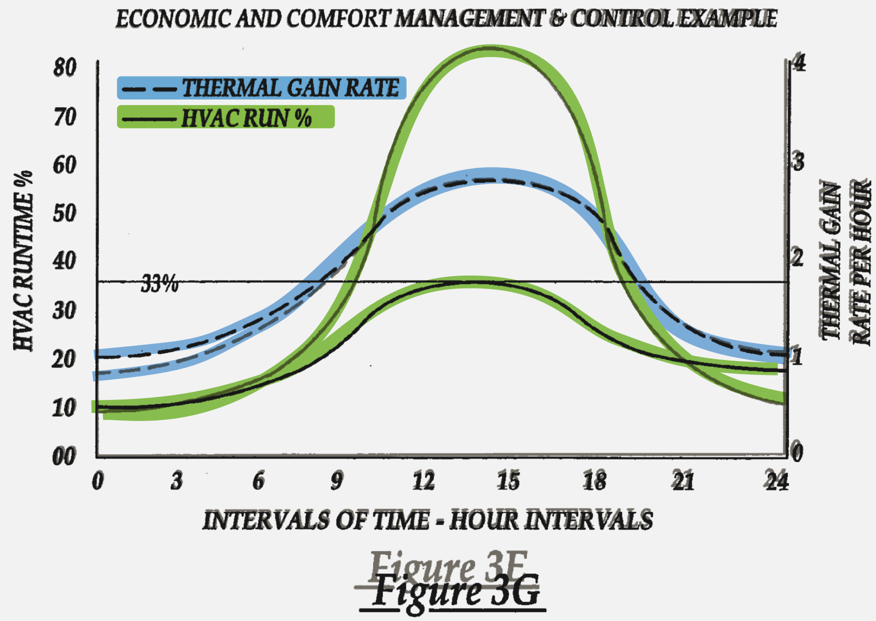


Figure 3G

983 IPR - POR at 16-18; Sur-reply at 8-9.
969 IPR – POR at 17-19; Sur-reply at 9.
Ex. 1004, Fig. 3G.

Petitioner Misunderstands the Teachings of Ehlers '330 Figs. 3E and 3G Provide Necessary Context

- *Fig. 3G superimposed on Fig. 3E*
- Same thermal gain rates but very different HVAC run % rates
- Under Petitioner's interpretation, the temperature would be increasing for both by 1-3 degrees per hour



983 IPR - POR at 18-19; Sur-reply at 9-10.
969 IPR – POR at 19-21; Sur-reply at 9-12.
Ex. 1004, Figs. 3E and 3G.

Prior Art Does Not Disclose "using the stored data to predict a rate of change of temperatures inside the structure in response to at least changes in outside temperatures"

- **Claim 1c; Claim 9c; Claim 17f:**

  "using the stored data to predict a rate of change of temperatures inside the structure in response to at least changes in outside temperatures"

Ex. 1001, col. 8:13-15, 57-59; col. 9:36-10:2.

Prior Art Does Not Disclose "us[ing] the stored data to predict changes in temperature inside the structure in response to at least changes in outside temperatures."

- Petitioner continues its error of conflating "thermal gain rate" with "rate of changes in temperature."
  - *But as noted, they are not the same.*

- The HVAC system being turned ON and functioning will not necessarily affect the thermal gain rate, as illustrated in Fig. 3E and Fig. 3G, discussed above, while it will significantly impact the rate of change of temperature.

983 IPR – POR at 21-22.
969 IPR - POR at 23-24.

Ehlers '330 Does Not Predict Changes in Inside Temperature Based on Changes in Outside Temperature

- Calculating a setpoint is not a prediction, it is developing an instruction for the control system.
    - A setpoint is a prediction only insofar as one might expect that when a thermostat receives a setpoint it will eventually control the HVAC system to achieve that temperature.
- In Ehlers '330, the user selecting the set point as well as providing "the number of degrees from the set point that the customer would make available to the system 3.08."
    - Based on this, the HVAC system is operated.
    - Not predicting a change in inside temperature based on change in outside temperature but merely setting a recovery time.

983 IPR – POR at 26-27; Sur-reply at 15-16.
969 IPR - POR at 28-29; Sur-reply at 15-16.
Ex. 1004, ¶255.

Ehlers '330 Does Not Predict Changes in Inside Temperature Based on Changes in Outside Temperature

- Calculating a recovery time is not a prediction of inside temperature based on changes in outside temperature.
  - It is merely a calculation when the HVAC system is ON and functioning.
- Ehlers '330 controlling inside temperature to balance occupant comfort with "energy savings" is not a prediction of "inside temperature based on changes in outside temperature."
  - HVAC runtime in Figs. 3E and 3G will keep inside temperature flat.
  - Thus, the thermal gain rate is not a prediction of how inside temperature will behave.

983 IPR – POR at 24-26; Sur-reply at 12-14.
969 IPR - POR at 26-28; Sur-reply at 12-14.

Ehlers '330 Does Not Predict Changes in Inside Temperature Based on Changes in Outside Temperature

- No disclosure in Ehlers '330 of how to calculate "thermal gain rate."
- Petitioner and Expert provide no support for conclusory statements about teachings of Ehlers '330.
- At best, shows changes in temperature for a single, specific outside temperature.

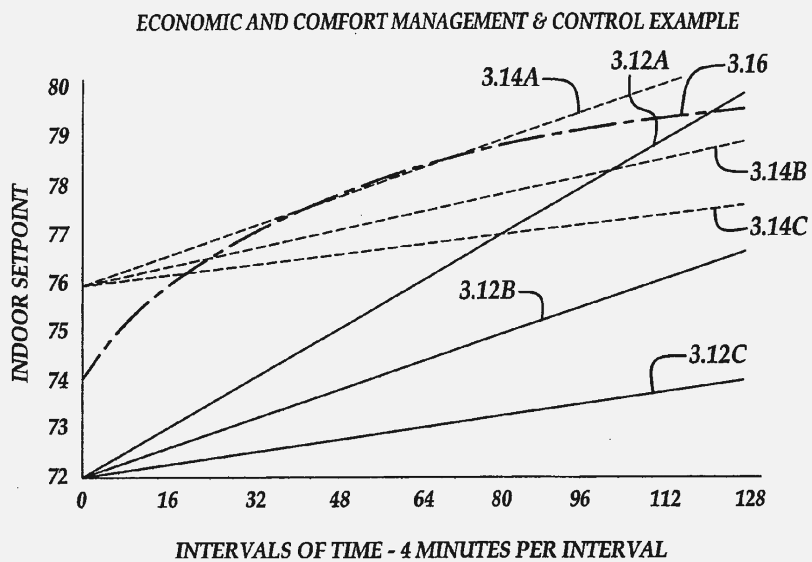


Figure 3D

983 IPR – POR at 27-28.
969 IPR - POR at 29-30.
Ex. 1004, Fig. 3D.

Petitioner's Interpretation of Ehlers '330 Is Incorrect

Under Petitioner's Interpretation, there would be a temperature increase of approximately 42 degrees in one 24-hour period.

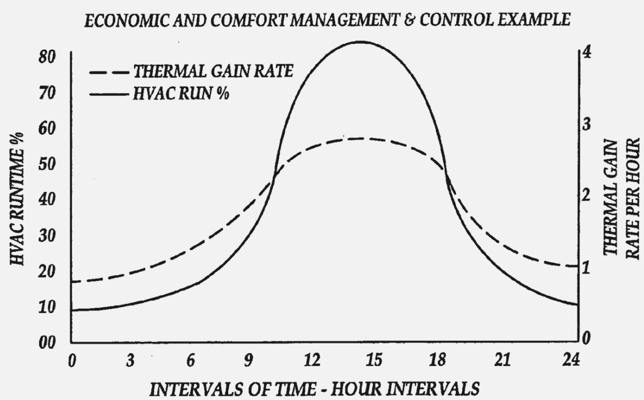


Figure 3E

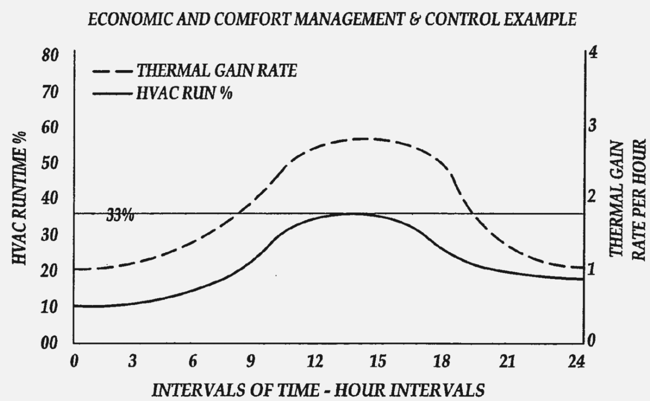


Figure 3G

983 IPR – POR at 27-29; 969 IPR - POR at 29-31; Ex. 1004, Figs. 3E and 3G.

The increase in operational runtime of the HVAC system is necessary to counteract the increase in thermal gain (energy absorbed by the structure) in order to maintain the same inside temperature consistent with the fixed setpoint.

Ehlers '330 Does Not Predict Changes in Inside Temperature Based on Changes in Outside Temperature

- Ehlers '330 describes only user provided setpoints and variance.
- Variance only used based on economic incentives.

In another aspect of the present invention, the system **3.08** uses the learned thermal gain characteristics of the site **1.04** along with the customer selected allowable temperature variation range to maintain a flat level of demand and consumption.

983 IPR – POR at 27-28; Sur-reply at 14-15.
969 IPR - POR at 29-30; Sur-reply at 14-15.
Ex. 1004, ¶256.

Ehlers ‘330 Does Not Predict Changes in Inside Temperature Based on Changes in Outside Temperature

- Ehlers ’330 recovery time is also not a predicted rate of change.
- No disclosure in Ehlers ‘330 that recovery time is calculated base don changes in outside temperature.

[0246] In still another aspect of the present invention, the system **3.08** may determine the time necessary to recover from a one occupancy mode to another mode. In another words, this recovery time at which a transition or recovery process is to be initiated if the system **3.08** is set to a “recover by” time versus the default of “start recovery at” time.

983 IPR – POR at 30-31.
969 IPR - POR at 32-33.
Ex. 1004, ¶246.

Ehlers ‘330 Does Not Calculate a Setpoint Based on a Predict Rate of Change

- Ehlers ’330 ramping in not a predicted rate of change.
- Nothing indicates it is based on outside temperatures.
- No disclosure of calculating intermediate setpoints in Ehlers
  - Rather, the system determine when to move from one setpoint provided by a customer to another setpoint provided by a customer.

983 IPR – POR at 33-35; Sur-reply at 14-16.
969 IPR - POR at 35-37; Sur-reply at 14-16.

Ehlers and Wruck Do Not Disclose "calculate scheduled setpoint programming … based on the predicted rate of change, the scheduled programming comprising one or more automated setpoints"

- **Claim 1d; Claim 9d; Claim 17g:**

  "calculate scheduled setpoint programming of the programmable communicating thermostat for one or more times based on the predicted rate of change, the scheduled programming comprising one or more automated setpoints"

  Ex. 1001, col. 8:16-20, 8:60-64; col. 10:3-8

Ehlers '330 Does Not Calculate a Setpoint Based on a Predict Rate of Change

- Petitioner relies on the three automated setpoints identified previously for claim elements Claim 1c; Claim 9c; Claim 17f.
- But as stated previously, none of these three are automated setpoints

983 IPR – POR at 31-34; Sur-reply at 14-16.
969 IPR - POR at 34-37; Sur-reply at 14-16.

Ehlers ‘330 Does Not Calculate a Setpoint Based on a Predict Rate of Change

- Ehlers ’330 describes only user provided setpoints and variance.
- Variance only used based on economic incentives.

In another aspect of the present invention, the system **3.08** uses the learned thermal gain characteristics of the site **1.04** along with the customer selected allowable temperature variation range to maintain a flat level of demand and consumption.

983 IPR – POR at 31; Sur-reply at 14-16.
969 IPR - POR at 34; Sur-reply at 14-16.
Ex. 1004, ¶256.

Ehlers ‘330 Does Not Calculate a Setpoint Based on a Predict Rate of Change

- Ehlers ’330 recovery time is also not a predicted rate of change.
- No disclosure in Ehlers ‘330 that recovery time is calculated based on changes in outside temperature.

[**0246**] In still another aspect of the present invention, the system **3.08** may determine the time necessary to recover from a one occupancy mode to another mode. In another words, this recovery time at which a transition or recovery process is to be initiated if the system **3.08** is set to a “recover by” time versus the default of “start recovery at” time.

983 IPR – POR at 30-31.
969 IPR - POR at 32-33.
Ex. 1004, ¶246.

Ehlers ‘330 Does Not Predict Changes in Inside Temperature Based on Changes in Outside Temperature

- Ehlers ’330 ramping in not a predicted rate of change.
- Nothing indicates it is based on outside temperatures.
- No disclosure of calculating intermediate setpoints in Ehlers
  - Rather, the system determines when to move from one setpoint provided by a customer to another setpoint provided by a customer.

[**0325**] The thermostat scheduling panel **4.36** permits the customer to select the occupancy mode which will be used for various time periods during the day.

Ex. 1004, ¶325.

983 IPR – POR at 27-28; Sur-reply at 14-15.
969 IPR - POR at 29-30; Sur-reply at 14-15.

Ols, Boait, and Wruck Do Not Render Obvious Claims 17-23

- 969 IPR Ground 2

No Motivation to Combine Ols and Boait

No Motivation to Combine Ols and Boait

Analysis Never Addresses Why A POSITA Would Make This Combination.

- Ols is directed to a zone temperature-control system that controls dampers and registers to direct airflow.
- Boait describes controlling a central heating system that uses water or steam to control temperature.

969 IPR – POR at 46-49.

Specifically, Ols explains that learning algorithms may predict a rate of change of temperatures inside the structure in response to particular conditions, including outdoor climate conditions. (Ex. 1006, 19:1-24, 11:53-12:34)(Ex. 1002, ¶155). Boait similarly describes utilizing outside temperature to predict a rate of change of temperature inside the structure, and further teaches that it was known to utilize the predicted rate of change inside, due to temperatures outside, to determine scheduled setpoint programming. (Ex. 1007, 6, 20)(Ex. 1002, ¶155).

969 IPR – Pet. at 52.

No Motivation to Combine Ols and Boait

Dr. Palmer's Testimony Does Not Support Combination

a POSITA would have understood that prior art smart thermostats would work on different types of systems and the control mechanisms would be relevant to various systems. Ex. 1022, 141:2-16; Ex. 1023, ¶33.

969 IPR – Reply at 20.

- Petitioner cites to Dr. Palmer's testimony.
- But Dr. Palmer's testimony does not support this.
  - When asked about "types of heating and cooling equipment" he said the opposite.

Q Do people use the same types of thermostats for all the different types of heating and cooling equipment?
A Not typically, no.
Q What changes from one to the other?
A Depending on the type of equipment being controlled, you can have different electrical ratings on the contacts. You could have different level of sophistication, in terms of operability, or operation characteristics, and so forth.
Q Before the '550 patent, could one buy a smart thermostat that could be used on a number of different heating and cooling systems?
A Potentially, sure.

Ex. 1023 - Palmer Dep 141:2-16

Ols, Boait, and Wruck Do Not "use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures"

- **Claim 17f:**

  "use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures"

  Ex. 1001, col. 9:36-10:2

Ols, Boait, and Wruck Do Not "use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures"

Ols explains that:

"the processor system of the controller may include a neural net or Turing machine control (such as a conventional feedback loop)," where "[a]s a result of learning from historical data, the adjustment to the parameter may be computed to take into account the slower temperature response as a result of the higher load that is normally in the room"). (Ex. 1006, 11:53-12:34)(Ex. 1002, ¶179).

969 IPR – Pet at 59

- But none of the various data and parameters listed in Ols include changes in outside temperature.

969 IPR – POR at 50

Performing an analysis of the electrical load required to change the temperature and/or climate of different rooms may enable businesses to manage their energy consumption more efficiently so that they can more effectively participate in utility company load management programs and reduce costs.

Learning software (e.g., algorithms) may embed intelligence into the retrofit control system by learning about the HVAC equipment and office spaces. The learning software may analyze relationships between past actions and effects, create and update a model (e.g., in real time) that more accurately predicts the additional/reduced airflow needed to account for relative room volume, the distance air must travel from HVAC equipment to the area where air is desired, relative air duct size, and differences in the ease of return airflow, and/or other factors that may affect the efficiency of heating, cooling, and/or humidifying an area.

Other thermostats typically turn on based on only one temperature input, and only respond to current errors (e.g., current difference between the desired and actual temperature. In an embodiment, many temperature inputs are analyzed, and the control algorithm learns the appropriate current action to take based on evaluations of what has happened in the past.

For example, the learning algorithm may learn how fast certain zones (e.g., rooms) react to actions relative to other rooms (e.g., a large room with a small and long duct vs. a small room with a large and short duct).

For example, the processor system of the controller may include a neural net or Turing machine control (such as a conventional feedback loop). The simplest version is to update a parameter which is proportional to how much more actuator input is needed for a certain zone (e.g., how much more the damper should be opened) to get a similar response in other zones (e.g., if a room is large, a duct is blocked, or the door is shut). Similarly, the parameter for the actuator input may need to be adjusted, because the room load is currently high (for example, the sun is shining on the room, the number of people in the room is high, the amount of equipment generating heat currently in the room is high, and/or other factors that may be currently present making the room difficult to cool). As a result of learning from historical data, the adjustment to the parameter may be computed to take into account the slower temperature response as a result of the higher load that is normally in the room. Similarly, a projected actuator input for a current load that is different than usual may be computed based on other times when the room had a similar load or based on the changes in the actuator input required in other rooms when the load is changed.

Ex. 1006, 11:53-12:34

Ols, Boait, and Wruck Do Not "use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures"

In my opinion, a POSITA would have understood from these disclosures that, for instance, the controller 124 may apply learning algorithms from historical data to take into account load conditions that may include outdoor climate conditions, including a change in outside temperature. Ols explains that "the outdoor climate conditions are used as factors for determining settings and actions," and that a room load may be high when "for example, the sun is shining the room . . . and/or other factors that may be currently present making the room difficult to cool." (Ex. 1006, 19:1-24, 12:14-34). In my opinion, a POSITA would have understood that outdoor climate conditions affect the ability to cool a room and could be considered in determining the room load. Indeed, the difference between the indoor and outdoor temperature was well known in the prior art to affect the rate at which a building loses or gains heat. (See, e.g., Ex. 1015, Book p. 200; Ex. 1016, Book p. 281). The learning algorithm takes into account the temperature response (or rate of change in the temperature) as a result of load and outdoor climate conditions.

969 IPR – Ex. 1002, ¶ 180

- This disclosure is about controlling the system to draw air in from outside into a room or dump air to the outside from a room.

969 IPR – POR at 51

100, and/or sensor device **562** is far enough away from the intake so the intake does not affect the climate measurements (especially if the intake is also used as an exhaust). Temperature sensor **563** and humidity sensor **564** may be embodiments of temperature sensor **502** and humidity sensor **504**, respectively. In an embodiment, input output port **566** receives data indicating outdoor climate conditions. As a result, the outdoor climate conditions are used as factors for determining settings and actions to be applied by retrofit control system **102**.

In an embodiment, the readings provided by temperature sensor **563** and humidity sensor **564** may be used by retrofit control system **102** to determine whether to draw outside air into one or more of rooms **113***aa*-**113***nm*, or dump air from one of rooms **113***aa*-**113***nm* outside. For example, if the temperature outside is cooler (hotter) than the temperature inside, the temperature inside one or more of rooms **113***aa*-**113***nm* is too hot (cold), a greater percentage of outside air may be brought in to the building cool the rooms, instead of cooling (heating) the air already in the building. In other words, a certain percentage of air may be brought into the building no matter what the temperature is for health reasons. However, a greater percentage of air may be brought into the building when climate control system **100** determines that bringing the air into the building is more efficient than heating or cooling inside air.

Ex. 1006, 19:15-40

Ols, Boait, and Wruck Do Not "use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures"

Petitioner Relies on The Boait Equations.

$$Q \times \delta Tr = L \times (Tr - Te) \times t$$

when the house is cooling, and

$$Q \times \delta Tr = (H \times t) - (L \times (Tr - Te) \times t)$$

when the house is being heated, where:

Tr is the measured room temperature,
Te is the measured external temperature,
t is the observation interval in which a small change in room temperature δTr takes place, and
H is the boiler heat output in Watts.

969 IPR – Pet at 61; Ex. 1007, 20.

- Te is the measured external temperature
- No mention of changes to the external temperature

Dr. Palmer agreed:

Q So, in this sense, Boait system is keeping track of the changes in outdoor temperature, correct?

A It doesn't say that.

Ex. 1022, 159:7-10.
969 IPR – POR at 53; Sur-reply at 24.

Ols, Boait, and Wruck Do Not "use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures"

New Argument Inconsistent with Disclosure of '550 Patent.

Thus, a POSITA would have understood Boait to be describing the prediction of a rate of change based on changes in outside temperature (*e.g.*, rate of change on a cold morning vs. rate of change on a warmer morning).

969 IPR – Reply at 21; Ex. 1007, 20.

- New argument.
- Inconsistent with disclosure of '550 patent.

969 IPR – POR at 53; Sur-reply at 24-25

100, and/or sensor device **562** is far enough away from the intake so the intake does not affect the climate measurements (especially if the intake is also used as an exhaust). Temperature sensor **563** and humidity sensor **564** may be embodiments of temperature sensor **502** and humidity sensor **504**, respectively. In an embodiment, input output port **566** receives data indicating outdoor climate conditions. As a result, the outdoor climate conditions are used as factors for determining settings and actions to be applied by retrofit control system **102**.

In an embodiment, the readings provided by temperature sensor **563** and humidity sensor **564** may be used by retrofit control system **102** to determine whether to draw outside air into one or more of rooms **113***aa*-**113***nm*, or dump air from one of rooms **113***aa*-**113***nm* outside. For example, if the temperature outside is cooler (hotter) than the temperature inside, the temperature inside one or more of rooms **113***aa*-**113***nm* is too hot (cold), a greater percentage of outside air may be brought in to the building cool the rooms, instead of cooling (heating) the air already in the building. In other words, a certain percentage of air may be brought into the building no matter what the temperature is for health reasons. However, a greater percentage of air may be brought into the building when climate control system **100** determines that bringing the air into the building is more efficient than heating or cooling inside air.

Ex. 1006, 19:15-40

Ols, Boait, and Wruck Do Not "use the stored data to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures"

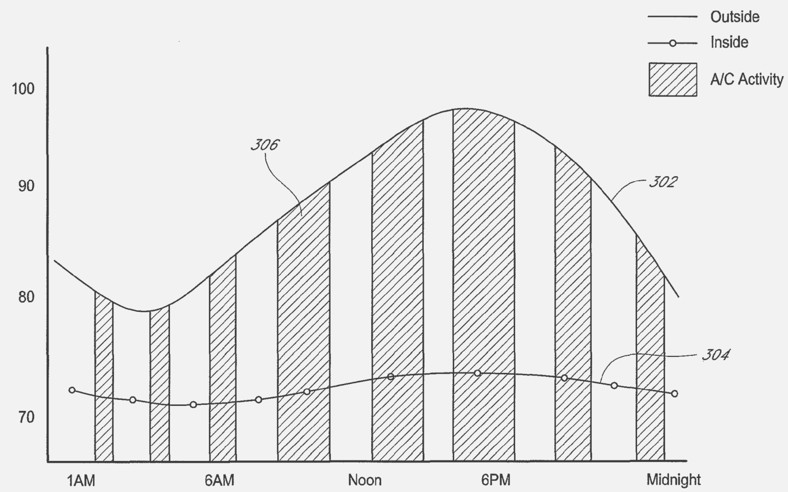


FIG. 6A

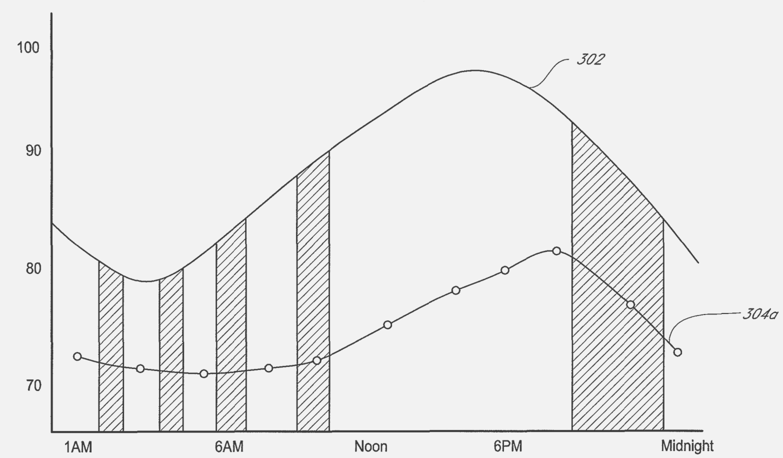


FIG. 6B

969 IPR – Sur-reply at 24-25

Ex. 1001, Figs. 6A and 6B.

Ols, Boait, and Wruck Do Not Disclose "calculate scheduled setpoint programming … based on the predicted rate of change, the scheduled programming comprising one or more automated setpoints"

- **Claim 17g:**

  "calculate scheduled setpoint programming of the programmable communicating thermostat for one or more times based on the predicted rate of change, the scheduled programming comprising one or more automated setpoints"

Ex. 1001, col. 10:3-8.

Ols, Boait, and Wruck Do Not Disclose "calculate scheduled setpoint programming … based on the predicted rate of change, the scheduled programming comprising one or more automated setpoints"

The "directives and settings" are physical configurations, not setpoints.

Ols discloses that the climate control system 100 may include code 834 that "include[s] instructions for analyzing (e.g. evaluating and/or comparing) the retrieved values as part of computing (1) whether to implement directives and settings associated with components of system 100 (e.g. a degree of change in settings required to obtain a desired climate), (2) when to implement the directives and/or settings, and (3) how to implement the directives and settings optimally and efficiently." (Ex. 1006, 26:27-48)(Ex. 1002, ¶188).

969 IPR – Pet. at 64.

- But the omitted portions of the Ols quote show that the "directives and settings" are physical configurations, not setpoints.

969 IPR – POR at 55; Sur-reply at 26

Code **834** may include instructions for retrieving temperature and humidity measurements from sensors **116***aa*-**116***nm* and optional thermostats **118***aa*-**118***nm*. In this specification, the terms "code" and "computer code" are generic to applications and software. Code **834** may further include instructions for retrieving user settings (e.g. input) and other data from optional thermostats **118***aa*-**118***nm*, computers **120***aa*-**120***nm*, remote server **132**, and/or other locations where user data may be located. Code **834** may also include instructions for analyzing (e.g. evaluating and/or comparing) the retrieved values as part of computing (1) whether to implement directives and settings associated with components of system **100** (e.g. the positions of the air registers **114***aa*-**114***nm*, the on/off state of devices within heating/AC system **104**, and a degree of change in settings required to obtain a desired climate), (2) when to implement the directives and/or settings, and (3) how to implement the directives and settings optimally and efficiently. Further, code **834** may contain methods for determining whether and how to modify existing directives and settings, and instances when such modifications will be necessary. Code **834** may also include instructions for checking remote server **132** for updates to code **834**.

Ex. 1006, 26:27-48.

Ols, Boait, and Wruck Do Not Disclose "calculate scheduled setpoint programming … based on the predicted rate of change, the scheduled programming comprising one or more automated setpoints"

Text

Ols explains that:

"[s]et point temperature 1024 is a computed value to which the temperature of the room is to be set." (Ex. 1006, 31:20-42)(Ex. 1002, ¶188).

969 IPR – Pet. at 64.

- But this computation is based on the humidity values, not on a predicted rate of change.
- Ols describes looking up the setpoint from data tables from the National Oceanic and Atmospheric Administration.

969 IPR – POR at 55-56; Sur-reply at 26

Comfort control **1021** may be a flag for determining whether a selected temperature applied within one of rooms **113***aa*-**113***nm* is a humidity adjusted temperature. In the specification, a humidity adjusted temperature is a perceived temperature felt when heat and humidity are combined.

Ex. 1006, 31:20-24.

Secondary Considerations

Secondary Considerations

- Dr. Auslander was hired as a consultant by EcoFactor. Ex. 2011, 55:24-56:24.
- EcoFactor prepared a document describing work EcoFactor did with the data it shared with Dr. Auslander and Dr. Auslander co-wrote the forward to that document. *Id.* at 56:25-57:17
  - Dr. Auslander testified "that document is probably the only one I've ever really written a forward for, other than my own stuff." *Id*. at 57:18-23.
- Dr. Auslander used the EcoFactor data to "develop control systems and strategies for controlling structure." *Id.* at 57:24-58:6.
- Dr. Auslander work included looking at "thermal modeling" of structure to "create dynamic signatures in a structure … [to] understand how an HVAC system interacted with a particular structure." *Id.* at 59:10-24.

969 IPR – POR at 62-63; Sur-reply at 28.