

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD ECOBEE

TECHNOLOGIES ULC

Petitioner

v.

ROSEN TECHNOLOGIES LLC.

Patent Owner

Patent No. RE40,437

DECLARATION OF DAVID M. AUSLANDER

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“1[Pre]. An occupancy response system with a central control device adapted to control space conditioning equipment affecting a conditioned space, the central control device located at a single physical location in one of multiple rooms comprising the conditioned space, where remote sensors are located in physical locations substantially apart from the central control device, the improvement comprising:”	40
“[1]A) two or more environmental sensors adapted to measure a local environmental condition and generate signals indicating its value;”	46
“[1]B) two or more occupancy sensors adapted to detect occupancy of space around an environmental sensor and generate signals indicating occupancy;”	50
“[1]C) either the central control device and one or more of the remote sensors or two or more of the remote sensors each comprise an environmental sensor and an occupancy sensor;”	54
“[1]D) a central processor for the central control device including: 1) a central processing unit; 2) a real time clock; 3) a memory coupled to said central processing unit for storing a central control program and data, said data including at least one of the values of the environmental conditions sensed by the environmental sensors; and 4) an input/output unit coupled to the central processing unit, to the space conditioning equipment for issuing control signals thereto, and to a reception interface adapted to receive signals representing environmental conditions at a remote sensor;”	57
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I. ENGAGEMENT AND COMPENSATION

1. My name is David M. Auslander. I have been retained by counsel for ecobee Technologies ULC, ecobee Ltd., and Generac Holdings Inc. (collectively, “ecobee”) for the purpose of providing my opinion with respect to the unpatentability of U.S. Patent No. RE40,437 (“the RE’437 patent”). I am being compensated for my time in preparing this declaration at my standard hourly rate, and my compensation is not dependent upon my opinions or the outcome of the proceedings. My curriculum vitae is attached as Ex. 1003.

II. QUALIFICATIONS

2. I received my Bachelors in Mechanical Engineering from The Cooper Union in 1961. From the Massachusetts Institute of Technology, I received a Master of Science (S.M.) in 1964 and a Doctor of Science (ScD) in 1966. I have over 50 years of experience in the study, research, teaching, and development in control system design and analysis, including energy management systems, real time software methodology, motion control, and dynamic system modeling and simulation.

3. My research areas focus on control system design and analysis, including energy management systems like those discussed in the RE’437 patent. This area also includes issues of real time software design and dynamic system simulation, which are key areas for designing successful products that need to adapt

to changing environments. For example, I co-authored the “Real-Time Software for Implementation of Feedback Control,” chapter in The Control Handbook, published by CRC Press and IEEE Press in 1996. I also co-authored a textbook entitled Control Software for Mechanical Systems: Object Oriented Design in a Real-Time World, published by Prentice-Hall in 2002. I also authored a chapter regarding “Digital Controllers,” in the Encyclopedia of Physical Science and Technology (Third Edition), published by Academic Press in 2003, and co-authored a chapter entitled “Network Fundamentals,” in the Handbook of Networked and Embedded Control Systems, published in 2005.

4. Some relevant research papers for which I was a co-author are: “Multi-Sensor Single-Actuator Control of HVAC Systems” at the International Conference for Enhanced Building Operations in Richardson, TX (2002), “A Tale of Two Houses: the Human Dimension of Demand Response Enabling Technology from a Case Study of an Adaptive Wireless Thermostat” and “Demand Response-Enabled Residential Thermostat Controls” for the American Council for an Energy Efficient Economy (ACEEE, 2008), and “Developing Affordable Smart Thermostats” for Home Energy (2008).

5. I have taught classes in the areas of real time software and feedback control systems. I developed a measurement and instrumentation course and several courses in the areas of mechatronics.

6. I have received several awards for my work, including an Education Award from the American Automatic Control Counsel, the Control Practice Award from the Dynamic Systems and Control Division of the American Society of Mechanical Engineers, the Donald P. Eckman Award from the Instrumentation, Systems, and Automation Society, and a Career Award from Mechatronics and Embedded Systems and Applications (MESA).

7. As a result, I am thoroughly familiar with the theory, practice, and history of the technology described and claimed in the RE'437 patent.

III. SUMMARY OF OPINIONS

8. In my opinion, a person of ordinary skill in the art would have found the subject matter of claims 1-12 to be obvious over: (1) Rein and Kates (Ground 1) and (2) Rein and Riley (Ground 2).

IV. MATERIALS REVIEWED

9. In forming my opinions, I have relied on my knowledge of the field and my experience, and have specifically reviewed the following exhibits:

Exhibit No.	Description
1001	U.S. Reissue Patent No. 40,437 (“RE’437 patent”)
1004	U.S. Patent No. 5,341,988 (“Rein”)
1005	U.S. Patent No. 7,168,627 (“Kates”)

Exhibit No.	Description
1006	Prosecution History Excerpts of U.S. Patent Application No. 11/804,324 (“324 application”)
1007	Prosecution History Excerpts of U.S. Patent Application No. 10/995,574 (“574 application”)
1008	U.S. Patent No. 7,058,477 (“477 patent”)
1009	U.S. Patent No. 5,395,042 (“Riley”)
1010	Texas Instruments TMS370 Microcontroller Family Application Book
1011	Microchip PIC16C5X EPROM/ROM-Based 8-bit CMOS Microcontroller Series
1012	Texas Instruments TMS320C1x Digital Signal Processors
1013	U.S. Patent No. 4,407,447 (“Sayegh”)
1014	U.S. Patent No. 4,294,404 (“Gajjar”)
1017	Lin et al, “Multi-Sensor Single-Actuator Control of HVAC Systems,” Proceedings of the Second Int’l Conf. for Enhanced Building Operations (October 2002)

V. UNDERSTANDING OF THE RELEVANT LAW

10. I have the following understanding of the applicable law:

A. Anticipation

11. I understand that a claim in an issued patent can be unpatentable if it is anticipated. I understand that “anticipation” means that there is a single prior art

reference that discloses every element of the claim, arranged in the way required by the claim.

12. I understand that an anticipating prior art reference must disclose each of the claim elements.

B. Obviousness

13. I understand that a claim in an issued patent can be unpatentable if it is obvious. Unlike anticipation, obviousness does not require that every element of the claim be in a single prior art reference. Instead, it is possible for claim elements to be described (or suggested) in different prior art references, so long as there is motivation or sufficient reasoning to combine the references, and a reasonable expectation of success in achieving what is set forth in the claims.

14. I understand that a claim is unpatentable for obviousness if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the alleged invention was made to a person having ordinary skill in the art to which said subject matter pertains.

15. I understand, therefore, that when evaluating obviousness, one must consider obviousness of the claim “as a whole.” This consideration must be from the perspective of the person of ordinary skill in the relevant art, and that such perspective must be considered as of the time the alleged invention was made.

16. The level of ordinary skill in the art is discussed in ¶¶ 23-25 below.

17. The relevant time frame for obviousness, the time the alleged invention was made, is discussed in ¶¶ 26-27, below.

18. I understand that in considering the obviousness of a claim, one must consider four things. These include the scope and content of the prior art, the level of ordinary skill in the art at the relevant time, the differences between the prior art and the claim, and any “secondary considerations.”

19. I understand that “secondary considerations” include real-world evidence that can tend to make a conclusion of obviousness either more probable or less probable. For example, the commercial success of a product embodying a claim of the patent could provide evidence tending to show that the claimed invention is not obvious. In order to understand the strength of the evidence, one would want to know whether the commercial success is traceable to a certain aspect of the claim not disclosed in a single prior art reference (*i.e.*, whether there is a causal “nexus” to the claim language). One would also want to know how the market reacted to disclosure of the invention, and whether commercial success might be traceable to things other than innovation, for example the market power of the seller, an advertising campaign, or the existence of a complex system having many features beyond the claims that might be desirable to a consumer. One would also want to know how the product compared to similar products not embodying the claim. I

understand that commercial success evidence should be reasonably commensurate with the scope of the claim, but that it is not necessary for a commercial product to embody the full scope of the claim.

20. Other kinds of secondary considerations are possible. For example, evidence that the relevant field had a long-established, unsolved problem or need that was later provided by the claimed invention could be indicative of non-obviousness. Evidence that others had tried, but failed to make an aspect of the claim might indicate that the art lacked the requisite skill to do so. Evidence of copying of the patent owner's products before the patent was published might also indicate that its approach to solving a particular problem was not obvious. Evidence that the art recognized the value of products embodying a claim, for example, by praising the named inventors' work, might tend to show that the claim was non-obvious.

21. I further understand that prior art references can be combined where there is an express or implied rationale to do so. Such a rationale might include an expected advantage to be obtained, or might be implied under the circumstances. For example, a claim is likely obvious if design needs or market pressures existing in the prior art make it natural for one or more known components to be combined, where each component continues to function in the expected manner when combined (*i.e.*, when there are no unpredictable results). A claim is also likely unpatentable where it is the combination of a known base system with a known technique that can

be applied to the base system without an unpredictable result. In these cases, the combination must be within the capabilities of a person of ordinary skill in the art.

22. I understand that when considering obviousness, one must not refer to teachings in the specification of the patent itself. One can, however, refer to portions of the specification admitted to being prior art, including the “BACKGROUND” section. Furthermore, a lack of discussion in the patent specification concerning how to implement a disclosed technique can support an inference that the ability to implement the technique was within the ordinary skill in the prior art.

VI. LEVEL OF ORDINARY SKILL IN THE ART

23. In my opinion, the relevant art was that of heating, ventilation, and air conditioning (“HVAC”) control and building automation. Ex. 1001, Abstract, 1:10-67, 5:59-6:16.

24. In my opinion, the level of ordinary skill encompassed a person with at least a bachelor’s degree in engineering, computer science, or a comparable field, with 2-3 years’ experience in temperature controls, embedded control systems, electronic thermostats, or HVAC controls, or similarly relevant industry experience, with relevant experience substituting for education and vice versa.

25. Given my experience in the field, I am familiar with the knowledge that a person of ordinary skill in the art would have had at the time and the manner in

which such a person would have viewed the available information at the time. My testimony is offered from this perspective, even if it does not specifically refer to the perspective of a person of ordinary skill in the art in every instance.

VII. RELEVANT TIMEFRAME FOR DETERMINING OBVIOUSNESS

26. I understand that obviousness must be evaluated “at the time of the invention.” From the cover pages of the RE’437 patent, I can see that the application for the original patent (U.S. Pat. No. 7,058,477) was filed in the United States on November 23, 2004.

27. For the purpose of this declaration, I have been asked to provide my analysis based on the time frame immediately prior to this date.

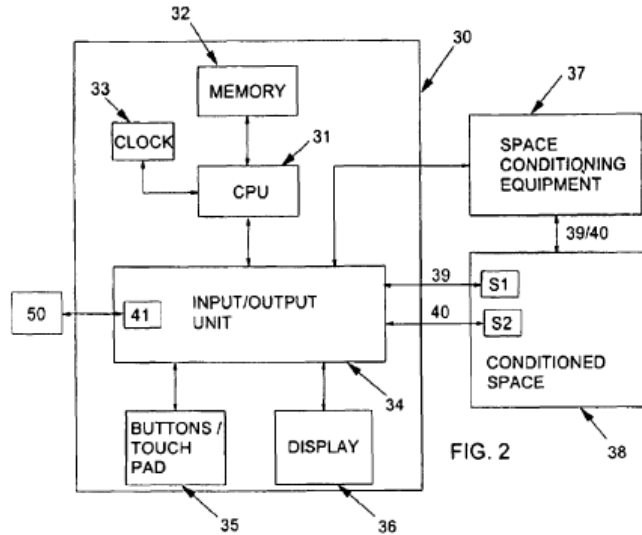
VIII. TECHNICAL INTRODUCTION

A. The RE’437 Patent Disclosure

28. The RE’437 patent is directed to controlling HVAC systems. The RE’437 patent at-issue relates generally to control of climate control systems, such as heating and cooling systems (“HVAC systems”). Ex. 1001, Abstract, 1:10-67, 4:10-43, 5:59-6:16. In general, the term “HVAC system” is understood to refer to the components responsible for heating and cooling a structure or location, that is, heating, ventilation, and/or cooling devices that transfer heat into or out of a structure/location.

29. The RE'437 patent is directed to controlling space conditioning equipment (heating and/or cooling equipment) utilizing thermostats. Ex. 1001, 1:10-26. As the RE'437 patent acknowledges, prior thermostat systems have taken advantage of rapid advances in electronic and integrated circuit technology. *Id.*, 1:27-45. It was known to utilize thermostat systems with processors that run control programs and that communicate with a central device that controls HVAC equipment. *Id.*, 1:46-64. It was also known to divide the conditioned space into “zones.” *Id.*, 1:65-67. One or more rooms may constitute a zone within a conditioned space. *Id.*, 1:65-67, 4:66-67; Fig. 1.

30. HVAC systems have, for decades, been controlled by thermostats. Ex. 1001, 1:10-67. At the most basic level, thermostats operate through a control scheme commonly referred to as “feedback control.” Direct feedback control is the simplest form of feedback control. Direct feedback control is defined by a control variable, that is, the quantity that is to be controlled, in this case the temperature of the enclosed space, and the desired value for target measurement. Thermostats are typically wall-mounted units that have an internal temperature sensor, and which allow a user to set a target temperature. The target temperature, or “setpoint,” is compared against the actual temperature, and the HVAC system is essentially switched on or off in an attempt to maintain the setpoint temperature, or a level close thereto.



Ex. 1001, Fig. 2.

31. The RE'437 patent states that “[t]hermostats have been used for many years.” Ex. 1001, 1:17. According to the RE'437 patent,

“Modern thermostat systems, which take advantage of the ongoing rapid advances in electronic technology and circuit integration, have many features which provide more precise Supervision of the heating and/or cooling equipment to achieve more economical and more comfortable management of the temperature of a conditioned space. Many modern thermostat systems include a real time clock, a memory and a data processor to run a process control program stored in the memory to accurately measure the temperature of a temperature sensor disposed in the conditioned space and to send control signals to the heating and/or cooling equipment to closely control the temperature of the conditioned space.

...

[¶] Many modern thermostat systems have a central control device or unit that receives environmental sensor data from sensors remote from the central control device. These sensors can detect temperature, humidity, or other parameters that may be used in a control program by the central control device to control environmental control equipment. The environmental control equipment (comprising HVAC equipment, among others) responds to signals from the central control device to affect the ambient comfort in rooms of a conditioned space.”

Ex. 1001, 1:26-55.

32. According to the RE’437 patent, however, “[t]he control value established by prior art thermostat systems can easily over or under-condition a room where a user most desires environmental control.” Ex. 1001, 2:10-13.

33. The RE’437 patent suggests improving typical thermostat function with “a thermostat system where remote sensor values are averaged for occupied rooms at a central control device. The averaged sensor data establish a Zone control value. This Zone control value more accurately reflects environmental conditions of rooms where the user most desires control of those environmental conditions.” Ex. 1001, 2:10-12.

34. The RE’437 patent purports to introduce averaging sensor data from, e.g., remote temperature sensors, so as to control the system based on the averaged value rather than a value reported from any one particular sensor. Ex. 1001, 2:14-

19. The averaging of temperature values from specific zones within a conditioned space was known in the art. Ex. 1004, 24:4-23 (“controller 58 averages the temperature data from the three sensors, and compares that average to a setpoint”); *see* Ex. 1017.

35. The RE’437 patent presents independent claims (claims 1 and 6) that recite a laundry list of well-known features and functions including: a central control device for controlling an HVAC, remote environmental sensors., remote occupancy sensors, and processing units for the various devices, which processing unit include conventional CPUs, memories, input/output units. Claim 6 distinguishes itself from claim 1 in that it requires that values of environmental conditions be stored in a memory such that the “values ... are associated with their source of occupied or unoccupied rooms.” However, it was known that, upon detecting that a room has become occupied, remote sensors send a packet of data containing an identifier that identifies the source of the information and the sensor readings. Ex. 1004 at 21:19-34 (“Each time a relevant data packet 86 is received, data files associated with the particular zone sensor 58 or personal comfort sensor 110 are updated . . .”). That association allows the system to know which rooms are occupied and the current conditions in those rooms.

36. In addition, varying the programming of an HVAC system based on the detection of occupancy was also known in the art. For instance, Riley teaches

utilizing “an occupancy detector such as sensor 100, and when no one is present to allow for a greater deviation from the set point, but to drive the temperature back to the set point $\pm\Delta\text{TEMP}$ when someone returns.” Moreover, it was known that, after prolonged periods of vacancy, systems would completely suspend operations and restart upon the detection of someone entering the premises. This is established by both the Riley and Kates references.

IX. CLAIM INTERPRETATION

A. BACKGROUND ON CLAIM INTERPRETATION

37. I understand that it is sometimes necessary or useful for claim terms in a patent to be further explained or interpreted (“construed”). I understand that in the present proceeding, the Board applies the same claim construction standard used by District Courts in actions involving the validity or infringement of a patent. This involves construing claim terms in accordance with the ordinary and customary meaning of such terms, as understood by one of ordinary skill in the art, in light of the claim language, the technical disclosure of the patent (*i.e.*, the specification) and the prosecution history or “file history” of correspondence with the United States Patent and Trademark Office (USPTO) pertaining to the patent.

38. I further understand that the file history of a parent patent application can be relevant to the claim construction of claim terms appearing in patents that have descended from that parent application.

39. I understand that certain “extrinsic” evidence, such as dictionaries or other prior art, can sometimes be useful to understand the meaning of a claim term. However, I understand that where there is a conflict between any such extrinsic evidence and the patent and patent’s prosecution history, the latter controls.

B. CLAIM INTERPRETATION OF THE RE’437 PATENT

1. “Only”

40. Claim 1 ([1G]2)) recites “causing a coupled central processing unit to selectively . . . read current signals from a coupled environmental sensor and transmit them for storage...only if occupancy is detected.” In the counterpart litigation, I have been informed that Patent Owner alleges infringement by devices that transmit signals from environmental sensors at regular intervals, as well as when an override command is provided (e.g., switching from an unoccupied mode to an occupied mode). This may suggest that Patent Owner interprets “only” loosely, so as to pertain to periods between signals sent at regular intervals and to exclude override commands that change programming modes. Accordingly, for purposes of this proceeding, I have been asked to consider the prior art in view of Patent Owner’s apparent understanding of “only,” as well as a more restrictive interpretation of “only.”

2. “Zone control means”

41. Claims 5 and 12 recite “zone control means.” I have been informed that this language may trigger legal requirements related to “means-plus-function” language.

42. I understand that the construction of a means-plus-function limitation is a two-step process. The first step is to determine the function of the means-plus-function limitation. The second step is to determine the corresponding structure described in the specification and equivalents thereof.

43. The claimed “zone control means” functions “so that only occupied rooms have their space affected by the space conditioning equipment.” The specification does not make clear what is intended to be the corresponding structure for this recitation. Consequently, I have been asked to evaluate two options. Under one interpretation, the central control device, and associated elements, serve as the zone control means. Ex. 1001, 4:9-18 (“The central control device can act to average temperatures to calculate a control value and at the same time divert substantially all conditioned air only to the occupied rooms.”). With that understanding, as articulated in claim 1, the corresponding structures are the CPU, clock, memory, and input/output unit for diverting air to occupied rooms (and using averaging). Ex. 1001, 2:23-26; 5:9-34. In the other option, the “zone control means” refer to the duct dampers. Ex. 1001, 4:9-18 (“It is a feature of some modern thermostat systems

to control duct dampers or diverters so that conditioned air from air handlers and fans is directed only to certain rooms of a conditioned space.”).

X. GROUND 1: Rein and Kates (Claims 1-12)

44. In my opinion, the subject matter of claims 1-12 would have been obvious to a POSA in view of the combination of U.S. Patent No. 5,341,988 (“Rein”) (Ex. 1004) and U.S. Patent No. 7,168,627 (“Kates”) (Ex. 1005).

A. Effective Prior Art Dates of Rein and Kates

45. Rein is a patent that issued on August 30, 1994, and I understand that it is thus prior art.

46. Kates is a patent that was filed on October 6, 2004, and I understand that it is thus prior art.

47. I understand that Rein was of record during prosecution of the original application, but that it was not discussed on the record by the Examiner or Applicant.

48. I understand that Kates was not of record during the prosecution of either the original or reissue application.

B. Overview of the Combination

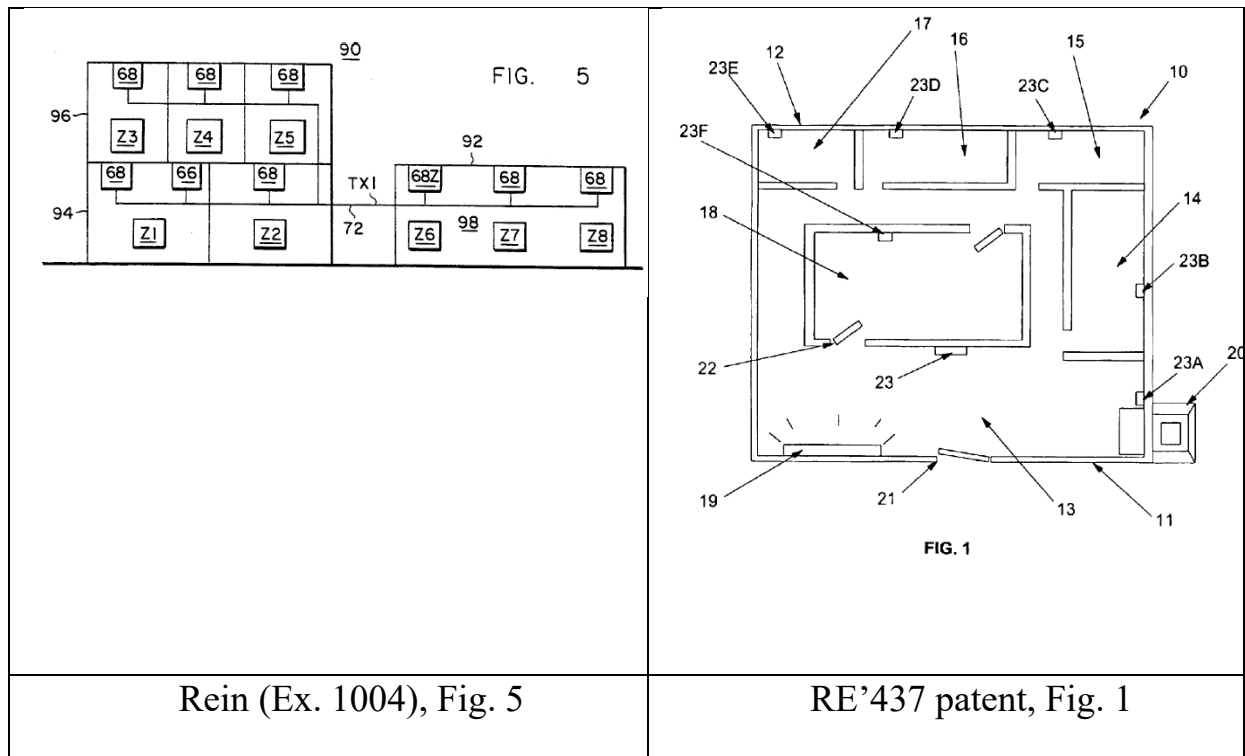
49. In my opinion, while Rein teaches and/or suggests all elements of the claims, Kates reinforces the obviousness cases with respect to, at least, the feature: “read current signals from a coupled environmental sensor and transmit

1. **Overview of Rein**

50. Rein is similar to the RE'437 patent. Shown below are Fig. 5 of Rein (left side), compared with Fig. 1 of the RE'437 patent (right side):

1. Overview of Rein

50. Rein is similar to the RE'437 patent. Shown below are Fig. 5 of Rein (left side), compared with Fig. 1 of the RE'437 patent (right side):



51. In both systems, there are conditioned spaces that use remote sensors to monitor the spaces being conditioned. Ex. 1004, 1:10-12; 2:16-20; Ex. 1001, 1:10-26, 4:66-5:5. Like the RE'437 patent, Rein's system sends information from environmental sensors (e.g., temperature) and occupancy sensors, to a central device (central receiver 66 alone or in combination with

controller 68 and/or building automation system 76) in order to control HVAC operations. Ex. 1004, 5:21; 13:14-18; 14:17-38; 14:58-15:11, 24:26-30; 9:50-56. While Rein describes central receiver 66 for receiving data and controller 68, along with automation system 76, for receiving and acting in response to data from the remote sensors, whether to integrate those different elements would have been a simple design choice. A POSA would have appreciated where to, for instance, combine transceiver functionality and, for instance, controller functionality in one device would have been simply a well-known design option.¹ With these systems, sensor information was (and still is) used to maintain setpoint programming in which the temperature of the conditioned space is kept close to a specified setpoint. Ex. 1004, 1:67-2:6.

52. Both systems employ the use of temperature sensors and occupancy sensors, as well as humidity sensors, in controlling HVAC operations. Ex. 1004, 9:67-10:14; 12:54-65; 22:38-50; 23:58-24:53; 25:6-32; Ex. 1001, 6:17-7:9. Rein describes, for example:

“The present invention also contemplates a generic sensor input connection 49,104H, 359 respectively associated with the zone sensor 58, the personal comfort sensor 110, and the setup tool 320. The generic

¹ To the extent I refer to Rein’s central receiver 66 or its central device, the same should be understood to include control functionality from controller 68 and/or automation system 76.

sensor input 49,104H, 359 allows an external device (not shown) such as a humidity or occupancy sensor to be attached to the zone sensor 58, the personal comfort sensor 110, or the setup tool 320. The zone sensor 58, the personal comfort sensor 110, or the setup tool 320 recognizes the attachment of a generic sensor to the generic sensor input 49,104H, 359, identifies the type of generic sensor, and thereafter uses the generic sensor in a conventional manner.”

Ex. 1004, 25:35-47.

53. In Rein, zone sensors and personal comfort sensors transmit information to the central device when there is a change of state. Ex. 1004, 5:21-32; 9:6-20 (“after a change of state”); 13:59-61; 17:39-43; 23:15-38; 8:28-34; 8:55-57; 25:35-47; Figs. 17, 21. According to Rein, the objective of its remote sensors is “to responsively communicate information and to react to changes in zone conditions.” Ex. 1004, 8:39-9:13; 15:29-57. Similarly, when occupancy is detected, occupancy sensors indicate to the central device the change of state from unoccupied to occupied. Ex. 1004, 16:44-53 (“data packet 100 indicates the occupied/unoccupied status 110i of the area being monitored by the occupancy sensor”).

54. Rein thus describes (i) the use of occupancy sensors, (ii) different programming during occupied vs. unoccupied modes of operation (e.g., shutting off late at night, but allowing a change back to an occupied mode (Ex. 1004, 9:67-

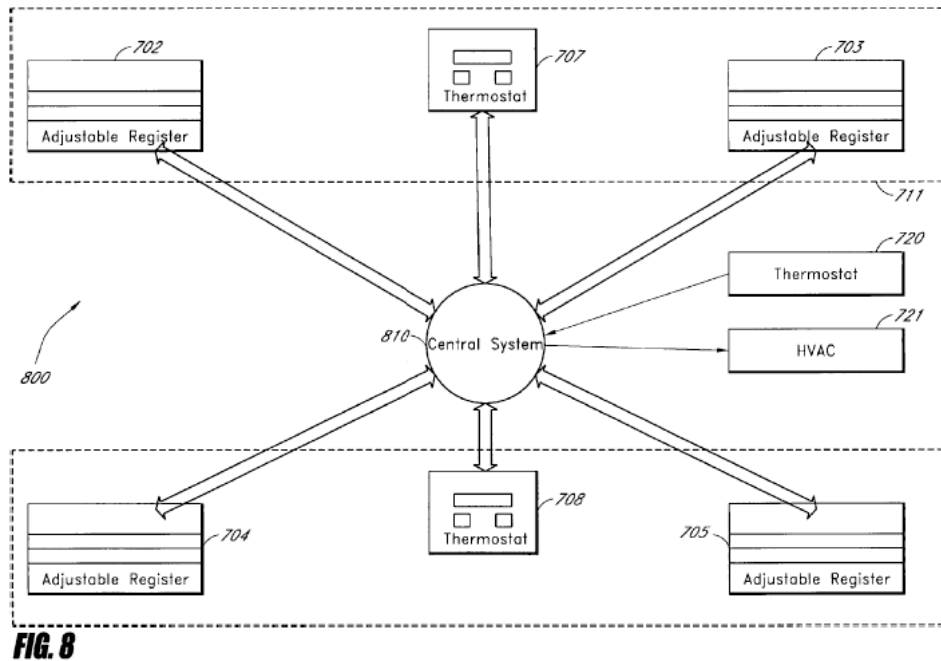
10:14)), and (iii) transmitting sensor data upon a change in state of the room (Ex. 1004, 9:6-20). It was well known in the field that remote sensing devices in HVAC systems would typically send back sensor data at, for instance, regular intervals, upon the change of a mode, and detection of occupancy. In the case of smart thermostats, these triggers can be implemented on the sensor side (as compared to being polled from a central device to perform functions). As for regular intervals, HVAC systems, when maintaining a setpoint, typically send back data at regular intervals so that the HVAC system may determine what steps are needed to maintain the setpoint. Regarding mode changes, when a mode of operation is changed (e.g., a manual change from an unoccupied mode to an occupied mode) data is typically sent so that the system can determine what actions are needed to achieve the setpoint for the new mode. Also, when a sensor detects occupancy the mode of operation is automatically changed.

55. Rein's system also calculates and uses a temperature average from readings received from multiple remote environmental sensors. Ex. 1004, 2:21-25; 22:38-50; 23:58-24:24. The averaged value is then compared to a stored setpoint in order to determine whether to actuate the HVAC equipment. Ex. 1004, 24:4-23.

2. Overview of Kates

56. Kates describes a system where a central device controls HVAC equipment by utilizing information from sensors that monitor conditions in zones of

a conditioned space. Ex. 1005, 2:1-3:14; 4:26-36; 10:13-37; 11:65-12:2. Shown below is Fig. 8 of Kates:



Ex. 1005, Fig. 8.

57. Kates describes a system in which information is transmitted from sensors to a central device for control of HVAC operations. Kates teaches that environmental sensors transmit signals indicating current conditions when occupancy is detected. Ex. 1005, 2:63-3:14; 4:26-36; 10:20-37; 11:65-12:2. When an occupancy sensor detects occupancy in a previously unoccupied room, the sensor device sends a signal to the central system so that the system may know to employ the programming for an occupied room. Kates describes what was well known in the field—namely, that it is preferable to place HVAC systems in an

“inactive” state during periods when a zone is unoccupied. Ex. 1005, 1:39-45 (“can program each specific zone to be active or inactive depending on their needs. For example, the occupants can set the bedrooms to be inactive during the day.”). Once a zone becomes occupied, the system activates to transfer, at least, environmental sensor data. Ex. 1005, 2:63-3:1-14; 4:26-36; 10:20-37; 11:65-12:2. Indeed, Kates explains that occupancy is used to determine how to operate HVAC in certain zones. *Id.*, 1:39-45. (“A zoned system allows more control over the indoor environment because the occupants can decide which areas to heat or cool and when.”). This operation was well known. Occupancy sensors were used in HVAC systems to provide for automatic changes in modes of operations, which typically involved one setpoint when a space was unoccupied and a different setpoint when the space was occupied. As discussed in more detail below, the unoccupied option could involve shutting off the HVAC to conserve energy. However, in some climates where there are risks of, for instance, frozen pipes, the unoccupied mode could involve a setpoint that save energy but keeps the space above the freezing point.

58. In my opinion, POSA would have appreciated that the transmission of environmental signals only upon occupancy detection would be useful to the system in Rein. In particular, Rein already teaches (i) the use of occupancy sensors, (ii) different programming during occupied vs. unoccupied modes of

operation (e.g., shutting off late at night, but allowing for switching back to an occupied mode (Ex. 1004, 9:67-10:14)), and (iii) transmitting sensor data upon a change in state of the room (Ex. 1004, 9:6-20).

59. Kates, much like Rein, acknowledges the need to save battery life in the remote sensors and that the overall system preferably goes into a low power state during an unoccupied period to conserve electricity usage. Ex. 1005, 1:43-45 (“For example, the occupants can set the bedrooms to be inactive during the day while the kitchen and living areas are active.”), 16:55-57. Thus, Kates establishes that it was would have been known to perform transmission of environmental data only upon detection of a change from an unoccupied state to an occupied state. This would allow a system operating in an unoccupied mode (when people are not in the building) to operate in a low power mode and to switch to an occupied mode automatically when a person enters the relevant zone. In this way, the system can re-activate and begin sending environmental conditions, such as temperature, so that the HVAC system can determine current conditions and, thus, what actions are needed to reach the occupied setpoint. Specifically, for the system to know what action to take to reach an occupied set point, it would need to know current conditions in the zone. Therefore, there would have been a clear motivation to combine the teachings.

60. With respect to claims 1 and 6, while Rein does not expressly state the CPUs of its remote sensors (e.g., zone sensor 58) have a connected memory that stores the transmission control program for transmitting the sensor data. Nevertheless, this was well known in the field. A POSA would have known that CPUs use memories, input/output devices, etc. in order to be able to store their programs and perform the tasks required of them. Rein explains that the “objective” of zone sensor 58 is “to responsively communicate information and to react to changes in zone conditions.” Ex. 1004, 8:39-9:13; 15:29-57. That teaching would have suggested a memory with a program for accomplishing that objective and, in any event, a POSA would understand that this is just a simple issue of how CPUs operate.

61. Kate further suggests this feature. In particular, as detailed below, Kates teaches program instructions executed by the remote sensor systems, which instructions includes data transmission steps. Ex. 1005, 11:39-12:14. A POSA would have found it obvious to combine the teachings of Rein and Kates to ensure that the CPU of the remote sensor system, which monitors and transmits sensor data, has a memory for storing the program instructions for executing such transmission operations.

62. In addition, a POSA would have had a reasonable expectation of success in making the combination given the similarity of the systems and the fact

that the combination would require simply using programming, and conventional hardware, intended for occupancy detection and HVAC control with a system that has occupancy detection features for use with HVAC control.

3. Overview of the Combination

63. As I explained above, in my opinion, Rein teaches and/or suggests all of the features of claims 1-12. With respect to “read current signals from a coupled environmental sensor and transmit them for storage in the memory of the central control device only if occupancy is detected,” as discussed above, Rein teaches that remote sensors enter a dormant state to save battery life. Other than the operations occurring at regular intervals and actions forced by an override command, a remote sensor sends data upon a change of state (e.g., occupancy detection in a previously unoccupied room). Ex. 1004, 23:15-31. The data sent includes samples of the current environmental conditions. Ex. 1004, 23:15-31. Rein further teaches that the overall system preferably goes into a low power state during an unoccupied period to conserve electricity usage.

64. As discussed above, Rein teaches (i) the use of occupancy sensors, (ii) different programming during occupied vs. unoccupied modes of operation (e.g., shutting off late at night, but allowing a change back to an occupied mode (Ex. 1004, 9:67-10:14)), and (iii) transmitting sensor data upon a change in state of the room (Ex. 1004, 9:6-20). Rein also teaches that data from signals transmitted by remote

sensors is stored in memory. Ex. 1004, 21:19-34 (“Each time a relevant data packet 86 is received, data files associated with the particular zone sensor 58 or personal comfort sensor 110 are updated . . .”). Therefore, Rein teaches reading and transmitting environmental conditions upon the detection of occupancy.

65. In my opinion, based on Rein alone, it would have been obvious that the system reads and transmits (or at least can be configured to read and transmit) environmental sensor signals upon detecting occupancy. This would have allowed the system to use the indication of occupancy from remote sensor data packets to trigger the changes between occupied and unoccupied modes. A POSA would have understood from Rein that an occupancy sensor can generate a change of state that triggers transmission of a data packet containing the current environmental conditions. A detection of occupancy would trigger the transmission of a data packet. A POSA would readily appreciate this in light of Rein’s emphasis on saving remote sensor battery life and conserving electricity usage.

66. Moreover, Kates confirms this operation. Specifically, Kates provides, at least, an example of a system utilizing signals from occupancy sensors to automatically switch modes of operation and condition occupied rooms differently than unoccupied rooms. Kates also emphasizes the objective of conserving electricity usage.

67. Thus, in view of Kates, it would have been obvious to perform transmission of environmental data in Rein only upon detection of a change from an unoccupied state to an occupied state. This would allow a system operating in an unoccupied mode (when people are not in the building) to operate in a low power mode and to switch to an occupied mode automatically when a person enters the relevant zone. In this way, the system can re-activate and begin sending environmental conditions, such as temperature, so that the HVAC system can determine current conditions and, thus, what actions are needed to reach the occupied setpoint. Specifically, for the system to know what action to take to reach an occupied set point, it would need to know current conditions in the zone.

68. Also, with respect to claims 1 and 6, while Rein does not expressly state the CPUs of its remote sensors (e.g., zone sensor 58) have a connected memory that stores the transmission control program for transmitting the sensor data, the same would have been obvious. A POSA would have readily understood that memories are provided in connection for CPUs in order to store programs for execution by the CPUs. Also, Rein explains that the “objective” of zone sensor 58 is “to responsively communicate information and to react to changes in zone conditions.” Ex. 1004, 8:39-9:13; 15:29-57. That teaching would have suggested a memory with a program for accomplishing that objective. Moreover, Kates teaches program instructions executed by the remote sensor systems, which instructions include data transmission

steps. Ex. 1005, 11:39-12:14. Thus, a POSA would have found this concept to have been obvious in view of Rein and Kates because the CPU of the remote sensor system, which monitors and transmits sensor data, should have a memory for storing the program instructions for executing such transmission operations.

C. Rationale (Motivation) Supporting Obviousness

69. I have provided a detailed explanation of the rationale (motivation) supporting obviousness below, under each element as appropriate.

D. Reasonable Expectation of Success

70. In my opinion, a POSA in the relevant timeframe would have had a reasonable expectation of success in implementing the combination (as described with particularity below in the claim mapping section) of Rein and Kates. In my opinion, the art was relatively predictable in the relevant timeframe. Programmable HVAC systems were known at this time and a POSA would have been able to make any necessary modifications to implement the combination, including adjusting programming and selecting hardware for performing the functions. This is discussed in more detail in the claim mapping section, where appropriate.

E. Analogous Art

71. Rein and Kates are in the same field as the RE'437 patent (building energy management and controls). Ex. 1001, 1:10-26, 4:66-5:5; Ex. 1004, 1:10-12; 2:16-20; Ex. 1005, 2:1-3:14; 4:26-36; 10:13-37; 11:65-12:2.

72. In my opinion, these references address controlling heating and cooling systems, calculation and implementation of setpoints, and HVAC control utilizing signals from occupancy and environmental sensors. Ex. 1001, 1:10-26, 4:66-5:5; Ex. 1004, 1:10-12; 2:16-20; Ex. 1005, 2:1-3:14; 4:26-36; 10:13-37; 11:65-12:2.

F. Claim Mapping

73. In the claim mapping below, I have added numbering and lettering in brackets (e.g., [1]A), [1]B)) to certain claim limitations, to facilitate the discussion.

Independent Claim 1

“1[Pre]. An occupancy response system with a central control device adapted to control space conditioning equipment affecting a conditioned space, the central control device located at a single physical location in one of multiple rooms comprising the conditioned space, where remote sensors are located in physical locations substantially apart from the central control device, the improvement comprising:”

74. A POSA would have understood that the elements of the preamble were well known.

75. First, Rein teaches a system that uses occupancy sensors and wireless communications to control HVAC equipment. Ex. 1004, 1:10-12; 9:6-8. Rein’s system employs zone sensors 58 and personal comfort sensors 110 to communicate

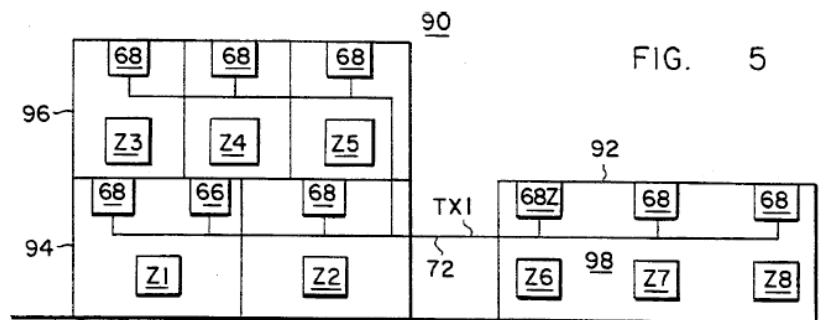
local information pertaining to the zone (e.g., one room of the building) and react to changes in zone conditions.

76. Rein's system includes a central control device that receives information from the sensors (central receiver 66 alone or in combination with controller 68 and/or building automation system 76) and controls space conditioning equipment (e.g., HVAC equipment). Ex. 1004, 10:24-68; 11:7-9; 11:46-49; 12:27-38; 13:14-45; 14:17-15:11; 9:50-56. Of note, central receiver 66 receives sensor data from remote devices. Central receiver 66, in turn, works with controller 68 and/or building automation system 76 so that the operations are implemented. In this regard, Rein seems to distribute some functionality of the central control device among elements. A POSA would have appreciated that it would have been obvious to implement central receiver 66, controller 68, and building automation system 76 as one central controller, as this would simply be a design choice. Reliance on central receiver 66 should be understood to be a reliance on that device in combination with controller 68 and/or system 76.

77. Rein's zone sensors 58 (and personal comfort sensors 110) preferably comprise a number of individual sensors, such as occupancy sensors used to transmit signals indicating occupancy to the central control device. Ex. 1004, 6:10-11; 10:24-38; 11:42-52; 12:39-47; Fig. 21. It was common for remote devices in HVAC system to have multiple sensors for detecting various conditions. Rein teaches that remote

sensors transmit information to central receiver 66, which is adapted to receive the sensor data, check it for validity, store it, and make it readable for the corresponding controller 68 in order to control HVAC operations in that zone. Ex. 1004, 12:21-13:33; 23:15-57. Controller 68 receives signals from its designated zone sensors 58. Ex. 1004, 10:62-68.

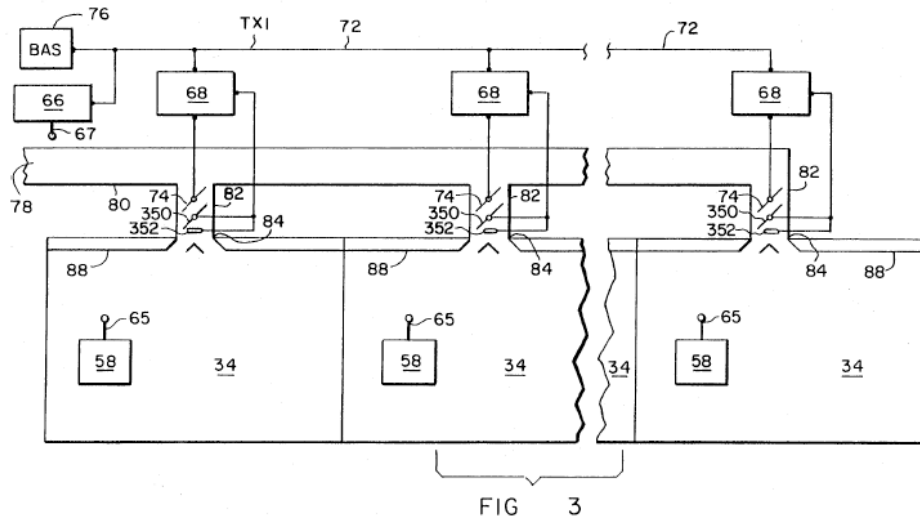
78. Rein's central receiver 66 is located at a one location in one room of multiple rooms comprising the conditioned space, as shown in Figs. 3 and 5. Ex. 1004, Figs. 3, 5; 11:7-13; 11:42-52; 13:46-50. Figure 5 of Rein shows a conditioned space as multiple rooms bounded by outside walls. Ex. 1004, 13:46-50. Figure 5 also shows zone sensors 58 (which are designated as Z1-Z8 in Fig. 5) located in different rooms of the conditioned space. Ex. 1004, 13:46-65 ("zone sensors Z1 through Z8).



Ex. 1004, Fig. 5.

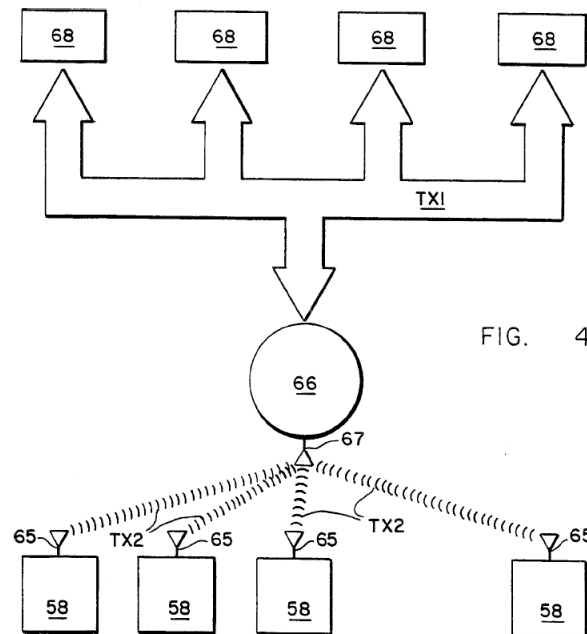
79. Figure 3 shows central receiver 66 located above a drop ceiling 88 in one of multiple rooms comprising the conditioned space. Ex. 1004, 11:7-52; 13:3-9. Of course, as a POSA would have appreciated, central receiver 66 could be placed

at any position in the room (or elsewhere). In Fig. 3, Rein also shows zone sensors 58 provided in different rooms than the central receiver 66. *Id.*, 12:39-47; 13:3-9.



Ex. 1004, Fig. 3.

80. Figures 4 and 8 also show a system in which a single central receiver 66 receives signals from a plurality of zone sensors 58 and personal comfort sensors 110. Ex. 1004, 12:45-47; 15:14-18; 15:47-50.



Ex. 1004, Fig. 4.

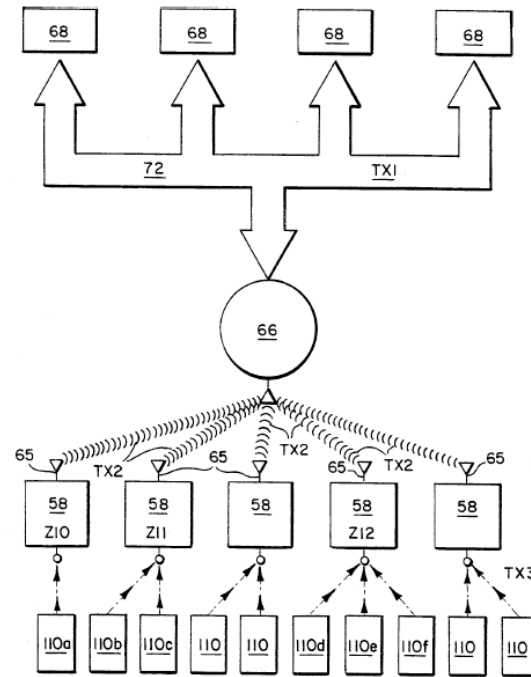
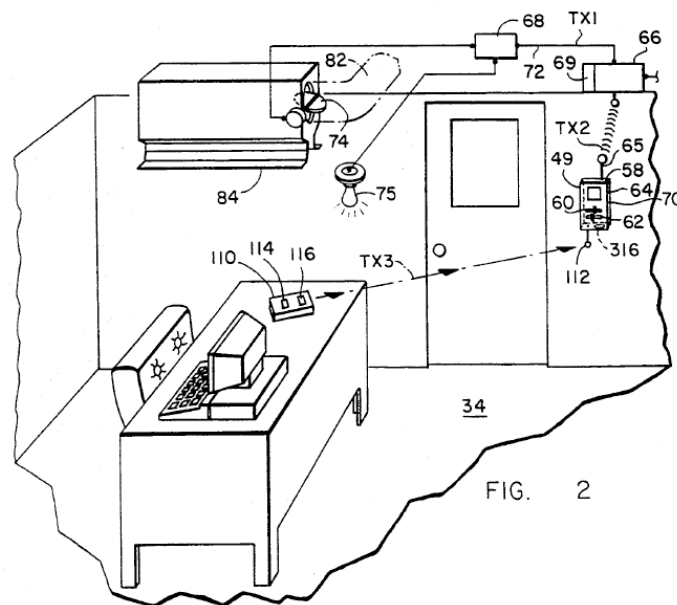


FIG. 8

Ex. 1004, Fig. 8.

81. Rein's remote sensors (zone sensors 58 and personal comfort sensors 110) are located in physical locations (e.g., rooms) substantially apart from central receiver 66 (and from controller(s) 68). Even when located in the same room as receiver 66, Rein explains that the sensors may communicate wirelessly with central receiver 66, i.e., they are physically spaced from central receiver 66 (and controller(s) 68). In Fig. 3, Rein's zone sensors 58 are in different rooms relative to central receiver 66. Ex. 1004, 12:39-47; 13:3-9.

82. Figure 2 shows zone sensor 58 located on a wall and communicating wirelessly with central receiver 66 via communication medium TX2. Ex. 1004, 11:42-52. Wall mounted devices of this type were usually provided in the form of programmable thermostats. Personal comfort sensor 110 also communicates wirelessly with the central receiver 66 through the zone sensor 58. Ex. 1004, 15:48-64; 16:9-18; 16:54-64. That comfort sensor allows for the person's particular location within the room to be the baseline for sensing. Often, different parts of a room may experience somewhat different conditions (e.g., near a window vs. near a heating vent).



Ex. 1004, Fig. 2.

83. An objective of Rein's system is to be able to easily retrofit to existing HVAC systems and eliminate wired connections between zone sensors and an air

handler controller. *Id.*, 1:54-57; 2:35-38. Rein describes utilizing central receiver 66 to format the data received from sensors so that the appropriate controller 68 generates a control signal to actuate the HVAC equipment in a zone. *Id.*, 9:21- 10:38.

84. In my opinion, a POSA would have appreciated utilizing a single device to both receive sensor data and directly transmit control signals to actuate HVAC equipment to be a basic design choice. In this regard, Kates describes the use of a “central system.” Ex. 1005, 8:63-9:8; 10:31-59; Figs. 8, 13.

“[1]A) two or more environmental sensors adapted to measure a local environmental condition and generate signals indicating its value;”

85. In my opinion, Rein describes and/or suggests this element. Rein’s system uses multiple zone sensors 58, each of which includes multiple individual sensors, as shown below with respect to Fig. 21. Ex. 1004, 7:49-50; 8:28-38; 9:6-8; 9:57-62; 11:50-52.

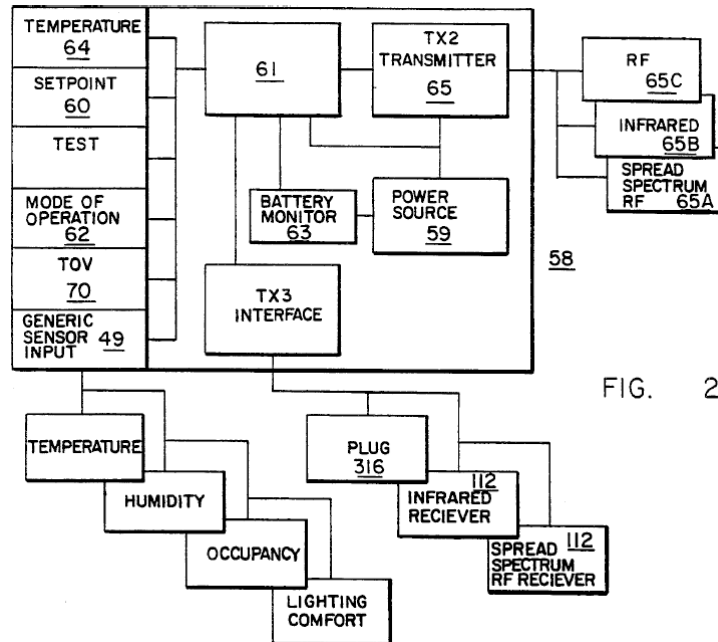


FIG. 21

Ex. 1004, Fig. 21.

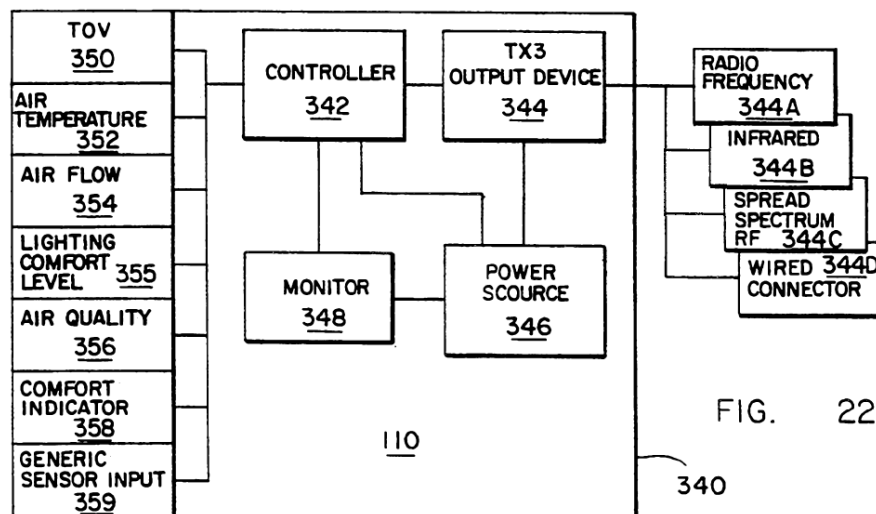
86. Each zone sensor 58 includes a temperature sensor 64 and, according to Rein, any one of a number of other sensor options (e.g., humidity sensor). Ex. 1004, Fig. 21; 4:55-57 (“sensor for sensing environmental conditions”); 8:28-57; 9:6-8; 23:26-29; 25:38-47. Thus, each zone sensor 58 preferably comprises at least one environmental sensor (e.g., temperature sensor). Different sensors 58 are provided for different zones of the conditioned space. Ex. 1004, 11:50-52; 12:27-47; 13:46-57; 15:16-25; 21:10-16. Thus, Rein teaches two or more environmental sensors measuring a local environmental condition. Ex. 1004, Figs. 5, 21; 12:45-47.

87. Each temperature sensor 64 of a zone sensor 58, in addition to measuring the local temperature, generates signals indicative of the sensed temperature, which signal are transmitted to central receiver 66. Ex. 1004, 9:13-29

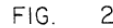
(“the zone sensor 58 uses the wireless transmitter 65 to transmit a wireless signal to a receiver portion 67 of a central receiver 66”); 24:62-66; 25:38-47.

88. A POSA would have readily understood that temperature sensors respond to the temperature around the sensor and generate a signal indicating the value of that temperature. Rein explains that the “sensors provide information to” a controller 68 via a central receiver 66. Ex. 1004, 22:24-37. Rein uses the data to determine which temperature has “the largest deviation from the setpoint,” indicating that the sensor data indicates the temperature value. Ex. 1004, 22:24-41; 24:62-66 (“provide a sensed signal value for transmission”). Temperature sensors were well known and have long been used in heating and cooling systems.

89. Rein also describes personal comfort sensors 110, which include, at least, temperature sensor 352, as shown below with respect to Fig. 22. Ex. 1004, Fig. 22; 15:41-50; 16:34-42; 16:44-53; 17:16-19; 23:26-29; 25:35-47.



90. Comfort sensors 110 monitor local conditions (e.g., conditions closer to the occupant of the room) and transmit that data (through zone sensors 58) to central receiver 66. Ex. 1004, 15:47-50. As shown in Fig. 2, comfort sensors 110 and zone sensors 58 may be used together in one room.



91. Different comfort sensors 110 may be provided for different zones of the conditioned space. Ex. 1004, Fig. 2, 15:47-50; 17:16-19; 21:10-16 (“a zone data packet 86 from one of a plurality of predesignated zone sensors 58 and personal comfort sensors 110.”). Thus, this claim element is met by the environmental sensors in zone sensors 58 and/or personal comfort sensors 110.

“[1]B) two or more occupancy sensors adapted to detect occupancy of space around an environmental sensor and generate signals indicating occupancy;”

92. In my opinion, Rein describes and/or suggests this element. As discussed above, zone sensors 58 include multiple individual sensors, as shown respect to Fig. 21.

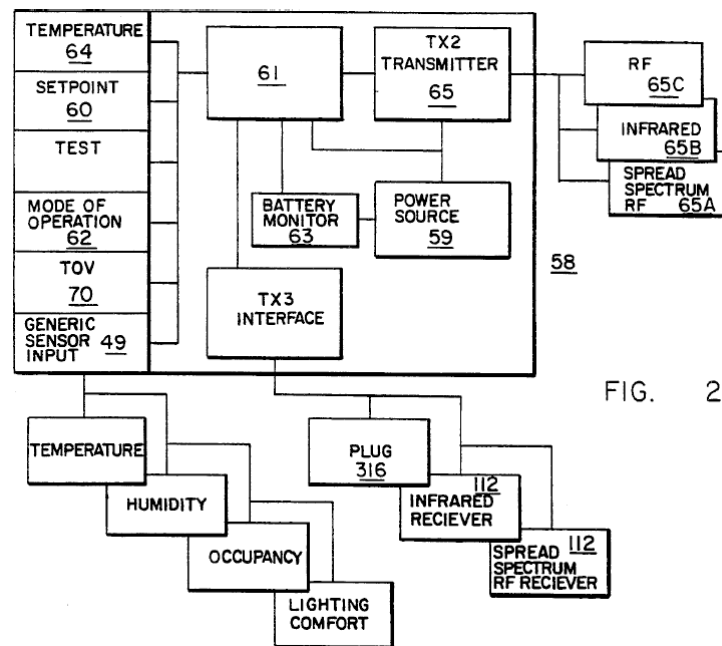


FIG. 21

Ex. 1004, Fig. 21.

93. Each zone sensor 58 includes temperature sensor 64 and a generic sensor input 49, to which various sensors may be coupled, including an occupancy sensor, such that both a temperature sensor and occupancy sensor monitor the area around zone sensor 58. Ex. 1004, Fig. 21; 8:28-34; 8:55-57; 9:6-8; 23:26-29; 25:35-47.

94. Rein also describes that different modes of operation are used, depending on whether a zone is occupied or unoccupied, which suggests a reason to track the occupied/unoccupied state of different rooms. Ex. 1004, 9:57-10:14. As discussed with respect to limitation [1]A), Rein teaches that zone sensors 58 are provided in different zones of the conditioned space. Ex. 1004, Figs. 3 and 5; 11:50-52; 12:27-38; 12:45-47; 13:46-57; 15:16-25; 21:10-16.

95. Thus, in my opinion, a POSA would understand Rein to suggest the use of multiple occupancy sensors. Ex. 1004, Figs. 5 and 21; 12:45-47. Further, as also discussed above, Rein describes the use of multiple personal comfort sensors 110, which themselves may include occupancy sensors. Ex. 1004, Fig. 22; 16:48-53; 25:35-47.

96. With respect to generating signals, Rein indicates that the occupancy sensors generate signals indicating occupancy, which would have been clear to a POSA. Figure 6 of Rein illustrates the contents of an example data packet 86 sent from zone sensors 58. When an occupancy sensor is coupled to a zone sensor 58, the signal indicating whether the space is occupied is transmitted along with the packet information. Ex. 1004, 16:48-53 (“other sensors can also be connected In this case, the ... *packet [] indicates the occupied/unoccupied status*” (emphasis added)); 9:67-10:14; 15:58-16:9; 16:44-64; 25:38-47; Figs. 21 and 22. (While the

specification states the packet includes occupied/unoccupied status when an occupancy sensor is used, Fig. 6 does not illustrate that information.)

FIG. 6 86

MESSAGE TYPE	86T
ZONE SENSOR	86A
AIR TEMPERATURE	86B
SET POINT, HEATING	86C
SET POINT, COOLING	86D
MODE (HEAT, COOL)	86E
BATTERY STATUS	86F
TIMED OVERRIDE	86G

Ex. 1004, Fig. 6.

97. Personal comfort sensors 110 also include occupancy sensors that generate signals indicating occupancy. Comfort sensors 110 include a generic sensor input 359, to which an occupancy sensor would be coupled. Ex. 1004, Fig. 22; 15:41-50; 16:34-53; 17:16-19; 23:26-29; 25:35-47.

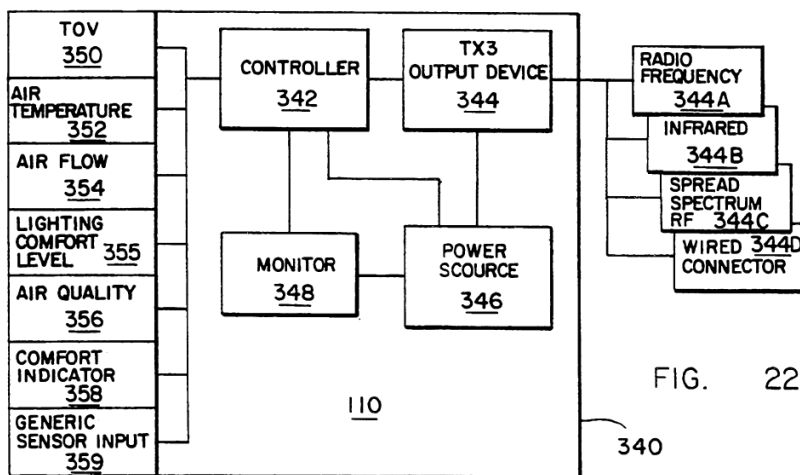


FIG. 22

Ex. 1004, Fig. 22.

98. As shown in Fig. 9, when an occupancy sensor is used for the generic sensor input, signals indicating the occupied/unoccupied status of the area being monitored by comfort sensors 110 would be included in 100I of data packet 100. Ex. 1004, 16:48-53.

FIG 9

100

MESSAGE TYPE	100T
PERSONAL COMFORT SENSOR	100A
AIR TEMPERATURE	100B
AIR FLOW	100C
AIR QUALITY	100D
COMFORT INDICATOR TOO WARM TOO COLD	100E
BATTERY STATUS	100F
TIMED OVERRIDE	100G
LIGHTING COMFORT LEVEL	100H
GENERIC SENSOR INPUT	100I

Ex. 1004, Fig. 9.

99. This type of data packet would have been expected by a POSA. Thus, Rein indicates that occupancy sensors generate the claimed signals.

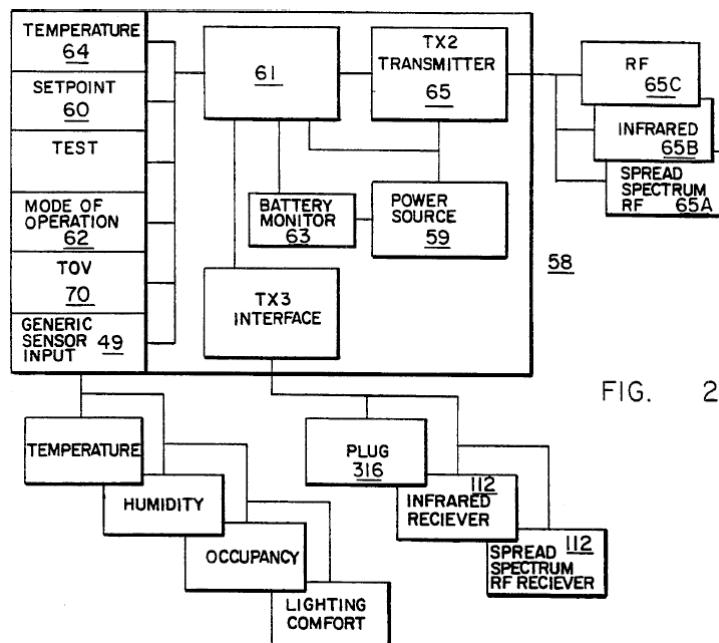
100. Kates also describes occupancy sensors that generate signals indicating occupancy. Ex. 1005, 2:63-3:1; 3:1-14; 4:26-36; 10:20-37; 11:65-12:2. In Kates, when occupancy is detected by an occupancy sensor, a signal is transmitted to a

central device indicating that the space is occupied. Ex. 1005, 2:63-3: 14; 4:26-36; 10:20-37; 11:65-12:2.

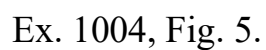
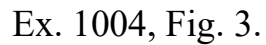
“[1]C) either the central control device and one or more of the remote sensors or two or more of the remote sensors each comprise an environmental sensor and an occupancy sensor;”

101. I understand that the term “either” in this claim element indicates that the claim can be met by either option. This section focuses on the recited “two or more of the remote sensors each compris[ing] an environmental sensor and an occupancy sensor.” In my opinion, Rein discloses and/or suggests this element.

102. As established above, each of Rein’s (remote) zone sensors 58 preferably comprises both an environmental sensor (temperature sensor 64) and an occupancy sensor. Ex. 1004, Fig. 21; 8:28-57; 9:6-8; 23:26-29; 25:38-47; 16:48-53.



103. As discussed with respect to limitation [1]A), Rein teaches that multiple zone sensors 58 are provided across zones. Ex. 1004, 11:50-52; 12:27-47; 13:46-57; 15:16-25; 21:10-16. Zone sensors 58 are remotely positioned for the reasons I already discussed above with respect to the preamble. Ex. 1004, 1:39-42; 13:24-28.



104. As also discussed above, Rein describes comfort sensors 110, which may include a temperature sensor and an occupancy sensor (connected to generic sensor input 359), as shown below with respect to Fig. 22.

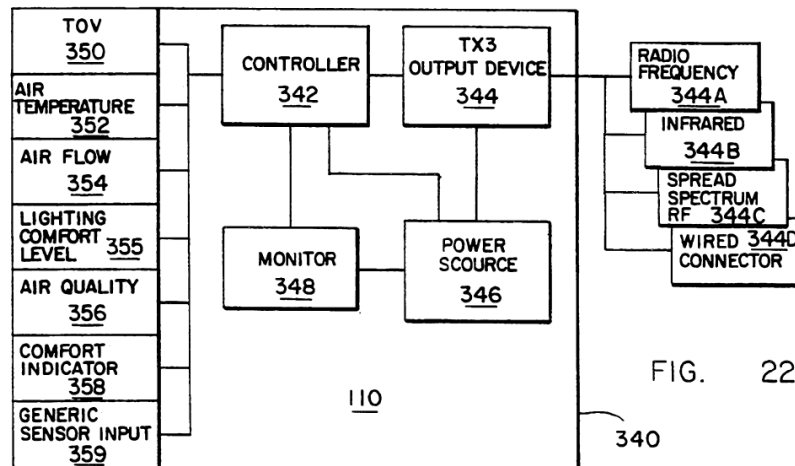


FIG. 22

Ex. 1004, Fig. 22.

105. Therefore, Rein suggests this element through the use of multiple zone sensors 58 and personal comfort sensors 110, each of which comprises an environmental sensor and an occupancy sensor.

“[1]D) a central processor for the central control device including: 1) a central processing unit; 2) a real time clock; 3) a memory coupled to said central processing unit for storing a central control program and data, said data including at least one of the values of the environmental conditions sensed by the environmental sensors; and 4) an input/output unit coupled to the central processing unit, to the space conditioning equipment for issuing control signals thereto, and to a reception interface adapted to receive signals representing environmental conditions at a remote sensor;”

106. In my opinion, Rein discloses and/or suggests this element. As discussed above, Rein describes a system where sensors transmit signals to central receiver 66, which stores the data from signals in memory and provides it to controller 68 to control the HVAC equipment. Ex. 1004, 9:6-56; 10:39-11:6.

107. For context, this claim language is oddly worded. The language indicates that “a central processor” includes “a central processing unit.” In the field, a CPU is a processor. However, as shown in Fig. 2 of the RE’437 patent, the processor 30 is indicated to be the collection of elements including the CPU, memory, clock, and input/output. Ex. 1001, Fig. 2; 5:9-22. Thus, I treat the recitation of the processor in the claims to be the aggregation of the recited elements.

108. Rein’s central receiver 66 includes a CPU (data controller 362). Ex. 1004, Figs. 4, 8, 23; 7:53-54; 9:17-56 (“The central receiver 66 preferably includes

a conventional microprocessor data controller 362 . . .”); 12:45-47; 15:14-18; 15:47-50.

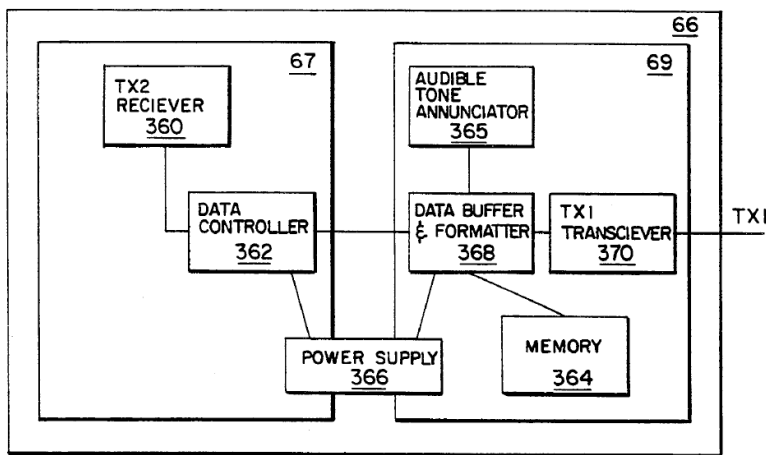


FIG. 23

Ex. 1004, Fig. 23.

109. Rein’s CPU (data controller 362) in central receiver 66 may be a TMS 320C14 microcontroller (the specification sheet for which is provided as Ex. 1012), which includes a clock. Ex. 1004, 9:32-35. As a POSA would have understood, a CPU is a logic that enables the computer to operate. To operate as intended, a POSA would have understood that the CPU would have associated with it a memory (for storing programs that enable the CPU to perform functions), inputs/outputs, and clocks. Clocks are used because computers are synchronous circuits that need to keep time. A real-time clock just indicates that the clock being used is able to track calendar time (e.g., day, date, and time of day). Whether to select a processor that uses a real-time clock or a processor that uses a basic clock is just a simple design

choice based on the needs of the system. And even when the processor is built with a basic clock, a real-time clock can be implemented through software (the TMS controller does not indicate a real-time clock in the hardware). As a POSA would have appreciated, CPUs used in programmable thermostat systems typically used real time clocks inasmuch as the systems are intended to allow for the programming of HVAC operations on, e.g., different days of the week. For instance, a typical programmable thermostat might have one program for 9am to 5pm on weekdays and another for that same time on weekends. A real-time clock allows for the tracking of calendar time for such functionality.

110. In my opinion, a POSA would have understood that computers often included real-time clocks, particularly where day and date programming was to be used. Indeed, the RE'437 patent admits that this feature was known in the prior art. Ex. 1001, 1:32-38. Also, a POSA would have found the use of real-time clocks to be an obvious option. Ex. 1004, 14:58-15:4; 21:27-34; Ex. 1005, 3:12-24; 8:38-42. Allowing for the programming of scheduling different setpoints based on times of the day and/or days of the week had also long been known in the field. This was enabled by the use of real-time clocks included in CPUs.

111. As shown in Fig. 23, central receiver 66 also includes memory 364 coupled to the data controller 362. Ex. 1004, 9:17-20). The memory 364 stores data

used in the operation of the system. Ex. 1004, 9:5-56 (“memory device 364 is provided to store such data”); 12:21-38.

112. Controller 68 also includes controller logic unit 404, message encoder/decoder 402, and memory 408. Rein describes that data, instructions, and algorithms used to determine proper actuation of the HVAC equipment are stored in the memory 408 of controller 68. Ex. 1004, 5:33-44; 10:39-54.

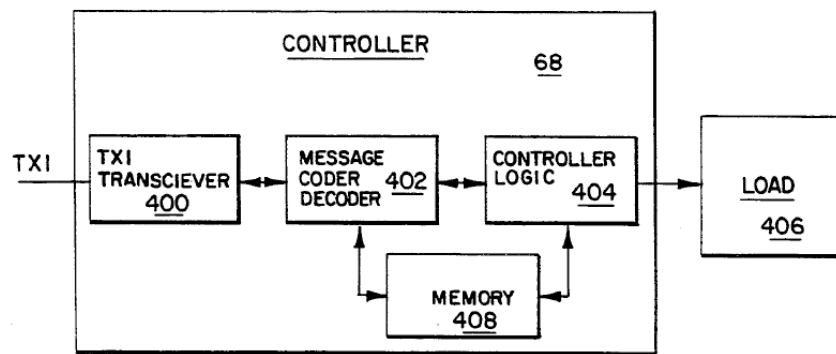


FIG. 24

Ex. 1004, Fig. 24.

113. As discussed above, it is my opinion that a POSA would have appreciated that one could use a single central control device to receive data from sensors and generate the corresponding control signals to actuate HVAC equipment. Indeed, Kates describes a central system (710, 810, 910) that communicates with zone thermostats, stores a computer program for executing the HVAC functions, and controls the HVAC equipment. Ex. 1005, 8:63-9:8; 10:38-59; 14:49-65.

114. A POSA would have also appreciated that central devices for controlling HVAC systems, as described in Rein and Kates, would be expected to contain programs for allowing for the control of the HVAC functions, which functions are described throughout Rein and Kates. These functions would have been expected to have been stored in memory to be available to the processors. Furthermore, HVAC control systems were known to employ a single control device (e.g., a computer) with programming to both communicate with remote sensors and generate corresponding control signals to actuate HVAC equipment since at least 1983. Ex. 1013, Fig. 4; 3:44-4:21.

115. Rein also describes that sensor data transmitted from zone sensor 58 and/or personal comfort data packet 100 to central receiver 66 is stored in a memory when it is received. Ex. 1004, 9:40-45; 21:19-34 (“Each time a relevant data packet 86 is received, data files associated with the particular zone sensor 58 or personal comfort sensor 110 are updated . . .”).

116. Central receiver 66 also includes an input/output unit in the form of a receiver portion 67 and a translator portion 69 that respectively utilize a TX2 Receiver 360 and a TX1 Transceiver 370 for sending and receiving signals to/from sensors, controllers 68, and the space conditioning equipment. Ex. 1004, Fig. 23; 9:21-40; 9:45-50. TX2 Receiver 360 and TX1 Transceiver 370 are coupled to data controller 362. Ex. 1004, Fig. 23; 9:21-40; 9:45-50. TX1 Transceiver transmits the

signals to the controller 68 via the TX1 communication medium. Ex. 1004, 9:21-56. TX2 Receiver 360 receives data transmitted from the sensors. *Id.* In any event, a POSA would have understood that the inputs and outputs were basic parts of computerized systems that would be expected to be used to implement such devices.

117. Thus, Rein describes and/or suggests this element of the claim.

“[1]E) a remote processor for each of the remote sensors including a central processing unit, a clock, a memory coupled to said central processing unit for storing a transmission control program, and an input/output unit coupled to the central processing unit and to a transmissions interface adapted to send to the central control device signals representing environmental conditions from a coupled environmental sensor”

118. In my opinion, Rein and Kates combined disclose and/or suggest this claim element. Again, the language used in this element is odd because the term “processor” is usually used to mean a CPU. Here, the “remote processor,” appears to indicate the collection of recited elements. In that regard, each zone sensor in Rein 58 includes a central processing unit (CPU) in the form of microprocessor 61. Ex. 1004, 8:28-32. That these types of remote devices had CPUs was already well known in the field.

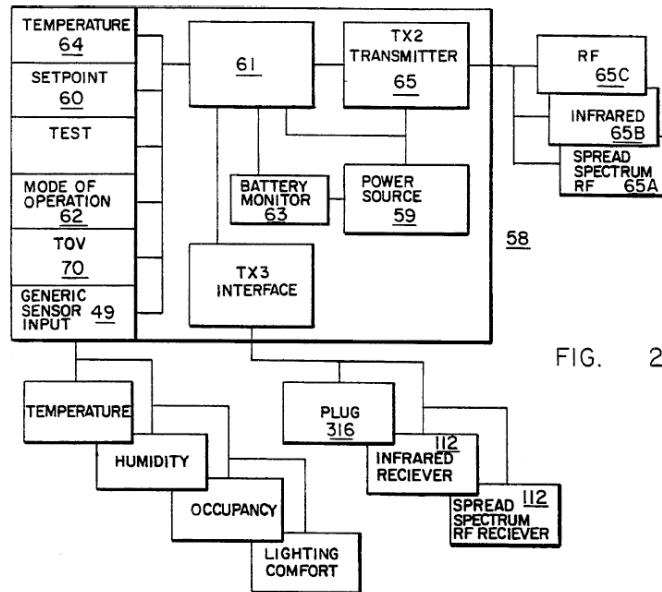


FIG. 21

Ex. 1004, Fig. 21.

119. Also, personal comfort sensor 110 includes a CPU in the form of a microprocessor controller 342. Ex. 1004, 15:29-35.

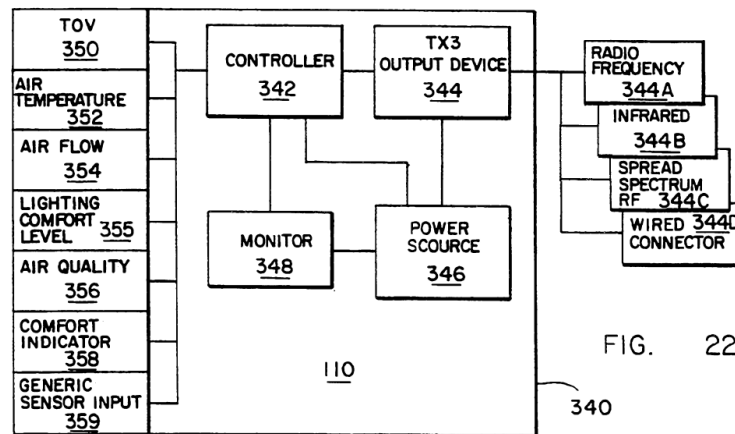


FIG. 22

Ex. 1004, Fig. 22.

120. In my opinion, the CPU in each of Rein's remote sensors would be understood to include a clock. As I explained above, computers are synchronous circuits and a POSA would have expected that some sort of clock would have been

used to allow the computer to function. For instance, Rein describes that microprocessor 61 includes a hardware “timer” interrupt, which a POSA would understand is connected to a clock for performing actions based on timing signals. Ex. 1004, 8:48-59. Additionally, signals may be transmitted at timed intervals, which a POSA would understand would be measured using a clock. Ex. 1004, 8:48-9:3; 23:15-52. The remote sensor would need a clock to be able to measure the intervals for transmission of signals to the central receiver 66. This would be suggested, at least, because Rein describes more than one timer, including that there is also a timer on the central device side (e.g., the controller 68) that determines whether the zone sensor 58 has provided data within the specific time period. Ex. 1004, 21:52-66. Thus, in my opinion, a POSA would understand that remote sensors include a timer—enabled by a clock—that, upon expiration, triggers transmission and others that determine whether that transmission has occurred. And, the RE'437 patent admits that this feature was known in the art. Ex. 1001, 1:32-38.

121. In my opinion, a POSA would understand that microprocessor 61 of zone sensor 58 includes an input/output unit coupled to inputs of the zone sensor 58, to TX3 Interface, and to TX2 Transmitter 65. TX2 Transmitter 65 is an interface that sends signals representing environmental conditions from a coupled environmental sensor to central receiver 66. Ex. 1004, 9:6-56; 12:45-47. Again, inputs and outputs

are basic parts of computerized systems that allow them to perform their functions related to receiving data and providing control signals.

122. For similar reasons, it is also my opinion that a POSA would have expected that controller 342 of personal comfort sensor 110 includes an input/output unit coupled to inputs of the device and to TX3 output device 344. TX3 output device transmits signals representing environmental conditions from a coupled environmental sensor to the central receiver 66 through a zone sensor 58. Ex. 1004, 15:29-35; 16:14-33; 16:54-65; 18:19-21; 23:52-57.

123. While Rein does not expressly describe that there is a memory connected to the CPU in zone sensor 58 or comfort control sensor 110 or that such memory stores the transmission control program, it is my opinion that a POSA would have expected a memory to be used for reasons I have already explained. In particular, a POSA would have appreciated that CPUs and other controllers conventionally include memories in order to store their programs and perform the tasks required of them. Also, the stated “objective” of zone sensor 58 and comfort control sensor 110 is “to responsively communicate information and to react to changes in zone conditions.” Ex. 1004, 8:39-9:13; 15:29-57. In order to track the sensor data and determine when to transmit the same to central receiver 66, it would have been expected that the CPU would have had an associated memory that stores program instructions for such transmission control.

124. As discussed below with respect to claim limitation [1G)]2), Rein teaches that zone sensors 58 operate by transmitting upon, e.g., detection of a change of state (e.g., detection of occupancy) and a programming command, such as a user instruction provided via setup tool 320 for changing the program. Ex. 1004, 23:15-46; 23:58-24:24; Fig. 17. The zone sensor 58 also includes a timer for triggering transmission of signals to central receiver 66. Ex. 1004, 21:19-34.

125. Kates also supports the idea that stored programs were used in these systems. Kates describes instruction loops that are executed by the zone thermostats, including data transmission steps performed by the zone thermostat to ensure proper transmission. Ex. 1005, 11:39-12:14.

126. Kates also suggests inclusion of a clock in the zone thermostats, inasmuch as zone thermostats include a program step that listens for instructions and, if none are received (in some amount of time), the returns to a sleep mode. Ex. 1005, 11:52-58; 11:15-19. A POSA would understand that the amount of time for listening would suggest a clock in the zone sensor.

127. Thus, the combination of Rein and Kates also suggests this limitation.

“[1]F) for the central control device or remote sensors having environmental sensors and occupancy sensors, their input/output units further including a sensor input coupled to an environmental sensor and an occupancy input coupled to an occupancy sensor;”

128. In my opinion, Rein discloses and/or suggests this claim limitation. As discussed above, Rein describes that zone sensors 58 and personal comfort sensors 110 (remote sensors) include environmental sensors and occupancy sensors. Those sensors have corresponding sensor inputs. Ex. 1004, 8:55-57 (“the zone sensor 58 samples its environment by means of the available inputs 60, 62, 64, 49.”).

129. With respect to the “occupancy input,” zone sensors 58 and personal comfort sensors 110 respectively include a generic sensor input 49 and a generic sensor input 359. Ex. 1004, Figs. 21 and 22; 8:33-57; 25:38-42. Zone sensors 58 and personal comfort sensors 110 also include, respectively, temperature sensor inputs 64 and 352.²

² Rein labels both the temperature sensor and its accompanying input with the same reference numeral. Ex. 1004, 8:27-57; 15:41-47.

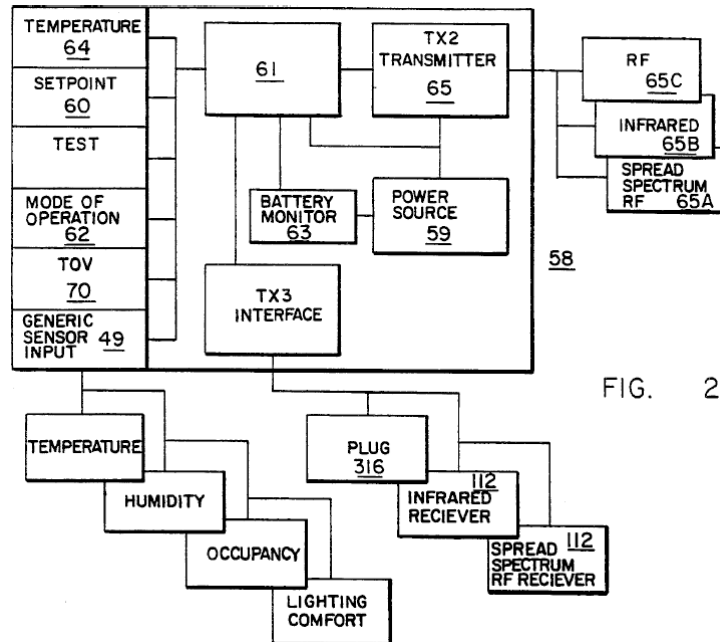


FIG. 21

Ex. 1004, Fig. 21.

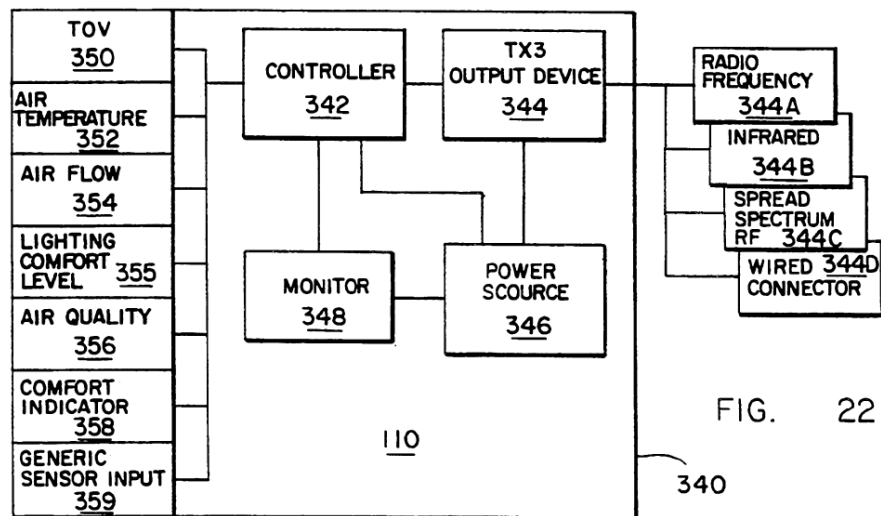


FIG. 22

Ex. 1004, Fig. 21.

“[1]G) the control programs causing a coupled central processing³ unit to selectively: 1) detect occupancy or vacancy of a nearby space from signals from a coupled occupancy sensor”

130. In my opinion, Rein and Kates suggest this element. As described with respect to limitation [1]B) and [1]C), Rein’s zone sensors 58 and comfort sensors 110 selectively detect occupancy or vacancy of a space using coupled occupancy sensors. Ex. 1004, 9:67-10:3; 16:48-53 (“the personal comfort data packet 100 indicates the occupied/unoccupied status 110i of the area being monitored by the occupancy sensor.”); 10:6-11 (“In this version the switch 70 acts as an on/off toggle to 10 indicate occupancy or unoccupancy of a zone respectively.”). The nearby space may be the room in which the sensor is located.

131. Also, Rein indicate that remote sensor 58 and comfort sensor 110 execute programming to control occupancy detection (as well as temperature detection). Ex. 1004, 8:39-9:13; 15:29-57; *see* limitation [1]E), above. Rein also teaches that remote sensors (zone sensors 58 and personal comfort sensors 110) append occupancy detection signals/values to their data packets 86, 100. As discussed above, Rein and Kates indicate that the central devices and remote sensors use their own processors and memories for executing programs required for

³ The specification of the RE’437 patent indicates that the coupled processor affected by this control program is a processor associated with a remote sensor. Ex. 1001, 2:23-27; 6:25-60.

operation. Ex. 1004, 9:56-10:14. Rein also discloses programming that works to awaken remote sensors from a sleep mode (Ex. 1004, 5:53-57), which relates to a remote sensor's reading of an occupancy sensor's signal indicating whether a zone is occupied or unoccupied. Rein teaches that, when occupancy is detected, as discussed with respect to limitations [1]B) and [1G)]2), a signal indicating occupancy or vacancy is generated by the occupancy sensor. Ex. 1004, 16:44-64.

132. In my opinion, a POSA would have appreciated that the detection and transmission would have been performed in connection with the programming for the particular mode of operation in the system. For instance, if in an unoccupied mode, the system would detect occupancy and inform the HVAC system of the change to the occupancy of the room. This is routinely how these types of system operated.

133. Kates confirms this understanding. In Kates, the programming of the central device and the remote sensors operate to execute a zone control program stored in the central device that involves detecting occupancy. Ex. 1005, 2:63-3:24; 10:21-59. Occupancy detection at the zone thermostat triggers a change in the mode of operation of the system and consequently of the HVAC equipment. Ex. 1005, 2:63-3:24; 10:21-59. For instance, upon occupancy detection, the system operates to heat or cool the space as needed to bring the relevant zones to an occupied setpoint. Ex. 1005, 2:63-3:11; 4:26-36; 10:20-37; 11:65-12:2.

134. A POSA would have known that this operation occurs in connection with the programming for transmission in the remote sensor and the programming for HVAC control in the central controller. Again, this was standard operation for such system at the time.

“[1G)]2) read current signals from a coupled environmental sensor and transmit them for storage in the memory of the central control device only if occupancy is detected.”

135. In my opinion, Rein and Kates suggest this claim element. As discussed above with respect to limitation [1]A), Rein describes reading and transmitting signals from a temperature sensor to the central receiver 66. Rein also describes that data from signals transmitted to central receiver 66 by zone sensor 58 and comfort sensor 110 are stored in a memory when received by central receiver 66. Ex. 1004, 9:40-45; 21:19-34 (“Each time a relevant data packet 86 is received, data files associated with the particular zone sensor 58 or personal comfort sensor 110 are updated . . .”).

136. As discussed in the Claim Interpretation section above, I have been asked to apply, at least, Patent Owner’s implied claim interpretation from the counterpart litigation. Specifically, the term “only” in this understanding indicates that the transmission of sensor data occurs only upon detection of occupancy during a period between regular interval transmissions of sensor data, and apart from, e.g.,

manual overrides that may result in changes of state. I also discuss in the latter part of this section that this claim element would have been obvious in view of more restrictive interpretations of “only.”

137. Rein teaches that zone sensors 58 and personal comfort sensors 110 read current signals from temperature sensors and occupancy sensors. Ex. 1004, 9:57-62 (“this data packet 86 includes . . . the current zone temperature 86B . . .”); 12:21-33; 15:47-50; 16:48-53; 25:35-47. In Rein, transmission of current sensor readings from the temperature sensor may occur at a regular interval set in the programming (e.g., “every five minutes”) and at the time of an override of the programming (e.g., an override of setpoint programming). Ex. 1004, Fig. 17; 23:15-57. Thus, other than at an override or expiration of an interval period, sensor data is not sent. As also established, Rein’s system tracks whether a zone is occupied or not and indicates that the HVAC operates differently when the building is unoccupied (e.g., late at night) as compared to when it is occupied. Ex. 1004, 9:6-8; 9:67-10:14; 15:58-16:9; 16:48-64; 25:38-47.

138. Rein also teaches efficiency in power consumption, describing that zone sensor 58 or personal comfort sensor 110 may go into a sleep mode that uses minimal power and be woken up by a signal, after which the awoken sensor reads the temperature in the zone from the included temperature sensor. Ex. 1004, 8:48-53; 19:18-25; 23:15-47. Rein suggests sending data when occupancy is detected

because the system will operate differently when the zone/building is occupied vs. unoccupied—this is why occupancy sensors were used in HVAC systems. Ex. 1004, 9:67-10:14. Rein explains that an objective of the sensors to “responsively communicate information and react to changes in zone conditions.” Ex. 1004, 4:4-7; 5:23-32; 8:27-32; 9:6-8. However, Rein does not explicitly describe reading and transmitting environmental sensor data when occupancy is detected.

139. Kates describes a system for controlling HVAC systems based on the readings from remote sensors, including environmental and occupancy sensors. Ex. 1005, 2:63-3:14; 4:26-36; 10:20-37; 11:65-12:2. Kates also explains that occupancy is used to determine how to operate HVAC in certain zones. In Kates, “[a] zoned system allows more control over the indoor environment because the occupants can decide which areas to heat or cool and when. With a zoned system, the occupants can program each specific zone to be active *or inactive* depending on their needs. For example, the occupants can set the bedrooms *to be inactive during the day*.” Ex. 1005, 1:39-45.

140. Kates explains that when an occupancy sensor detects occupancy, a signal is transmitted to a central device so that the system switches to programming for the occupied mode. Ex. 1005, 2:63-3:11; 4:26-36; 10:20-37; 11:65-12:2.

141. A POSA would have understood that, because Kates teaches that (i) the system may be rendered inactive when a room is not being used and (ii) it is

preferable to send signals from the remote sensors upon a change in occupancy in order to switch to an occupied mode, it would have been obvious to operate Rein's system similarly. Indeed, in order to know the manner in which to operate the HVAC system to effectuate the occupied setpoint programming, the system would need to know current conditions for the room.

142. In my opinion, a POSA would have appreciated that it would have been obvious to transmit Rein's data packets only upon the detection of occupancy. Rein's data packets include not only the sensor data from the occupancy sensor, but also the current readings from the environmental sensors. Ex. 1004, 14:6-23; 16:34-53. At the very least, a POSA would have found it obvious to send the "current" readings. A POSA would have appreciated that HVAC systems react to current sensors readings because stale readings would not allow the system to provide controls useful for the current environmental conditions of the room.

143. For these reasons, it is my opinion that a POSA would have understood this limitation to be obvious in view of Rein and Kates, at least under what I have been informed is Patent Owner's apparent construction of "only."

144. It is also my opinion that a POSA also would have found this limitation obvious in view of narrower interpretations of "only." A POSA would have understood that it was known to send sensor data upon changes in mode (e.g., manual changes), at regular intervals, and upon occupancy detection (which triggered an

automatic change of mode). Thus, using any one or more of those options would have been obvious to a POSA, inasmuch as there were a limited number of known triggers in this regard. For example, Rein teaches that environmental sensor data may be sent at set intervals and upon override commands. And Kates indicates that such sensor readings may be sent upon a sensor detecting an occupied state in a zone/room. This finite number of known options would have provided a simple group of options among which a POSA could select to control their system. Selecting “only” one would have been a design choice.

145. Notably, Rein and Kates acknowledge the need to save battery life in the remote sensors and that the system overall preferably goes into a low power state during an unoccupied period (to conserve electricity usage). Rein describes that during periods when a building is not occupied, such as late at night, it is preferable to be in an unoccupied state. Ex. 1004, 9:67-10:3. Kates also explains that it is preferable to have HVAC systems go “inactive” during periods when the zone is unoccupied. Ex. 1005, 1:39-45.

146. While Rein explains that remote sensors may transmit sensor data at regular intervals, it is my opinion that a POSA would also understand that during extended unoccupied periods in which a building or zone is empty (and “inactive”) not transmitting at all would save power and battery life for remote sensors. Rein also notes the energy savings associated with sleep and dormant states. Ex. 1004,

5:53-57; 8:51-53; 15:37-41; 23:46-47. And, because the point of the extended inactive period is due to vacancy, a POSA would also understand to use Kates' teaching that, upon the detection of occupancy, the system would transmit data (such as the data packets described in Rein) in order to trigger the switch to an occupied mode. This would be a simple design preference using known options taught in Rein and Kates.

147. Of note, the use of regular interval data is typically used because, in many unoccupied states, there is a different setpoint used rather than no setpoint (and interval data is used to maintain that other setpoint). For instance, in the winter, an unoccupied setpoint could be 55 degrees F. The reason for that is that, in climates where freezing temperatures are possible, it is preferable to ensure that the inside temperature does not drop below the freezing point, as that could cause water pipes to burst. However, in climates where freezing is not a concern, the unoccupied mode could simply shut down the HVAC to conserve even more power. Doing so would have the added benefit of conserving power in the remote sensors by not monitoring and transmitting sensor data at regular intervals. While a small power draw, the remote devices are often battery powered, where any power draw makes a difference.

148. Also, as to manual mode changes, while allowing for the same would be preferable in many situations, unless the system allowed for remote control, the

user would typically need to enter the space to change the programming on the thermostat or other controller, in which case the occupancy sensor would be triggered before any mode change could be entered.

149. Thus, it is my opinion that a POSA would have found this limitation to have been obvious under even a narrower construction of “only,” such as when the system is completely inactive to save even more power.

“[1G)]3) for the central control program, calculate an average of the received environmental sensor values and use the average result as a control value which is compared with a setpoint stored in the memory of the central control program to determine actuation of the space conditioning equipment.”

150. In my opinion, Rein discloses and/or suggests this claim limitation. Also, for context, such averaging methods were known in the field regardless of Rein. Rein’s system calculates and uses a temperature average from readings from multiple remote environmental sensors. Ex. 1004, 2:21-25; 22:38-50; 23:58-24:24. The averaged value is then compared to a stored setpoint in order to determine whether to actuate the HVAC equipment. Ex. 1004, 24:4-23 (“the zone setpoint 86C or 86D [may] be used as a master setpoint 104G for comparison with averaged or weighted temperature information from a plurality of zones”); 18:41-51; 22:38-50; 23:58-24:24. In this manner, the system is able to account for the fact that different sensors in different locations read different temperatures, some of which may lead

to actuation of the HVAC and some of which may not lead to actuation. This was a known manner of operation in the field that accounted for the fact that multiple temperature reading could derive from one zone and the system needed to use one temperature to compare the current temperature to the setpoint. Using an average allows the system to create a temperature value for that comparison in order to determine whether or not to actuate the HVAC (e.g., to provide cool air).

CLAIM 2

“2. The system of claim 1 wherein averaging of received environmental sensor values is calculated by simple averaging or a weighted averaging depending on relative spaces of occupied rooms.”

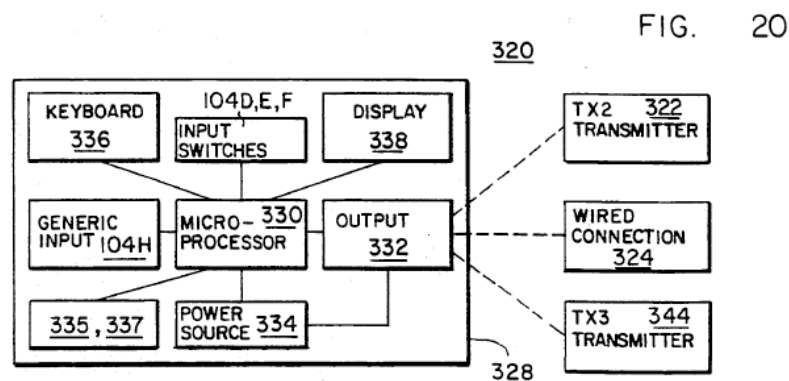
151. In my opinion, Rein discloses and/or suggests this claim element. As discussed with respect to limitation [1G)]3), Rein describes using an average reading from multiple environmental sensors. Ex. 1004, 2:21-25; 22:38-50; 23:58-24:24. Rein indicates that this may involve a simple average or the application of weighted averages. *Id.*, 24:4-23 (“comparison with averaged or weighted temperature information from a plurality of zones”); 18:41-51. When using weighted averages, Rein describes that the weights can be applied differently depending on which zone is being monitored. *Id.*, 23:58-24:24. Therefore, Rein teaches that the system may simply average the temperature from all sensors or apply a weighted average depending on the different zones comprising the conditioned space. These were

known methods of operation. Weighted averages allowed the user to prioritize a particular area. For instance, the reading from the master bedroom could be weighted higher than the reading from a guest bedroom.

CLAIM 3

“3. The system of claim 2 wherein a display and a user interface are coupled with the input/output unit of the central processing device so the central control program causes a display of averaging methods for averaging received environmental sensor values.”

152. In my opinion, Rein discloses and/or suggests this claim limitation. Figure 20 shows a setup tool 320. Rein describes that a user may program the system utilizing a setup tool 320, which includes a keyboard 336, a display 338, an output 332 and a number of input switches 104(D-F). Ex. 1004, 24:54-25:32. The setup tool 320 communicates with the central receiver 66 on the TX2 communication medium via the TX2 transmitter. *Id.*, Fig. 20; 24:54-25:32.



Ex. 1004, Fig. 20.

153. Using the setup tool 320, a user may input commands that indicate via, e.g., data packet 104, that data, such as the temperature, from certain zones should be averaged and in what manner. *Id.*, 23:15-31 (“receipt of command packet 104 from setup tool 320”); 9:47-56; 23:58-24:24; 25:6-9; 5:33-44. Different methods of averaging are discussed with respect to claim 2 above. Notably, data packet 104 resulting from the user programming through setup tool 320 includes instructions as to the manner of averaging data from different zones. *Id.*, 23:58-24:24; 24:54-25:32. This suggests what was already well known—that the user inputs commands concerning the averaging through an interface that includes display 338, such that the options would be displayed to the user. As I discussed with respect to claim 2, the user would indicate how to weight the sensors. To input that information, it would be expected that the display would allow for the selection of averaging and the preferred weighting. Thus, displaying the same for user selection would have been obvious.

CLAIM 4

“4. The system of claim 3 wherein the central control program further causes a display indicating that a user may select an averaging method through the user interface and thereafter accepting user input selecting one of the averaging methods.”

154. As I explained above with respect to claim 3, Rein discloses and/or suggests a display for a user to select an averaging method and accepting the user input.

CLAIM 5

“5. The system of claim 1 wherein the space conditioning equipment comprises zone control means so that only occupied rooms have their space affected by the space conditioning equipment.”

155. The possible constructions of “zone control means” are discussed in the Claim Interpretation section, above. Under one interpretation, the corresponding structures in the specification are the structures associated with the central processor (i.e., CPU, clock, memory, input/output unit). For that interpretation, the corresponding structures in the prior art have already been addressed in connection with claim 1 above (*see* limitation [1]D)).

156. The other interpretation is that the corresponding structures are the duct dampers. Ex. 1001, 4:9-18. Rein describes dampers. In particular, Rein describes dampers 74 that control the flow of air to certain areas of the space. Ex. 1004, 10:15-68; 11:42-52; 12:34-38; 13:12-22; 14:64-68; claim 9. Kates also describes the use

of dampers to control the flow of air to different zones/rooms so that unoccupied rooms are not heated or cooled. Ex. 1005, 2:63-3:14; 4:26-36; 4:62-5:32; 6:5-27; 8:53-58; 9:1-3; 10:13-37; 13:60.

157. Kates explains that “[t]he sensors can detect where and when heated or cooled air is needed. The sensors send information to a central controller that activates the zoning system, adjusting motorized dampers in the ductwork and sending conditioned air only to the zone in which it is needed.” Ex. 1005, 1:13-45. Kates describes dampers included in its “Electronically-Controlled Register Vent (ECRV).” Ex. 1005, 2:1-60; 15:15-23.

158. In my opinion, a POSA would have understood that dampers, as taught by Kates, would be used to prevent conditioned air from being sent to unoccupied rooms. Ex. 1005, 1:39-45. This practice was well known⁴ in the field and a purpose

⁴ For support on this understanding of the knowledge in the field, U.S. Patent No. 4,407,447 (“Sayegh”) issued in 1983 and discloses a system “directed to directed to heating or cooling rooms which are occupied by human beings—not empty rooms.” Ex. 1013, 6:11-16; Abstract (“Upon the detection of the presence of a human being in a room by the occupancy sensor, the computer sends a signal to the air damper controlling the air flow into that room to open the air flow through that air duct.”); 2:40-3:10; *see also* Ex. 1014, 6:42-48 (“Logic element 15 is programmed to provide control signals to cause heat to be provided to room 10 when the signal from temperature sensor 11 falls below a first preselected limit if, but only if, the signal from occupancy sensor 12 indicates that room 10 is occupied.”).

of Kates operations is to avoid wasting resources. Thus, a POSA would have appreciated that Kates suggests the claimed zone control means.

CLAIM 6

“6[Pre]. An occupancy response system ... comprising:”

159. As I set forth under claim element 1[Pre], a person of ordinary skill in the art would have found the subject matter of claim 1 obvious over Rein and Kates.

“[6]A). two or more environmental sensors adapted . . .;”

160. As I set forth under claim element [1]A), Rein discloses and/or suggests this claim element.

“[6]B). two or more occupancy sensors adapted ...;”

161. As I set forth under claim element [1]B), Rein discloses and/or suggests this claim element.

“[6]C). ... two or more of the remote sensors each comprise ...;”

162. As I set forth under claim element [1]C), Rein discloses and/or suggests this claim element.

“[6]D). a central processor for the central control device including ...;”

163. As I set forth under claim element [1]D), Rein discloses and/or suggests this claim element.

“[6]E). a remote processor for each of the remote sensors including ...;”

164. As I set forth under claim element [1]E), Rein and Kates combined disclose and/or suggest this claim element.

“[6]F). for the central control device or remote sensors ... their input/output units further including ...;”

165. As I set forth under claim element [1]F), Rein discloses and/or suggests this claim element.

“[6G)]1). the control programs causing ...;”

166. As I set forth under claim element [1G)]1), Rein and Kates suggest this claim element.

“[6G)]2). read current signals from a coupled environmental sensor and a coupled occupancy sensor and transmit them for storage in the memory of the central control device so that values of environmental conditions are associated with their source of occupied or unoccupied rooms;”

167. In my opinion, Rein discloses and/or suggests this claim element. This element differs from claim 1 in that there is a requirement to store values concerning environmental conditions in a memory so that they are associated with a source. This

would have been a routine expectation of a system. Indeed, if the sensor data was not stored in a manner that allowed the system to know the source of the data, the data would have been of little value.

168. As discussed with respect to claim limitations [1]A), [1]B), and [1G)]2), Rein teaches that zone sensors 58 and comfort sensors 110 read current signals from a temperature sensor 64 and an occupancy sensor. Ex. 1004, 9:57-62; 12:21-33; 15:47-50; 16:48-53; 25:35-47 (“the current zone temperature 86B . . .”). As discussed above with respect to limitation [1]E), each zone sensor 58 and comfort sensor 110 includes a CPU that reads signals from the individual sensors included in those devices. In Rein, zone sensors 58 and personal comfort sensors 110 operate to “responsively communicate information and react to changes in zone conditions.” *Id.*, 4:4-7; 5:23-32; 8:27-32; 9:6-8. The contents of the signals sent from zone sensor 58 and comfort sensor 110 are shown in Figs. 6 and 9, respectively. Rein’s system sends values/data related to the current temperature and the occupancy state. In addition, Rein explains that both zone sensor 58 and comfort sensor 110 transmit in their respective packets an identifier that associates the data with the sending device (and, thus, corresponding zone). *Id.*, Fig. 5, 6, and 9; 13:34-14:23 (“zone sensor identification code 86A”); 16:34-42 (“personal comfort identification code 100A”); 16:54-65. As also discussed above, the zone sensors may be associated with individual rooms. *Id.*, 8:27-36; 11:50-52.

169. Rein describes that each controller 68 connected to central receiver 66 stores in its memory 408 the identifier 86A of zone sensors 58 that are designated to it. *Id.*, 10:55-58. Also, central receiver 66 maintains an internal list of valid zone sensors 58 to use in verifying the validity of transmissions it receives. *Id.*, 12:54-13:2. This allows the signals transmitted by zone sensors 58 to the central receiver 66 to reach the appropriate controller 68 to control HVAC equipment for a specific zone. *Id.*, 10:58-11:6. To control a specific zone, the system would need to know from which zone the data was sent.

170. Once received by the central receiver 66 and validated, data from signals sent by zone sensors 58 (or comfort sensors 110) is stored in memory 364. *Id.*, Fig. 23; 9:40-45 (“A memory device 364 is provided to store such information as valid transactions and lists of valid message transmitters,”). After being validated, the various data are stored in memory 364. *Id.*, 12:26-33; 22:65-67; 23:4-6. Indeed, Rein explains that “[e]ach time a relevant data packet 86 is received, data files ***associated*** with the particular zone sensor 58 or personal comfort sensor 110 are updated” *Id.*, 21:19-34. In this manner, the data/values from each packet are associated, in memory 364, with the identity of zone sensor 58 or comfort sensor 110 that transmitted them and, thus, the data is associated with the room in which that sensor is located. *Id.*, 9:57-62; 12:21-26; 14:6-13; 16:34-37. This would be understood to be a standard operation in the field in order to make the data useful

for the objectives—e.g., knowing the temperatures in particular locations and controlling corresponding HVAC systems to maintain setpoints in this locations.

171. As discussed above, zone sensors 58 also preferably generate signals indicating occupancy. *Id.*, Fig. 21; 16:48-53; 25:35-47. Thus, a POSA would have understood that the occupancy signals are also included in data packet 86 and stored in its memory in association with the corresponding zone sensor 58. *Id.*, Fig. 21; 25:35-47; 16:44-53.

“[6G)]3). for the central control program, calculate an average”

172. As I set forth under claim limitation [1G)]3), Rein discloses and/or suggests this claim limitation.

CLAIM 7

“7. The system of claim 6 wherein averaging of received environmental sensor values is calculated by simple averaging or a weighted averaging where environmental condition Values from occupied rooms are given substantially more value than those of vacant rooms.”

173. As I set forth under claim 2, Rein discloses and/or suggests this claim element.

CLAIM 8

“8. The system of claim 6 wherein where occupancy sensors include infra-red motion detectors.”

174. In my opinion, Kates discloses and/or suggests this claim element. A POSA would have readily appreciated that infra-red was an obvious choice for an occupancy sensor. Infrared motion detectors have long been utilized in the field to detect occupancy and/or motion. Indeed, Kates describes that occupancy sensors used in its system may comprise infrared sensors. Ex. 1005, 10:12-24 (“The occupant sensor 1201, such as, for example, an infrared sensor, motion sensor, ultrasonic sensor, etc. senses when the zone is occupied.”). Thus, Kates discloses and/ or suggests this claim element.

CLAIM 9

“9. The system of claim 6 wherein environmental sensors include temperature sensors and humidity sensors.”

175. In my opinion, Rein discloses and/or suggests this claim element. Also, a POSA would have appreciated that humidity sensors were commonly used in HVAC systems in as much a user’s perception of the temperature is affected by the relative humidity of the space. As discussed above with respect to claim 1, Rein describes remote sensors that include multiple individual sensors, including temperature sensors. Ex. 1004, 4:55-57 (“sensor for sensing environmental conditions”); 8:28-38; 9:6-8; 9:57-62; 15:41-50; 16:34-42; 17:16-19; 23:26-29.

176. Rein also describes that humidity sensors may be attached to zone sensors 58, personal comfort sensors 110, or the setup tool 320 via the generic sensor input to measure humidity in an area. *Id.*, 25:35-47; 24:62-66; 16:44-48 (“a humidity sensor (not shown)”). Rein teaches that multiple remote sensors may be utilized in a zone, any of which may include occupancy sensors and/or humidity sensors. A POSA would have appreciated that it was known to combine each of humidity sensors, occupancy sensors, and temperatures sensors in remote sensor systems such that they are all in one unit.

177. Similarly, Kates also demonstrates this point because humidity sensors can be included in zone thermostats along with temperature sensors. Ex. 1005, 15:35-50.

CLAIM 10

“10. The system of claim 7 wherein a display and a user interface are coupled with the input/output unit of the central processing device so the central control program causes a display of averaging methods for averaging received environmental sensor values.”

178. As I set forth under claim 3, Rein discloses and/or suggests this claim element.

CLAIM 11

“11. The system of claim 10 wherein the central control program further causes a display indicating that a user may select an averaging method through the user interface and thereafter accepting user input selecting one of the averaging methods.”

179. As I set forth under claim 4, Rein discloses and/or suggests this claim element.

CLAIM 12

“12. The system of claim 6 wherein the space conditioning equipment comprises zone control means so that only occupied rooms have their space affected by the space conditioning equipment.”

180. As I set forth under claim 5, Rein discloses and/or suggests this claim element.

XI. GROUND 2: Claims 1-12 Are Obvious Over Rein and Riley

181. In my opinion, the subject matter of claims 1-12 would have been obvious to a POSA in view of Rein and U.S. Patent No. 5,395,042 (“Riley”) (Ex. 1009).

A. Effective Prior Art Dates of Rein and Riley

182. Riley issued on March 7, 1995, and I understand that it is thus prior art.

183. As discussed above, I understand that Rein was of record during prosecution of the original application, but that it was not discussed on the record by the Examiner or Applicant.

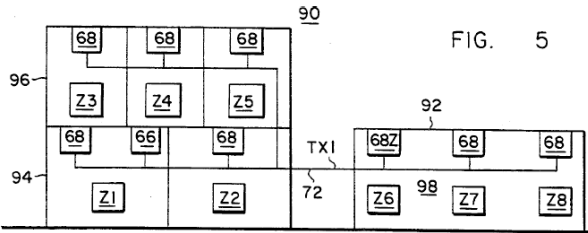
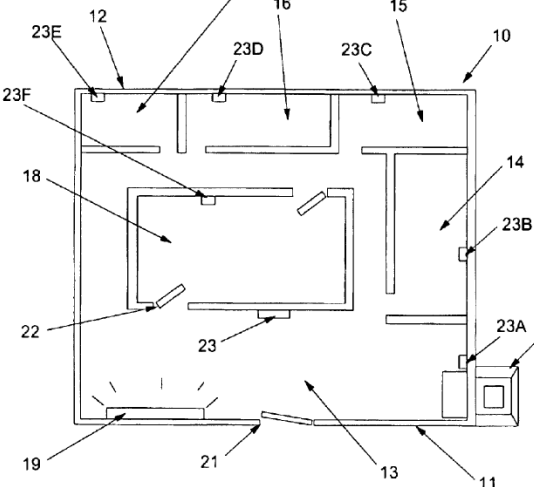
184. I understand that Riley was not of record during the prosecution of either the original or reissue application.

B. Overview of the Combination

185. In my opinion, a POSA would have found the elements of the challenged claims to have been suggested by the combination of Rein and Riley. I rely on Riley to establish, at least, the obviousness of the limitations of the RE'437 patent directed to “read[ing] current signals from a coupled environmental sensor and transmit[ting] them for storage in the memory of the central control device only if occupancy is detected,” as I describe in more detail below. I also rely on Riley to establish, at least, the obviousness of the limitations of the RE'437 patent directed to utilizing a single central control device that stores the control programming—as well as the signal data from sensors—in its memory, as I describe in more detail below.

1. Overview of Rein

186. Rein is similar to the RE'437 patent. Shown below are Fig. 5 of Rein (left side), compared with Fig. 1 of the RE'437 patent (right side):

 FIG. 5	 FIG. 1
Rein (Ex. 1004), Fig. 5	RE'437 patent, Fig. 1

187. In both systems, there are conditioned spaces that use remote sensors to monitor the spaces being conditioned. Ex. 1004, 1:10-12; 2:16-20; Ex. 1001, 1:10-26, 4:66-5:5. Like the RE'437 patent, Rein's system sends information from environmental sensors (e.g., temperature) and occupancy sensors, to a central device (central receiver 66 alone or in combination with controller 68 and/or building automation system 76) in order to control HVAC operations. Ex. 1004, 5:21; 13:14-18; 14:17-38; 14:58-15:11, 24:26-30; 9:50-56. While Rein describes central receiver 66 for receiving data and controller 68, along with automation system 76, for receiving and acting in response to data from the remote sensors, whether to integrate those different elements would have been a simple design

choice. A POSA would have appreciated where to, for instance, combine transceiver functionality and, for instance, controller functionality in one device would have been simply a well-known design option.⁵ With these systems, sensor information was (and still is) used to maintain setpoint programming in which the temperature of the conditioned space is kept close to a specified setpoint. Ex. 1004, 1:67-2:6.

188. Both systems employ the use of temperature sensors and occupancy sensors, as well as humidity sensors, in controlling HVAC operations. Ex. 1004, 9:67-10:14; 12:54-65; 22:38-50; 23:58-24:53; 25:6-32; Ex. 1001, 6:17-7:9. Rein describes, for example:

“The present invention also contemplates a generic sensor input connection 49,104H, 359 respectively associated with the zone sensor 58, the personal comfort sensor 110, and the setup tool 320. The generic sensor input 49,104H, 359 allows an external device (not shown) such as a humidity or occupancy sensor to be attached to the zone sensor 58, the personal comfort sensor 110, or the setup tool 320. The zone sensor 58, the personal comfort sensor 110, or the setup tool 320 recognizes the attachment of a generic sensor to the generic sensor input 49,104H, 359, identifies the type of generic sensor, and thereafter uses the generic sensor in a conventional manner.”

⁵ To the extent I refer to Rein’s central receiver 66 or its central device, the same should be understood to include control functionality from controller 68 and/or automation system 76.

Ex. 1004, 25:35-47.

189. In Rein, zone sensors 58 and personal comfort sensors 110 (collectively, remote sensors) transmit information to the central device when there is a change of state. Ex. 1004, 5:21-32; 9:6-20 (“after a change of state”); 13:59-61; 17:39-43; 23:15-38; 8:28-34; 8:55-57; 25:35-47; Figs. 17, 21. According to Rein, the objective of its remote sensors is “to responsively communicate information and to react to changes in zone conditions.” Ex. 1004, 8:39-9:13; 15:29-57. Similarly, when occupancy is detected, occupancy sensors indicate to the central device the change of state from unoccupied to occupied. Ex. 1004, 16:44-53 (“data packet 100 indicates the occupied/unoccupied status 110i of the area being monitored by the occupancy sensor”).

190. Rein thus describes (i) the use of occupancy sensors, (ii) different programming during occupied vs. unoccupied modes of operation (e.g., shutting off late at night, but allowing a change back to an occupied mode (Ex. 1004, 9:67-10:14)), and (iii) transmitting sensor data upon a change in state of the room (Ex. 1004, 9:6-20). It was well known in the field that remote sensing devices in HVAC systems would typically send back sensor data at, for instance, regular intervals, upon the change of a mode, and detection of occupancy. As for regular intervals, in an HVAC system, when maintaining a setpoint, sensors typically send back data at regular intervals so that the HVAC system may determine what steps are needed to

maintain the setpoint. Regards mode changes, when a mode of operation is changed (e.g., a manual change from an unoccupied mode to an occupied mode) data is typically sent so that the system can determine what actions are needed to achieve the setpoint for the new mode. Also, when a sensor detects occupancy the mode of operation is automatically changed.

191. Rein's system also calculates and uses a temperature average from readings received from multiple remote environmental sensors. Ex. 1004, 2:21-25; 22:38-50; 23:58-24:24. The averaged value is then compared to a stored setpoint in order to determine whether to actuate the HVAC equipment. Ex. 1004, 24:4-23.

2. Overview of Riley

192. Riley's system utilizes sensors that transmit conditions such as temperature, occupancy, and humidity of spaces (e.g., rooms) to a base station. Ex. 1009, 1:5-11; 2:32-54; 3:3-36; 4:25-49; 15:55-68; 19:2-30; 24:17-52; 24:59-26:28. Riley's system may be programmed in various ways to maximize energy efficiency when spaces are unoccupied. *Id.*, 2:32-54; 3:3-36; 8:16-20; 9:2-12. One of the unoccupied modes allows for the temperature to drift from the preferred setpoint during vacancy of the space. *Id.*, 8:10-20; 25:3-10. After a prolonged period of vacancy, the system will suspend operations completely until a sensor detects that the space has become occupied. *Id.*, 24:17-52.

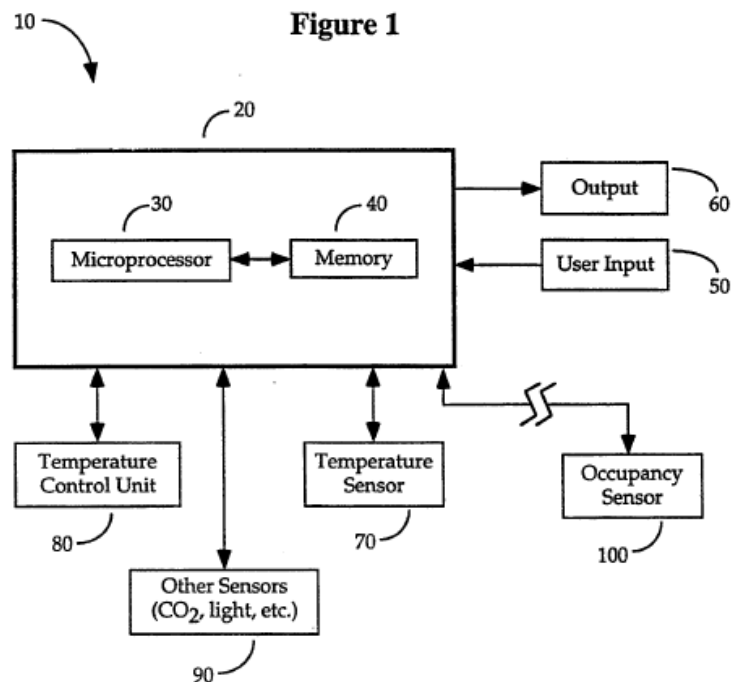
3. Overview of the Combination

193. In my opinion, a POSA would have found it obvious to combine Rein and Riley to provide a system that controls HVAC equipment based on signals from occupancy and environmental sensors, allowing for control of occupied spaces differently than unoccupied spaces. A POSA would have also found obvious from the combination to apply Riley's HVAC control of occupied spaces and Rein's averaging of temperature values to calculate a setpoint based on occupied rooms.

194. As I discussed above with respect to Ground 1, Rein describes a system that uses wireless communication between the HVAC controllers and temperature sensors in the zones, which description meets most limitations of the claims. Ex. 1004, 1:10-12. Rein's system, like many systems at the time, utilizes information from both environmental (e.g., temperature) and occupancy sensors to control HVAC operations. As discussed above, Rein utilizes central receiver 66 (along with, e.g., controller 68) to receive the data from sensors—storing the data in memory—and actuate the HVAC equipment in response to the data. Ex. 1004, 9:21-10:38.

195. Rein does not explicitly describe reading current signals from an environmental sensor and transmitting those signals for storage “only” upon the detection of occupancy, although such feature would have been obvious in view of Rein. In this Ground, Riley provides a more specific teaching of that feature.

196. Like Rein, Riley describes a control system for HVAC equipment in which remote sensors (e.g., remote sensor units 520-540) transmit information to a central device (e.g., base stations 20, 510, 620, 800). Ex. 1009, 25:11-53; Figs. 6, 7. Riley's remote sensors "may include ... sensors ... for sensing temperature, occupancy, and other conditions such as light intensity and the presence of CO₂ or other gases." *Id.*, 25:11-19; Fig. 1.



Ex. 1009, Fig. 1.

197. When an occupancy sensor detects occupancy in a previously unoccupied room, as would be expected, signals are transmitted to a central control device so that the system may employ the correct setpoint programming intended for an occupied room. *Id.*, 2:31-54; 3:3-35; 4:30-49; 8:10-20; 9:4-12; 19:2-30; 24:17-

52; 25:3-53. This may include actuating the HVAC to blow cool air as needed. As discussed above, Rein teaches that its system may be a retrofit system with a central receiver 66 (in combination with controller(s) 68 and/or system 76) that may be utilized with existing HVAC equipment. Thus, Rein and Riley both describe and/or suggest central controllers. Moreover, a POSA would have appreciated that utilizing a single central device to both receive sensor data and control HVAC equipment to be a simple design choice.

198. As discussed above, in Rein, the occupancy sensor data is sent in a packet together with the current environmental sensor data. Ex. 1004, 9:67-10:14; 15:58-16:9; 16:44-64; 25:38-47; Figs. 9, 13. Also as discussed above in Ground 1, while Rein does not expressly state that a data packet is transmitted upon a remote sensor detecting occupancy, the would have been a function expected by a POSA. Specifically, Rein describes using different programming for occupied and unoccupied modes. In order for a system to switch to the unoccupied mode and reach the setpoint for that mode, a POSA would have appreciated that the detection would lead to the transmission of the occupancy signal along with the current environmental data. This would allow the system to determine what action to take, if any, to reach the setpoint for the occupied mode. Indeed, Rein describes that the occupancy signal is transmitted along with the current temperature. Ex. 1004, 9:67-10:14; 16:44-64; 25:38-47; Figs. 6, 9, 13. Riley teaches that whenever occupancy is

detected, the base station is notified—along with an indication of the current temperature—so that it may implement the correct setpoint programming for the occupied mode.

199. Riley describes what was conventionally known in the field regarding the use of occupied and unoccupied modes in HVAC systems. Specifically, it was long known that, when a space was occupied, it was preferable to keep the setpoint at the user’s preferred target temperature and, when the space was unoccupied, to let the temperature in the room to drift away from setpoint in order to conserve energy. Ex. 1009, 8:10-20. In such operations, the unoccupied mode typically allowed the temperature to drift from the target setpoint by a certain amount, so that the system can get back to the target in a reasonable amount of time when the space becomes occupied again. *Id.*

200. Riley also describes alternatives to this typical operation in which system operations can be suspended completely for, as an example, prolonged periods of vacancy. Ex. 1009 at 24:17-52 (“the system may be programmed to suspend operations after a predetermined large period of time, ***until reset manually or when someone returns into the space***”). During that full suspension of operations, no transmissions of environmental data would be sent, as would have been appreciated by the POSA based on the plain language in Riley. Specifically, the data would not be needed during a full suspension of operations because there

would be no setpoint to maintain. The primary purpose of suspension of operations is to conserve energy, including the battery power of the remote sensors. Ex. 1004, 23:45-47 (“Going ‘dormant’ is a method of conserving a non-renewable power source 59 such as a battery 59.”); 8:39-43; Figs. 6, 9. Once a signal indicating occupancy is received by the base station, operation resumes and environmental conditions are transmitted to the base station. Ex. 1009 at 24:17-52 (“a temporary suspension of operation altogether, until operation is again triggered by someone reentering the space.”).

201. In my opinion, a POSA would have understood that the environmental conditions are transmitted upon occupancy detection because the system resumes operations to reach the target setpoint and the current temperature of the space would be needed in order for the system to know what to do (e.g., blow hot or cold air). And, as already established, Rein teaches sending environmental data with the packet containing the occupancy information.

202. While Riley describes a full suspension of operations, it adds that the suspension may be accompanied by “absolute boundaries, such as 40° F to 100° F” as an option for climates that are likely to experience extreme weather. Ex. 1009, 24:24-56. However, Riley offers this as an option and a POSA would have understood that the same is not required for climates (or times of the year) that do not experience extreme temperatures. As I discussed above in Ground 1 (which

positions and explanations are incorporated herein), these boundaries were often used to avoid conditions such as freezing pipes or dangerous heat build up in a space. Of course, a POSA would appreciate that such boundaries would not be needed in climates where extreme conditions do not occur.

203. In my opinion, a POSA would have appreciated that suspending operations during prolonged vacant states—in which no data needs to be transmitted—would be useful to the system in Rein (or any HVAC system using occupancy sensors), in order to further conserve energy. Ex. 1009, 24:16-24 (“to provide further savings of energy”). Indeed, Rein describes the intention to use energy “in the most efficient manner.” Ex. 1004, 17:16-38; 9:67-10:16 (“unoccupancy”). Therefore, there would have been a clear motivation to combine the teachings. Also, it is my opinion that a POSA would have had a reasonable expectation of success in making the combination given the similarity of the systems and the fact that the combination would require simply programming a different mode of operation in similar equipment.

204. With the combination, the system in Rein would enter a mode in which data would only be sent to a central controller once the system is awakened by occupancy detection, as taught in Riley. In particular, Rein already teaches (i) the use of occupancy sensors, (ii) different programming during occupied vs. unoccupied modes of operation (Ex. 1004, 9:67-10:14), and (iii) transmitting sensor

data upon a change in state of the room (Ex. 1004, 9:6-20). This would allow a system operating in an unoccupied mode (when people are not in the building), to switch to an occupied mode automatically when a person enters the relevant zone. In this way, the system can re-activate and begin sending environmental conditions, such as temperature, so that the HVAC system can determine current conditions and, thus, what needs to be done to reach the normal occupied setpoint.

205. Thus, the features of claims 1-12 would have been obvious over the combination of Rein and Riley for the reasons set forth below, including under any construction of “only.”

C. Rationale (Motivation) Supporting Obviousness

206. I provide a detailed explanation of the rationale (motivation) supporting obviousness below, under each element as appropriate.

D. Reasonable Expectation of Success

207. In my opinion, a POSA in the relevant timeframe would have had a reasonable expectation of success in implementing the combination (as described with particularity below in the claim mapping section) of Rein and Riley. In my opinion, the art was relatively predictable in the relevant timeframe. Programmable HVAC systems were known at this time and a POSA would have been able to make any necessary modifications to implement the combination, including

adjusting programming and selecting hardware for performing the functions. This is discussed in more detail in the claim mapping section, where appropriate.

E. Analogous Art

208. In my opinion, Rein and Riley are in the same field as the RE'437 patent (building energy management and controls). Ex. 1001, 1:10-26, 4:66-5:5; Ex. 1004, 1:10-12; 2:16-20; Ex. 1009, 1:5-11; 2:32-54; 3:3-36.

209. Specifically, these references address controlling heating and cooling systems, calculation and implementation of setpoints, and HVAC control utilizing signals from occupancy and environmental sensors. Ex. 1001, 1:10-26, 4:66-5:5; Ex. 1004, 1:10-12; 2:16-20; Ex. 1009, 1:5-11; 2:32-54; 3:3-36. The programming of these systems would have been known to a POSA.

F. Claim Mapping

210. In the claim mapping below, I have added numbering and lettering in brackets (*e.g.*, [1]A), [1]B)) to certain claim limitations, to facilitate the discussion.

Independent Claim 1

“1[Pre]. An occupancy response system ... comprising:”

211. As I set forth under Ground 1, claim limitation 1[Pre], Rein discloses and/or suggests this claim element.

212. Similarly, Riley discloses and/or suggests this claim element. Ex. 1009, 2:31-54; 3:3-35; 4:30-49; 8:10-20; 9:4-12; 19:2-30; 24:17-52; 25:3-26:3; Figs. 1, 6, 7, 8.

“[1]A) two or more environmental sensors adapted ...;”

213. As I set forth under Ground 1, claim limitation [1]A), Rein discloses and/or suggests this claim element.

214. Similarly, Riley discloses and/or suggests this claim element. Ex. 1009, 2:31-54; 4:25-49; 7:29-8:7; 15:55-68; 16:11-34; 24:59-64; 24:68-25:2; 25:11-26:3; Figs. 1, 6, 7, 8.

“[1]B) two or more occupancy sensors adapted ...,”

215. As I set forth under Ground 1, claim limitation [1]B), Rein discloses and/or suggests this claim element.

216. Similarly, Riley discloses and/or suggests this claim element. Ex. 1009, 2:31-54; 3:3-35; 4:30-49; 8:10-20; 9:4-12; 19:2-30; 24:17-52; 25:3-53; Figs. 1, 6, 7, 8.

“[1]C) ... two or more of the remote sensors each comprise ...,”

217. As I set forth under Ground 1, claim limitation [1]C), Rein discloses and/or suggests this claim element.

218. Similarly, Riley discloses and/or suggests this claim element. Ex. 1009, 2:31-54; 3:3-35; 4:25-49; 7:29-8:7; 8:10-20; 25:3-26:3; Figs. 1, 6, 7, 8.

“[1]D) a central processor for the central control device including: 1) a central processing unit; 2) a real time clock; 3) a memory coupled to said central processing unit for storing a central control program and data, said data including at least one of the values of the environmental conditions sensed by the environmental sensors; and 4) an input/output unit coupled to the central processing unit, to the space conditioning equipment for issuing control signals thereto, and to a reception interface adapted to receive signals representing environmental conditions at a remote sensor;”

219. As I set forth under Ground 1, claim limitation [1]D), Rein discloses and/or suggests this claim limitation.

220. Similarly, Riley discloses and/or suggests this claim limitation. Ex. 1009, 2:31-3:35; 4:9-49; 9:3-12; 25:54-26:28; 27:15-37; Figs. 1, 6, 8. Riley teaches a processor for a central control device (base stations 20/510/620/800). Ex. 1009, 3:3-15; 25:11-65. The control device includes a microcontroller and a memory, “and can be any one of a number of commercially available microcontrollers, such as the Texas Instruments TMS 370 Series microcontroller,” which, in my opinion, a POSA would have understood to suggest each of a CPU, real-time clock, memory, and input/output units, as are included in the TMS 370 Series (the specification sheet is provided as Ex. 1010). *Id.*, 4:9-24; 25:54-65; Ex. 1010, 256 (describing software used to implement a real-time clock). While the TMS 370 does not specify a real-time clock, as I have discussed above, a real-time clock was one of two known

options—a real-time or non-real-time clock. Also, in programmable HVAC systems, a POSA would have expected a real-time clock to allow for different setpoint programs on different days of the week (or month). A real-time clock allows for such programming. Riley allows for such programming and, thus, would have been expected to use a real-time clock. Ex. 1009, 1:32-42; 2:15-21; 27:58-28:30.

221. Also, the base station of Riley has “control programs stored in memory to implement the functions of the invention and to control the ... [H]VAC[.]” *Id.*, 2:31-48.

222. Thus, Rein and Riley disclose and/or suggest this claim limitation.

“[1]E) a remote processor for each of the remote sensors including a central processing unit, a clock, a memory coupled to said central processing unit for storing a transmission control program, and an input/output unit coupled to the central processing unit and to a transmissions interface adapted to send to the central control device signals representing environmental conditions from a coupled environmental sensor; and”

223. In my opinion, Rein and Riley combined disclose and/or suggest this claim limitation. I have discussed Rein with respect to claim limitation [1]E) in Ground 1.

224. Riley describes that control programs stored in the microcontrollers of remote sensors (520) control their operation. Ex. 1009, 2:31-46; 25:20-32. The remote sensor may be controlled by a microcontroller such as Microchip’s

“programmable” PIC16C54, which was known to have a CPU, clock (which is a real-time clock), memory, and input/output units (the specification sheet is provided as Ex. 1011). *Id.*, 25:20-32. Riley’s remote sensors include occupancy sensors that detect changes in occupancy. *Id.*, 2:31-54; 3:3-35; 4:30-49; 8:10-20. The remote sensors 520 are “programmed to work in cooperation” with base station (20/510/620/800). Remote sensors 520 transmit the changes in the occupancy of a space to a base station so that it may implement the appropriate occupied or unoccupied mode of operation utilizing its control programs. *Id.*, 2:31-54; 3:3-35; 4:30-49; 9:4-12; 25:3-53; Figs. 1, 2, 7. Riley also teaches that the manner in which occupancy detection is acknowledged may be changed via user programming. *Id.*, 19:2-30. Thus, Riley teaches and/or Rein suggest storing programming to detect a change in occupancy and transmit a signal so as to control HVAC systems based on the same. And, again, this was a common operation in the field.

***“[1]F) for the central control device or remote sensors
... their input/output units further including ...,”***

225. As I set forth under Ground 1, claim limitation [1]F), Rein discloses and/or suggests this claim element.

226. Similarly, Riley discloses and/or suggests this claim element. Ex. 1009, 4:9-48; 25:11-53; Figs. 1, 7, 8.

“[1]G) the control programs causing a coupled central processing⁶ unit to selectively: 1) detect occupancy or vacancy of a nearby space from signals from a coupled occupancy sensor;”

227. As I set forth under Ground 1, claim limitation [1G)]1), Rein and Riley suggest this claim element.

228. Further, Riley use of control programs to perform this function is discussed above with respect to elements [1]D) and [1]E).

“[1G)]2) read current signals from a coupled environmental sensor and transmit them for storage in the memory of the central control device only if occupancy is detected”

229. In my opinion, Rein and Riley suggest this claim element. As discussed above with respect to limitation [1]B) in Ground 1, Rein describes reading signals from a temperature sensor and transmitting them to central receiver 66 (and controller 68). Rein also describes that data from each signal transmitted to central receiver 66 by zone sensor 58 or comfort sensor 110 is stored in memory. Ex. 1004, 9:40-45; 21:19-34 (“Each time a relevant data packet 86 is received, data files associated with the particular zone sensor 58 or personal comfort sensor 110 are updated . . .”).

⁶ The specification of the RE’437 patent indicates that the coupled processor affected by this control program is a processor associated with a remote sensor. Ex. 1001, 2:23-27; 6:25-60.

230. As discussed in the claim interpretation section above, Patent Owner’s implied claim interpretation in the counterpart litigation treats “only” as precluding triggers other than, e.g., overrides of the current mode. Riley applies under Patent Owner’s implied construction as well as a narrower construction of “only.”

231. As established in Ground 1, Rein teaches that zone sensors 58 and comfort sensors 110 read current signals from temperature sensors and occupancy sensors. Ex. 1004, 9:57-62,12:21-33; 15:47-50; 16:48-53; 25:35-47. In Rein, transmission of current sensor readings from the temperature sensor may occur at regular intervals, at the time of an override that sets new programming, and upon a change of state which, as discussed in Ground 1, a POSA would have understood may be generated by a change in occupancy. *Id.*, Fig. 17; 23:15-57.

232. A POSA would have understood that whether to use all of these options or to select one of those triggers would have been a design choice from among a few known options. Notably, Rein describes unoccupied modes and sleep modes for conserving energy. Ex. 1004, 9:6-8; 9:67-10:14; 15:58-16:9; 16:48-64; 25:38-47.

233. In my opinion, a POSA would have appreciated that the level of power conservation in an unoccupied mode may depend on a number of considerations. For a home, a POSA would understand that a homeowner may not want the unoccupied temperature level to stray too far from the occupied setpoint so that, when the homeowner returns home, the house is not uncomfortable and the system

can quickly return to the occupied setpoint (although some homeowners would want the ability to shut off their systems while away on vacation). The needs of an office building over a weekend may be different, such that, for energy savings, the system may want to completely shut down. As Riley teaches, for prolonged periods of unoccupancy of a building, the system designer may opt to provide a more robust energy savings setting where HVAC operations are completely suspended. Riley articulates these different options. Ex. 1009, 3:3-35; 8:10-20; 9:4-12; 24:17-52; 25:3-53.

234. Riley is directed to a similar system for controlling HVAC systems based on the readings from remote sensors (including temperature and occupancy sensors). Ex. 1009, 2:31-54; 3:3-35; 4:30-49; 8:10-20; 9:4-12; 19:2-30; 24:17-52; 25:3-53. Riley describes that data transmitted from a remote sensor is stored in memory when received by the base station. Ex. 1009, 4:40-49; 9:3-12; 19:12-24. Riley also explains that occupancy is used to determine how to operate HVAC equipment in certain zones. Ex. 1009, 2:31-54; 3:3-35; 4:30-49; 8:10-20; 9:4-12; 19:2-30; 24:17-52; 25:3-19; 25:35-53.

235. While Riley describes the more typical unoccupied mode in which the temperature is permitted to “drift” higher by a certain amount (or to a specific setpoint), it also describes more robust unoccupied modes in which the system may suspend operations altogether. Ex. 1009 3:3-15; 24:17-57. For instance, after “a

week, the system could go into a temporary suspension of operation altogether.” *Id.*, 24:37-40; 24:53-55 (“cease or limit operation of the HVAC equipment”). Such operations “minimize[e] wasteful equipment operation when people are absent.” Ex. 1009, 25:3-10. While Riley states that such a full suspension of operation may be accompanied by “absolute boundaries,” that is a “prefer[ence]” where there is a need “to prevent heat or cold damage.” Ex. 1009, 24:37-45.

236. In my opinion, a POSA would have understood whether or not to include such boundaries is an option that would depend on, e.g., the climate in which the building is located. For instance, a building in Nevada may need to be protected against extreme heat, where there would be no such concern for a building in, for example, San Francisco. Absent such boundaries, a POSA would understand that no transmissions of sensor data would be employed inasmuch as all operations would have ceased and because the environmental sensors would conserve energy by entering a sleep mode. Ex. 1004, 8:51-53; 9:4-5; 15:37-41; 23:15-57; *see also* Ex. 1009, 24:17-52.

237. As Riley explains, when operations are altogether suspended after unoccupancy, “operation is again triggered by someone reentering the space.” Ex. 1009, 24:37-40. Thus, Riley teaches and/or suggests restarting operations, and thus sending environment data from the sensors, “only if occupancy is detected,” as claimed. Riley also offers that the system may not restart “until reset manually or

when someone reenters the space.” Ex. 1009, 24:46-52. As to the possible manual reset, under the Patent Owner’s implied construction, such a manual override to change modes would be exempted from the meaning of “only.” Also, Riley’s description pertains to the manual change of a mode (i.e., no longer in the unoccupied mode) such that, while in the unoccupied mode, there would be transmissions only upon occupancy detection. And, absent remote controlling capabilities, a user would typically need to enter the space to change the setting, such that the occupancy sensor would be triggered before the manual override could be entered.

238. Furthermore, in my opinion, whether to change the mode based on occupancy detection alone or upon either of occupancy detection or a manual mode change would be an obvious selection between a limited number of known options. Thus, a POSA would have understood that the “only” limitation would have at least been obvious from Riley under any reasonable interpretation.

239. Once occupancy was detected, occupancy data and environmental sensor data would be transmitted to the central controller. Rein teaches this data being sent together. Ex. 1004, 9:67-10:14; 15:58-16:9; 16:44-64; 25:38-47; Figs. 9, 13. Indeed, as a POSA would have understood, in order to return to the setpoint for the occupied mode, it is preferable to send environmental sensor signals (particularly the current temperature) so that the central control system would know how to

operate the HVAC system to effectuate the setpoint programming (e.g., should the system blow cold air or warm air). Riley describes that the first operation after detecting occupancy is to detect the current temperature, in order to compare the current temperature to the target setpoint. Ex. 1009, 9:3-12.

240. In this regard, Rein's data packets would be transmitted upon the detection of occupancy. Rein's data packets include not only the sensor data from the occupancy sensor, but also the current readings from the environmental sensors. Ex. 1004, 9:57-66; 14:6-23; 16:34-53. At the very least, a POSA would have found it obvious to send the "current" readings inasmuch as the sensor readings are used to control the system such that the system would not know what to do to reach the setpoint for the occupied mode absent knowing current conditions (e.g., should the system blow warm air or cool air to reach the setpoint).

241. For these reasons, a POSA would have understood this limitation to be suggested by Rein and Riley.

"[1G)]3) for the central control program, calculate an average"

242. As I set forth under Ground 1, claim limitation [1]F), Rein discloses and/or suggests this claim element.

CLAIM 2

“2. The system of claim 1 wherein averaging of received environmental sensor values is calculated by simple averaging or a weighted averaging depending on relative spaces of occupied rooms.”

243. As I set forth under Ground 1, claim 2, Rein discloses and/or suggests this claim element.

CLAIM 3

“3. The system of claim 2 wherein a display and a user interface are coupled with the input/output unit of the central processing device so the central control program causes a display of averaging methods for averaging received environmental sensor values.”

244. As I set forth under Ground 1, claim 3, Rein discloses and/or suggests this claim element.

CLAIM 4

“4. The system of claim 3 wherein the central control program further causes a display indicating that a user may select an averaging method through the user interface and thereafter accepting user input selecting one of the averaging methods”

245. As I set forth under Ground 1, claim 3, Rein discloses and/or suggests this claim element.

CLAIM 5

“5. The system of claim 1 wherein the space conditioning equipment comprises zone control means so that only occupied rooms have their space affected by the space conditioning equipment.”

246. In my opinion, Rein and Riley combined disclose and/or suggest this claim element.

247. As discussed with respect to Ground 1, Rein teaches dampers 74 that control the flow of air to certain areas of a space. Ex. 1004, 10:15-68; 11:42-52; 12:34-38; 13:12-22; 14:64-68; claim 9. Riley teaches that “[t]he base station controls the HVAC equipment to maximize energy savings by running the HVAC equipment at minimal levels when the space is not occupied.” Ex. 1009, 3:13-35; 16:25-34; 24:17-52. Riley also teaches that when a room has been unoccupied for a prolonged period of time, the system preferably ceases to condition that space at all. Ex. 1009, 24:17-52. Rein’s dampers would be understood allow for ceasing to send conditioned air to unoccupied spaces, such as when the HVAC controls multiple zones with one unit, such that the unit would be operated to condition the occupied space, but not the unoccupied space.

248. Also, as discussed above with respect to element [1]D) in this Ground, both Rein and Riley together teach and/or suggest the structures of central processor of the central control device.

CLAIM 6

“6[Pre]. An occupancy response system ... comprising:”

249. As I set forth under Ground 1, claim limitation 1[Pre], Rein discloses and/or suggests this claim element.

“[6]A). two or more environmental sensors adapted . . .;”

250. As I set forth under Ground 1, claim limitation [1]A), Rein discloses and/or suggests this claim element.

“[6]B). two or more occupancy sensors adapted ...;”

251. As I set forth under Ground 1, claim limitation [1]B), Rein discloses and/or suggests this claim element.

“[6]C). ... two or more of the remote sensors each comprise ...;”

252. As I set forth under Ground 1, claim limitation [1]C), Rein discloses and/or suggests this claim element.

“[6]D). a central processor for the central control device including ...;”

253. As I set forth under Ground 1, claim limitation [1]D), Rein discloses and/or suggests this claim element.

“[6]E). a remote processor for each of the remote sensors including ...;”

254. As I set forth under Ground 1, claim limitation [1]E), Rein and Riley disclose and/or suggest this claim element.

“[6]F). for the central control device or remote sensors ... their input/output units further including ...;”

255. As I set forth under Ground 1, claim limitation [1]F), Rein discloses and/or suggests this claim element.

“[6G)]1). the control programs causing ...;”

256. As I set forth under Ground 1, claim limitation [1G)]1), Rein discloses and/or suggests this claim element.

“[6G)]2). read current signals from a coupled environmental sensor and a coupled occupancy sensor and transmit them for storage in the memory of the central control device so that values of environmental conditions are associated with their source of occupied or unoccupied rooms;”

257. As I set forth under Ground 1, claim limitation [6G)]2), Rein discloses and/or suggests this claim element.

258. Riley also describes associating the values of environmental conditions with their source of occupied or unoccupied rooms. As I have discussed, this would have been an expected operation in order to make the data useful to the system. Riley explains that remote sensors send a “remote sensor i.d.” to the base station so that

the base station may distinguish transmissions received from different remote sensors. Ex. 1009, 26:4-28. Riley describes that the base station in the system receives occupancy status transmissions and temperature information from associated remote sensors in order to analyze temperature fluctuations in the corresponding space. *Id.*, 3:3-35. Indeed, the system “learns” about the space over time. To learn about the space, a POSA would have understood that the system would need to know the locations from which the data was derived.

259. Thus, in my opinion, the system is able, based on the transmissions and sensor identifiers, to store the values from temperature sensors in association with the space for the particular remote sensor providing the information.

“[6G)]3). for the central control program, calculate an average”

260. As I set forth under Ground 1, claim limitation [1G)]3), Rein discloses and/or suggests this claim element.

CLAIM 7

“7. The system of claim 6 wherein averaging of received environmental sensor values is calculated by simple averaging or a weighted averaging where environmental condition Values from occupied rooms are given substantially more value than those of vacant rooms.”

261. As I set forth under Ground 1, claim 2, Rein discloses and/or suggests this claim element.

CLAIM 8

“8. The system of claim 6 wherein where occupancy sensors include infra-red motion detectors.”

262. In my opinion, as I set forth under Ground 1, claim 8, Rein suggests this claim limitation.

263. However, Riley expressly discloses infra-red motion detectors. Ex. 1009, 4:35-39; 25:11-53.

CLAIM 9

“9. The system of claim 6 wherein environmental sensors include temperature sensors and humidity sensors.”

264. As I set forth under Ground 1, claim 9, Rein discloses and/or suggests this claim element.

265. Similarly, Riley discloses and/or suggests this claim element. Ex. 1009, 15:55-68; 25:11-53.

CLAIM 10

“10. The system of claim 7 wherein a display and a user interface are coupled with the input/output unit of the central processing device so the central control program causes a display of averaging methods for averaging received environmental sensor values.”

266. As I set forth under Ground 1, claim 3, Rein discloses and/or suggests this claim limitation.

CLAIM 11

“11. The system of claim 10 wherein the central control program further causes a display indicating that a user may select an averaging method through the user interface and thereafter accepting user input selecting one of the averaging methods.”

267. As I set forth under Ground 1, claim 4, Rein discloses and/or suggests this claim element.

CLAIM 12

“12. The system of claim 6 wherein the space conditioning equipment comprises zone control means so that only occupied rooms have their space affected by the space conditioning equipment.”

268. As I set forth under Ground 1, claim 5, Rein discloses and/or suggests this claim element.

XII. SECONDARY CONSIDERATIONS

269. I am not aware of any secondary considerations (see Sec. V.B. above) that would affect my positions set forth above.

XIII. OATH

270. This declaration and my opinions herein are made to the best of my knowledge and understanding, and based on the material available to me, at the time of signing this declaration. I declare under penalty of perjury under the laws of the United States of America that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I

understand that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon.

Date: September 22, 2023

A handwritten signature in black ink, appearing to read 'DMA', followed by a long horizontal flourish.

David M. Auslander, Sc.D.