

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC

Petitioner

v.

ECOFACITOR, INC.

(record) Patent Owner

Patent No. 8,019,567
IPR2021-01218

**PETITION FOR INTER PARTES REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.100 ET. SEQ**

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TABLE OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 8,019,567 (“ the ’567 patent ”).
1002	Declaration of Rajendra Shah.
1003	C.V. of Rajendra Shah.
1004	U.S. Pat. No. 5,729,474 (“ Hildebrand ”).
1005	U.S. Pat. No. 5,640,153 (“ Hildebrand ’153 ”).
1006	U.S. Pat. No. 5,539,633 (“ Hildebrand ’633 ”).
1007	U.S. Patent Publication 2005/0159846 A1 (“ Van Ostrand ”).
1008	U.S. Pat. Pub. 2006/0111816 (“ Spalink ”).
1009	U.S. Pat. No. 6,789,739 (“ Rosen ”).
1010	Public Copy of Initial Determination in <i>Smart HVAC Systems, and Components Thereof</i> 337-TA-1185 (ITC).
1011	File History of U.S. App. Ser. No. 12/211,690.
1012	U.S. Pat. App. Pub. 2005/0288822 (“ Rayburn ”).
1013	U.S. Pat. App. Pub. 2004/0117330 (“ Ehlers ’330 ”).
1014	Email string between EcoFactor and Google ITC counsel regarding continued assertion of patents found invalid at the ITC.
1015	U.S. Pat. No. 8,423,322 (“ the ’322 patent ”).

Petitioner respectfully requests *inter partes* review under 35 U.S.C. § 311 of claims 1-20 of U.S. Pat. No. 8,019,567.

NOTICE OF LEAD AND BACKUP COUNSEL

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NOTICE OF THE REAL-PARTIES-IN-INTEREST

The real-party-in-interest for this petition is Google LLC (“Google”).

NOTICE OF RELATED MATTERS

The ’567 patent is currently at-issue in the following litigations:

- *EcoFactor, Inc. v. Johnson Controls, Inc.*, Case No. 6-21-cv-00413 (W.D. Tex.)(**stayed** pending ITC investigation);
- *Carrier Global Corporation v. EcoFactor, Inc.*, Case No. 1-21-cv-00328 (D. Del.)(**stayed** pending ITC investigation);
- *ecobee, Inc. v. EcoFactor, Inc.*, Case No. 1-21-cv-00323 (D. Del.)(**stayed** pending ITC investigation);
- *Resideo Technologies, Inc. v. EcoFactor, Inc.*, Case No. 3-21-cv-01496 (N.D. Cal.)(**stayed** pending ITC investigation);

- *Google LLC f/k/a Google Inc. v. EcoFactor, Inc.*, Case No. 3-21-cv-01468 (N.D. Cal.)(**stayed** pending ITC investigation);
- *Certain Smart Thermostat Systems, Smart HVAC Systems, Smart HVAC Control Systems, And Components Thereof*, Inv. No. 337-TA-1258 (USITC).

NOTICE OF SERVICE INFORMATION

Please address all correspondence to the lead counsel at the addresses shown above. Petitioners consent to electronic service by email at: smith@smithbaluch.com, laughton@smithbaluch.com.

GROUND FOR STANDING

Petitioner hereby certifies that the patent for which review is sought is available for *inter partes* review, and that the Petitioner is not barred or estopped from requesting an *inter partes* review on the grounds identified in the petition.

STATEMENT OF PRECISE RELIEF REQUESTED

Petitioner respectfully requests that claims 1-20 of the '567 patent be canceled based on the following grounds:

Ground 1: Claims 1-2, 5-7, 15-16, and 19-20 are obvious over Hildebrand in view of Van Ostrand.

Ground 2: Claims 1-3, 5-7, 15-17, and 19-20 are obvious over Hildebrand and Van Ostrand, in further view of Rosen.

Ground 3: Claims 4 and 18 are obvious over Hildebrand and Van Ostrand,

in further view of Ehlers '330.

Ground 4: Claims 8-9 and 14 are obvious under 35 U.S.C. §103(a) over Spalink.

Ground 5: Claims 8-10 and 12-14 are obvious over Spalink in view of Rosen.

Ground 6: Claim 11 is obvious over Spalink and Ehlers '330.

THRESHOLD REQUIREMENT FOR INTER PARTES REVIEW

This petition presents “a reasonable likelihood that the Petitioners would prevail with respect to at least one of the claims challenged in the petition”, 35 U.S.C. § 314(a), as shown in the Grounds explained below.

I. INTRODUCTION

A. The '567 Patent Disclosure

The '567 patent at-issue (with an earliest-possible benefit date of September 2007) relates generally to heating or cooling systems (“HVAC systems”). (Ex. 1001, Abstract, 1:15-16). Such HVAC systems have, for decades, been controlled by thermostats. (Ex. 1001, 1:21-23)(Ex. 1002, ¶37). Thermostats are typically wall-mounted units that have an internal temperature sensor, and which allow a user to set a target temperature. (Ex. 1001, 1:21-37)(Ex. 1002, ¶37). The target temperature, or “set point”, is compared against the actual temperature, and the HVAC system switched on or off in an attempt to achieve the set point temperature. (*Id.*).

HVAC systems may degrade in their performance over time. (Ex. 1002, ¶38).

Detecting such degradations in performance is, broadly speaking, the purpose of the claims of the '567 patent. Claim 1 of the '567 patent purports to collect temperature data from inside a building conditioned by an HVAC system, collect outside temperature data, and estimate a rate of change in temperature. Claim 1 also relates to determining whether the efficiency has decreased, and if it has, evaluating the change in efficiency to suggest a cause of degradation.

Petitioner notes that the ITC has found several substantially identical limitations in related U.S. U.S. Pat. No. 8,423,322 to be without support in the specification. (Ex. 1010, pp. 527-533).

II. CLAIM CONSTRUCTION

“In an inter partes review proceeding, a claim of a patent...shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35U.S.C. 282(b)....” 37 C.F.R. §42.100(b).

A. Claim Constructions in Co-pending Litigations

The ITC investigation captioned *Smart HVAC Systems, and Components Thereof* 337-TA-1185 (ITC) resolved, at least at the level of an Initial Determination, certain claim construction positions on similar terminology for related patents. The ITC’s constructions may be found on pages 32, 41, 45 48-49, 53, 58, and 61. Furthermore, Respondents in the parallel ITC investigation 337-TA-1258, may, but have not yet, advocate that certain claim terms are indefinite. Without conceding

the definiteness of these terms, Petitioner submits that the prior art presented herein does not implicate the claim construction disputes between the parties, and thus no construction of terms is necessary. *See, e.g., NEC Display Solutions of America, Inc. v. Ultravision Tech.*, IPR2019-01123, Institution Decision, Paper 7, pp. 12-14 (PTAB Dec. 2, 2019).

III. DETAILED EXPLANATION OF THE REASONS FOR UNPATENTABILITY

Ground 1. Claims 1-2, 5-7, 15-16, and 19-20 are obvious over Hildebrand in view of Van Ostrand.

Claims 1-2, 5-7, 15-16, and 19-20 are obvious under pre-AIA 35 U.S.C. § 103(a) over U.S. Pat. No. 5,729,474 (“**Hildebrand**”)(Ex. 1004) in view of U.S. Pat. App. Pub. 2005/0159846 A1 (“**Van Ostrand**”)(Ex. 1007).

Neither Hildebrand nor Van Ostrand were of record during any application leading to the ’567 Patent. Hildebrand was presented to the ITC in investigation 337-TA-1185, where the ITC found Hildebrand to anticipate claim 1 of the related ’322 patent (Ex. 1015), which is similar to claim 1 of the ’567 patent. (Ex. 1010, pp. 470-477).

A. Effective Prior Art Dates

Hildebrand issued on March 17, 1998, and is thus prior art under pre-AIA 35 U.S.C. §102(b).

Van Ostrand published on July 21, 2005, and is thus likewise prior art under

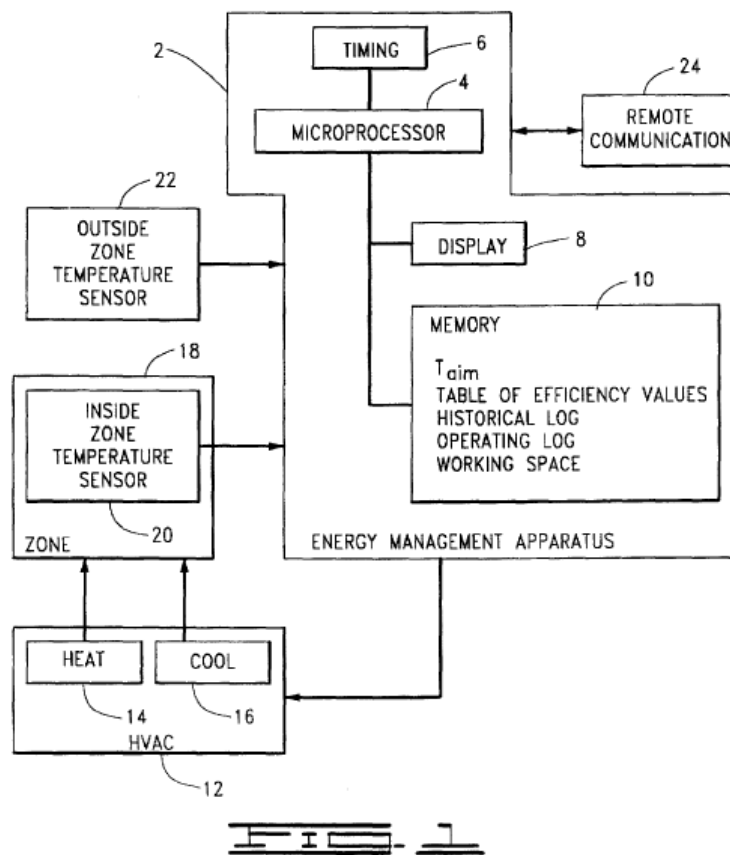
pre-AIA 35 U.S.C. §102(b).

B. Overview of the Ground

In brief, Hildebrand teaches most of the elements of the challenged claims, in the context of a system for monitoring the operating efficiency of an HVAC system. While Hildebrand suggests monitoring degradation in operational efficiency to predict when maintenance is needed, Hildebrand does not teach suggesting a cause of the degradation. Van Ostrand, however, teaches using rates of change in inside temperature to suggest which components are failing. This ground posits that it would have been obvious to use Van Ostrand's method with Hildebrand.

1. Overview of Hildebrand

Hildebrand teaches a “[m]ethod of anticipating potential HVAC failure”. (Ex. 1004, Title)(Ex. 1002, ¶50). The overall system of Hildebrand is depicted in Fig. 1, reproduced here:



(Ex. 1004, Fig. 1, 3:33-4:34)(Ex. 1002, ¶50). In Fig. 1, there is an “HVAC system 12” (lower left), an inside temperature sensor 20 (left side), an outside temperature sensor 22 (upper left), a microprocessor 4 to analyze data (top middle), and a memory 10 (right side) that stores historical values of data gathered by the system. (Ex. 1004, 3:33-4:34)(Ex. 1002, ¶50).

During operation, Hildebrand’s system collects indoor and outdoor temperature values and repeatedly calculates values for the operational efficiency. (Ex. 1004, Abstract)(Ex. 1002, ¶51). Different efficiency values are compared to determine whether a deterioration in efficiency has occurred. (Ex. 1004,

Abstract)(Ex. 1002, ¶51). If so, Hildebrand's system sends a signal indicating that maintenance is necessary. (Ex. 1004, Abstract)(Ex. 1002, ¶51). Hildebrand's Abstract explains:

“To anticipate potential failure of a temperature modification device (e.g., heating, ventilating and air conditioning equipment used in a commercial building), **an efficiency value** representing the ability of the temperature modification device to change temperature in a predetermined zone **is repeatedly computed**. When one of these values is computed, it is used in **determining whether** the ability of the temperature modification device to change temperature in the predetermined zone **has deteriorated over time**. This is done by **comparing a current efficiency value with a previous efficiency value**. In response to a determined deterioration exceeding a predetermined tolerance, **a control signal for initiating inspection** of the temperature modification device is communicated, thereby enabling the device to be serviced in response to a detected operating condition of the device and before actual failure of the device.”

(Ex. 1004, Abstract)(Emphasis added)(Ex. 1002, ¶51).

Hildebrand also teaches calculating a heating or cooling rate relative to outside temperature. Hildebrand explains:

“Each efficiency determination is made **with regard to the particular T_{out} obtained at the time of making the determination**. This is so that comparisons can be made as to determinations made at different times but **under the same external condition(s)**....For

the particular condition or conditions, the efficiency determination further includes **determining an actual rate at which the temperature modification device changes the sensed temperature** in the zone 18 from a first temperature value to a second temperature value.”

(Ex. 1004, 6:17-30)(Emphasis added)(Ex. 1002, ¶52).

2. Overview of Van Ostrand

Van Ostrand, in turn, teaches that the behavior of the **rate of change of the inside temperature** of a structure (already calculated by Hildebrand) can be used to “infer” whether a specific HVAC system component is functioning properly, and if not, exactly which component has failed. (Ex. 1007, ¶¶0029-0033, 0007)(Ex. 1002, ¶53).

Van Ostrand’s system is depicted in its Fig. 1, reproduced below:

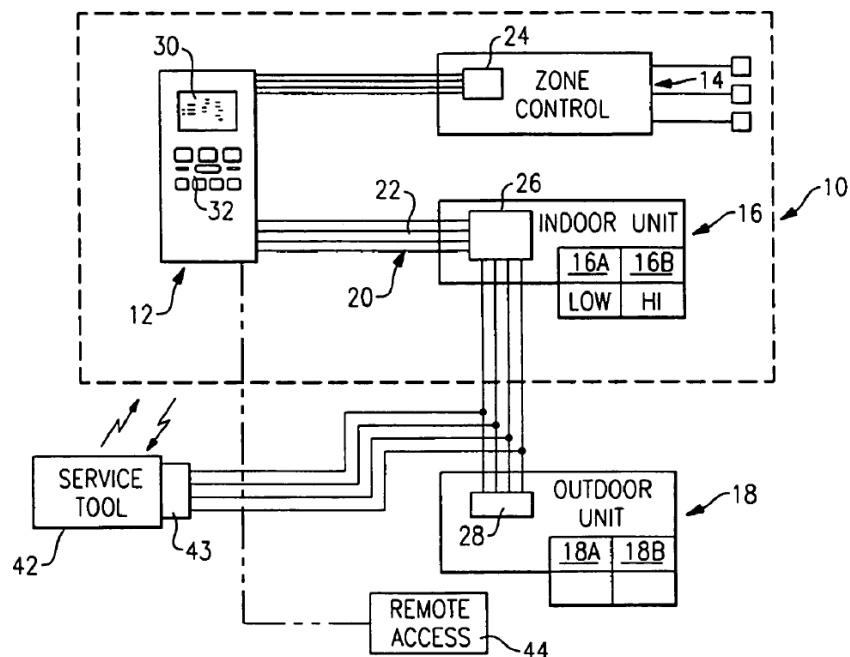


FIG. 1

(Ex. 1007, Fig. 1, ¶¶0016-0024)(Ex. 1002, ¶54). In the Figure, an HVAC system 10 (top) has a central controller 12 (top left) that communicates with an indoor unit 16 (middle right) and a zone controller 14 (top right). (Ex. 1007, ¶¶0016-0017)(Ex. 1002, ¶54). Associated with this system are heating or cooling devices. (Ex. 1007, ¶¶0019-0029)(Ex. 1002, ¶54). Each heating and cooling device may have several “stages” of heating or cooling capacity. (*Id.*). A basic stage might be used for most heating or cooling needs, with additional (usually more expensive) stages of capacity being used for more extreme needs. (Ex. 1002, ¶54). Van Ostrand explains:

“Typical HVAC systems include multiple stages of heating and/or cooling capacity. At the lowest demand, the first (lowest capacity) stage is activated. As demand increases past the capacity of the lowest stage, the next higher capacity stage is activated.”

(Ex. 1007, ¶0004)(Ex. 1002, ¶54).

The heating and cooling stages can fail. (Ex. 1002, ¶55). Van Ostrand's system detects failed stages using the central controller 12. (Ex. 1007, ¶¶0006-0007)(Ex. 1002, ¶56). The central controller 12 can detect failed stages by direct communication with the HVAC system component or, as is more relevant here, by monitoring the rate of change in inside temperature that occurs when a stage is supposedly operating. (*Id.*). Van Ostrand explains:

“the central control detects the failed stages and/or components by **monitoring the temperature of a controlled area** to determine if any particular stage is operating properly. A higher stage having more capacity will create a **more positive slope to the controlled environment temperature vs. time** curve than a lower stage if the higher stage is properly operating.”

(Ex. 1007, ¶0007)(Emphasis added)(Ex. 1002, ¶56). The “slope to the controlled environment temperature versus time” is the difference between inside temperature measurements divided by the span of time between the measurements (*i.e.*, $\Delta T/\Delta t$), or rate of change in inside temperature over a period of time. (Ex. 1007, Fig. 4, Fig. 5, ¶¶0029, 0031)(Ex. 1002, ¶56).

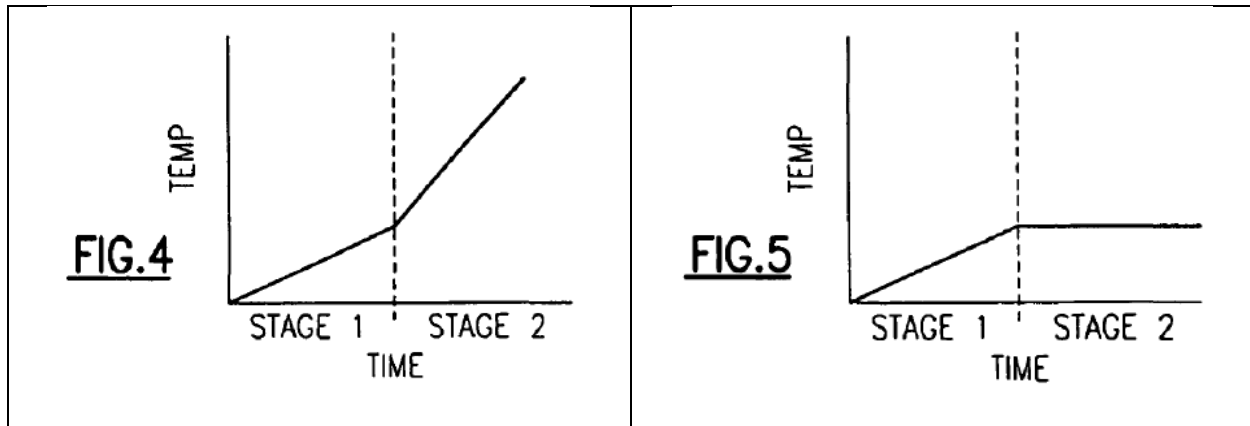
Van Ostrand uses the rate of change in inside temperature in multiple ways to monitor the operation of the HVAC system. First, Van Ostrand explains that

“[t]he central control 12 monitors the rate of change of a room

temperature before and after it turns on the stage. If there is a **change in the rate of change of room temperature**, it can be inferred that the component is **operating**. If there is no change in the rate of change, the component can be assumed to be **inoperative**”

(Ex. 1007, ¶0031)(Emphasis added)(Ex. 1002, ¶57). In other words, Van Ostrand first determines the rate of change of the temperature inside a structure during a first time period (before a stage or heating or cooling element is turned on). Van Ostrand then determines the rate of change of inside temperature over a second period of time (after a stage or heating or cooling element is turned on). (See Ex. 1007, Fig. 4, Fig. 5, ¶¶0029-0031)(Ex. 1002, ¶57). Van Ostrand then compares this first rate of change to the second rate of change to determine whether a specific component of the HVAC system has failed. (Ex. 1002, ¶57). Van Ostrand’s system can also “learn[]” “the amount of change in the rate of change” over time and that “[w]hen the system does not respond with the learned capacity, the controller 12 infers that there has been a failure”. (Ex. 1007, ¶0033)(Ex. 1002, ¶58).

For example, Van Ostrand provides a method for identifying whether a second stage of an HVAC system has failed by comparing two graphs, shown in Fig. 4 and Fig. 5, reproduced side-by-side below:



Van Ostrand, Fig. 4

Van Ostrand, Fig. 5

Figure 4 of Van Ostrand shows the slope of the time versus temperature curve when Stage 2 is operating properly. (Ex. 1007, ¶¶0014, 0029)(Ex. 1002, ¶59). Figure 5, in contrast, shows the slope of the time versus temperature curve when Stage 2 is malfunctioning. (Ex. 1007, ¶¶0015, 0031)(Ex. 1002, ¶59). By monitoring the slope (rate of change of temperature with time), Van Ostrand's system is able to specifically diagnose the malfunction of Stage 2. (Ex. 1007, ¶¶0029-0031)(Ex. 1002, ¶59).

C. Rationale (Motivation) Supporting Obviousness

It would have been obvious to use Van Ostrand's technique—diagnosing the failure of HVAC components by using rates of change—in Hildebrand. (Ex. 1002, ¶60). Hildebrand already teaches gathering inside and outside temperature data, calculating rates of change in temperature, and forming a K value, which is equivalent to both an efficiency and a rate of change. (Ex. 1004, Abstract, 6:18-64)(Ex. 1002, ¶60). Thus, much of the data needed to use Van Ostrand's method is

already present in Hildebrand's system. (Ex. 1002, ¶60). Hildebrand likewise already teaches monitoring the performance of the HVAC system over time using its K value, observing degradation in efficiency, and suggesting maintenance when efficiency degrades. (Ex. 1004, Abstract, 6:18-64, 7:63-8:20)(Ex. 1002, ¶60).

Van Ostrand, in turn, teaches a method that uses that rate of change in inside temperature to diagnose when specific stages of an HVAC system have failed. (Ex. 1008, ¶¶0033, 0007, 0039-032, Figs. 4 and 5)(Ex. 1002, ¶61). Much like Hildebrand, Van Ostrand teaches learning the response (in terms of the rate of change in temperature) to an HVAC system stage being engaged. (Ex. 1008, ¶0033)(Ex. 1002, ¶61). Using such previously-stored responses, Van Ostrand's system then observes when the rate of change in inside temperature is lower than expected (*i.e.*, situations where Hildebrand's K value is higher than expected), and can use such changes to diagnose that specific stages have failed. (Ex. 1008, ¶0033)(Ex. 1002, ¶61) It would have been obvious to use such a technique in Hildebrand to be able to diagnose when HVAC system stages have failed, and which stages have failed. (Ex. 1002, ¶61). This would have allowed Hildebrand's system to provide users useful information concerning the source of the failure. (Ex. 1002, ¶61).

Hildebrand's disclosure does not expressly address whether HVAC systems used by its buildings are multi-stage systems (it would work with single or multi-

stage systems), but multi-stage systems were commonplace in the relevant timeframe, as Van Ostrand explains. (Ex. 1007, ¶0004)(“Typical HVAC systems include multiple stages of heating and/or cooling capacity.”)(Ex. 1002, ¶62). It would have been obvious to use “typical” HVAC systems in Hildebrand. (Ex. 1002, ¶62). Furthermore, it would have been obvious to modify Hildebrand to form and store, correlated to outside temperature, an efficiency value (rate of change) for each stage, in order to implement the method taught by Van Ostrand, which expressly teaches to “‘learn’ the capacity of each state of the system.” (Ex 1007, ¶0033)(Ex. 1002, ¶62). This would have the advantage taught by Hildebrand, of specifically diagnosing which stages have failed. (Ex. 1007, ¶¶0029-0033).

Furthermore, Van Ostrand’s technique represents a known method that can be used to improve a known system ready for improvement (Hildebrand) in a predictable way, without unexpected results. (Ex. 1002, ¶63). It was thus likewise obvious under *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416-21.

D. Graham Factors

The **level of ordinary skill** encompassed a (1) Bachelor’s degree in engineering, computer science, or a comparable field of study, and (2) at least five years of (i) professional experience in building energy management and controls, or (ii) relevant industry experience. Additional relevant industry experience may compensate for lack of formal education or vice versa. (Ex. 1002, ¶¶31-33).

The **scope and content of the prior art** are discussed throughout the ground.

The **differences between the prior art and the claims** are discussed in the “Overview of the Combination” and in the claim mapping, below.

Petitioner is not aware of any **secondary considerations** that would make an inference of non-obviousness more likely.

E. Reasonable Expectation of Success

A POSA in the relevant timeframe would have had a reasonable expectation of success in combining Hildebrand and Van Ostrand in each of the ways discussed in the Overview and Claim Mapping sections. (Ex. 1002, ¶¶64-65). As Mr. Shah explains, the art was relatively predictable in the relevant timeframe (2007). (*Id.*). Hildebrand and Van Ostrand, moreover, are software-based systems that use well-known components, and were thus predictable in nature. (*Id.*).

F. Analogous Art

Hildebrand and Van Ostrand are analogous art because they are in the same field as the ’567 patent (building energy management and controls), and their methods would have been reasonably pertinent to the problems facing the named inventors. (Ex. 1004, Abstract)(Ex. 1007, Abstract)(Ex. 1002, ¶66). *See Wyers v. Master Lock Co.*, 616 F.3d 1231, 1238 (Fed. Cir. 2010).

G. Claim Mapping

This section maps the challenged claims to the relevant disclosures of Hildebrand and Van Ostrand, where the claim text appears in bold-italics, and the

relevant mapping follows the claim text. The Petitioner has added numbering and lettering in brackets (*e.g.* [1a], [1b]) to certain claim elements, to facilitate the discussion.

CLAIM 1

“1[a]. A system for evaluating changes in the operational efficiency of an HVAC system over time comprising:”

Hildebrand is a **system for evaluating changes in the operational efficiency of an HVAC system over time**. (Ex. 1004, 1:46-49, 2:29-51, 7:18-33)(Ex. 1002, ¶68). Specifically, Hildebrand teaches “[t]he preferred embodiment of the present invention is **designed to monitor the** operation and the effectiveness (**efficiency**) of an HVAC system.” (Ex. 1004, 1:46-49)(Emphasis added)(Ex. 1002, ¶68). The system monitors “operational efficiency”, because it is tracking the ability of the HVAC system to heat or cool the structure, which Hildebrand expressly uses as an indicator of the efficiency of **operation**. (Ex. 1004, 7:17-66)(Ex. 1002, ¶68).

The monitoring takes place **over time**, because Hildebrand monitors efficiency by comparing the heating or cooling rate relative to outside temperature. (Ex. 1004, 2:2-9, 7:18-33)(Ex. 1002, ¶69). As Hildebrand states:

“[a]s the rate of cooling or heating **increases**, thereby indicating a deterioration in the efficiency of the cooling/heating ability of the HVAC system, one or more signals for initiating corrective action are generated. Data can be collected and plotted **over a period of time** and made available for display or hard copy printout. Historical

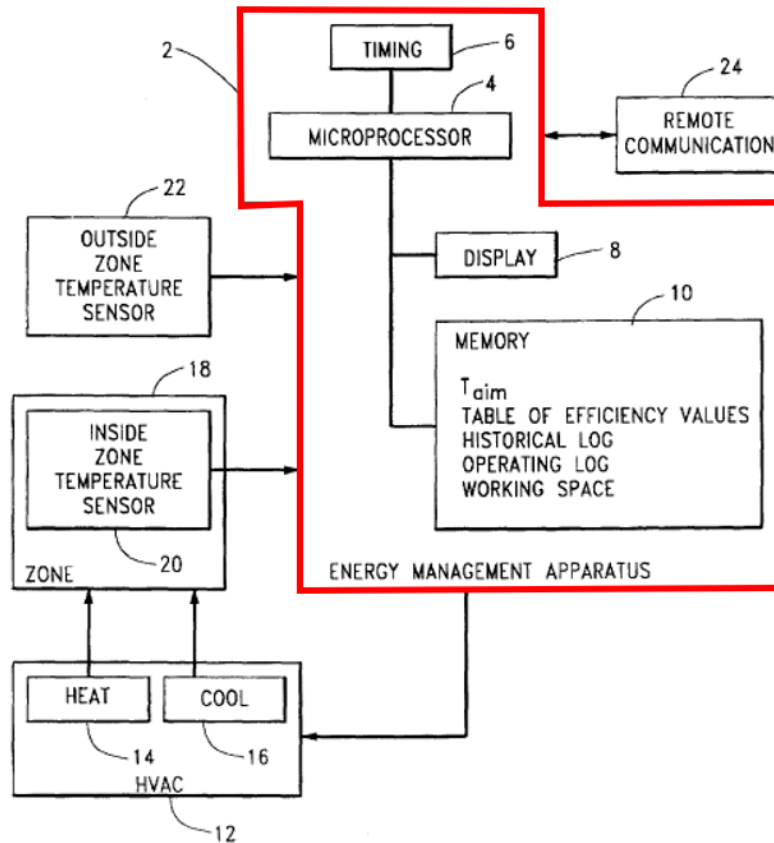
readings can be made on a **periodic basis.**”

(Ex. 1004, 2:2-9)(Emphasis added)(Ex. 1002, ¶69).

The ITC has previously found an identical limitation of the related ’322 patent to be disclosed by Hildebrand. (Ex. 1010, pp. 474-475).

“[1b] at least one HVAC control system associated with a first structure that receives temperature measurements from at least a first structure conditioned by at least one HVAC system, and receives status of said HVAC system;”

Hildebrand teaches this limitation. First, Hildebrand teaches an HVAC control system, in the form of the energy management apparatus 2, shown in Fig. 1, reproduced below, with the HVAC Control System outlined in red:



(Ex. 1004, Fig. 1, 3:41-43)(Ex. 1002, ¶70). The energy management apparatus 2 is an **HVAC control system** because it operates to control the HVAC system to maintain particular temperatures within a zone. (Ex. 1004, 2:55-67, 5:3-10, 5:40-44)(Ex. 1002, ¶70).

The HVAC control system is **associated with a first structure** that is **conditioned by at least one HVAC system**, namely “HVAC system 12”, shown in Fig. 1, above, which is “in a building”. (Ex. 1004, 4:45-48)(Ex. 1002, ¶71).

The HVAC control system receives **temperature measurements from the structure**. Specifically, the energy management apparatus 2 receives temperature measurements from the “inside zone temperature sensor 20” (shown in Fig. 1,

above), which is inside the building. (Ex. 1004, 4:11-14, 5:11-17, 6:12-16)(Ex. 1002, ¶72).

The HVAC control system receives **the HVAC system status**. First, the HVAC control system (energy management apparatus 2 of Hildebrand) determines whether heating or cooling is needed based on the difference between the actual temperature and the setpoint temperature, and also measures the rate of change in temperature during heating and cooling. (Ex. 1004, 4:64-5:27, 6:17-64)(Ex. 1002, ¶73). Thus, the HVAC control system would obviously receive the status of the HVAC system. (Ex. 1002, ¶73)(Ex. 1010, p. 475).

Second, Hildebrand provides a program listing as an example implementation of its invention. The program listing begins with a method declaration that receives a parameter entitled “mode”, as shown here, with highlighting added:

```
void CheckHVACTrends (char mode, char zone, unsigned char *deviation)
```

(Ex. 1004, col. 9, at top)(Ex. 1002, ¶74). This indicates that the method entitled “CheckHVACTrends” receives an input parameter “mode”. (Ex. 1002, ¶75). The parameter “mode”, moreover, indicates whether the HVAC system is in heating or cooling mode, as shown by the following C code and comments (highlighting added):

```

/* Get temperature difference from start to end */
if (!mode) /* cool mode, Delta = Tstart - Taim */
    Delta = data_ptr->start - data_ptr->aim;
else /* heat mode, Delta = Taim - Tstart */
    Delta = data_ptr->aim - data_ptr->start;

```

(Ex. 1004, 9:35-39 (counting line numbers starting at “void”))(Ex. 1002, ¶75).

Because the program listing is code executed by the microprocessor in the energy management apparatus (Ex. 1004, 8:53-57, 4:55-64), the program listing indicates that the HVAC control system **receives** (via a passed parameter “mode”) **status of said HVAC system** (*i.e.* whether the system is in heat or cool mode). (Ex. 1002, ¶75).

The ITC has previously found a similar limitation of the related ’322 patent to be disclosed by Hildebrand. (Ex. 1010, pp. 474-475).

“[1c] one or more processors that receive measurements of outside temperatures from at least one source other than said HVAC system and”

Hildebrand teaches that the HVAC control system (energy management apparatus 2) has **one or more processors**, in the form of microprocessor 4, as shown in Fig. 1. (Ex. 1004, Fig. 1, 3:41-44)(Ex. 1002, ¶76). The microprocessor performs the rate-of-change and efficiency calculations described by Hildebrand. (Ex. 1004, 4:55-64)

The one or more processors **receive measurements of outside temperatures**

from at least one source other than said HVAC system. (Ex. 1002, ¶77).

Specifically, the microprocessor 4 receives measurements of outside temperature from the outside zone temperature sensor 22, as shown in Fig. 1, reproduced again below with added red outlining:

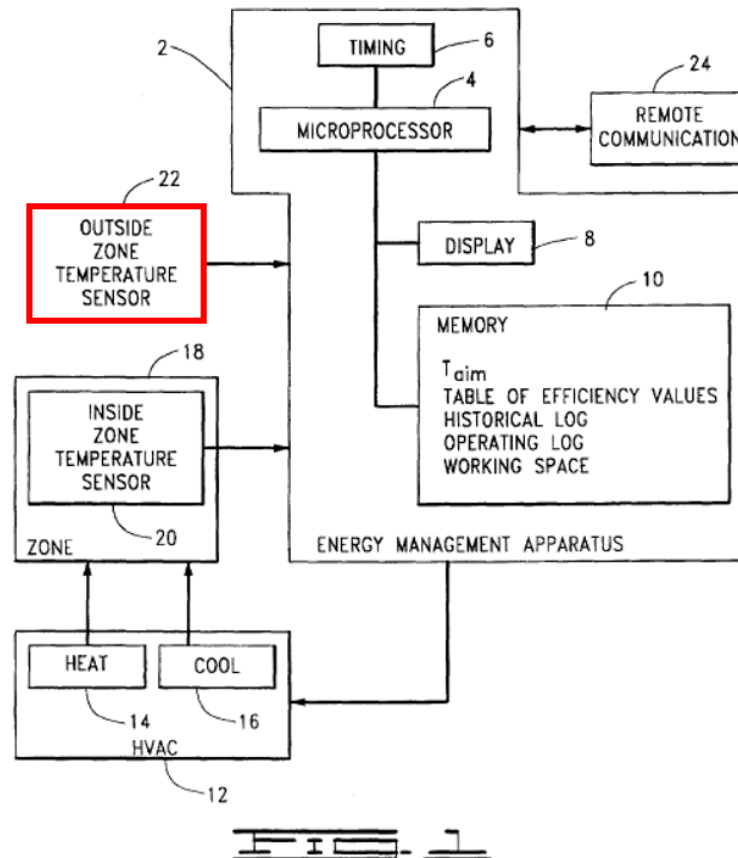


FIG. 1

(Ex. 1004, Fig. 1, 4:16-21)(Ex. 1002, ¶77). The outside temperature measurement (called " T_{out} ") is **received by the one or more processors** (microprocessor 4). (Ex. 1004, 6:2-5)(T_{out} is "derived in conventional manner by the energy management apparatus 2 from the sensor 22"). The reception by the microprocessor is apparent both because T_{out} is stored in memory 10 (a task which would be carried out by the processor), and because it is used in efficiency calculations (a task also carried out

by the microprocessor). (Ex. 1004, 5:65-6:28, 6:44-58, 7:18-23, 7:45-50, 14:32-48)(Ex. 1002, ¶77).

The outside zone temperature sensor 22 is **at least one source other than said HVAC system**. (Ex. 1002, ¶78). The HVAC system is “HVAC system 12”, which is separate from the outside zone temperature sensor 22. (Ex. 1004, Fig. 1, 4:1-10)(Ex. 1002, ¶78).

The ITC has previously found an identical limitation of the related '322 patent to be disclosed by Hildebrand. (Ex. 1010, pp. 475-476).

“[1d] compare said temperature measurements from said first structure, wherein said one or more processors compares the inside temperature of said first structure and the outside temperature over time to derive an estimation for the rate of change in inside temperature of said first structure when said HVAC system is in a first state of repair; and”

Hildebrand discloses this limitation. Specifically, Hildebrand teaches that it measures the temperature change over a specific period of time, and at a particular outside temperature, in order to estimate the heating or cooling rate of change. (Ex. 1004, 1:58-2:3, 6:17-40, 7:45-55)(Ex. 1002, ¶79). Hildebrand explains:

“The preferred embodiment of the present invention employs the following parameters: 1) **outside ambient temperature (T_{out})**, 2) **inside starting temperature (T_{start})**, 3) desired temperature setpoint (T_{aim}), 4) HVAC recovery time to change inside temperature from T_{start} to T_{aim} , and 5) the best or most efficient performance of the

HVAC system to date. The method uses these parameters to **determine the heating or cooling rate** based on the temperature differential between the starting temperature (T_{start}) and the desired temperature setpoint (T_{aim}) and the corresponding recovery time to go from the starting temperature to the setpoint temperature. **The method then logs this heating or cooling rate relative to the outside ambient temperature.**”

(Ex. 1004, 1:58-2:3)(Emphasis added)(Ex. 1002, ¶79). In the process described here, Hildebrand demonstrates **compar[ing] said temperature measurements from said first structure**, because Hildebrand is repeatedly comparing inside temperatures by calculating an inside temperature change, namely the change from T_{start} to T_{aim} . (Ex. 1004, 6:17-40). When the comparison occurs, T_{aim} is a **temperature measurement from said first structure**, because at the end of the recovery time, inside temperature has reached the desired temperature setpoint, and thus T_{aim} is the same as the inside temperature. (Ex. 1004, 6:34-37)(Ex. 1002, ¶79).

Furthermore, the one or more processors (microprocessor 4) **compares the inside temperature of said first structure and the outside temperature over time to derive an estimation for the rate of change in inside temperature of said first structure.** (Ex. 1002, ¶80). This occurs because Hildebrand’s microprocessor repeatedly uses inside temperature and time to calculate a rate of change of inside temperature, at the current outside temperature for that particular time. (Ex. 1004,

12:66-13:37, 6:17-7:44)(Ex. 1002, ¶80). The respective rates of change are calculated several times per day—for example, each time the inside temperature deviates significantly from the setpoint, such that the HVAC system must be turned on. (Ex. 1004, 5:40-50)(Ex. 1002, ¶80).

Each time Hildebrand's microprocessor calculates a rate of change, it stores the rate of change of the inside temperature in a table indexed by the outside temperature for which the rate is valid. (Ex. 1004, 7:38-50)(Ex. 1002, ¶81). The result is a table that describes the rate of change in inside temperature (for both heating and cooling cases) as a function of outside temperature, where each value of the heating or cooling rate was taken at a different time. Thus, Hildebrand teaches **compar[ing] the inside temperature of said first structure and the outside temperature over time to derive an estimation for the rate of change in inside temperature of said first structure.** (Ex. 1002, ¶82).

Note that Hildebrand teaches both the calculation of the rate of change of inside temperature over a time period (Ex. 1004, 6:25-30, 7:45-50, 12:66-13:37) and the calculation of the efficiency values K , which are a time period divided by a temperature change that occurs over that time period ($\Delta t / |T_{\text{start}} - T_{\text{aim}}|$). (Ex. 1004, 6:37-64, 13:50-14:52)(Ex. 1002, ¶83). The two values are the reciprocal of one another, and Hildebrand expressly recognizes the efficiency value K to be both a rate of change in inside temperature and a measure of operating efficiency. (Ex. 1004,

6:44-46, 6: 56-58)(Ex. 1002, ¶83). A POSA would thus have found it obvious that whether one expresses the ratio as time over temperature ($\Delta t / |T_{\text{start}} - T_{\text{aim}}|$), or the reciprocal temperature over time ($|T_{\text{start}} - T_{\text{aim}}| / \Delta t$), the result is a ratio of temperature and time, and that both expressions of that ratio are useful as both a measure of rate of change in inside temperature and a measure of efficiency. (Ex. 1002, ¶83).

Hildebrand teaches that the system can monitor deterioration in an HVAC system, which reflect changes in the state of repair. (Ex. 1004, 2:62-3:6)(Ex. 1002, ¶84). Thus, Hildebrand teaches performing this element when the HVAC system is in a **first state of repair**. (Ex. 1002, ¶84).

The ITC has previously found an identical limitation of the related '322 patent to be disclosed by Hildebrand. (Ex. 1010, pp. 475-476).

“[1e] one or more databases that store at least said temperature measurements obtained from said first structure over time,”

Hildebrand teaches that its energy management apparatus **stores said temperature measurements obtained from said first structure over time**.

Hildebrand explains:

“Energizing the HVAC system 12 in the preferred embodiment also includes **storing in the digital computer a value of an actual temperature in the zone**. This is performed by **monitoring and processing the output of the temperature sensor 20**, which can be

performed in a conventional manner, within the energy management apparatus 2 and **storing the value in memory 10.**”

(Ex. 1004, 5:12-17)(Emphasis added)(Ex. 1002, ¶85). Hildebrand further discloses that “data” including the inside temperature T_{start} , “can be collected and plotted over a period of time and made available for display or hard copy printout. Historical readings can be made on a periodic basis.” (Ex.1004, 1:58-2:9)(Ex. 1002, ¶85). The temperature T_{start} , is the “the sensed temperature for the zone 18”, or the current temperature measurement from inside the structure at the time efficiency measurements begin. (Ex. 1004, 6:12-16)(Ex. 1002, ¶85).

The memory 10 of Hildebrand is the claimed **database**. (Ex. 1002, ¶86). Hildebrand notes that data stored in the memory 10 can be stored in a table structure and indexed. (Ex. 1004, 6:65-7:4)(Ex. 1002, ¶86). The data structures include **temperature measurements obtained from said first structure over time** as can be seen from the C (or C++) program listing, which access T_{start} by dereferencing a pointer to the structure containing a property T_{start} , as shown in code reproduced here (highlighting added):

```
/* Get temperature difference from start to end */  
if (!mode) /* cool mode, Delta =  $T_{start} - T_{aim}$  */  
    Delta = data_ptr->start - data_ptr->aim;  
else /* heat mode, Delta =  $T_{aim} - T_{start}$  */  
    Delta = data_ptr->aim - data_ptr->start;
```

(Ex. 1004, 9:35-39 (counting line numbers starting at “void”))(Ex. 1002, ¶86). The

same structure includes outside temperature and run time. (Ex. 1004, 9:31-34)(Ex. 1002, ¶86).

The ITC has previously found an identical limitation of the related '322 patent to be disclosed by Hildebrand. (Ex. 1010, p. 477).

“[1f] wherein said one or more processors compares an inside temperature recorded inside the first structure with said estimation for the rate of change in inside temperature of said first structure to determine whether the operational efficiency of the HVAC system has decreased over time; and”

Hildebrand teaches this limitation. (Ex. 1002, ¶87). First, Hildebrand teaches checking efficiency values **to determine whether the operational efficiency of the HVAC system has decreased over time.** (Ex. 1004, 7:18-33)(Ex. 1002, ¶87).

Hildebrand explains:

“If the present computed efficiency value exceeds the prior computed efficiency value (*i.e.*, the present value indicates it is taking longer to effect a 1° F. temperature change), **this represents a decrease in efficiency of the HVAC equipment.**”

(Ex. 1004, 7:18-33)(Emphasis added)(Ex. 1002, ¶87).

Comparing efficiency values comprises **comparing an inside temperature recorded inside the first structure with said estimation for the rate of change in inside temperature of said first structure**, because the efficiency value is a value that comprises inside temperature inside the first structure, and because the

efficiency value is also an estimation for the rate of change. (Ex. 1004, 6:29-41)(Ex. 1002, ¶88).

This efficiency value $K = \Delta t / |T_{\text{start}} - T_{\text{aim}}|$ (see Ex. 1004, 6:29-41), is an **estimate for the rate of change**, because it is a ratio of a temperature change and a time it took to effect the temperature change. (Ex. 1002, ¶89). Notably, Hildebrand specifically refers to its efficiency values as the “cooling rate” or the “heating rate”. (Ex. 1004, 6:44-46, 6:56-58)(Ex. 1002, ¶89). The K value is an **estimate** in the sense that it would not have been expected to be 100% accurate, but also because the stored values of K will later used as estimated (or predicted) values of K at later times when the same outside temperature is present. (Ex. 1002, ¶89). The efficiency (K) value also comprises inside temperatures recorded inside the first structure, specifically T_{start} and T_{aim} . (Ex. 1004, 6:12-16, 6:36-37)(Ex. 1002, ¶89). Thus, comparing efficiency values is a comparison of **an inside temperature recorded inside the first structure with said estimation for the rate of change in inside temperature of said first structure**. (Ex. 1002, ¶89).

Furthermore, as discussed above under limitation [1e], it would have been obvious to a POSA that the efficiency value could have easily been used as its reciprocal, which would also have been an expression of an estimate of a rate of change in inside temperature. (Ex. 1002, ¶90).

Finally, as discussed above in the section entitled “Rationale (Motivation)

Supporting Obviousness” beginning on page 18, it would have been obvious to use the technique of Van Ostrand in Hildebrand’s system (including forming and storing rates of change by stage). Van Ostrand teaches comparing rates of change in inside temperature to determine whether the operational efficiency of the HVAC system has decreased over time. (Ex. 1007, ¶¶0007, 0029-0033, claim 12)(Ex. 1002, ¶91).

Van Ostrand explains:

“[T]he central control detects the failed stages and/or components by **monitoring** the temperature of a controlled area to determine if any particular stage is operating properly. A higher stage having more capacity will create a **more positive slope to the controlled environment temperature vs. time curve** than a lower stage if the higher stage is properly operating.”

(Ex. 1007, ¶0033)(Emphasis added)(Ex. 1002, ¶91). The “slope to the controlled environment temperature vs. time curve” is a rate of change in inside temperature. (Ex. 1007, ¶¶0029-0031)(Ex. 1002, ¶91). Van Ostrand explains:

“The central control 12 **monitors the rate of change of a room temperature before and after it turns on the stage**. If there is a change in the rate of change of room temperature, it can be inferred that the component is operating. If there is no change in the rate of change, the component can be assumed to be inoperative (FIG. 5).”

(Ex. 1007, ¶0031)(Emphasis added)(Ex. 1002, ¶91).

Van Ostrand’s technique—which would have been obvious to use with

Hildebrand—likewise **compares an inside temperature recorded inside the first structure with said estimation for the rate of change in inside temperature of said first structure to determine whether the operational efficiency of the HVAC system has decreased over time.** (Ex. 1002, ¶92). This is because Van Ostrand’s rates of change (the slope of the temperature vs. time curve) are **estimation for the rate of change in inside temperature of said first structure.** Furthermore, the estimates **comprise inside temperatures recorded inside the first structure,** because they are formed from the slope of the temperature vs. time curve. (Ex. 1004, ¶0007, 0029)(Ex. 1002, ¶92). Thus, comparing Van Ostrand’s rates of change also meets the claim language. (Ex. 1002, ¶92).

“[1g] wherein if said operational efficiency has decreased, said one or more processors analyzes the changes in the operational efficiency over time to suggest a cause of degradation.”

Hildebrand teaches that when there is a degradation in efficiency, the operator should be warned that maintenance is likely necessary. (Ex. 1004, 1:46-52, 7:63-8:11, 13:20-33)(Ex. 1002, ¶93).

As discussed above, it would have been obvious to use Van Ostrand’s technique with Hildebrand. Hildebrand already captures temperature versus time data, and calculates a ratio of elapsed time to temperature change (a form of heating and cooling rate). (Ex. 1004, 6:44-46, 6:56-58)(Ex. 1002, ¶94). Van Ostrand teaches using heating and cooling rates to diagnose the source of lowered capacity.

(Ex. 1007, ¶¶0007, 0029-0033)(Ex. 1002, ¶94). Specifically, when Van Ostrand detects a lower heating or cooling rate (which is equivalent to a higher K value and lower efficiency in Hildebrand), Van Ostrand’s system can infer whether a stage of the heating or cooling appliance has failed. (Ex. 1007, ¶¶0007, 0029-0033)(Ex. 1002, ¶94). As Van Ostrand explains:

“[T]he central control 12 **detects the failed stages and/or components** by monitoring a temperature of a controlled area to determine if any particular stage is operating properly. A higher stage, having more capacity, will create a more positive slope to the controlled environment temperature vs. time curve than the stage below it (FIG. 4). If such a response is not identified by the controller 12, **the stage is classified as having failed.**”

(Ex. 1007, ¶0029)(Emphasis added)(Ex. 1002, ¶94). As Van Ostrand explains, “[t]his **permits a failure in any one of several capacity producing components in a system to be found and identified.**” (Ex. 1007, ¶0030)(Emphasis added)(Ex. 1002, ¶94). When Van Ostrand identifies a failed component, it removes the failed component from the staging sequence (Ex. 1007, ¶0029) and provides an alert (Ex. 1007, ¶0033). (Ex. 1002, ¶95).

Van Ostrand and Hildebrand render obvious **suggest[ing] a cause of degradation** in three ways, namely by identifying the cause of the degradation, by communicating the cause to the staging controller, and by suggesting the cause to

the human operator. (Ex. 1007, ¶¶0029, 0033)(Ex. 1002, ¶96). First, Van Ostrand teaches identifying a particular component of an HVAC system that has failed. (Ex. 1007, ¶0030)(Ex. 1002, ¶96). This is a suggestion of a cause of degradation. (Ex. 1002, ¶96). Second, Van Ostrand teaches communicating with the staging controller that the cause of the degradation in efficiency is failure of the component, allowing the staging controller to take appropriate action focusing only on the failed stage. (Ex. 1007, ¶0029)(Ex. 1002, ¶96) Third, Van Ostrand teaches that “an alert is provided” after two successive identifications of failure of a component. (Ex. 1007, ¶0033)(Ex. 1002, ¶96). It would have been obvious for this alert to provide information concerning the failed stage, because Van Ostrand has already identified it, and the information would be useful to a user. (Ex. 1002, ¶96). Thus, Van Ostrand and Hildebrand also render obvious suggesting a cause of the degradation to a human operator. (Ex. 1002, ¶96).

CLAIM 2

“2. A system as in claim 1 in which said processors receive measurements of outside temperatures for geographic regions such as ZIP codes from sources other than said HVAC control systems.”

As discussed above under claim 1, element [1c], Hildebrand teaches measuring outside temperature using an outdoor sensor, which is a source other than said HVAC control system. (Ex. 1002, ¶97). A measurement of temperature from a sensor located outside is a temperature **for geographic regions**, because the

measured air temperature at a location outside will approximate the air temperature around the sensor within a certain geographic region. (Ex. 1002, ¶97). The language “such as ZIP codes” does not limit the claim. *See Catalina Mktg. Int'l v. Coolsavings.com, Inc.*, 289 F.3d 801, 812 (Fed. Cir. 2002).

CLAIM 5

“5. A system as in claim 1 in which said HVAC system includes a programmable thermostat and said programmable thermostat is the sole source for current data regarding temperature inside said first structure conditioned by said HVAC system.”

This claim is obvious from the combination. First, Hildebrand discloses the use of thermostats and microcontroller-based HVAC system controllers, which a POSA would have understood to be a programmable thermostat. (Ex. 1004, 1:10-17)(Ex. 1002, ¶98). The '567 patent acknowledges that programmable thermostats were well-known in the relevant timeframe. (Ex. 1001, 1:21-47)(Ex. 1002, ¶98). Furthermore, programmable thermostats typically employed an inside temperature sensor that, for residential systems, was the sole source for current inside temperature data. (Ex. 1002, ¶98). Claim 5 would have been obvious from Hildebrand's disclosure of microcontroller-based HVAC controllers, the widespread use of programmable thermostats containing the sole temperature sensor in a home, and Hildebrand's own disclosure of a single zone temperature sensor. (Ex. 1004, 4:11-15, Fig. 1)(Ex. 1002, ¶98).

CLAIM 6

“6. A system as in claim 1 in which said HVAC system measures inside said first structure at only one physical location.”

Hildebrand’s system has only one temperature sensor, and thus **measures inside said first structure at only one physical location.** (Ex. 1004, 4:11-15, Fig. 1)(Ex. 1002, ¶99). The sensor is called a “zone” sensor, but even if this implies that there could be multiple zones within a structure, there were obviously structures with only one zone, *e.g.* many apartments or single-family homes. (Ex. 1002, ¶99).

CLAIM 7

“7. A system as in claim 1 in which the status of said HVAC system includes whether said system is ‘on’ or ‘off’.”

See above, claim 1, element [1b]. Hildebrand’s status indicates whether or not the system is in heat or cool mode. (Ex. 1002, ¶100). If the system is in heat or cool mode, it is obviously ‘on’, and if the system is in neither mode, it is obviously ‘off’. (Ex. 1002, ¶100). For that reason, Hildebrand obviously provides status of said HVAC system includ[ing] whether said system is ‘on’ or ‘off’.” (Ex. 1002, ¶¶7-75, 100).

CLAIM 15

“15[a]. A method for evaluating changes in the operational efficiency of an HVAC system over time comprising:”

See claim 1, element 1[a]. The system of Hildebrand and Van Ostrand also

teaches a **method**. (Ex. 1002, ¶101).

“[15b] storing temperature measurements from at least a first structure conditioned by an HVAC system; and”

See above, claim element [1b] (discussing a first structure conditioned by an HVAC system) and element [1e] (discussing storing temperature measurements from at least a first structure). (Ex. 1002, ¶102).

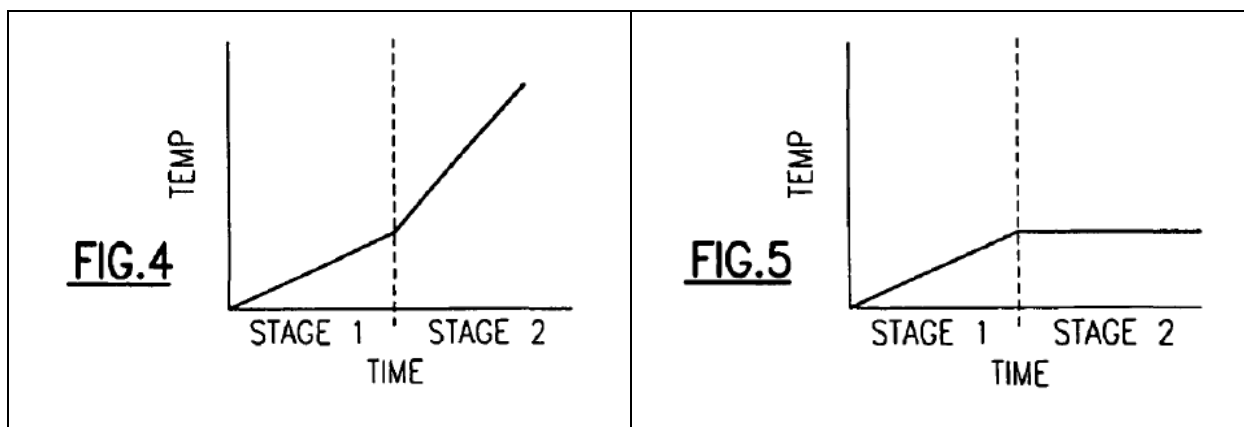
“[15c] comparing with one or more processors said temperature measurements from said first structure with outside temperature measurements over time to derive expected temperature measurements of a rate of change in inside temperature of said first structure when the HVAC system is in a first state of repair”

See above, claim element [1d]. The present element recites “to derive expected temperature measurements of a rate of change”, which differs from the corresponding limitation of claim 1. The combination, however, renders this additional limitation obvious for two reasons.

First, as explained above under element [1f], Hildebrand teaches forming efficiency values expressed in rates of change, and correlated to outside temperature. (Ex. 1002, ¶104). Hildebrand then monitors efficiency, by comparing finding the outside temperature, looking up the expected, previously-recorded efficiency at that temperature, and treating that as the expected efficiency. (Ex. 1002, ¶104). This efficiency, again, is calculated using temperature measurements and reflects a rate

of change, or is an obvious equivalent to a rate of change, as discussed above under element [1f].

Second, Hildebrand's system would also meet this element when modified to use Van Ostrand's method to diagnose the failure of specific components of an HVAC system. (Ex. 1002, ¶105). For example, Van Ostrand can diagnose the failure of an HVAC system stage by observing a time versus inside temperature curve, and comparing the slope of that curve with the expected slope (rate of change) of the curve under similar conditions. (Ex. 1007, ¶¶0033)(Ex. 1002, ¶105). This is shown for example, in Figs. 4 and 5 of Van Ostrand, reproduced here:



Van Ostrand, Fig. 4

Van Ostrand, Fig. 5

(Ex. 1007, Figs. 4-5, ¶0033)(Ex. 1002, ¶105). Van Ostrand explains:

“Alternatively, or in addition, **the amount of change in the rate of change is learned by the controller 12 from monitoring the system 10 responses to its outputs over a number of cycles.** That is, the controller 12 after a number of cycles ‘learns’ the capacity of each state of the system. **When the system does not respond with the learned capacity, the controller 12 infers that there has been**

a failure.”

(Ex. 1007, ¶0033)(Emphasis added)(Ex. 1002, ¶105).

Thus, the combination, using Van Ostrand’s techniques to detect failure of a specific component of an HVAC system, learns rates of change from inside temperatures for each stage, stores them correlated to outside temperatures (per Hildebrand), and then later uses the current outside temperature to look up the appropriate rate of change to derive the “expected” temperature versus time curve (as shown in Van Ostrand Fig. 4), which are **expected temperature measurements of a rate of change in inside temperature** of said first structure. (Ex. 1007, Fig. 4, ¶0033)(Ex. 1002, ¶106). The expected temperature measurements are “of a rate of change” because they are based on the stored rate of change for a given outside temperature. (Ex. 1002, ¶106).

“[15d] wherein the expected temperature measurements are based at least in part upon past temperature measurements and based at least in part on outside temperature measurements,”

See above, claim 15 element [15c] and claim 1, element [1d]. As explained under those limitations, the expected rates of change calculated by Hildebrand are correlated to outside temperature, so that the proper rate of change can be used for the prevailing conditions. (Ex. 1002, ¶107). The expected temperature measurements (the expected temperature versus time curve, e.g. Fig. 4 of Van

Ostrand, above) are thus **based at least in part on the past temperature measurements** (because the expected rate of change was previously computed using temperature measurements) and **at least in part on the outside temperature measurements**, because the rates of change are correlated to outside temperature, and thus the expected rate of change is chosen based on the current measured outside temperature. (Ex. 1002, ¶107).

“[15e] wherein said one or more processors compares an inside temperature recorded inside the first structure with said expected temperature measurements to determine whether the operational efficiency of the HVAC system has decreased.”

See above, claim 1, element [1f] and claim 15, element [15d]. Hildebrand teaches comparing an **expected**, previously-recorded efficiency value to a new efficiency value (calculated using current temperature measurements), to determine whether efficiency has decreased. (Ex. 1004, 7:18-33)(Ex. 1002, ¶108).

Additionally, Van Ostrand teaches comparing the **expected** time versus temperature curve with the measured time versus temperature curve (Ex. 1007, ¶¶0029-0033, Figs. 4-5). The measured time versus temperature curve would obviously be formed from **inside temperature recorded inside the first structure**, which is already present in Hildebrand’s system, as discussed above with respect to claim elements [1b] and [1e]. (Ex. 1002, ¶109).

CLAIM 16

“16. The method as in claim 15 wherein said outside temperature measurements are for geographic regions such as ZIP codes from sources other than said HVAC system.”

See above, claim 2, which has the same limitation for a system claim. (Ex. 1002, ¶110).

CLAIM 19

“19. The method as in claim 15 wherein a programmable thermostat associated with said HVAC system is the sole source for current data regarding temperature inside the first structure conditioned by said HVAC system.”

See above, claim 5, which has the same limitation for a system claim. (Ex. 1002, ¶111).

CLAIM 20

“20. The method as in claim 15 further comprising whether the status of said HVAC system is ‘on’ or ‘off’.”

See above, claim 7, which has the same limitation for a system claim. (Ex. 1002, ¶112).

Ground 2. Claims 1-3, 5-7, 15-17, and 19-20 are obvious over Hildebrand and Van Ostrand, in further view of Rosen.

Claims 1-3, 5-7, 15-17, and 19-20 are obvious under 35 U.S.C. §103(a) over **Hildebrand and Van Ostrand** (cited in Ground 1), in further view of U.S. Pat. No. 6,789,739 (“**Rosen**”)(Ex. 1009).

Rosen was cited by an Examiner in combination with U.S. Pat. App. Pub. 2005/0288822 (“**Rayburn**”)(Ex. 1014), in a rejection of certain then-pending dependent claims of the application leading to the related ’322 patent (U.S. Pat. App. Ser. No. 13/230,610, Ex. 1011, pp. 142-143). However, the Applicant did not make any specific arguments with respect to Rosen (which was applied only to dependent claims), but rather relied on arguments made with respect to the Rayburn reference and the independent claims. (Ex. 1011, p. 128).

A. Effective Prior Art Date of Rosen

Rosen issued on September 14, 2004, and is therefore also prior art under pre-AIA 35 U.S.C. § 102(b).

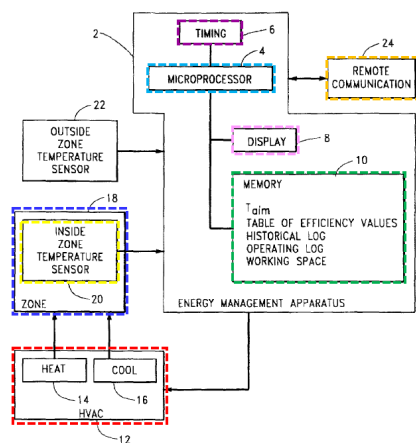
B. Overview of the Ground

Hildebrand and Van Ostrand are applied as in Ground 1, with the exception that Rosen teaches the ability to obtain measurements of outside temperature over the Internet from a weather data provider. This Ground posits that it would have been obvious to obtain outside temperature measurements from the Internet, thus replacing Hildebrand’s use of outside temperature sensors. Rosen also teaches several other features recited by dependent claims. Furthermore, it would have been obvious to use in Hildebrand Rosen’s Internet-capable, programmable thermostat with a single temperature sensor.

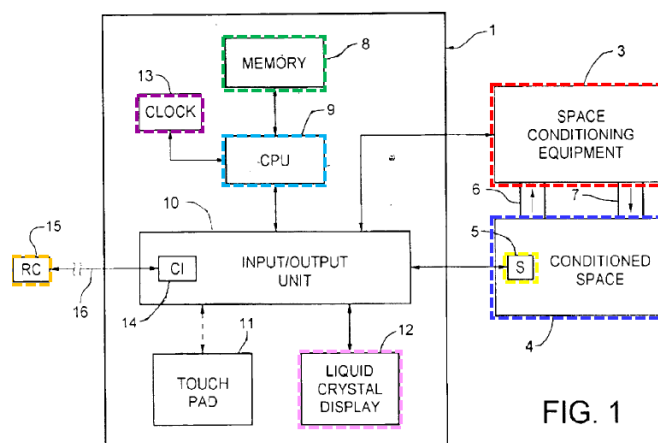
C. Overview of Rosen

Rosen teaches an HVAC control system that has hardware elements similar

to Hildebrand's. (Ex. 1009, A side-by-side comparison of Fig. 1 of Hildebrand (left) and Fig. 1 of Rosen (right), with dashed boxes of the same color added around similar elements (HVAC system in red, building in blue, temperature sensor in yellow, microprocessor in light blue, clock/timer in purple, display in light purple, memory in green, and remote communications in orange):



Hildebrand, Fig. 1



Rosen Fig. 1

(Ex. 1002, ¶116).

Rosen's HVAC control system intelligence is found within a programmable thermostat. (Ex. 1009, 3:3-7)(Ex. 1002, ¶117). The thermostat has a processor and a single temperature sensor within the same housing, although Rosen notes that the processor can be separate. (Ex. 1009, 3:3-7)(Ex. 1002, ¶117).

Rosen's HVAC control system has the ability to communicate over the Internet to a weather service provider. (Ex. 1009, 4:4-15)(Ex. 1002, ¶118). The weather service provider provides data including current outdoor temperature, localized to a particular geographic region based on, e.g., a ZIP code. (Ex. 1009,

4:40-49, 7:58-8:11)(Ex. 1002, ¶118).

D. Motivation (Rationale) for the Combination

It would have been obvious to a POSA to obtain outdoor temperatures for a geographic region, as taught by Rosen, in Hildebrand. (Ex. 1002, ¶119). Petitioner notes that the ITC found the combination of Rosen and Hildebrand obvious for this purpose. (Ex. 1010, pp. 479-480).

Hildebrand teaches measuring outdoor temperature using a sensor. (Ex. 1004, 4:16-21)(Ex. 1002, ¶120). Rosen, in turn, teaches (in 2004) that “local current weather information sources are widely available and are routinely accessed by, for example, using the Internet.” (Ex. 1009, 4:10-15)(Ex. 1002, ¶120). Hildebrand already teaches that its local HVAC control systems have a network connection. (Ex. 1004, 4:22-34, 7:63-8:20)(Ex. 1002, ¶120). A POSA would have seen an advantage in avoiding the expense of obtaining, wiring and servicing an extra outside temperature sensor by obtaining weather information from the Internet. (Ex. 1002, ¶120). Additionally, using the Internet to obtain outdoor temperatures, per Rosen, was a known technique that could have been substituted for the technique of measuring temperature with home sensors, with no unexpected results. *See KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416-421 (2007).

E. Reasonable Expectation of Success

A POSA would have had a reasonable expectation of success in combining

Rosen with Hildebrand in this manner, because the combination involved computer programming and network communications that were well-established by the relevant timeframe. (Ex. 1002, ¶¶121).

F. Analogous Art

Rosen is analogous art because it is in the same field as the '567 patent (building energy management and controls), and its methods would have been reasonably pertinent to the problems facing the named inventors. (Ex. 1004, Abstract)(Ex. 1009, 2:1-38)(Ex. 1002, ¶122). *See Wyers*, 616 F.3d at 1238.

G. Claim Mapping

CLAIMS 1, 7, 15 AND 20

Independent claims 1 and 15, and their respective dependent claims 7 and 20, are obvious in the same manner discussed in Ground 1, with the exception that the outside temperature measurements, first recited in claim elements [1c] and [15c], come from an Internet weather data source. (Ex. 1009, 4:40-59, Fig. 6)(Ex. 1002, ¶123). Such outdoor temperature data would obviously have been a measurement, and would have been from a source other than the HVAC system. (Ex. 1002, ¶123). The ITC has previously found the combination of Rosen and Hildebrand obvious. (Ex. 1010, pp. 479-480).

CLAIMS 2 AND 16

Claims 2 and 16 recite system and method limitations requiring that the “outside temperature measurements are for geographic regions such as ZIP codes

from sources other than said HVAC system”. In the combination, the outside temperature measurements come from an online weather information system per Rosen, and are localized (i.e. they are **for geographic regions**) using, for example, a ZIP code. (Ex. 1009, 7:19-57)(Ex. 1002, ¶124). The ITC has previously found that the combination of Rosen and Hildebrand rendered a similar claim (claim 2 of the ’322 patent) obvious. (Ex. 1010, pp. 479-480).

CLAIMS 3 AND 17

“3. A system as in claim 1 wherein said temperature measurements are obtained from a programmable thermostat that communicates using the Internet.”

“17. The method in claim 15 further comprising communicating with a programmable thermostat associated with said HVAC system using the Internet.”

The combination renders claims 3 and 17 obvious. Specifically, Rosen teaches (as recited in claim 3) a **single thermostat unit that has a single indoor temperature sensor** (like Hildebrand), and would provide the indoor temperature measurements. (Ex. 1009, 2:2-6, 1:17-28, 3:3-9)(Ex. 1004, 4:11-15, Fig. 1)(Ex. 1002, ¶125). Furthermore, Rosen teaches (as recited in claims 3 and 17) a **programmable thermostat that communicates via the Internet** (e.g. to obtain outside temperature information). (Ex. 1009, 1:65-67, 2:11-15, 6:62-7:9)(Ex. 1002, ¶125). The thermostat is **associated with the HVAC system**. (Ex. 1002, ¶125).

Ground 3. Claims 4 and 18 are obvious over Hildebrand and Van Ostrand, in further view of Ehlers '330.

Claims 4 and 18 are obvious under 35 U.S.C. §103(a) over **Hildebrand** and **Van Ostrand** (cited in Ground 1), in further view of U.S. Pat. App. Pub. 2004/0117330 (“**Ehlers '330**”)(Ex. 1013).

Ehlers '330 itself was not cited during the application leading to the '567 patent, although a related publication (US2007/0043477) was. This related reference, however, was cited in a list of 74 other references, and was never expressly analyzed or applied in a rejection. (Ex. 1012, pp. 134-139).

A. Effective Prior Art Date of Ehlers '330

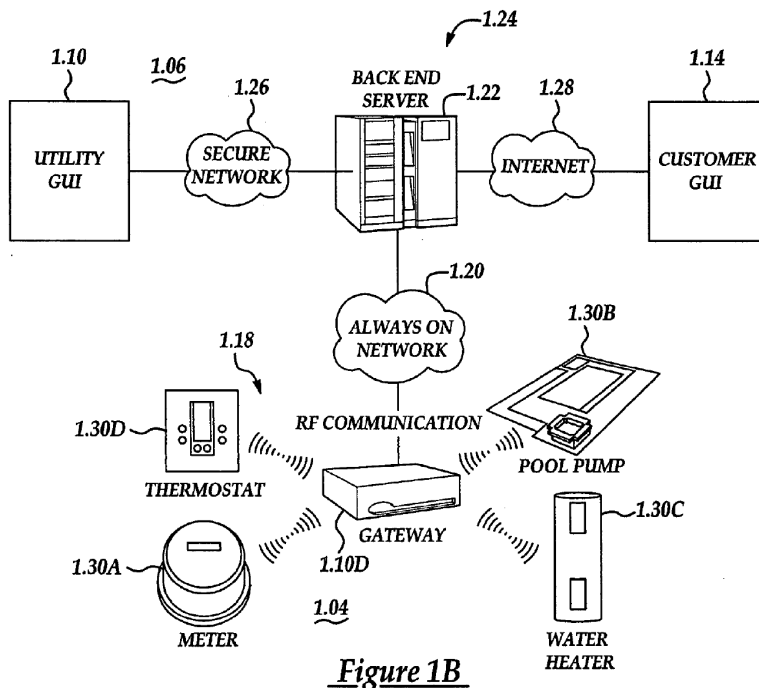
Ehlers '330 was published on June 17, 2004, and is therefore prior art under pre-AIA 35 U.S.C. § 102(b).

B. Overview of Ehlers '330

Ehlers '330 teaches “[a] system and method [to] manage delivery of energy from a distribution network to one or more sites.” (Ex. 1013, Abstract)(Ex. 1002, ¶128). The Ehlers '330 system allows a computer to control the operation of various appliances in a home, including an HVAC system. (Ex. 1013, ¶¶0015-0016)(Ex. 1002, ¶128). Like Hildebrand, Ehlers '330 teaches performing advanced control of the HVAC system by collecting inside and outside temperature data. (Ex. 1013, ¶¶0088, 0151, 0268-0309)(Ex. 1001, 7:20-24)(Ex. 1002, ¶128). Ehlers '330 is analogous art, because it is directed to the same field as the '567 patent, and

addresses similar problems (e.g. increasing efficiency). (Ex. 1013, Abstract, ¶0224)(Ex. 1002, ¶128).

An example of the system of Ehlers '330 is shown in Fig. 1B, reproduced here:



(Ex. 1013, Fig. 1B, ¶¶0072-0079)(Ex. 1002, ¶129). The system has a conditioned space including a thermostat 1.30D. (Ex. 1013, ¶0076)(Ex. 1002, ¶129). The thermostat communicates with a server 1.22 via a network facilitated by a gateway. (Ex. 1013, ¶¶0061-0062, 0072-0073)(Ex. 1002, ¶129). Also communicating with the network is an electric meter 1.30A. (Ex. 1013, ¶0076)(Ex. 1002, ¶129).

C. The Combination, Motivation, and Claim Mapping.

Dependent claim 4 recites the system of claim 1 “in which said processors communicate with said HVAC system using a network that includes an electricity

meter”. Claim 18 recites a similar method claim.

Ehlers ’330 teaches a networked electricity meter 1.30A, as shown in Fig. 1B, above. (Ex. 1013, ¶¶0076, 0117, 0163-0164, Fig. 1B)(Ex. 1002, ¶131). The meter “communicates with the gateway node or gateway 1.10D.” (Ex. 1013, ¶0076)(Ex. 1002, ¶131). The meter and gateway are part of a network, to which the processing computers of the Ehlers ’330 system are also connected. (Ex. 1013, ¶¶0062, 0071-0072, 0110, Fig. 1B)(Ex. 1002, ¶131).

It would have been obvious to provide communications between the HVAC control system of Hildebrand and an electric meter associated either with the building or the HVAC system via a network connection, as taught by Ehlers ’330. Such a network connection would have provided three advantages taught by Ehlers ’330. First, the control system of Hildebrand would have been able to access electric meter data to measure energy usage data, and provide this information to the user, along with the historical and HVAC efficiency data already provided by Hildebrand. (Ex. 1004, 2:3-10)(Ex. 1013, ¶0117)(Ex. 1002, ¶132). Second, access to electrical power consumption data via the electric meter would have allowed Hildebrand to correlate Hildebrand’s efficiency to power consumption. (Ex. 1002, ¶132). Third, by allowing the electrical meter to communicate over the Internet (including a home wireless network), a utility would be able to read and access electricity usage data without performing manual meter reading. (Ex. 1002, ¶132).

Separately, by the relevant timeframe, it was a well-known technique to connect utility meters to communication networks, and this could have been performed with a reasonable expectation of success and no unexpected results. (Ex. 1002, ¶133). *See KSR*, 550 U.S. at 416-421.

Ground 4. Claims 8-9 and 14 are obvious over Spalink

Claims 8-9 and 14 are obvious under 35 U.S.C. §103(a) over U.S. Pat. Pub. 2006/0111816 (“**Spalink**”)(Ex. 1008).

Spalink was published on May 25, 2006, and is thus prior art under pre-AIA 35 U.S.C. §102(b).

Spalink was not considered during examination of any application leading to the ’567 patent.

A. Overview of the Ground

This ground challenges independent claim 8 and its dependent claims 9 and 14. While claim 8 is similar in some respects to claim 1, it adds the concept of comparing certain kinds of data between *two different structures*. Spalink teaches such an approach, and anticipates claim 8. This ground is nevertheless presented under 35 U.S.C. §103(a) because certain features of Spalink’s system are described in a way that could imply claim features without expressly stating them. In such instances, the ground makes a case for obviousness. These instances are explained in the Claim Mapping section below, under each claim element where appropriate.

B. Overview of Spalink

Spalink teaches a system for detecting and correcting for anomalous behavior in HVAC control systems. An embodiment of Spalink's system is shown in Fig. 2, reproduced here:

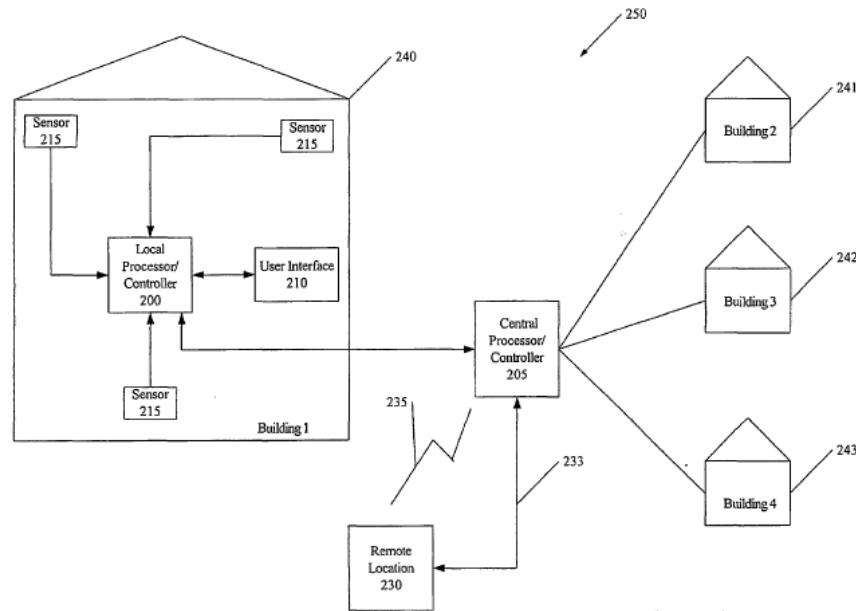


Figure 2

(Ex. 1008, Fig. 2, ¶¶0061-0064)(Ex. 1002, ¶137). Figure 2 shows a central processor / controller 205 (middle), connected to several buildings 240-243. (Ex. 1008, ¶0061)(Ex. 1002, ¶137). Building 240 has an expanded conceptual view, showing a local processor / controller 200, several sensors 215, and a user interface 210 (e.g., a thermostat). (Ex. 1008, ¶0061)(Ex. 1002, ¶137).

Spalink teaches that the system, including the central and local processors, collects weather data as well as temperature measurements from inside the buildings, using the data to construct a mathematical model of each building and its climate

control system, including the efficiency. (Ex. 1008, Abstract, ¶¶0073-0076, Fig. 3).

The performance of climate control systems from similar buildings can be compared, and problems identified and corrected. Spalink explains:

“Referring to FIGS. 1A and 1B, the central receiving module 131 is configured to receive the sensed data associated with the buildings and sensed data associated with one or more other buildings....[A]ccording to some embodiments of the present invention, climate control systems that appear to be operating within performance metrics and/or specifications at a local level, may be further improved by **comparing** the performance of the climate control system in the **building with the performance of climate control systems in similar buildings**, i.e., **systemic problems may be identified and corrected.**”

(Ex. 1008, ¶0044)(Emphasis added)(Ex. 1002, ¶138). Spalink teaches that such correction can occur by changing building control parameters to fix an identified problem, or by scheduling appropriate maintenance. (Ex. 1008, ¶¶0044, 0057, 0075, 0087)(Ex. 1002, ¶138).

C. Rationale (Motivation) Supporting Obviousness

The rationale for each instance of obviousness is discussed in the Claim Mapping section, below, where appropriate.

D. *Graham* Factors

The explanation of the *Graham* factors under Ground 1 likewise applies here.

E. Reasonable Expectation of Success

A POSA in the relevant timeframe would have had a reasonable expectation of success of implementing Spalink in the ways discussed in the Claim Mapping sections. (Ex. 1002, ¶140). As Mr. Shah explains, the art was relatively predictable in the relevant timeframe (2007). (Ex. 1002, ¶140). Spalink is a software-based system that used well-known components, and was thus predictable in nature. (Ex. 1002, ¶140).

F. Analogous Art

Spalink is analogous art because it is in the same field as the '567 patent (building energy management and controls), and its methods would have been reasonably pertinent to the problems facing the named inventors. (Ex. 1008, Abstract, ¶¶0044, 0057, 0073-0076, 0087)(Ex. 1002, ¶141).

G. Claim Mapping

CLAIM 8

“8[a]. A system for detecting and correcting for anomalous behavior in HVAC control systems comprising:”

Spalink teaches the preamble. First, as discussed above in the section entitled “Overview of Spalink”, beginning on page 55, Spalink teaches a system for controlling HVAC systems in multiple buildings. (Ex. 1002, ¶142).

Spalink further teaches **detecting and correcting for anomalous behavior in HVAC control systems**. Spalink teaches **detecting** anomalous behavior in

HVAC control systems by comparing the efficiency of an HVAC system with the efficiency of HVAC systems in other buildings. (Ex. 1008, ¶0076)(Ex. 1002, ¶143). Spalink states, “when the actual sensed data from the building is compared to sensed data from other similar buildings, **a systemic problem may be revealed**. For example, **the building may be consuming 10 percent more energy than the other similar houses.**” (Ex. 1008, ¶0076)(Emphasis added)(Ex. 1002, ¶143). Thus, Spalink teaches **detecting anomalous behavior in HVAC control systems** by identifying poor relative efficiency compared to other buildings. (Ex. 1008, ¶0076)(Ex. 1002, ¶143).

Spalink then teaches **correcting for anomalous behavior in HVAC control systems** in two ways. **First**, Spalink corrects for anomalous behavior by adjusting parameters in the HVAC control system to compensate for the anomalous behavior. (Ex. 1008, ¶0039)(Ex. 1002, ¶144). To “adjust the parameters”, Spalink teaches adjusting the control system to improve the performance of the HVAC system. (Ex. 1008, ¶¶0075, 0039, 0041, 0045, 0051-0056, 0060)(Ex. 1002, ¶144).

Second, Spalink also (separately) teaches correcting for anomalous behavior by scheduling timely maintenance. (Ex. 1008, ¶0087)(Ex. 1002, ¶145).

“[8b] a first HVAC control system that receives temperature measurements from at least a first structure conditioned by at least one HVAC system, and receives status of said HVAC system;”

Spalink teaches a first HVAC control system, in the form of a central /

processor controller (such as central / processor controller 205) in combination with local processors / controllers 200, both of which are shown in Fig. 2 (reproduced below) with added red-dashed boxes:

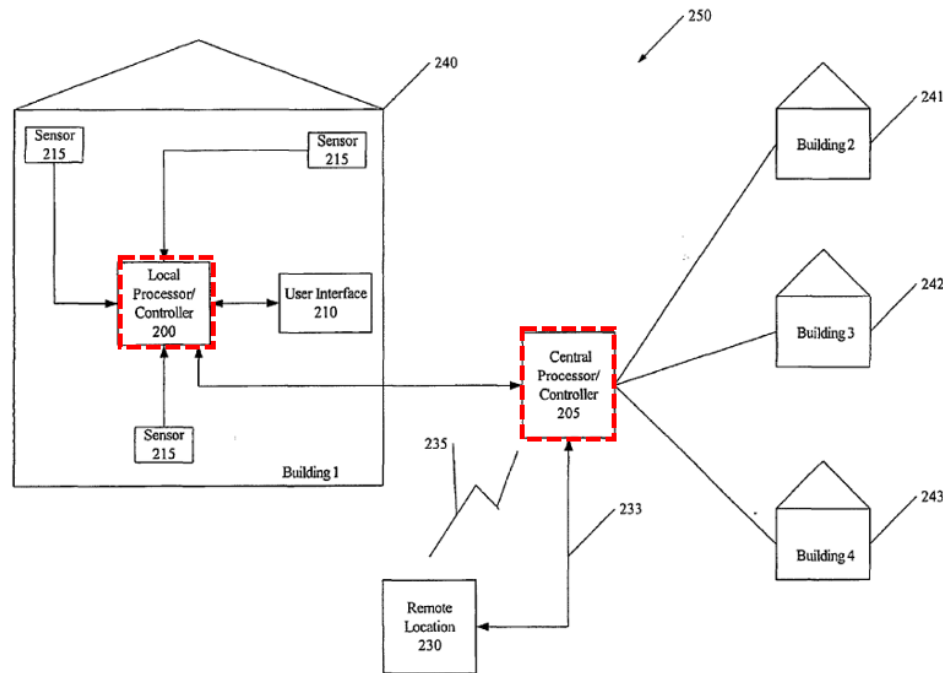


Figure 2

(Ex. 1008, Fig. 2, ¶¶0042, 0061-0063, Figs. 1A and 1B)(Ex. 1002, ¶146). The basic concept of the processors / controllers and their principal functions are the same with respect to each figure of Spalink. (Ex. 1008, ¶¶0042, 0046, 0063, 0093)(Ex. 1002, ¶146).

The central and local processors / controllers form an **HVAC control system**, because they adjust parameters of the climate control system (*i.e.* an HVAC system) to control the indoor climate. (Ex. 1008, ¶¶0063, 0027, 0039, 0093-0097, Abstract)(Ex. 1002, ¶147). Adjusting parameters of a climate-control system means

controlling an HVAC system. (Ex. 1008, ¶0027)(Ex. 1002, ¶147).

The HVAC control system further **receives temperature measurements from at least a first structure conditioned by at least one HVAC system.** Specifically, the building includes sensors (e.g. sensors 215 in Fig. 2, above) that collect “sensed data”, which includes temperature inside the building. (Ex. 1008, ¶0030, Abstract)(Ex. 1002, ¶148). The sensed data is **received** and stored by the local controller (HVAC control system). (Ex. 1008, ¶0057, 0030)(Ex. 1002, ¶148). This is shown, for example, in Fig. 4, reproduced here with an added red-dashed box:

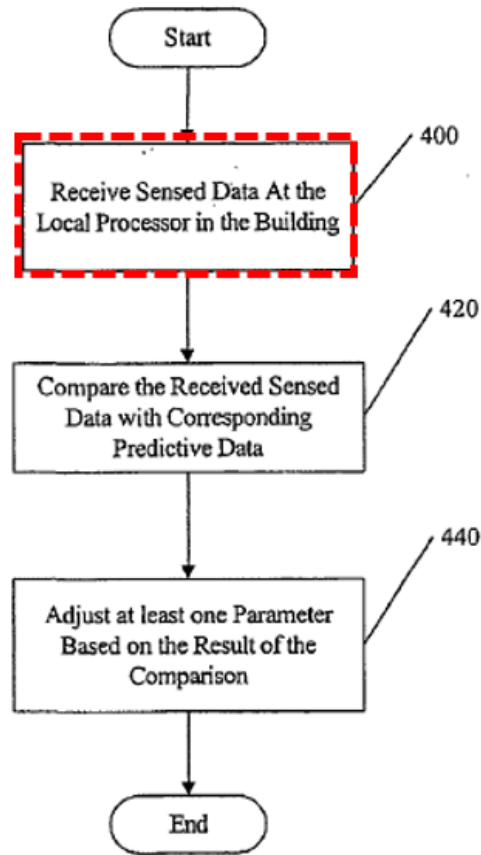


Figure 4

(Ex. 1008, Fig. 4, ¶0093)(Ex. 1002, ¶148). This received sensed data, including the temperature inside the building (¶0030), is stored in the memory of the local processor / local controller, and passed along to the central processor controller. (Ex. 1008, ¶¶0036, 0042, 0074)(Ex. 1002, ¶148).

The **HVAC control system** (central and local processors / controllers) also **receives status of said HVAC system**. (Ex. 1002, ¶149). Spalink teaches this in two ways. First, Spalink teaches that “control systems of the present invention” (*e.g.* the local processor / local controller) can receive the “state of the climate control

system”. (Ex. 1008, ¶0080)(Ex. 1002, ¶149). Second, Spalink teaches that the local processor / local controller can receive user interface (e.g. thermostat) transactions initiated by a user, which also renders obvious receiving the status of the HVAC control system. (Ex. 1008, ¶¶0080-0081)(Ex. 1002, ¶149). Specifically, it would have been obvious to include the resulting status from a user interface transaction when, for example, the HVAC system is turned on or off. (Ex. 1002, ¶149). Furthermore, it would have been obvious to a POSA that the local processor / local controller would receive the status of the HVAC system (e.g. whether it is ‘on’ or ‘off’, or in heating or cooling mode), because the local processor / local controller uses a model that uses as input the state of the climate control system. (Ex. 1008, ¶0092)(Ex. 1002, ¶149).

“[8c] at least a second HVAC control system that obtains temperature measurements from at least a second structure conditioned by a second HVAC system, and status of said second HVAC system;”

Spalink teaches an overall system that comprises a plurality of buildings (as shown in Fig. 2, reproduced above), each with its own local processor / local controller. (Ex. 1008, ¶0062)(“As further illustrated in FIG. 2, the first building 240 **(as well as the second through fourth buildings,** although not illustrated in FIG. 2) includes one or more local processor/controllers 200...”)(Emphasis added)(Ex. 1002, ¶150). There is thus a **second HVAC control system** (found in any of the

second through fourth buildings). (Ex. 1002, ¶150).

The **second HVAC control system obtains temperature measurements from at least a second structure conditioned by a second HVAC system, and status of said second HVAC system** in the same manner as the first HVAC control system, described above under element [8b]. (Ex. 1002, ¶151).

“[8d] one or more processors that receive measurements of outside temperatures from at least one source other than said first and second HVAC systems and compare said temperature measurements from said first HVAC system and said second HVAC system and said outside temperature measurements over time to determine the relative efficiency of the first HVAC system and the second HVAC system; and”

Spalink teaches **one or more processors**. Specifically, the central and local processors / controllers, together each comprise computer systems with microprocessors. (Ex. 1008, ¶¶0035, 0042)(Ex. 1002, ¶152).

The one or more processors receive both inside temperature measurements and **measurements of outside temperatures from at least one source other than said first and second HVAC systems**. (Ex. 1002, ¶153). First, the *local* processors / controllers 200 receive temperature measurements as discussed above under claim elements [8b] and [8c]. The temperature measurements include measurements of outside temperature from sensors located outside each building. (Ex. 1008, ¶¶0030-0031)(Ex. 1002, ¶153). Second, the *central* processor / controller 205 also receives both inside and outside temperature measurements in the form of “reference data”

from the local processors / controllers 200. (Ex. 1008, ¶¶0057)(Ex. 1002, ¶153). The “reference data” includes both the inside and outside temperature measurements. (Ex. 1008, ¶¶0030, 0031-0032, Abstract)(Ex. 1002, ¶153).

The outside temperature measurements received by both the local processors / controllers and the central processor / controller are **from at least one source other than said first and second HVAC systems**, because they are from sensors that are not part of the HVAC systems. (Ex. 1008, ¶¶0030-0031)(Ex. 1002, ¶154).

Spalink further teaches that the central processor / controller **compares** the reference data (inside and outside temperature measurements) **from said first HVAC system and said second HVAC system and said outside temperature measurements over time**. Spalink states that a central processor / controller has a “central analyzing module 132” which “may be configured to **compare and/or aggregate reference data from one building with reference data from one or more other buildings.**” (Ex. 1008, ¶0057)(Emphasis added)(Ex. 1002, ¶155).

The data is compared “over time”. (Ex. 1008, ¶0031)(“As used herein, ‘**reference data**’ refers to recorded and persistently stored metrics and **time series of metrics**, which may include but are not limited to information about building structures, indoor climates, mechanical equipment, control systems, and/or the **local weather**, either in analog or digital format, and at various levels of resolution and accuracy.”)(Emphasis added)(*see also* Ex. 1008, ¶¶0072, 0049, 0073)(Ex. 1002,

¶155).

The comparison of reference data is “**for comparisons of energy efficiency** of certain types of structures **over time** and **under specific weather conditions.**” (Ex. 1008, ¶0073)(Emphasis added)(Ex. 1002, ¶156). The word “structures” clearly indicates how a structure, including its associated climate control system, performs. (e.g. Ex. 1008, ¶¶0076, 0057)(Ex. 1002, ¶156).

To perform “comparisons of energy efficiency” (Ex. 1008, ¶0073), the central processor compares sensed reference data. (Ex. 1008, ¶0076)(Ex. 1002, ¶157). Again, the “sensed data” being compared includes inside and outside temperatures from sensors inside and outside of the respective buildings connected to the central processor / controller. (Ex. 1008, ¶¶0030-0032, Abstract)(Ex. 1002, ¶157). The comparison results in a calculation of relative efficiency, *i.e.* the relative efficiency is the efficiency of the HVAC system, within the context of a particular building and particular weather conditions, as compared to HVAC systems in other buildings—just like the ’567 patent. (Ex. 1008, ¶¶0027, 0032, 0072). The comparison of the performance of one HVAC system to another allows the system to identify and correct problems. (Ex. 1008, ¶0044)(Ex. 1002, ¶157).

Thus, Spalink teaches that the central processor / controller receives and records “reference data”, including sensed inside temperatures and outside temperatures as a time series. (Ex. 1008, ¶¶0030, 0074)(Ex. 1002, ¶158). Spalink

further teaches that the central processor analyzes and compares such reference data from different buildings (Ex. 1008, ¶0057), which can be used “for **comparisons** of energy **efficiency** of certain types of structures **over time** and under **specific weather conditions.**” (Ex. 1008, ¶¶0073)(Emphasis added)(*see also* ¶¶ 0076, 0057, 0044)(Emphasis added)(Ex. 1002, ¶158). This allows Spalink to **determine the relative efficiency of the first HVAC system and the second HVAC system.** (Ex. 1008, ¶¶0076, 0044)(Ex. 1002, ¶158).

Furthermore, based on Spalink, it would have been *obvious* to **compare said temperature measurements from said first HVAC system and said second HVAC system and said outside temperature measurements over time to determine the relative efficiency of the first HVAC system and the second HVAC system.** Spalink expressly teaches to compare sensed reference data—which includes inside and outside temperatures from first and second buildings—to be able to compare the energy efficiency over time and under different weather conditions. (Ex. 1008, ¶¶0057, 0072-0076)(Ex. 1002, ¶159). From this, it would have been obvious to use inside temperature measurements to determine efficiency, adjusting for outside temperature, because the outside temperature significantly impacts the energy required by the HVAC system to change the inside temperature. (Ex. 1002, ¶159).

“[8e] one or more databases that store said temperatures [sic]

measurements,”

Spalink teaches that its temperature measurements (part of the “reference data”, Ex. 1008, ¶¶0030-0031) are stored in memories at both the local processor / controller and central processor controller. (Ex. 1008, ¶¶0036, 0042)(Ex. 1002, ¶161). For the central processor / controller, the data is stored in a data store 156 separately for each building and as “aggregated reference data”, as shown in Fig. 1B, reproduced below with an added red-dashed box:

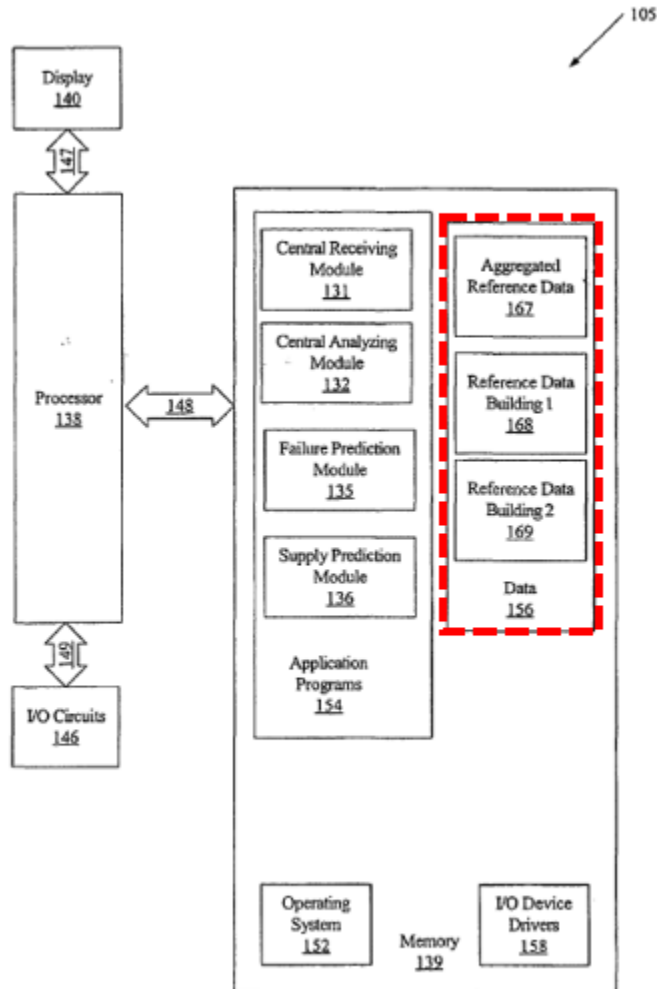


Figure 1B

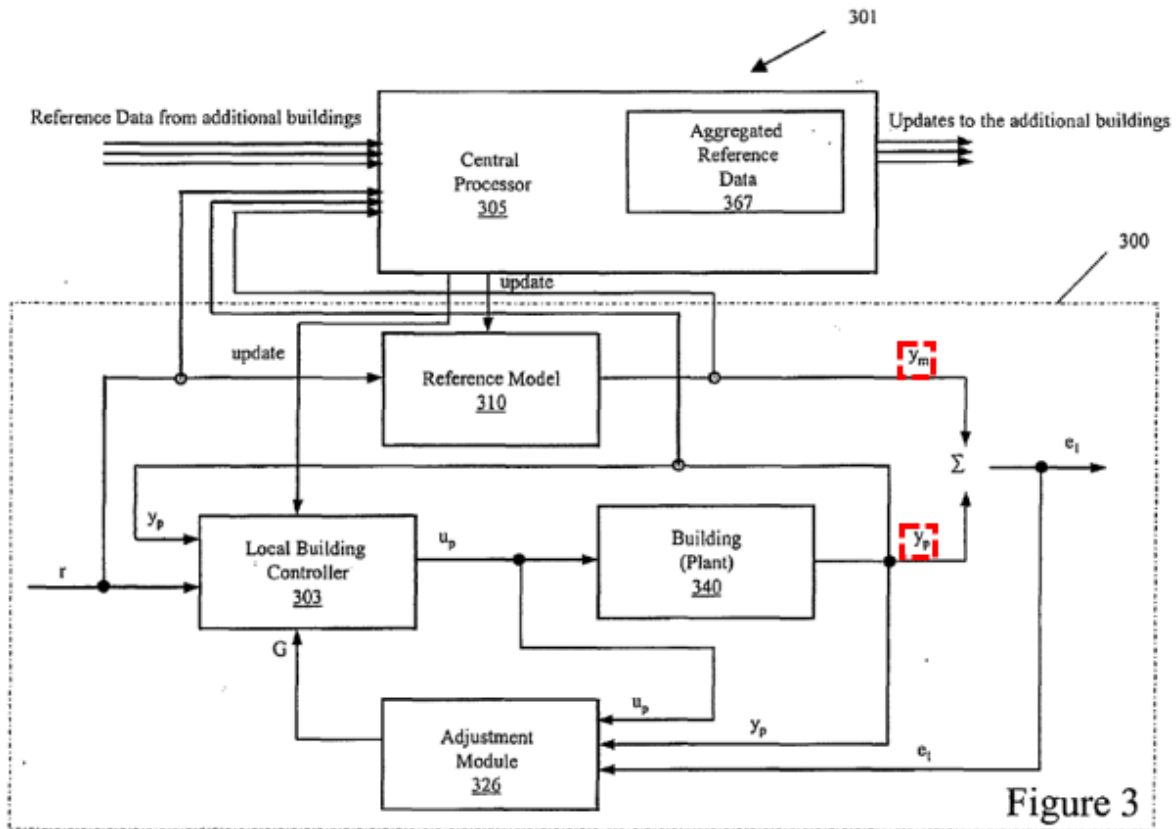
(Ex. 1008, Fig. 1B, ¶0042)(Ex. 1002, ¶161). The central processor / controller receives all temperature measurements as “reference data”, as described above under claim element [8d], and stores them in the data store 156. (Ex. 1008, ¶0042)(Ex. 1002, ¶161). This stored data is then used for Spalink’s calculations. (Ex. 1008, ¶0057)(Ex. 1002, ¶161).

As Mr. Shah explains, a POSA would have understood the data store of the central processor / controller to be a **database**. (Ex. 1008, ¶¶0065-0071)(Ex. 1002, ¶¶162-163). Furthermore, in the relevant timeframe (no earlier than September, 2007), it would have been obvious to use a database to store reference data collected from the various buildings. (Ex. 1002, ¶164). As Mr. Shah explains, databases were a common and well-known method of data storage in that timeframe, and could have been used to fulfill the function of storing reference data with no unpredictable results. (Ex. 1002, ¶164). *See KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416-21 (2007).

“[8f] wherein said one or more processors compares the relative efficiency of the first HVAC system and the second HVAC system to determine whether the operational efficiency of the first HVAC system has decreased over time; and”

Spalink teaches this limitation. As discussed above, Spalink first teaches that the “performance metrics” of climate control systems can be compared between buildings. (Ex. 1008, ¶0044)(Ex. 1002, ¶165).

One way in which Spalink performs a comparison of performance metrics is shown via the control system diagram of Fig. 3, reproduced below with added red-dashed boxes:



(Ex. 1008, Fig. 3, ¶¶0074-0076)(Ex. 1002, ¶166).

Spalink compares the output y_p of the plant 340 (the measured conditions of the building, including temperature and the efficiency of the climate control system) with the output of a model of the building y_m . (Ex. 1008, ¶¶0073-0076)(Ex. 1002, ¶167). If the climate control system is working well, the output of the plant y_p should be approximately equal to the output of the model y_m . (Ex. 1002, ¶167). If there is a difference, however, Spalink's system can detect a degradation in efficiency. (Ex.

1002, ¶167). Spalink explains:

“if the **comparison of y_m and y_p** indicates that **the building in the same season last year operated 10 percent more efficiently** and cooled 50 percent faster, control algorithms of the controller 303 may be adjusted to achieve similar results during the next season.”

(Ex. 1008, ¶0075)(Emphasis added)(Ex. 1002, ¶167). Thus, by the comparison of the building (plant) and model output parameters, Spalink analyzes whether **the operational efficiency of the first HVAC system has decreased over time**. (Ex. 1002, ¶167).

This analysis is also performed by **comparing the relative efficiency of the first HVAC system and the second HVAC system**. (Ex. 1002, ¶168). This can be seen from the fact that the central processor 305 in Fig. 3 is collecting data from other buildings, and updating the reference model with such data. (Ex. 1008, ¶0075)(Ex. 1002, ¶168). This allows the efficiency comparison to also be made between the respective HVAC systems of different buildings. (Ex. 1008, ¶0076)(Ex. 1002, ¶168).

Thus, Spalink teaches that **said one or more processors** (local and central processors) **compare the relative efficiency of the first HVAC system and the second HVAC system** (by comparing reference model parameters) **to determine whether the operational efficiency of the first HVAC system has decreased over time**. (Ex. 1008, ¶¶0075-0076, 0057, 0072-0073, Abstract)(Ex. 1002, ¶169).

“[8g] wherein if said operational efficiency has decreased, said one or more processors analyzes the changes in the operational efficiency over time to suggest a cause of degradation.”

Spalink teaches this limitation in two ways. **First**, Spalink teaches that by comparing the climate control systems of similar buildings, “systemic problems may be identified and corrected.” (Ex. 1008, ¶0044)(*see also* Ex. 1008, ¶¶0044, 0032, 0041, 0075-0076)(Ex. 1002, ¶171). Spalink likewise teaches that “previously unknown failure modes may be identified and analyzed for the first time.” (Ex. 1008, ¶¶0086-0087)(Ex. 1002, ¶171). In correcting a problem that has been identified, the system obviously **suggests a cause** for the problem. (Ex. 1002, ¶171).

Second, Spalink teaches adjusting building parameters to correct for losses in efficiency. (Ex. 1008, ¶¶0075-0076)(Ex. 1002, ¶172). In so doing, Spalink’s system compares actual building (and HVAC system) output with predicted output, and to the extent there is a difference, provides different input parameters to the building (and its HVAC system), thus correcting for the degradation. (Ex. 1008, ¶0075)(Ex. 1002, ¶172). In this (second) case, Spalink’s system suggests a cause of degradation because it adjusts the input parameters to the building and its HVAC system. (Ex. 1008, ¶0075)(Ex. 1002, ¶172). By adjusting certain input parameters, Spalink is suggesting that improper setting of those parameters caused the degradation. (Ex. 1002, ¶172).

CLAIM 9

“9. A system as in claim 8 in which said processors receive said outside temperature measurements for geographic regions such as ZIP codes from sources other than said HVAC control systems.”

Spalink teaches using outdoor sensors at a building to measure local temperatures. (Ex. 1008, ¶¶0030)(Ex. 1002, ¶173). These temperatures are **received by the one or more processors** as discussed above under claim 8, element [8d]. The temperatures are **from sources other than said HVAC control systems** because they come from sensors, not from the central or local processors / controllers. (Ex. 1002, ¶173). Furthermore, a measurement of temperature from a sensor located outside is a temperature **for geographic regions**, because the measured air temperature at a location outside will approximate the air temperature around the sensor within a certain geographic region. (Ex. 1002, ¶173).

CLAIM 14

“14. A system as in claim 8 in which the status of said first HVAC system includes whether said first HVAC system is ‘on’ or ‘off’.”

As discussed above under claim 8, element [8b], the HVAC control system of Spalink receives the “state of the climate control system”, as well as transactions entered at the user interface (*i.e.* at the thermostat). (Ex. 1008, ¶¶0080-0082)(Ex. 1002, ¶174). It would have been obvious that such information (the “state of the climate control system” and “transactions” entered at the user interface”) included

whether the HVAC system was ‘on’ or ‘off’, because this is the most basic status information concerning an HVAC system, and would have been seen as necessary for performing even basic calculation concerning the performance metrics of the Spalink climate control system. (Ex. 1008, ¶¶0075, 0044)(Ex. 1002, ¶174). For example, if inside temperature is rising, any calculation of efficiency would need to account for whether the HVAC system is ‘on’ or ‘off’. (Ex. 1002, ¶174).

Ground 5. Claims 8-10 and 12-14 are obvious over Spalink in view of Rosen.

Claims 8-10 and 12-14 are obvious under pre-AIA 35 U.S.C. §§ 103(a) over Spalink (presented in Ground 4), in further view of Rosen.

Rosen is described above under Ground 2. This ground posits that it would have been obvious to use Rosen’s provision of outside temperature in Spalink’s system, analogous to the obviousness case of Ground 2.

A. The Combination, Motivation, and Claim Mapping

It would have been obvious to a POSA to obtain outdoor temperatures for a geographic region, as taught by Rosen, in Spalink’s system. (Ex. 1002, ¶177).

Spalink already teaches obtaining information about “the local weather, either in analog or digital format, and at various levels of resolution and accuracy.” (Ex. 1008, ¶0031)(Ex. 1002, ¶178). This data includes measurements of outside temperature. (Ex. 1008, ¶0038-0039)(Ex. 1002, ¶178). While Spalink measures outside temperature directly using sensors, Rosen teaches (in 2004) that “local

current weather information sources are widely available and are routinely accessed by, for example, using the Internet.” (Ex. 1009, 4:10-15)(Ex. 1002, ¶178). Spalink further teaches a user interface, which is likely a thermostat, that is connected to a network. (Ex. 1008, ¶¶0052-0053, 0062)(Ex. 1002, ¶178). A POSA would have seen an advantage and found it obvious to use a programmable thermostat, such as one described by Rosen, to obtain outside temperature measurements, in order to avoid the expense of obtaining, wiring and servicing an extra outside temperature sensor. (Ex. 1008, ¶0023)(Ex. 1002, ¶178). Additionally, using the Internet to obtain outdoor temperatures, per Rosen, was a known technique that could have been substituted for the technique of measuring temperature directly, with no unexpected results. (Ex. 1002, ¶178). *See KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416-421 (2007).

CLAIMS 8 AND 14

Independent claim 8 and dependent claim 14 are obvious in the same manner discussed in Ground 4, with the exception that the outside temperature measurements, first recited in claim elements [8c], come from an Internet weather source. (Ex. 1009, 4:40-59, Fig. 6)(Ex. 1002, ¶178). Such outdoor temperature data would obviously have been a measurement, and would have been from a source other than the HVAC system. (Ex. 1002, ¶178).

CLAIM 9

Claim 9 recites system and method limitations requiring that the “outside temperature measurements are for geographic regions such as ZIP codes from sources other than said HVAC system”. In the combination, the outside temperature measurements come from an online weather information system per Rosen, and are localized (i.e. they are **for geographic regions**) using, for example, a ZIP code. (Ex. 1009, 7:19-57)(Ex. 1002, ¶179).

CLAIM 10

“10. A system as in claim 8 wherein said temperature measurements are obtained from a programmable thermostat that communicates with said first HVAC control system using the Internet.”

Spalink teaches that its user interface communicates with the processor (part of the HVAC control system) via a network. (Ex. 1008, ¶0053)(Ex. 1002, ¶180). The network can be the Internet. (Ex. 1008, ¶0023). Rosen teaches a **programmable thermostat that communicates via the Internet** (e.g. to obtain outside temperature information). (Ex. 1009, 1:65-67, 2:11-15, 6:62-7:9)(Ex. 1002, ¶180).

CLAIMS 12 AND 13

“12. A system as in claim 8 in which said first HVAC system includes a programmable thermostat and said programmable thermostat is the sole source for current data regarding temperature inside said location conditioned by said first HVAC system.”

“13. A system as in claim 8 in which said first HVAC system

measures inside said first location at only one physical location.”

Rosen teaches a **single thermostat unit that has a single indoor temperature sensor**. (Ex. 1009, 2:2-6, 1:17-28, 3:3-9)(Ex. 1002, ¶181). While Spalink shows multiple sensors 215 in Fig. 1B, the number of these sensors is not fixed. (Ex. 1002, ¶181). In a single-family home, it was common and obvious in the relevant timeframe to have one temperature sensor in the building, located in a thermostat. (Ex. 1009, 2:2-6, 1:17-28, 3:3-9)(Ex. 1002, ¶181). Claims 12 and 13 were thus obvious. (Ex. 1002, ¶181).

Ground 6. Claim 11 was obvious over Spalink and Ehlers ’330.

Claim 11 was obvious under 35 U.S.C. §103(a) over **Spalink** (cited in Ground 4), in further view of **Ehlers ’330**. Ehlers ’330 was cited in Ground 3, and that discussion applies here.

A. The Combination, Motivation, and Claim Mapping.

Dependent claim 11 is similar in scope to claims 4 and 18 discussed under Ground 3, above. It would have been obvious to add an electrical meter communicating via the Spalink network for reasons similar to those discussed above under Ground 3. First, the control system of Spalink would have been able to access electric meter data to measure actual energy usage data, and provide this information to the user, (Ex. 1013, ¶0117)(Ex. 1002, ¶184), and second access to electrical power consumption data via the electric meter would have allowed Hildebrand to correlate

Hildebrand's efficiency to actual power consumption. (Ex. 1002, ¶184). Third, by allowing the electrical meter to communicate over the Internet (including a home wireless network), a utility would be able to read and access electricity usage data without performing manual meter reading. (Ex. 1002, ¶184) Separately, by the relevant timeframe, it was a well-known technique to connect utility meters to communication networks, and this could have been performed with a reasonable expectation of success and no unexpected results. *See KSR*, 550 U.S. at 416-421.

IV. THE BOARD SHOULD INSTITUTE UNDER §314(A)

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential) weighs against exercising discretion in this case. Specifically, factors 1-4 and 6 weigh against denial because there is no pending district court case litigating the '567 patent's validity, and the merits of the petition are strong. The only matter addressing validity is ITC proceeding Inv. No. 337-TA-1258, which is still in its infancy. However, validity determinations made by the ITC are not binding outside of the ITC (*see Texas Instruments, Inc. v. Cypress Semiconductor Corp.*, 90 F.3d 1558, 1569 (Fed. Cir. 1996), nor is it clear at this stage of the ITC proceeding there would be any significant overlap between the ITC and this IPR. Currently, other than the PTAB, no forum will make a dispositive validity or patentability determination for the '567 patent claims.

In opposing institution of petitions for patents related to the '567 patent,

EcoFactor took two largely inconsistent positions, namely that “validity disputes as to the [’497 or ’322] patent are likely to carry over to the district court cases” and that an invalidity determination in the ITC “will likely be instructive and may be dispositive” of issues at the PTAB and in district court. IPR2020-00946, Paper 7 at 5-6; IPR2020-00947, Paper 7 at 5-6; IPR2020-00968, Paper 6 at 4-6. EcoFactor argued (citing dicta in *Fintiv*) that it would be “difficult to maintain a district court proceeding” when the ITC determines the same claims are invalid. *Id.* Despite this representation, once the ITC administrative law judge issued a Final Initial Determination (Ex. 1010) finding claims of the related patents invalid, EcoFactor continued to assert those related patents in district court. (Ex. 1014). Thus, EcoFactor cannot credibly assert that it might be “difficult to maintain a district court proceeding” over the ’567 patent after an adverse ITC judgment, because EcoFactor is doing exactly that with respect to related patents.

V. CONCLUSION

Petitioner respectfully requests that claims 1-20 of the '567 patent be canceled.

Date: <u>July 26, 2021</u>	<u>/Matthew A. Smith/ (RN 49,003)</u> Matthew A. Smith SMITH BALUCH LLP 1100 Alma St., Ste 109 Menlo Park, CA (202) 669-6207 smith@smithbaluch.com <i>Counsel for Petitioner Google LLC</i>
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CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing petition for *inter partes* review, together with all exhibits and other documents filed therewith, was served by Express Mail on July 26, 2021, on the Patent Owner's counsel of record at the United States Patent & Trademark Office having the following address:

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CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that the foregoing petition for *inter partes* review contains 13,897 words according to the word processing program used to prepare it.

Date: July 26, 2021

/Matthew A. Smith/ (RN 49,003)