

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

CONTROLTEC, LLC,	)	
	)	
Plaintiff,	)	
	)	
v.	)	C.A. No. _____
	)	
ANTHONY, INC. and	)	JURY TRIAL DEMANDED
HILL PHOENIX, INC.,	)	
	)	
Defendants.	)	

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff ControlTec, LLC (“ControlTec”) for its Complaint against Defendants Anthony, Inc. (“Anthony”) and Hill Phoenix, Inc. (“Hill Phoenix”) (collectively, “Defendants”) hereby alleges as follows:

BACKGROUND

1. ControlTec is a leading manufacturer and supplier in the anti-sweat controls sector for grocery stores with its headquarters in Laramie, Wyoming. For the last twenty years, ControlTec has sold, installed, and monitored its control systems throughout the United States, and it continues to do so today. ControlTec’s systems include its AS-20 system, which gives grocery stores complete control of all frozen and medium temperature equipment.

2. ControlTec’s AS-20 system combines anti-sweat controls for energy-hungry glass display doors with optional 24-hour temperature sensing and monitoring for refrigerator food cases. ControlTec has manufactured and installed thousands of AS-20 systems throughout the United States. The AS-20 system is designed for easy retrofit installation or factory installation.

3. ControlTec’s AS-20 system includes a local controller unit connected with an array of case sensors including an internal case temperature sensor, an external case frame temperature

sensor, and a dew point sensor. The case frame temperature sensor and dew point sensor are housed to thermally isolate sensing elements thereof from effects of frame temperature changes and ambient air temperature in the vicinity of a sensing element and to limit heat transfer by the housing to the sensing elements, thereby improving sensing accuracy and apparatus performance.

4. ControlTec's AS-20 system incorporates patented sensor technology that uses a revolutionary dew point sensor to control anti-sweat heaters in glass display doors. Instead of running these heaters 24 hours a day, seven days a week, ControlTec's AS-20 sensor technology determines when the display doors will condensate and turns the heaters on automatically before condensation begins. The system then turns the heaters off when they are no longer needed.

5. ControlTec's AS-20 sensor technology is protected by patents regarding systems for refrigeration unit condensation prevention and related methods. From at least 2018, upon information and belief, Defendants began making, offering for sale, and selling infringing control units and installing them in grocery stores around the country, blatantly infringing ControlTec's intellectual property that is the core of its business.

6. ControlTec brings this lawsuit to recover its damages and stop the Defendants from continuing their wrongful infringement.

PARTIES

7. ControlTec is a Wyoming limited liability company with its principal place of business at 62 Turnberry Drive, Sheridan, Wyoming 82801.

8. On information and belief, Defendant Anthony, Inc. is a Delaware corporation with its principal place of business at 12391 Montero Avenue, Sylmar, California 91342.

9. On information and belief, Defendant Hill Phoenix, Inc. is a Delaware corporation with its principal place of business at 2016 Gees Mill Road, Conyers, Georgia 30013.

10. On information and belief, the parent company of Defendant Hill Phoenix, Dover Corporation, acquired Defendant Anthony in 2012, thereby making Defendant Hill Phoenix and Defendant Anthony affiliated companies. Currently, Defendant Hill Phoenix and Defendant Anthony remain affiliated companies and work together in the commercial refrigerated food space.

11. More specifically, Defendants work together to make, use, offer to sell, and sell refrigeration unit anti-sweat controllers for use on glass refrigerator doors used in grocery stores.

NATURE OF THE ACTION

12. This action is for infringement of United States Patent Nos. 7,207,181 (the “181 Patent”) and 7,421,847 (the “847 Patent”) (collectively, the “Patents-in-Suit”) under the patent laws of the United States, 35 U.S.C. §§ 1, *et seq.*

13. This action involves the Defendants’ manufacture, use, sale, or offer for sale of infringing products, methods, processes, services, and systems involving refrigeration unit anti-sweat controllers that infringe one or more the claims of the Patents-in-Suit.

JURISDICTION AND VENUE

14. This Court has original jurisdiction over the subject matter of this Complaint under 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, including 35 U.S.C. §§ 271, *et seq.*

15. Defendants are subject to personal jurisdiction in this judicial district at least because: (1) both Defendants are incorporated in Delaware; (2) both Defendants have registered agents for service of process in Delaware; (3) both Defendants have purposefully availed themselves of the privileges of conducting business in this judicial district by, among other things, offering Defendants’ products and services to customers, business affiliates, and partners located

in this judicial district; and (4) both Defendants have committed acts of patent infringement of one or more claims of the Patents-in-Suit in this judicial district.

16. Venue in this district is proper under 28 U.S.C. § 1400(b) because both Defendants are Delaware corporations and are therefore deemed to reside within this district. *TC Heartland LLC v. Kraft Food Group Brands LLC*, 581 U.S. 258, 267-270 (2017).

CONTROLTEC'S INVENTION AND THE PATENTS-IN-SUIT

17. ControlTec is a leading innovator and manufacturer of anti-sweat controllers used in grocery store refrigeration units. Through its investment in research and development and commitment to innovation, ControlTec developed a revolutionary refrigeration unit condensation prevention system that provides unrivaled accuracy, energy conservation, and regulatory compliance.

18. ControlTec has been recognized as a market leader in the retail food refrigeration industry and has successfully installed and monitored thousands of its AS-20 control units over the years.

19. On April 24, 2007, the United States Patent Office ("USPTO") duly and legally issued U.S. Patent No. 7,207,181, entitled "Refrigeration Unit Condensation Prevention." A true and correct copy of the '181 Patent is attached to this Complaint as Exhibit 1.

20. On September 9, 2008, the USPTO duly and legally issued U.S. Patent No. 7,421,847, entitled "Refrigeration Unit Condensation Prevention." A true and correct copy of the '847 Patent is attached to this Complaint as Exhibit 2.

21. ControlTec is the owner by assignment of the Patents-in-Suit from Brad Geuke. A true and correct copy of the assignments from Mr. Geuke to ControlTec is attached to this

Complaint as Exhibit 3. ControlTec owns all rights and title to the Patents-in-Suit, including the right to enforce and recover damages for infringement of the Patents-in-Suit.

22. All maintenance fees for the Patents-in-Suit have been timely paid, and there are no fees currently due.

DEFENDANTS' INFRINGING ACTIVITIES

23. Defendants make, offer for sale, sell, and install commercial refrigeration units and refrigerated doors for use in grocery stores across the country. These units also include anti-sweat control units (the “Anthony Energy Controllers”) that are standard equipment on all of Defendants’ frozen and medium temperature refrigerated doors (e.g., part number 60-22715-0002): “The Anthony Energy Controller comes standard factory installed on all Domestic (US & CANADA) Anthony Walk-In Cooler/Freezer Frames. . . .” https://www.anthonyintl.com/docs/default-source/2020-literature-updates/energy-controllers-1-page-flyer_rev-c-09-20.pdf (last visited July 25, 2024).

	Normal Temp					Low Temp		
	35°F Walk-In					-10°F Walk-In		
	401	101	INFINITY 90	INFINITY 60	VISTA C	401	101	INFINITY 90
Temperature/Environment								
RH Protection (at 75°F Ambient)	55	65	65	65	65	55	65	65
Application								
Cooler	✓	✓	✓	✓	✓			
Freezer						✓	✓	✓
Heavy-Duty Beer Cave		OPTIONAL						
Glass Pack Configuration								
Glass Standard - 3-pane		✓	✓			✓	✓	✓
Glass Standard - 2-pane	✓			✓	✓			
Standard Package								
Energy Controller	✓	✓	✓	✓	✓	✓	✓	✓
Magnetic Door Gasket	✓	✓	✓			✓	✓	✓
LifePlus Gasket "with 3 Year Warranty"		✓	✓				✓	✓
Automatic Hold-Open & Door Stop	✓	✓	✓	✓	✓	✓	✓	✓
Hinge Pin	✓	✓	✓	✓	✓	✓	✓	✓
Torque & Sag Adjust	✓	✓	✓	✓	✓	✓	✓	✓
Reversible	✓	✓	✓		✓	✓	✓	✓
Handle	TRIMLINE	SLIMLINE	VISTA ARCH	VISTA ARCH	FULL LENGTH	TRIMLINE	SLIMLINE	VISTA ARCH
Full Length Handle	OPTIONAL	OPTIONAL	OPTIONAL		STANDARD	OPTIONAL	OPTIONAL	OPTIONAL
Lighting Options								
Optimax 7 Lower Power	✓					✓		
Optimax 7 Standard Power	OPTIONAL	✓	✓	✓	✓	OPTIONAL	✓	✓
Optimax 7 French Swing		OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL			
Swing Availability								
Standard L/R	✓	✓	✓	✓	✓	✓	✓	✓
French-Swing without Mullion		OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL			
Heat Settings								
Door Rail Heat						✓	✓	✓
Pass-Thru Options								
Matching Pass-Thru Door	✓	✓	✓					
Optional Glass (1/3 Glass with 2/3 Solid Panel)	✓	✓						
Energy Consumption*								
Energy Consumption (kWh/Day)	3.30	3.20	3.20	4.10	3.58	9.26	10.01	10.05

Anthony Energy
Controllers

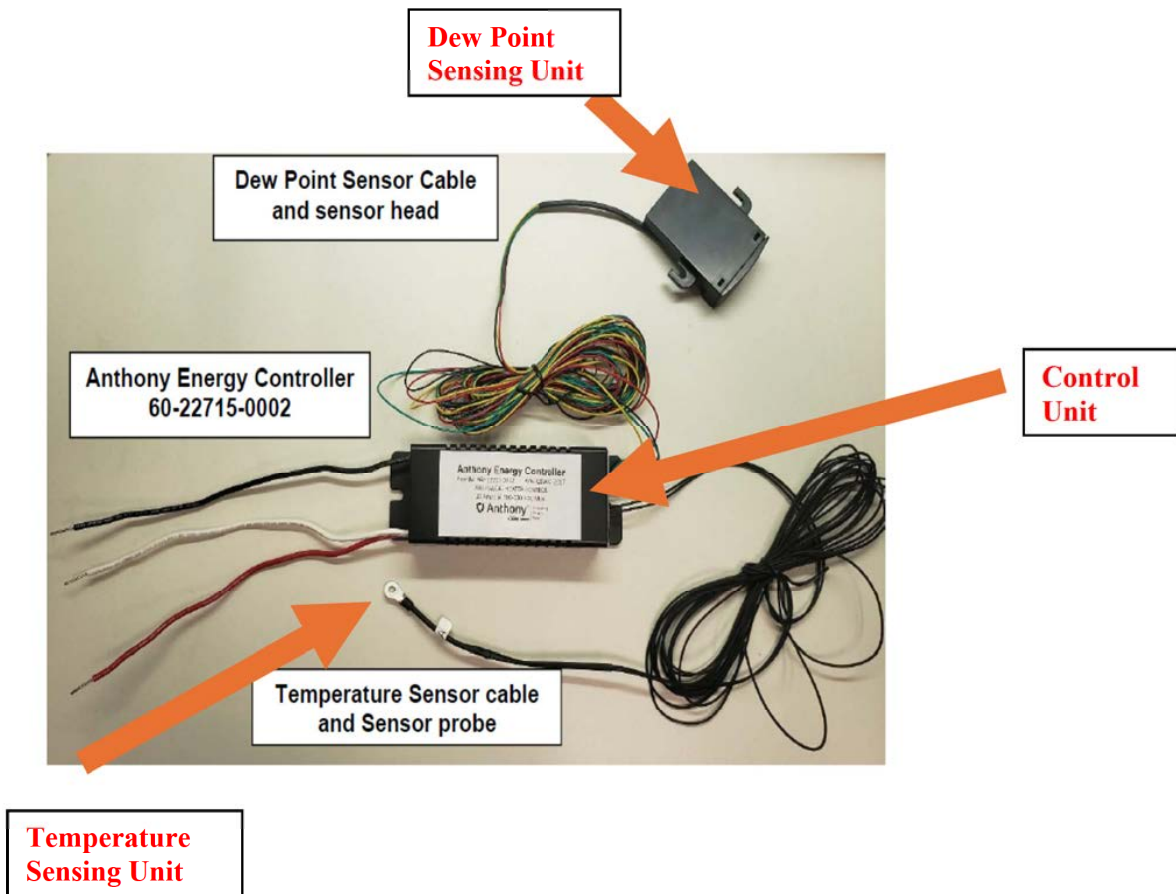
24. Starting in 2017, upon information and belief, the Department of Energy (“DOE”) began requiring an enhanced anti-sweat control unit—like the Anthony Energy Controllers—on all medium and frozen temperature refrigerators in grocery stores. *See* 10 C.F.R. § 431.306. On information and belief, around the same time the DOE changed its regulations requiring anti-sweat control units on refrigerator doors, Defendants changed their anti-sweat unit controller to a design that infringes the Patents-in-Suit.

25. Upon information and belief, Defendant Anthony manufactures, offers for sale, sells, and installs refrigerated doors for its 401 series and 101 series. Upon information and belief, both the 401 and 101 series contain Anthony Energy Controllers (e.g., part number 60-22715-0002).

26. Upon information and belief, Hill Phoenix also manufactures, offers for sale, sells, and installs refrigerated doors, as well as the display units and reach in merchandiser units that house the refrigerator doors. Upon information and belief, Hill Phoenix, in both its Infinity Series (Infinity 090; Infinity 060) and Vista C Series, contain Anthony Energy Controllers (e.g., part number 60-22715-0002).

27. The Anthony Energy Controllers—as configured and used in the refrigerator doors in Defendants’ 101 series, 401 series, Infinity Series and Vista C Series, and all versions and variations that include the same or similar Anthony Energy Controller (e.g., part number 60-22715-0002) (collectively, the “Accused Anti-Sweat Controlled Products”)—infringe one or more claims of the Patents-in-Suit.

28. A non-limiting example of the Anthony Energy Controller, which is incorporated into the Accused Anti-Sweat Controlled Products, is as follows:



29. In the above picture, the Anthony Energy Controller includes a frame temperature sensing unit adapted for monitoring temperature of one of the display case door or display case frame, which also includes a carrier having a temperature sensor thereat. The temperature sensor cable and sensor probe are part of the frame temperature sensing unit. The carrier is the wire shown ("Temperature Sensor cable"). The temperature sensor is the end of the wire ("Sensor probe").

30. The Anthony Energy Controller includes a dew point sensing unit adapted for monitoring ambient air temperature and relative humidity outside of the display case, including a carrier having at least one dew point sensing component thereat.

31. The Anthony Energy Controller also includes a control unit communicating with said sensing units and including processing means connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity.

32. The Anthony Energy Controllers are mounted to a refrigerator door in a way that infringes the Patents-In-Suit.

33. On information and belief, Anthony makes, uses, offers for sale, or sells the Accused Anti-Sweat Controlled Products in the United States, and Defendants then distribute, install, use, or otherwise provide the Accused Anti-Sweat Controlled Products to customers within the United States.

34. On or about July 10, 2017, the DOE changed its regulations and requirements related to refrigerator doors. More specifically, upon information and belief, in 2017 the DOE enhanced energy efficiency requirements from the 2009 requirements, mandating that if anti-sweat heaters are over a certain wattage, a controller is required.

35. As a result, upon information and belief, Defendants changed their control units in their refrigerator doors to make them compliant with the new DOE requirements.

36. On information and belief, Anthony has actual notice of the Patents-in-Suit based on business dealings of the parties. On or around 2005, ControlTec, under an agreement with Anthony, was to develop and manufacture anti-sweat-control devices for refrigeration doors and Anthony was to pay ControlTec and provide testing laboratories for such devices. Accordingly, Anthony was aware of ControlTec's development and patenting of the technology represented in the Patents-in-Suit.

37. ControlTec has marked its products with the '181 Patent since shortly after the USPTO granted the '181 Patent.

38. ControlTec was forced to bring this lawsuit to protect its business and enforce its intellectual property rights.

39. Defendants have, and continue to, willfully, knowingly, and intentionally infringe the Patents-in-Suit.

COUNT I
(Defendants' Direct Infringement of the '181 Patent)

40. Paragraphs 1 through 39 are incorporated by reference as if fully restated herein.

41. The '181 Patent is a valid, enforceable, and patent-eligible patent that was duly issued by the USPTO. Exhibit 1.

42. ControlTec is the owner, by valid assignment, of the '181 Patent with full rights to pursue recovery of damages for infringement, including full rights to recover past and future damages. Exhibit 3.

43. On information and belief, Defendants have directly infringed (literally and equivalently), and continue to directly infringe, at least claim 14 of the '181 Patent in violation of 35 U.S.C. § 271(a) by, for example and without limitation, making, using, selling, or offering for sale one or more of the Accused Anti-Sweat Controlled Products in the United States.

44. Claim 14 of the '181 Patent claims:

Claim 14. A system for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, said system comprising:

a temperature sensing unit in contact with the display case frame to monitor case frame temperature;

a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case; and

control means for receiving data from said sensing units and utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.

45. For example, upon information and belief, Defendants' Accused Anti-Sweat Controlled Products infringe each of the above limitations of claim 14 of the '181 Patent.

46. A more detailed analysis of Defendants' infringement of claim 14 of the '181 Patent can be found in the claims charts that are attached to this Complaint as Exhibit 4 and incorporated into this Complaint for all purposes.

47. Defendants have committed these acts of infringement in the United States and without license or authorization.

48. Defendants' infringement of the '181 Patent has been, and continues to be, willful, knowing, and intentional.

49. ControlTec has suffered economic harm because of Defendants' infringing activities in an amount to be proven at trial, but in no case less than a reasonable royalty.

COUNT II
(Defendants' Direct Infringement of the '847 Patent)

50. Paragraphs 1 through 49 are incorporated by reference as if fully restated herein.

51. The '847 Patent is a valid, enforceable, and patent-eligible patent that was duly issued by the USPTO. Exhibit 2.

52. ControlTec is the owner, by valid assignment, of the '847 Patent with full rights to pursue recovery of damages for infringement, including full rights to recover past and future damages. Exhibit 3.

53. On information and belief, Defendants have directly infringed (literally and equivalently), and continue to directly infringe, at least claim 8 of the '847 Patent in violation of 35 U.S.C. § 271(a) by, for example and without limitation, making, using, selling, or offering for sale one or more of the Accused Anti-Sweat Controlled Products in the United States.

54. Claim 8 of the '847 Patent claims:

Claim 8. A method for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, said method comprising the steps of:

placing a temperature sensing unit in contact with the display case frame to monitor case frame temperature;

mounting a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case; and

utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.

55. For example, upon information and belief, Defendants' Accused Anti-Sweat Controlled Products infringe each of the above limitations of claim 8 of the '847 Patent.

56. A more detailed analysis of Defendants' infringement of claim 8 of the '847 Patent can be found in the claim charts that are attached to this Complaint as Exhibit 5 and incorporated into this Complaint for all purposes.

57. Defendants have committed these acts of infringement in the United States and without license or authorization.

58. Defendants' infringement of the '847 Patent has been, and continues to be, willful, knowing, and intentional.

59. ControlTec has suffered economic harm because of Defendants' infringing activities in an amount to be proven at trial, but in no case less than a reasonable royalty.

COUNT III
(Defendants' Induced Infringement of the '181 Patent)

60. Paragraphs 1 through 59 are incorporated by reference as if fully restated herein.

61. On information and belief, Defendants knowingly and intentionally induce others to infringe at least claim 14 of the '181 Patent in violation of 35 U.S.C. § 271(b) by instructing or aiding others to use the Accused Anti-Sweat Controlled Products in the United States in a manner that infringes at least claim 14 of the '181 Patent.

62. Since at least 2005, Defendants have been aware of the Patents-in-Suit, including the '181 Patent, and of the infringing nature of the Accused Anti-Sweat Controlled Products.

63. Despite their knowledge of the '181 Patent, Defendants continue to actively encourage, aid, and instruct their customers to implement and use the Accused Anti-Sweat Controlled Products in the United States in ways that directly infringe the '181 Patent (e.g., by instructing grocery store chains how to use the anti-sweat controller on the Accused Anti-Sweat Controlled Products in their grocery stores). Defendants do so knowingly and intending that their customers will commit infringing acts.

64. Defendants also continue to provide the Accused Anti-Sweat Controlled Products to customers in the United States, despite Defendants' knowledge of the '181 Patent, thereby

specifically intending for and inducing their customers to infringe the '181 Patent through their customers' normal and customary use of the Accused Anti-Sweat Controlled Products.

65. ControlTec has suffered economic harm because of Defendants' induced infringement in an amount to be proven at trial, but in no case less than a reasonable royalty.

COUNT IV
(Defendants' Contributory Infringement of the '181 Patent)

66. Paragraphs 1 through 65 are incorporated by reference as if fully restated herein.

67. On information and belief, Defendants have also knowingly and willfully contributed, and continue to contribute, to their customers' direct infringement of the '181 Patent in violation of 35 U.S.C. § 271(c) by using, selling, or offering to sell the Accused Anti-Sweat Controlled Products to customers in the United States.

68. Since at least 2005, Defendants have been aware of the Patents-in-Suit, including the '181 Patent, and of the infringing nature of the Accused Anti-Sweat Controlled Products.

69. As described above, Defendants provide customers with the Accused Anti-Sweat Controlled Products that are specially made and adapted for use with their anti-sweat heaters in grocery stores. The Accused Anti-Sweat Controlled Products, and specifically their anti-sweat heaters, are not a staple article of commerce or suitable for any non-infringing use. Use and implementation of the Accused Anti-Sweat Controlled Products by Defendants and their customers in the United States infringes at least claim 14 of the '181 Patent.

70. ControlTec has suffered economic harm because of Defendants' contributory infringement in an amount to be proven at trial, but in no case less than a reasonable royalty.

COUNT V
(Defendants' Induced Infringement of the '847 Patent)

71. Paragraphs 1 through 70 are incorporated by reference as if fully restated herein.

72. On information and belief, Defendants knowingly and intentionally induce others to infringe at least claim 8 of the '847 Patent in violation of 35 U.S.C. § 271(b) by instructing and/or aiding others to use the Accused Anti-Sweat Controlled Products in the United States in a manner that infringes at least claim 8 of the '847 Patent.

73. Since at least 2005, Defendants have been aware of the Patents-in-Suit, including the '847 Patent, and of the infringing nature of the Accused Anti-Sweat Controlled Products.

74. Despite their knowledge of the '847 Patent, Defendants continue to actively encourage, aid, and instruct their customers to implement and use the Accused Anti-Sweat Controlled Products in the United States in ways that directly infringe the '847 Patent (e.g., by instructing grocery store chains how to use the anti-sweat controller on the Accused Anti-Sweat Controlled Products in their grocery stores). Defendants do so knowingly and intending that their customers will commit infringing acts.

75. Defendants also continue to provide the Accused Anti-Sweat Controlled Products to customers in the United States, despite Defendants' knowledge of the '847 Patent, thereby specifically intending for and inducing their customers to infringe the '847 Patent through their customers' normal and customary use of the Accused Anti-Sweat Controlled Products.

76. Control Tec has suffered economic harm because of Defendants' induced infringement in an amount to be proven at trial, but in no case less than a reasonable royalty.

COUNT VI
(Defendants' Contributory Infringement of the '847 Patent)

77. Paragraphs 1 through 76 are incorporated by reference as if fully restated herein.

78. On information and belief, Defendants have also knowingly and willfully contributed, and continue to contribute, to their customers' direct infringement of the '847 Patent in violation of 35 U.S.C. § 271(c) by using, selling or offering to sell the Accused Anti-Sweat Controlled Products to customers in the United States.

79. As described above, since at least 2005, Defendants have been aware of the Patents-in-Suit, including the '847 Patent, and of the infringing nature of the Accused Anti-Sweat Controlled Products.

80. As described above, Defendants provide customers in the United States with the Accused Anti-Sweat Controlled Products that are specially made and adapted for use with their anti-sweat heaters in grocery stores. The Accused Anti-Sweat Controlled Products are not a staple article of commerce or suitable for any non-infringing use. Use and implementation of the Accused Anti-Sweat Controlled Products by Defendants and their customers infringes at least claim 8 of the '847 Patent.

81. ControlTec has suffered economic harm because of Defendants' contributory infringement in an amount to be proven at trial, but in no case less than a reasonable royalty.

PRAYER FOR RELIEF

WHEREFORE, ControlTec, LLC, respectfully requests the following relief:

1. A judgment that Defendants have directly infringed the '181 Patent;
2. A judgment that Defendants have directly infringed the '847 Patent;
3. A judgment that Defendants have contributorily infringed the '181 Patent;
4. A judgement that Defendants have induced infringement of the '181 Patent;

5. A judgement that Defendants have contributorily infringed the '847 Patent;
6. A judgement that Defendants have induced infringement of the '847 Patent;
7. A judgment that awards ControlTec all appropriate damages under 35 U.S.C. § 284 for Defendants' past infringement and any continuing or future infringement of the Patents-in-Suit, up until the date such judgment is entered, including interest, costs, and disbursements as justified under 35 U.S.C. § 284 to adequately compensate ControlTec for Defendants' infringement;
8. An adjudication that Defendants' infringement of the Patents-in-Suit has been willful and deliberate;
9. An adjudication that ControlTec be awarded treble damages and pre-judgment interest under 35 U.S.C. § 284 as a result of Defendants' willful and deliberate infringement of the Patents-in-Suit;
10. An adjudication that this case is exceptional within the meaning of 35 U.S.C. § 285;
11. An adjudication that ControlTec be awarded the attorneys' fees, costs, and expenses it incurs in prosecuting this action; and
12. An adjudication that ControlTec be awarded such further relief at law or in equity as the court deems just and proper.

DEMAND FOR JURY TRIAL

ControlTec hereby demands a trial by jury of all issues so triable.

MORRIS, NICHOLS, ARSHT & TUNNELL LLP

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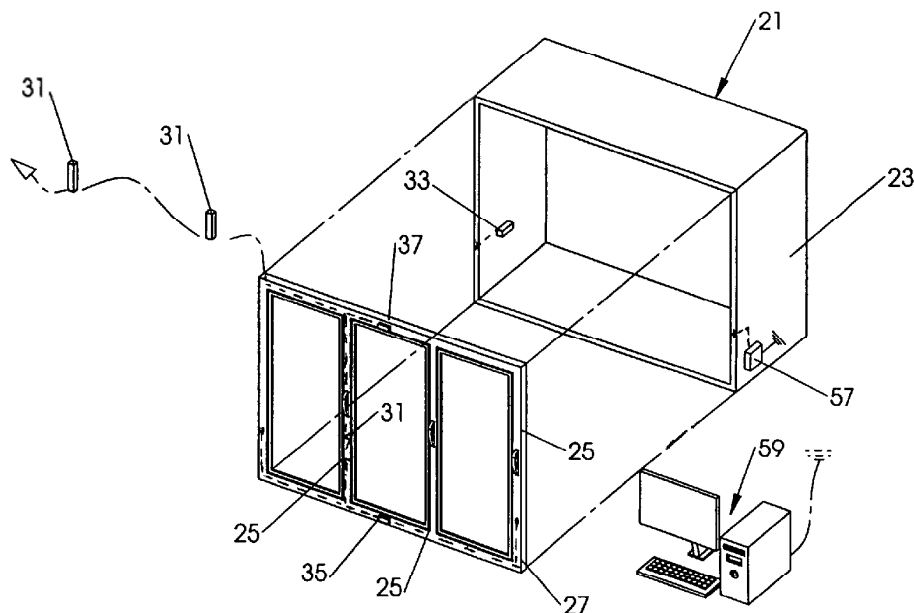
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July 26, 2024

EXHIBIT 1

(10) **Patent No.:** US 7,207,181 B2
(45) **Date of Patent:** Apr. 24, 2007

20 Claims, 29 Drawing Sheets



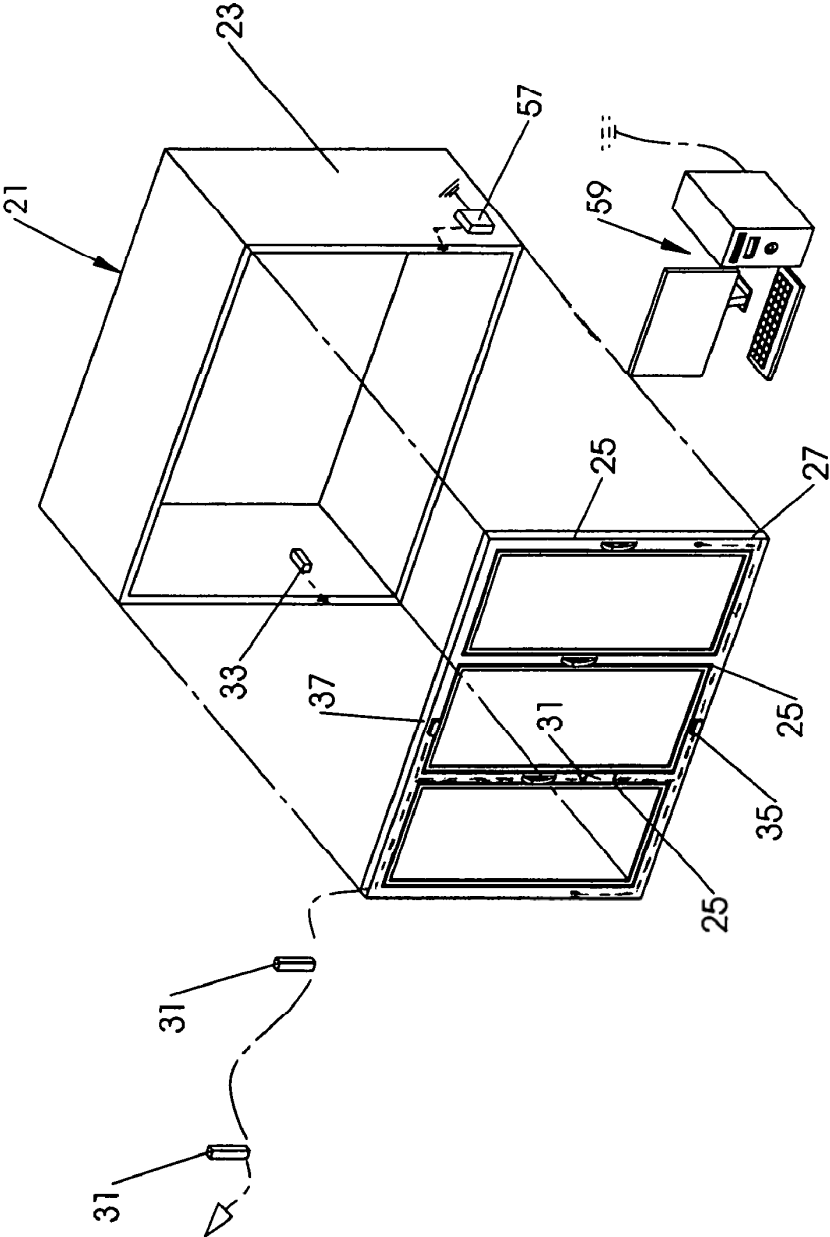


FIGURE 1

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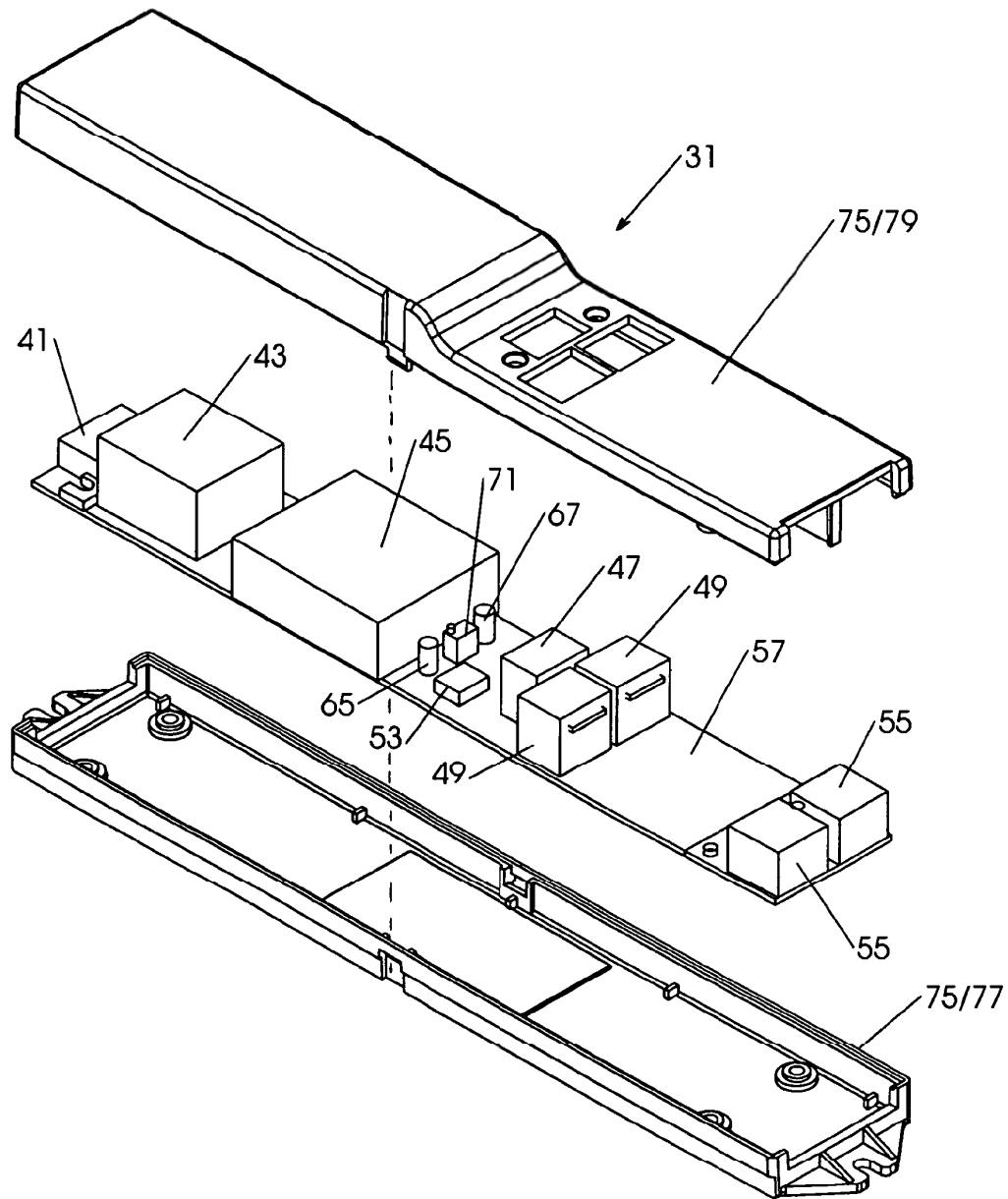


FIGURE 2

U.S. Patent

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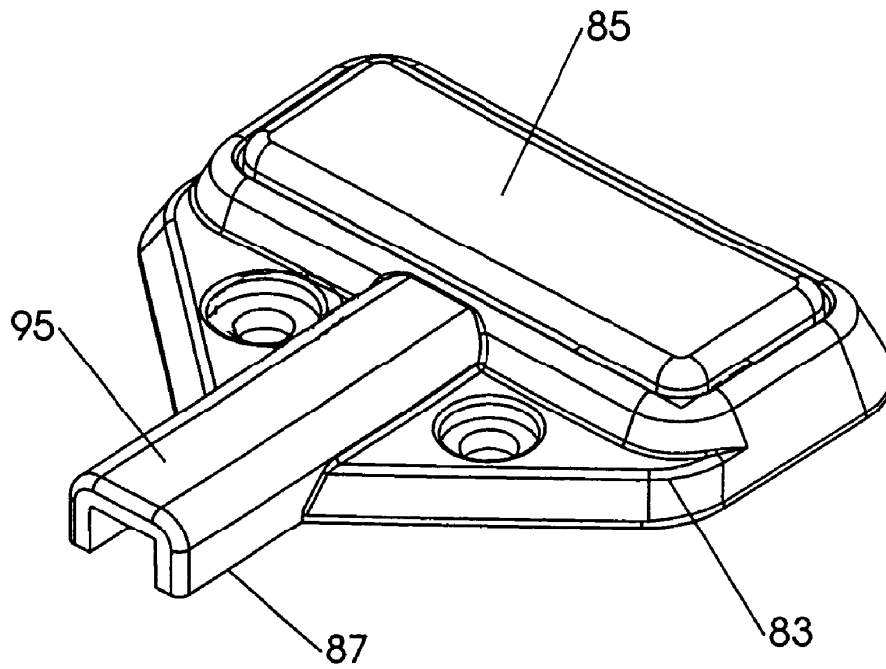


FIGURE 3

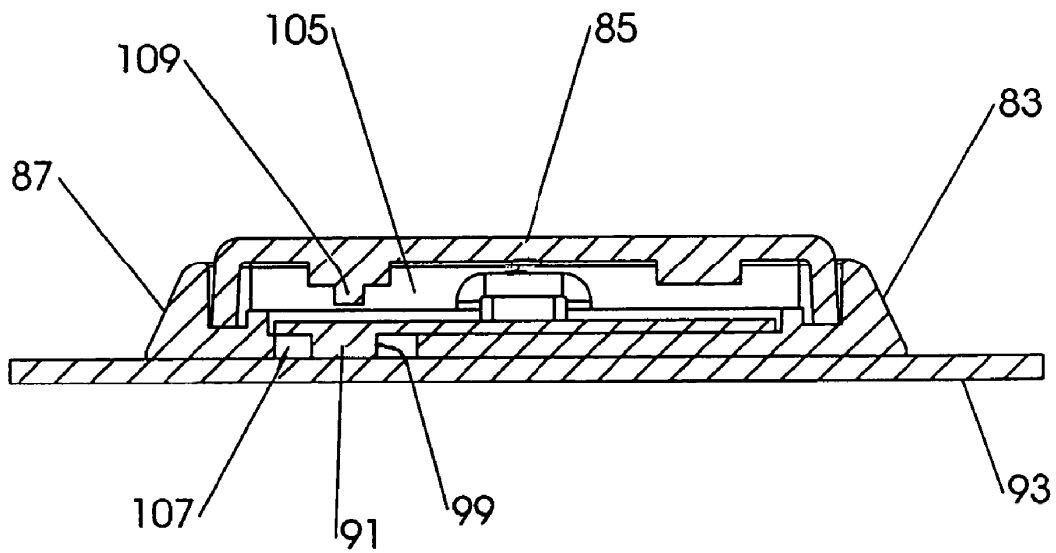


FIGURE 5

U.S. Patent

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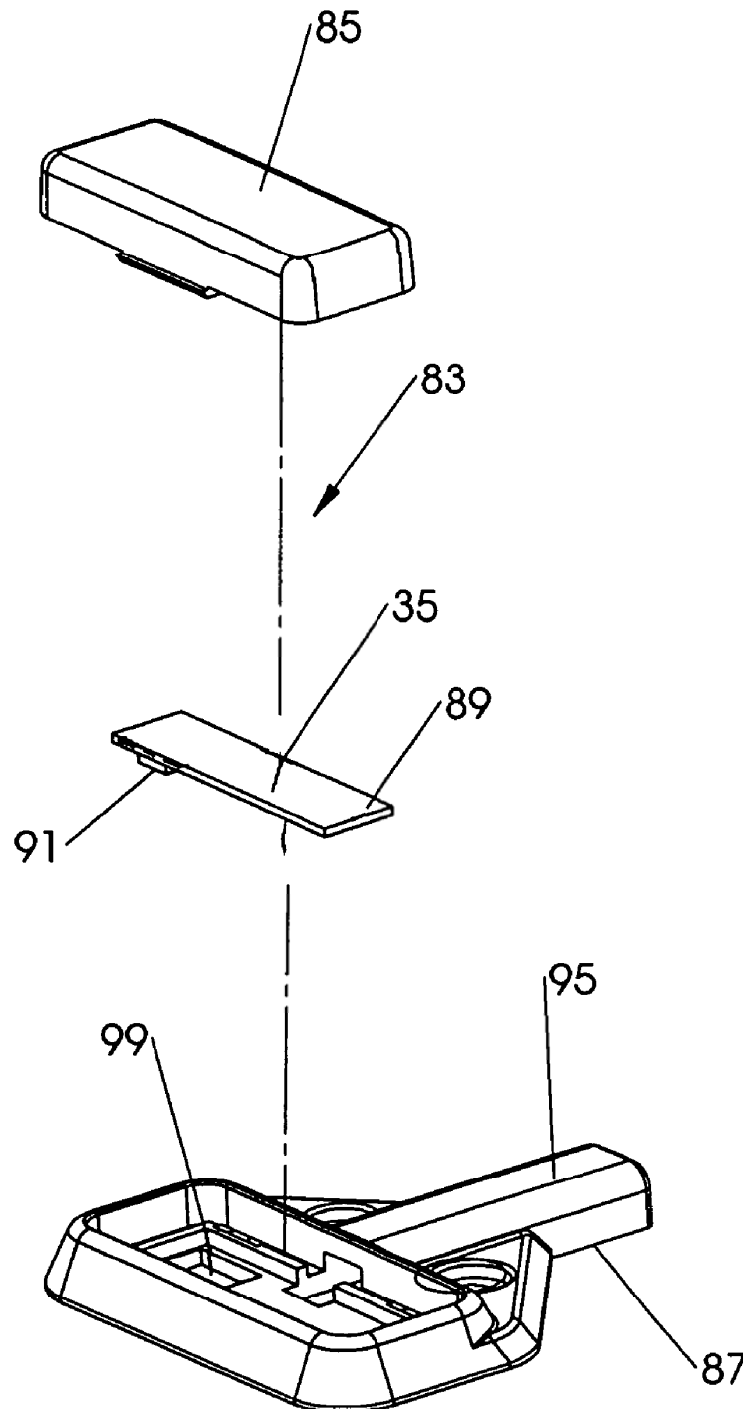


FIGURE 4

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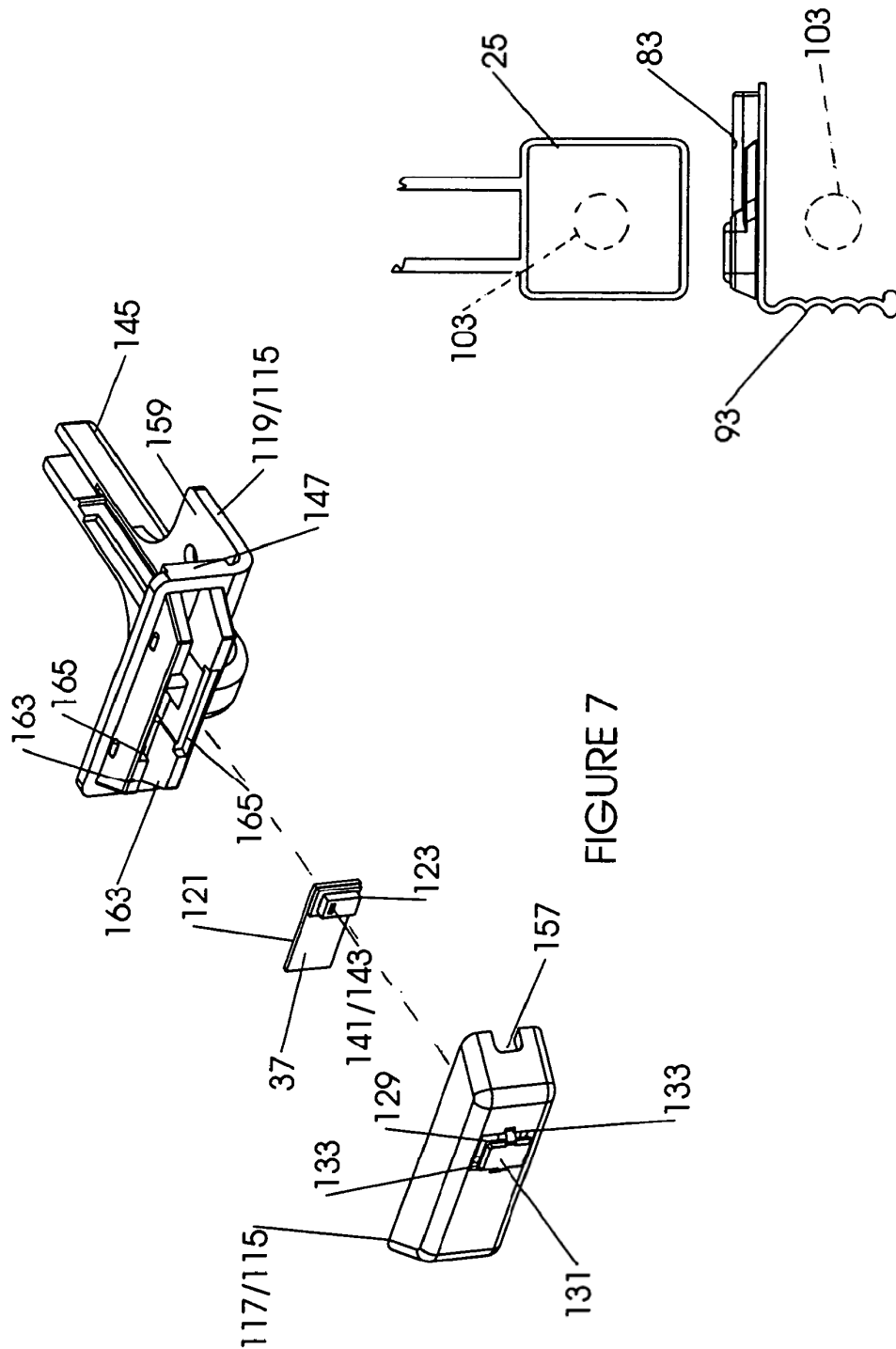


FIGURE 6

FIGURE 7

U.S. Patent

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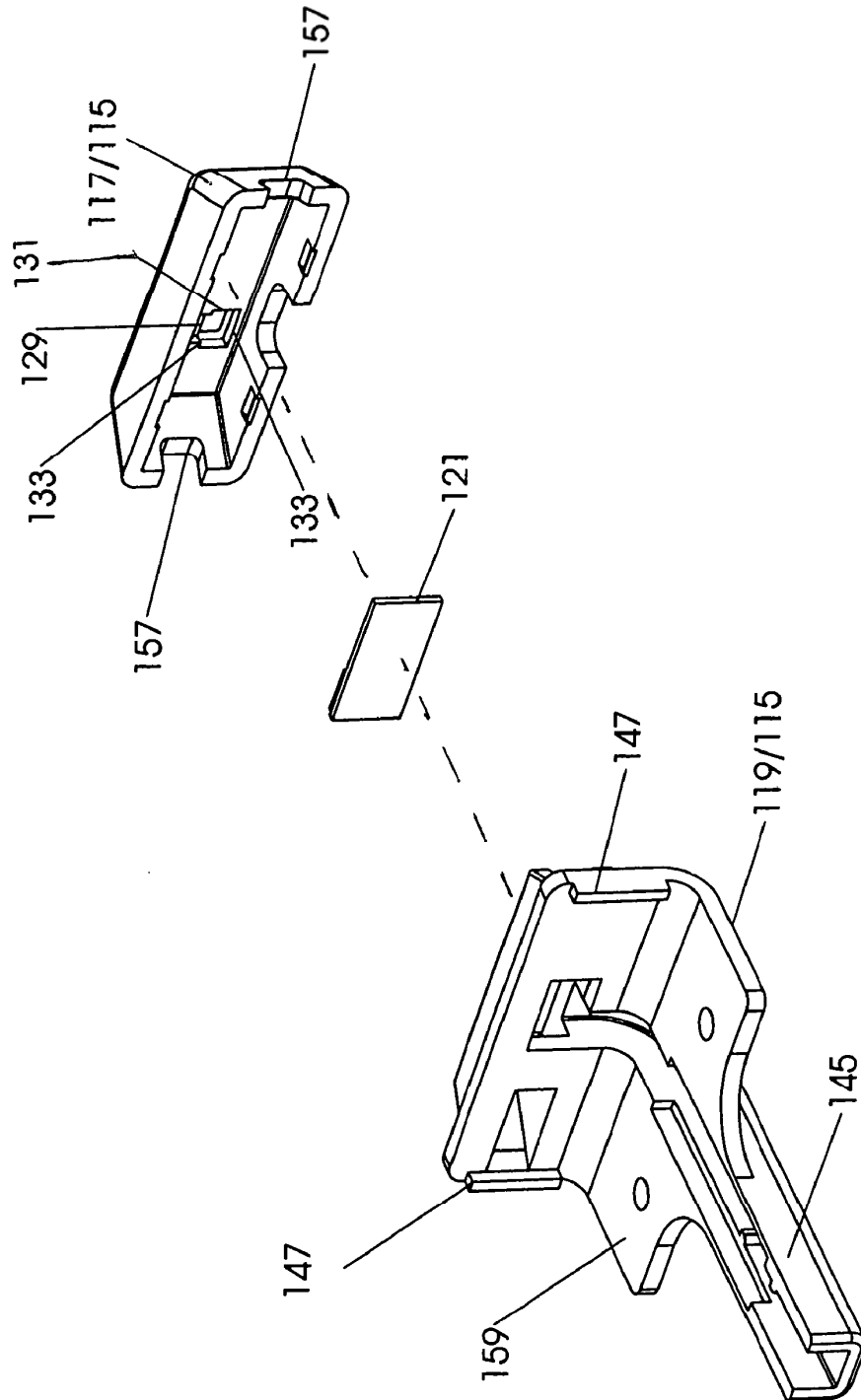


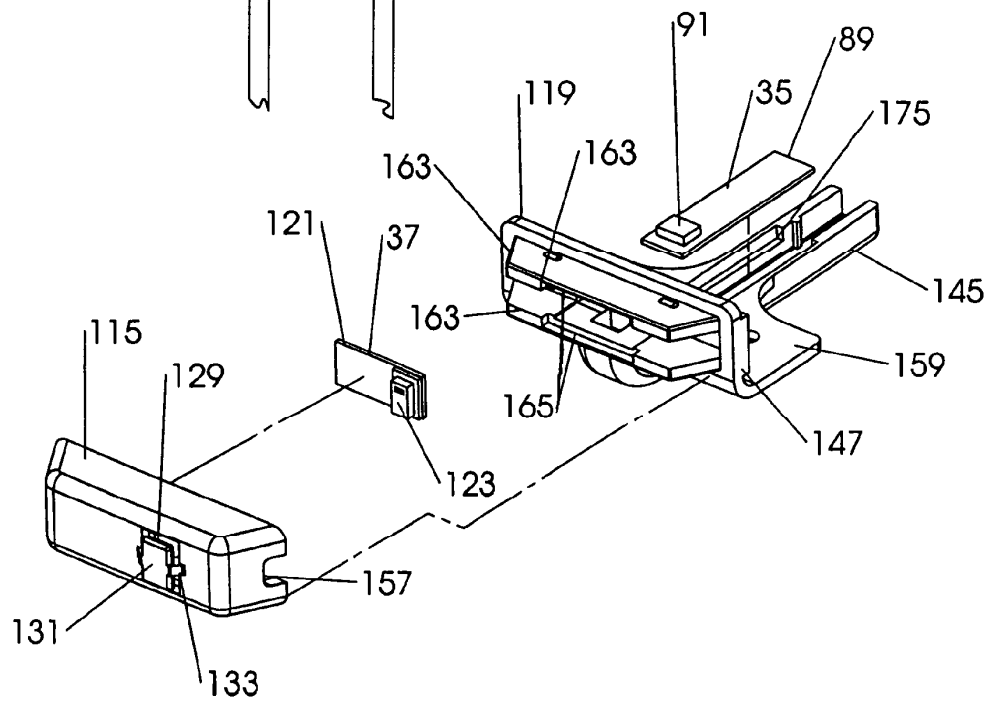
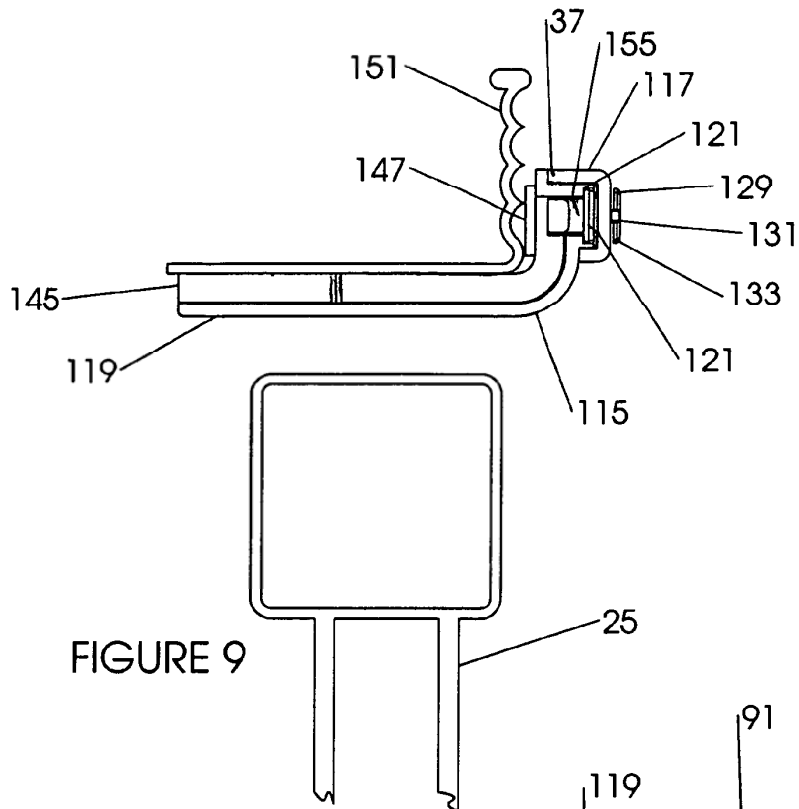
FIGURE 8

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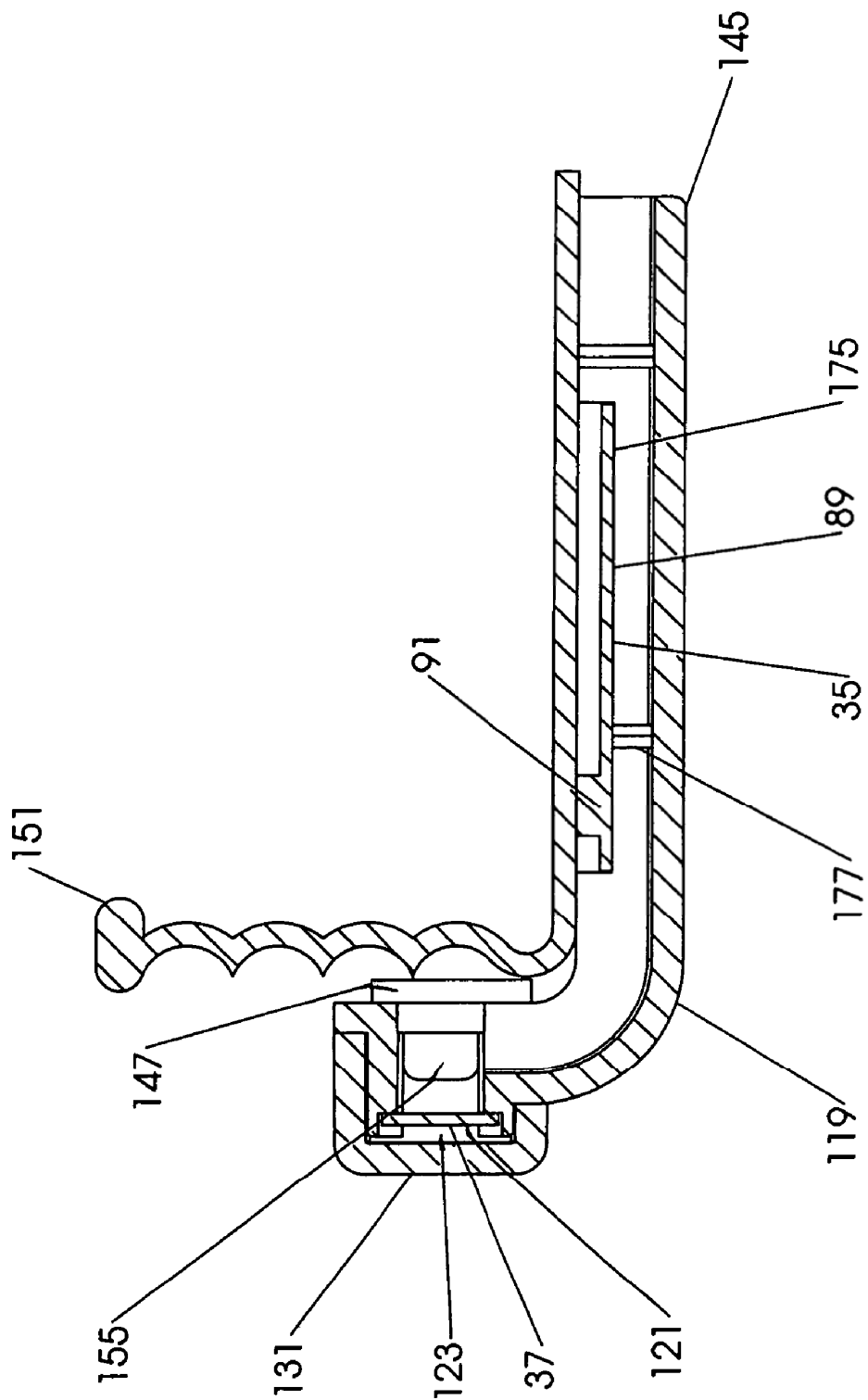


FIGURE 11

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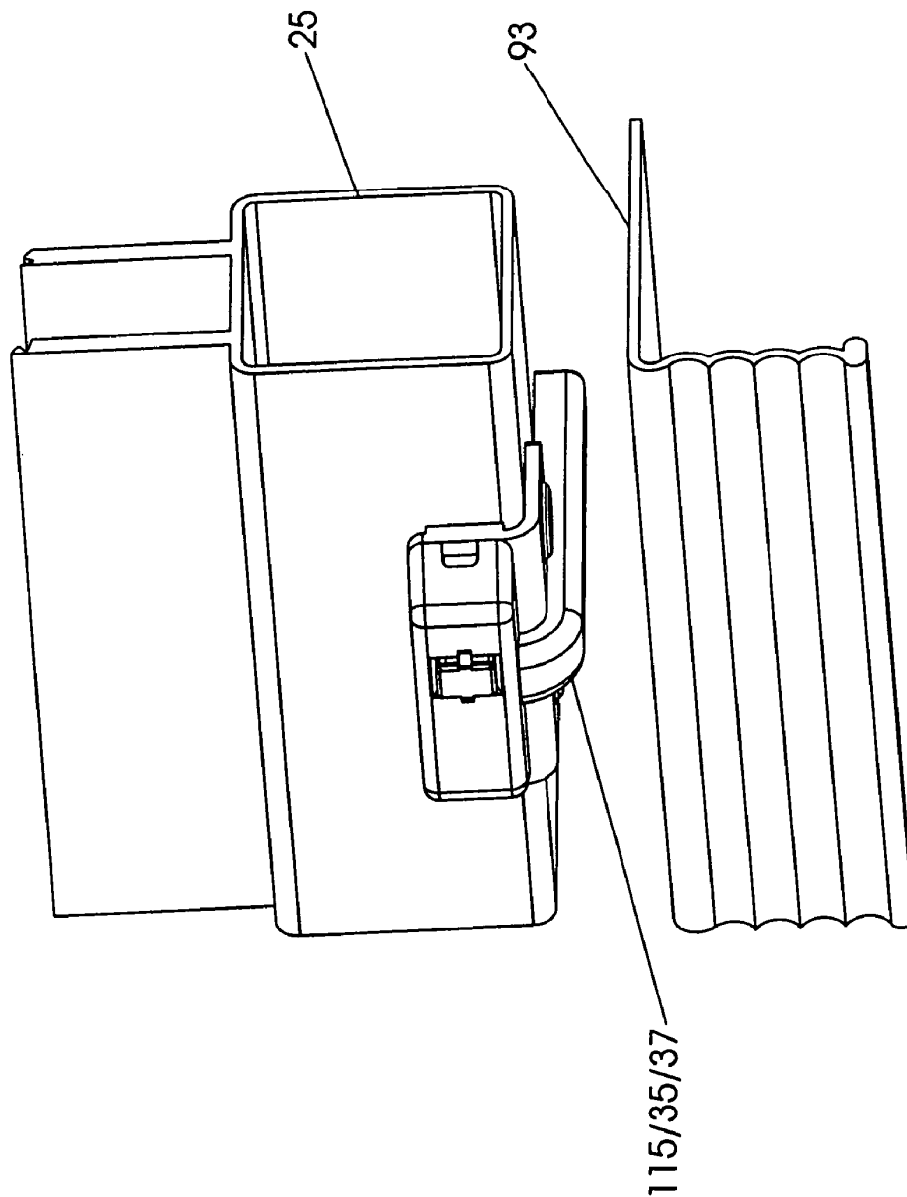


FIGURE 12

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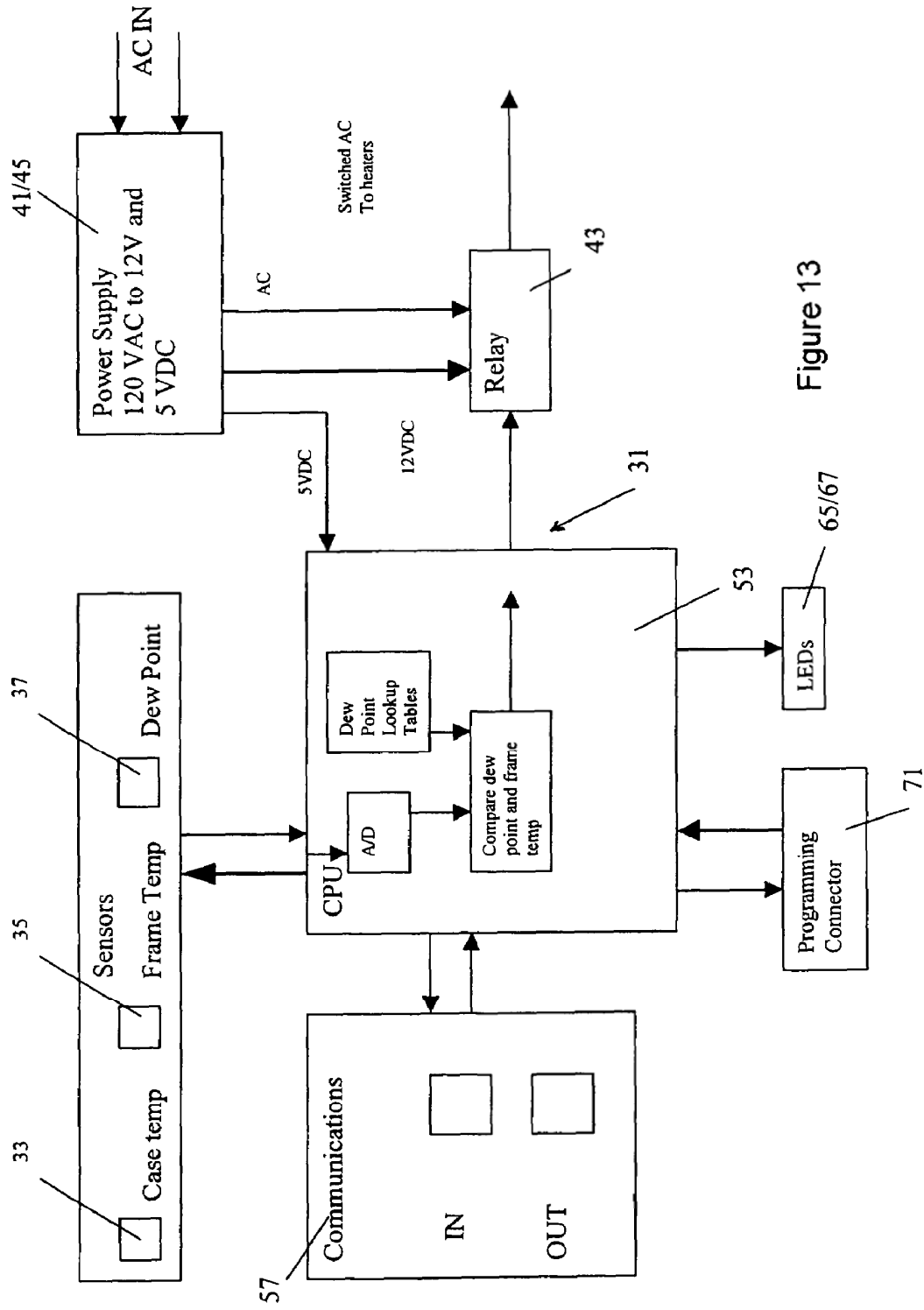


Figure 13

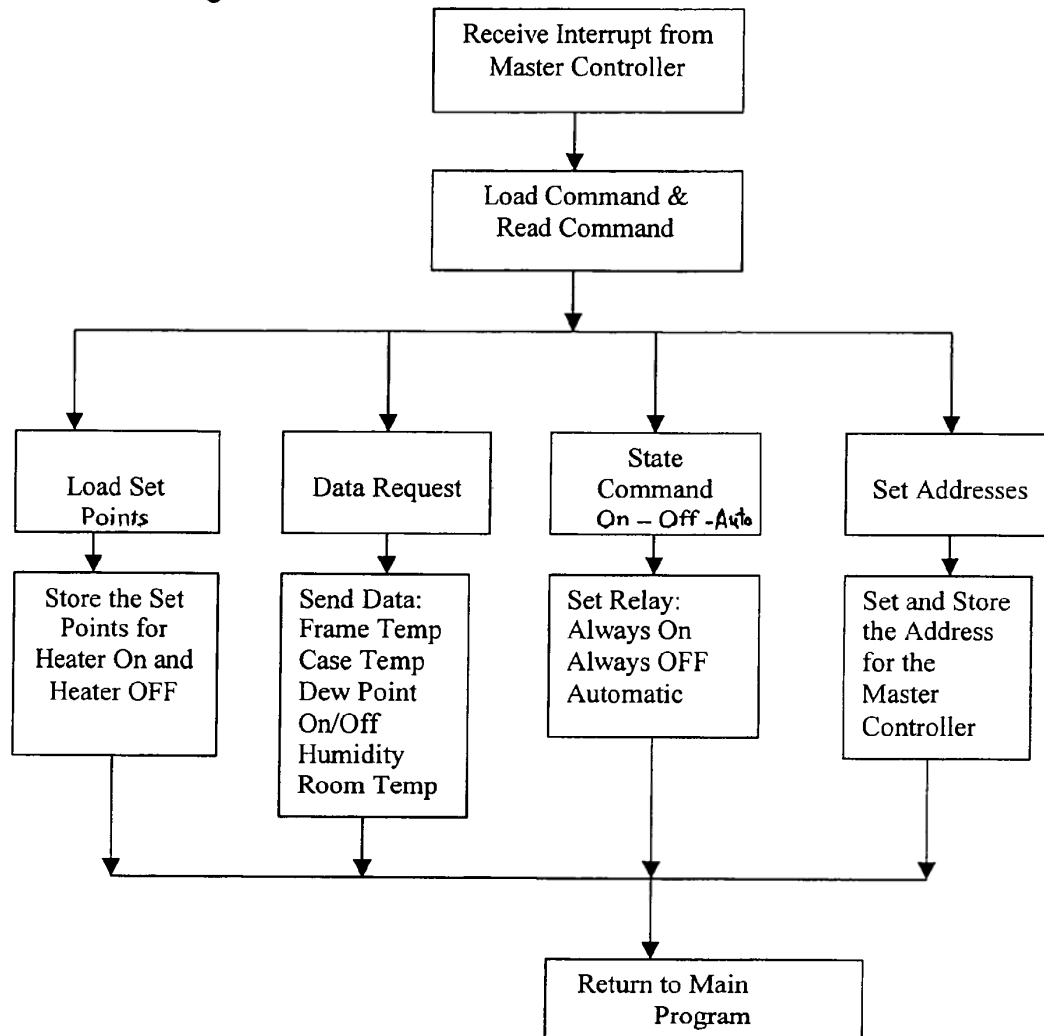
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Figure 14a



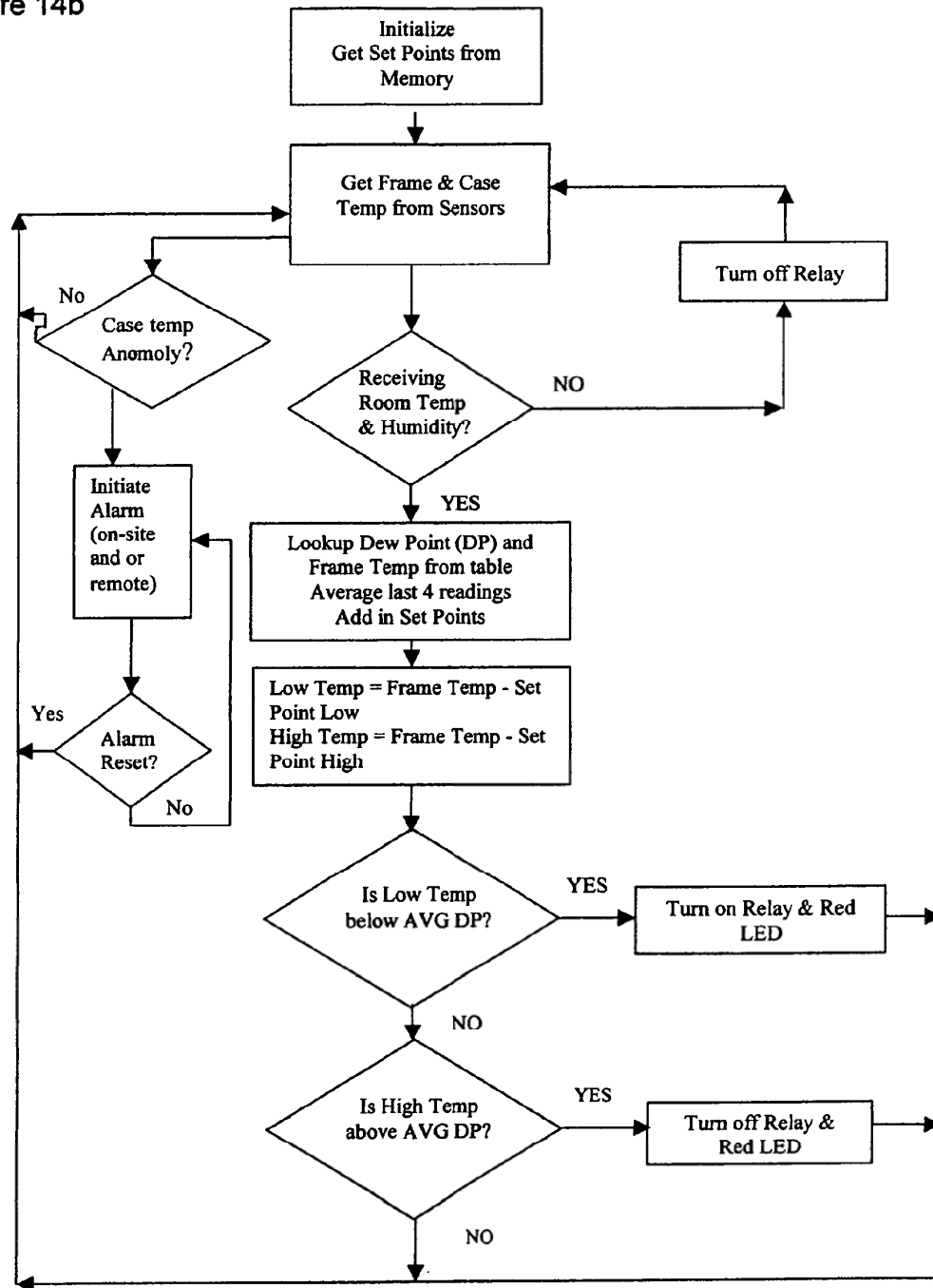
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Figure 14b



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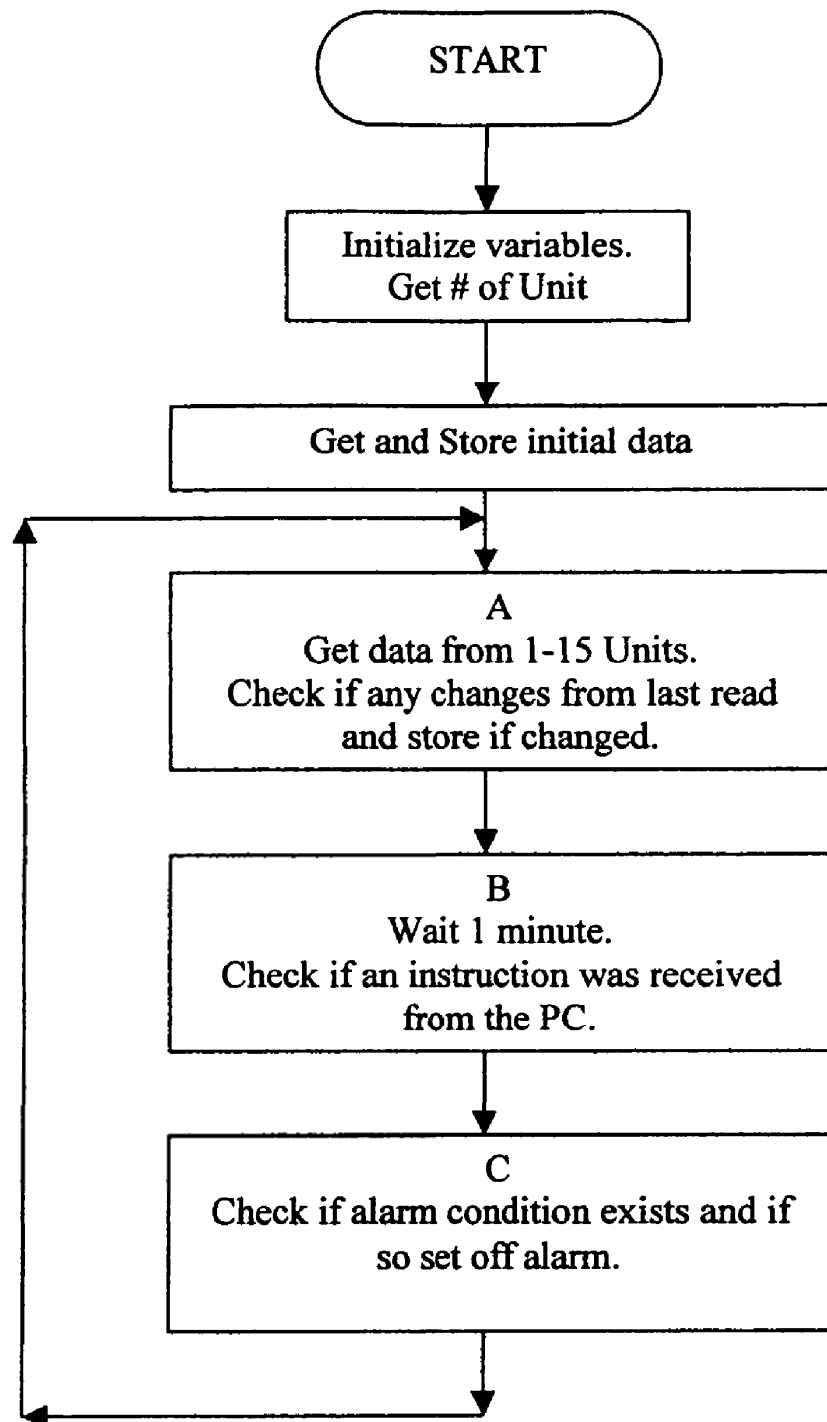


Figure 14c

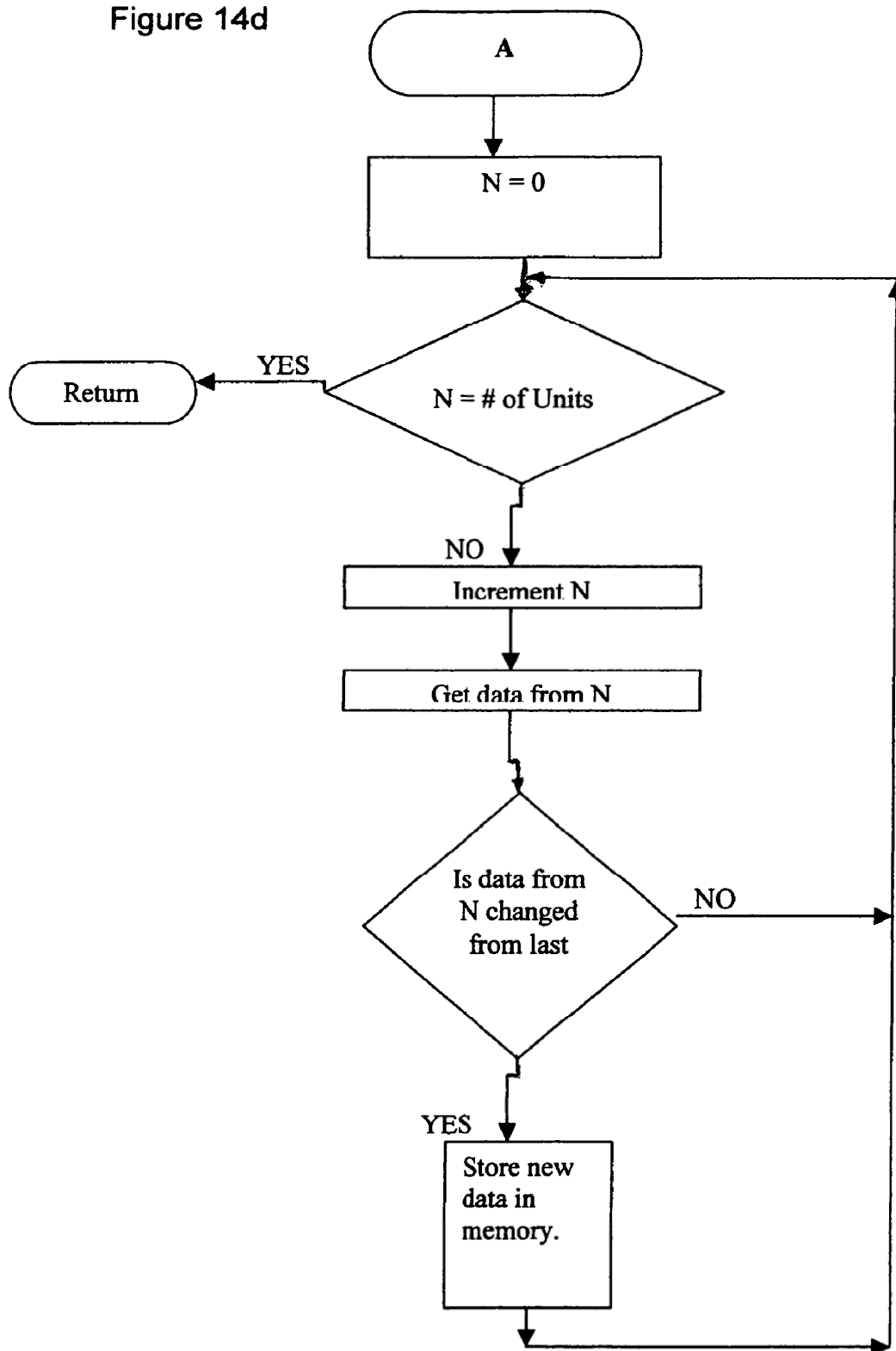
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Figure 14d



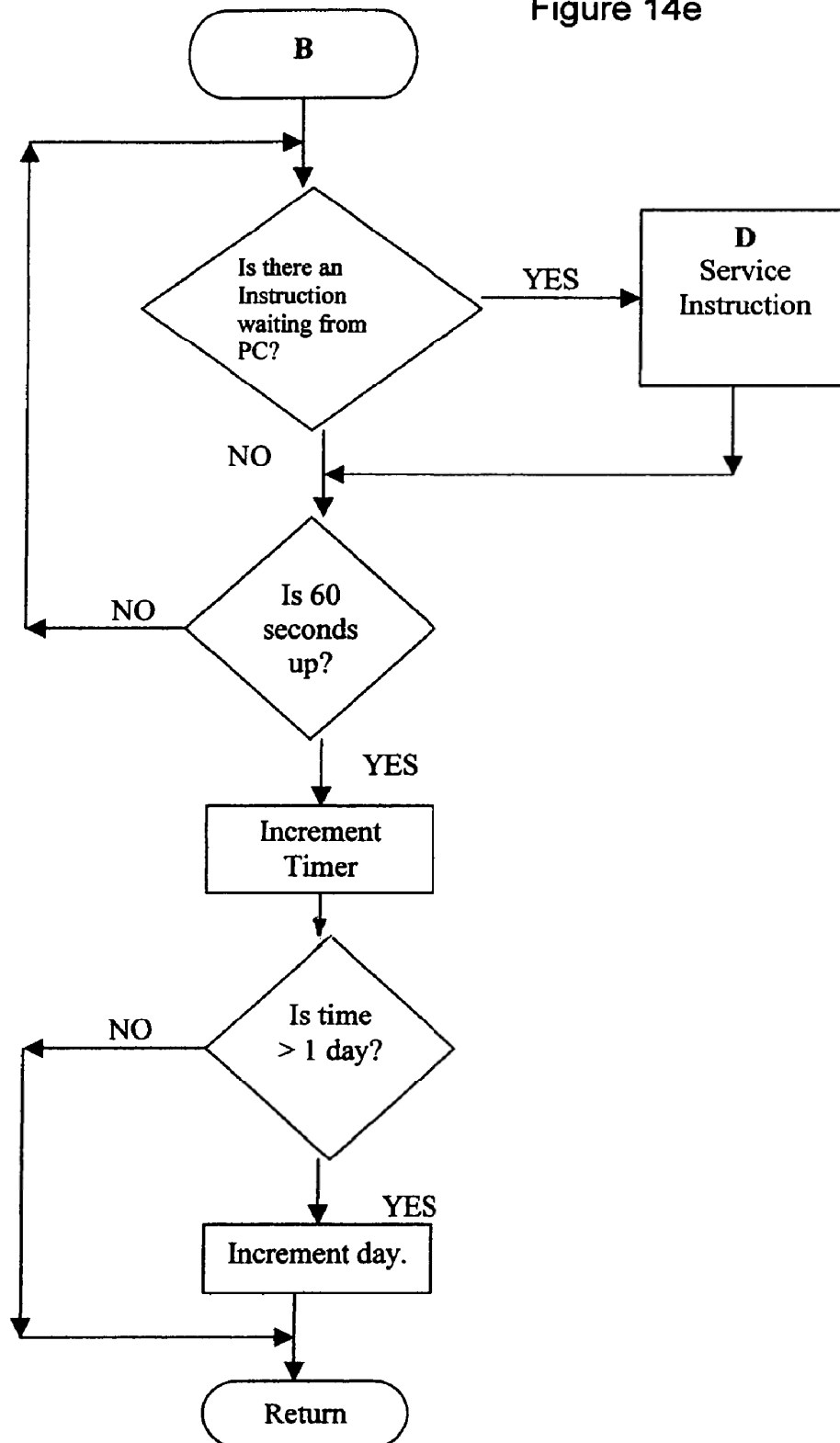
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Figure 14e



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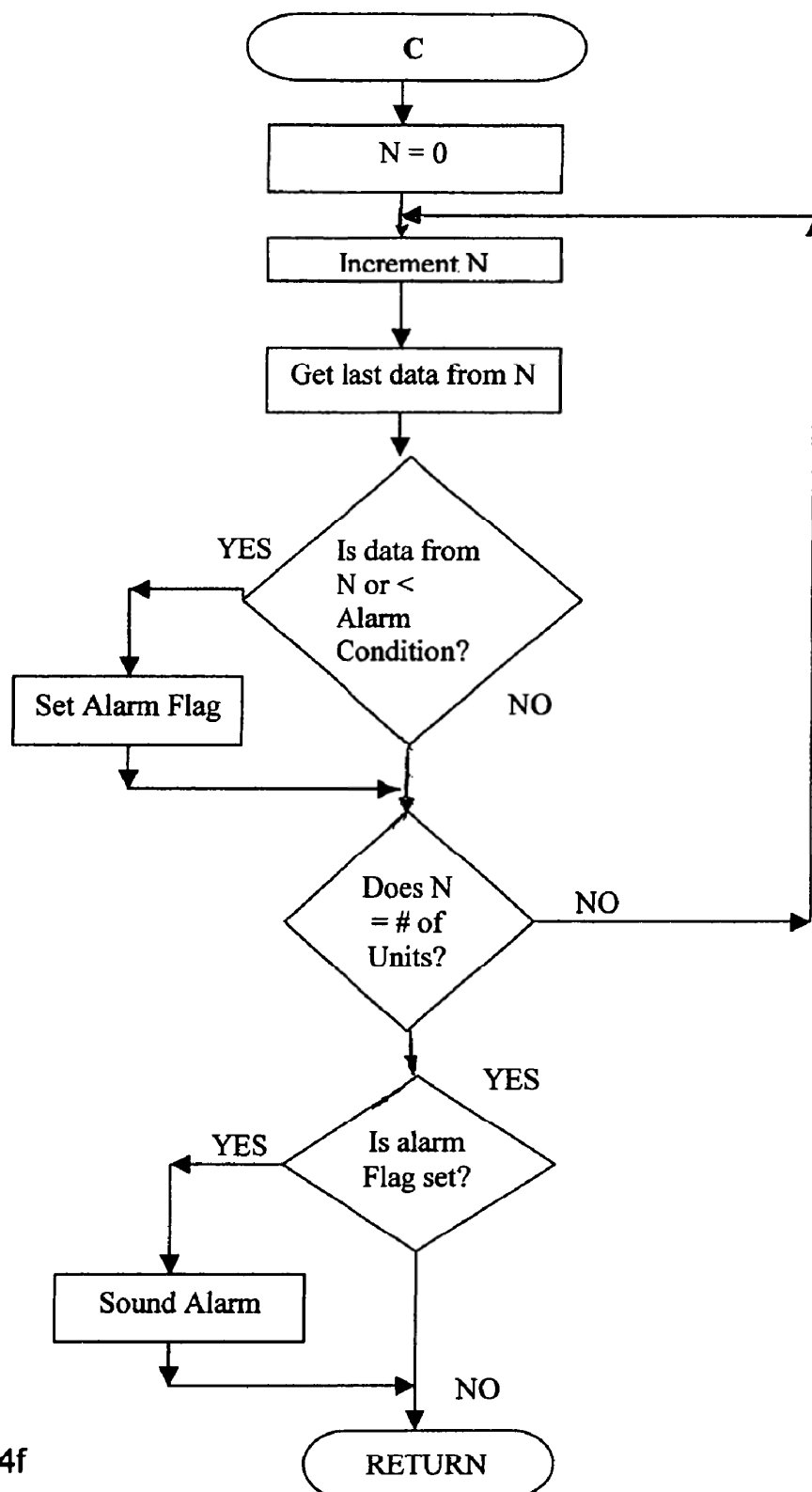


Figure 14f

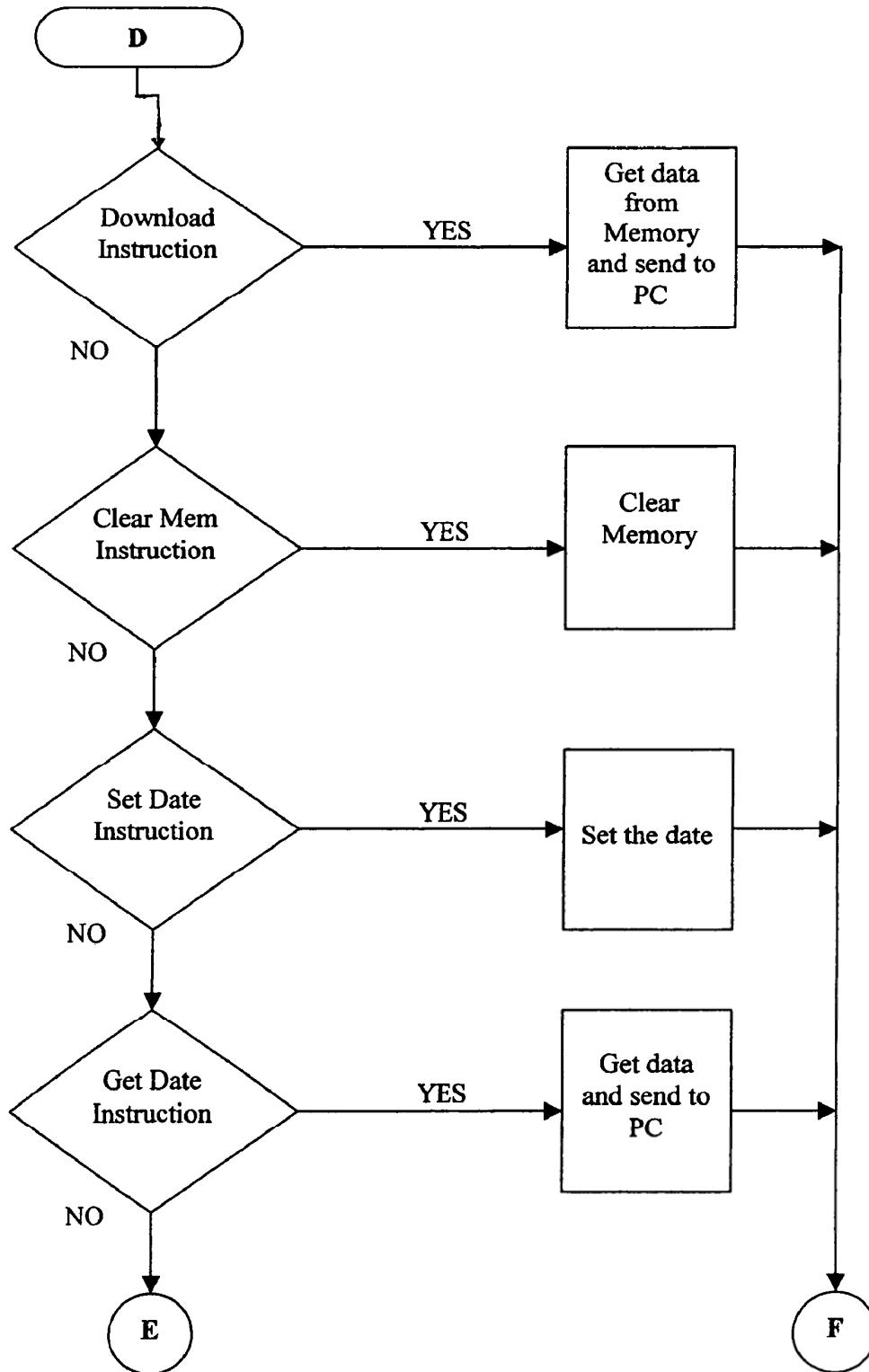
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Figure 14g



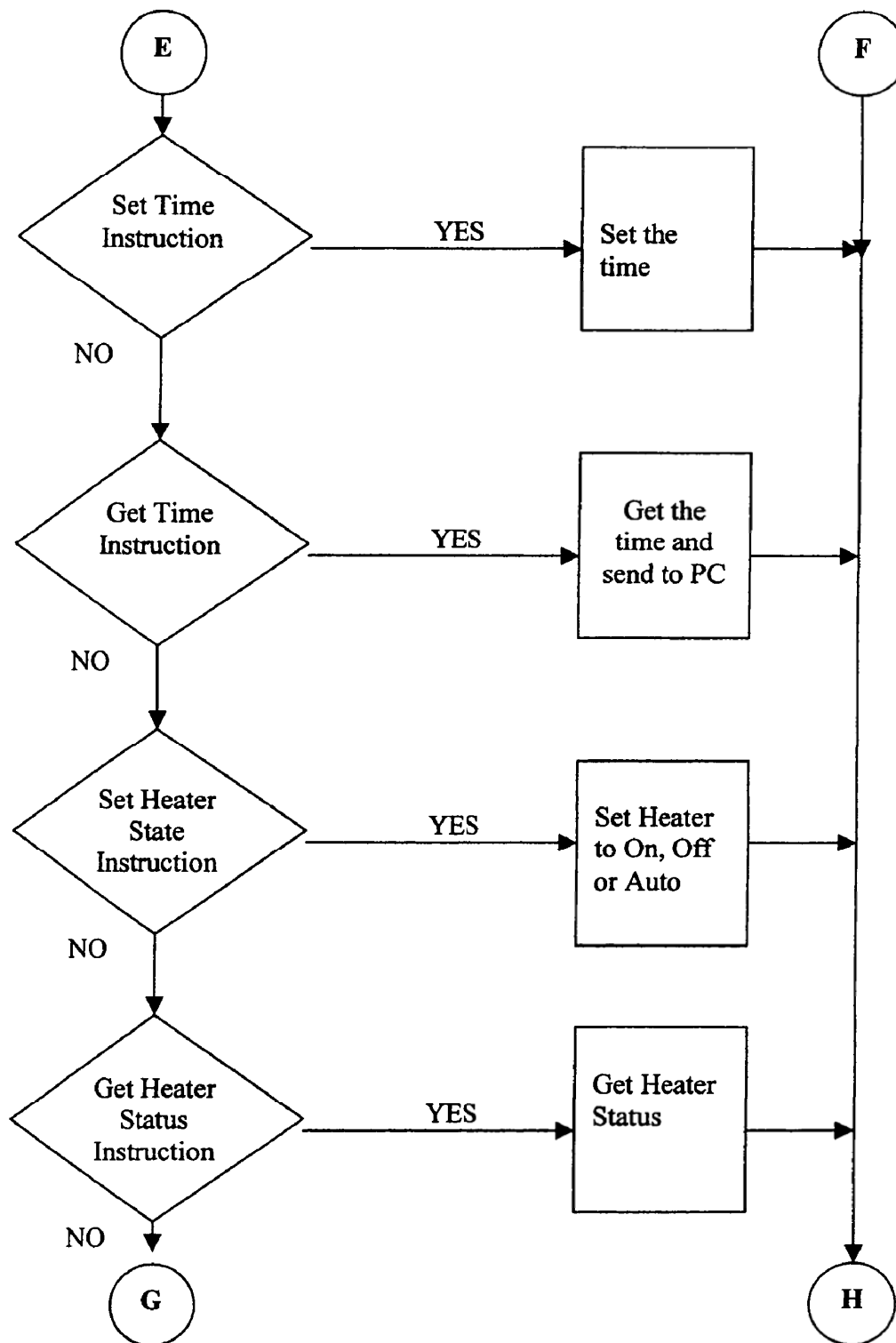
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FIGURE 14h



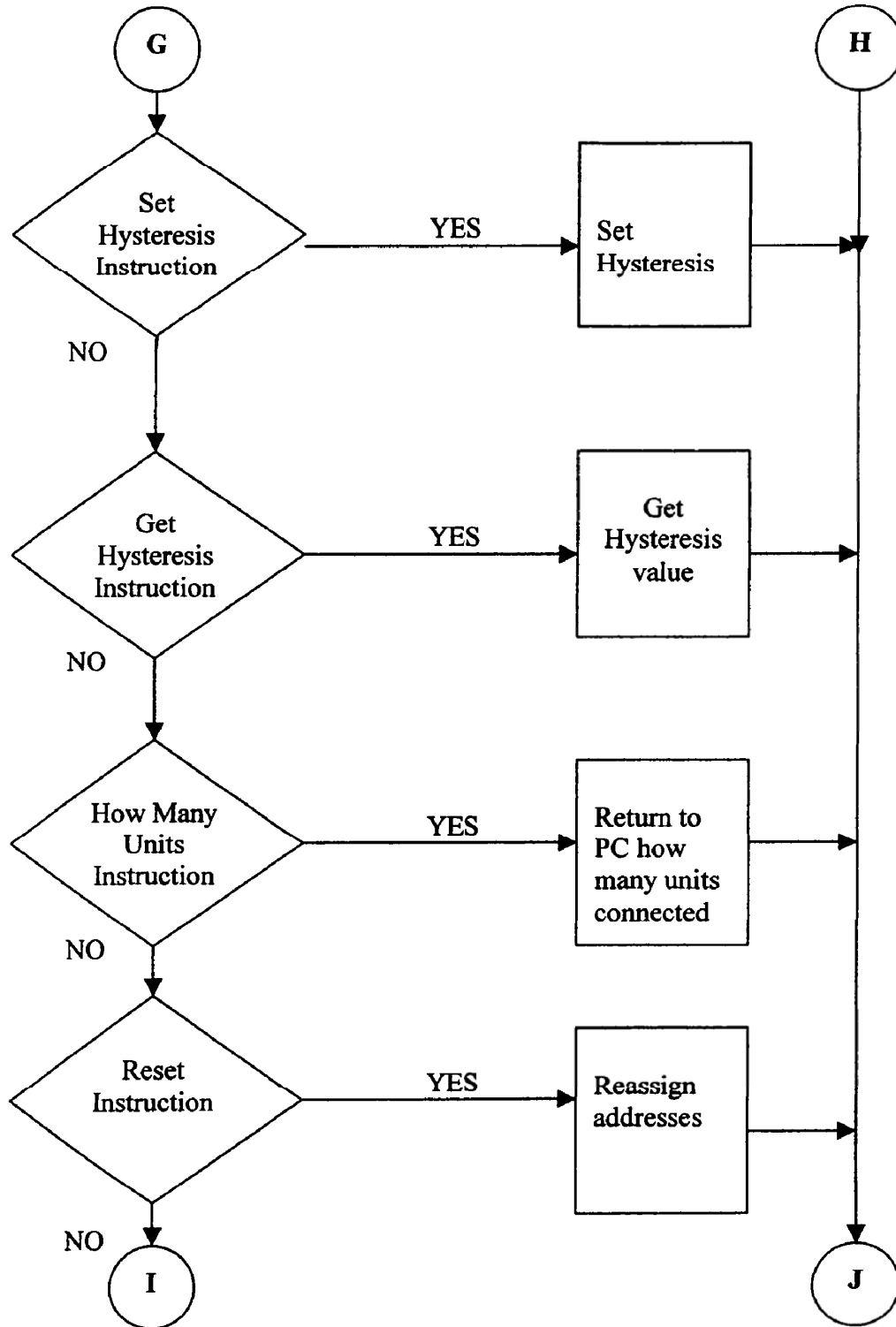
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FIGURE 14i



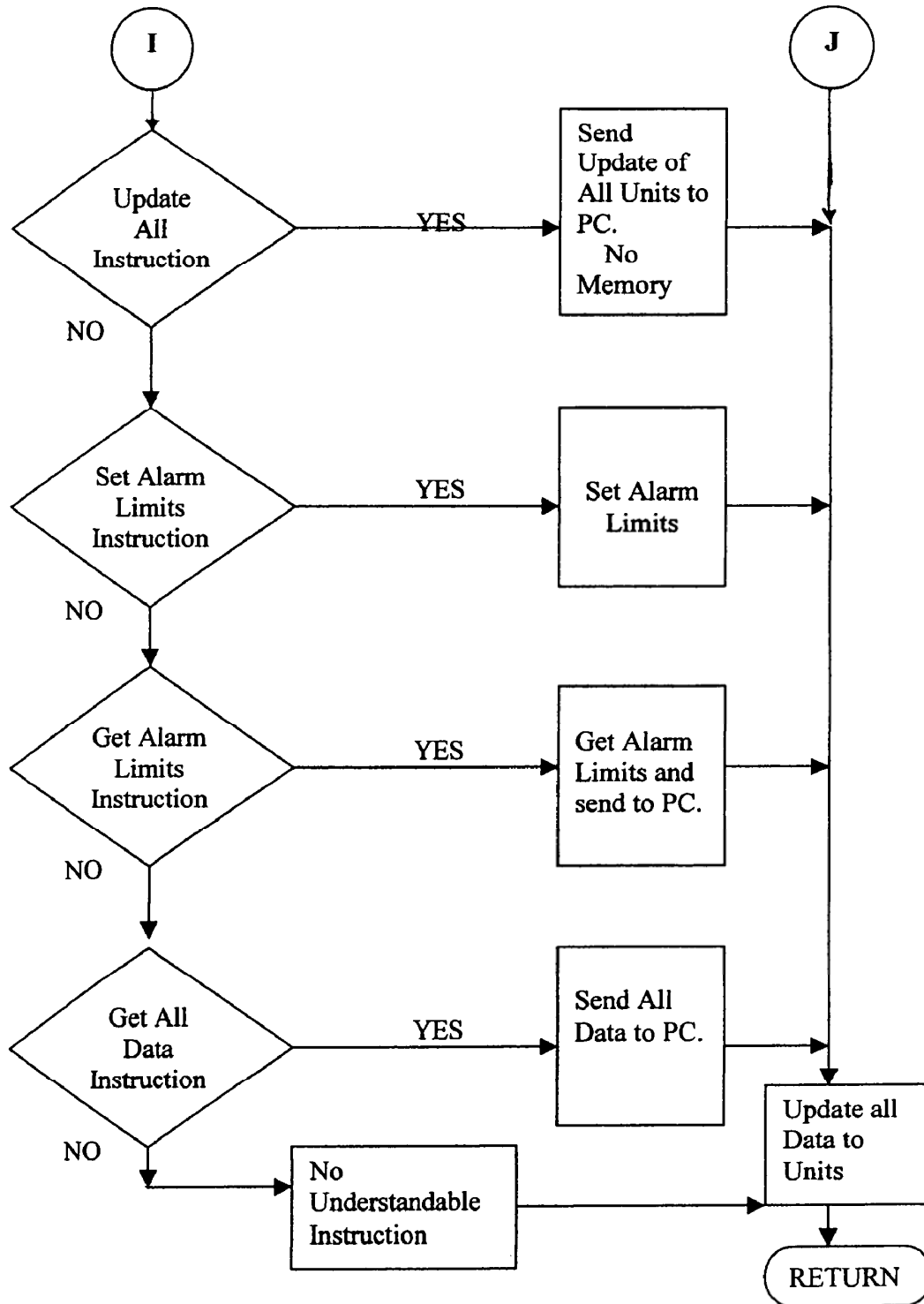
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FIGURE 14j



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Figure 15a

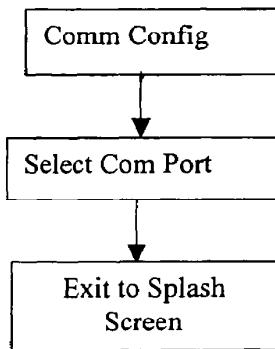


Figure 15c

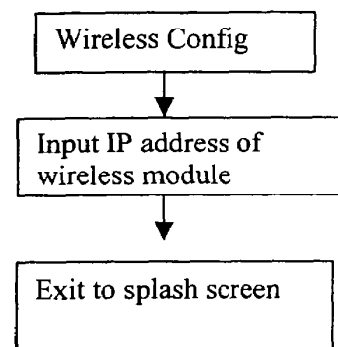


Figure 15b

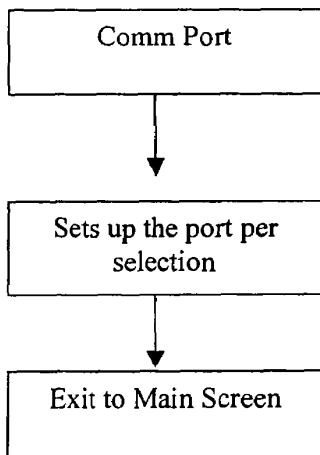
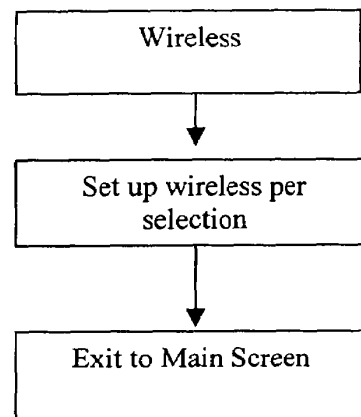


Figure 15d



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Figure 15e

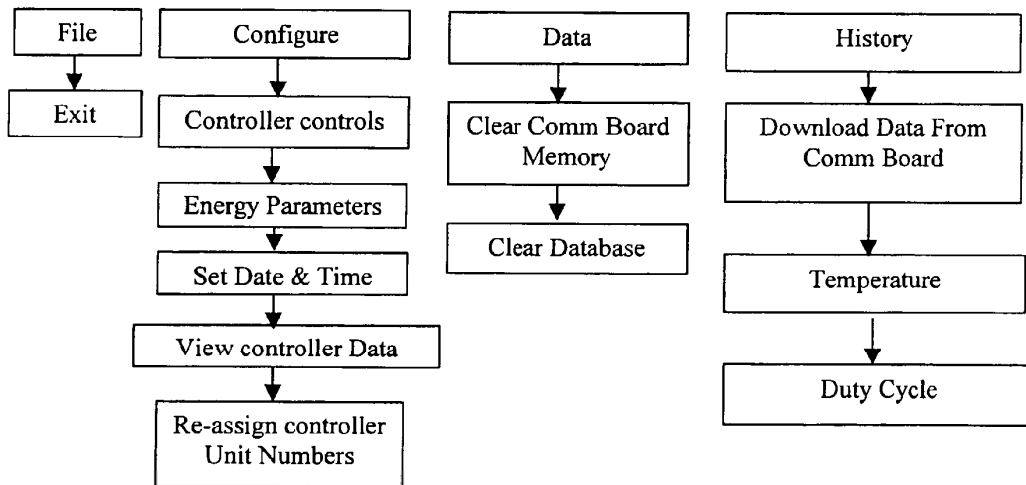
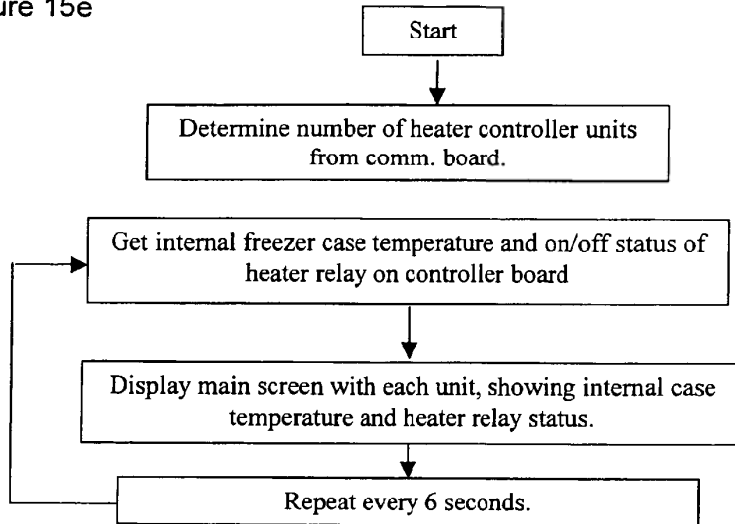


Figure 15f

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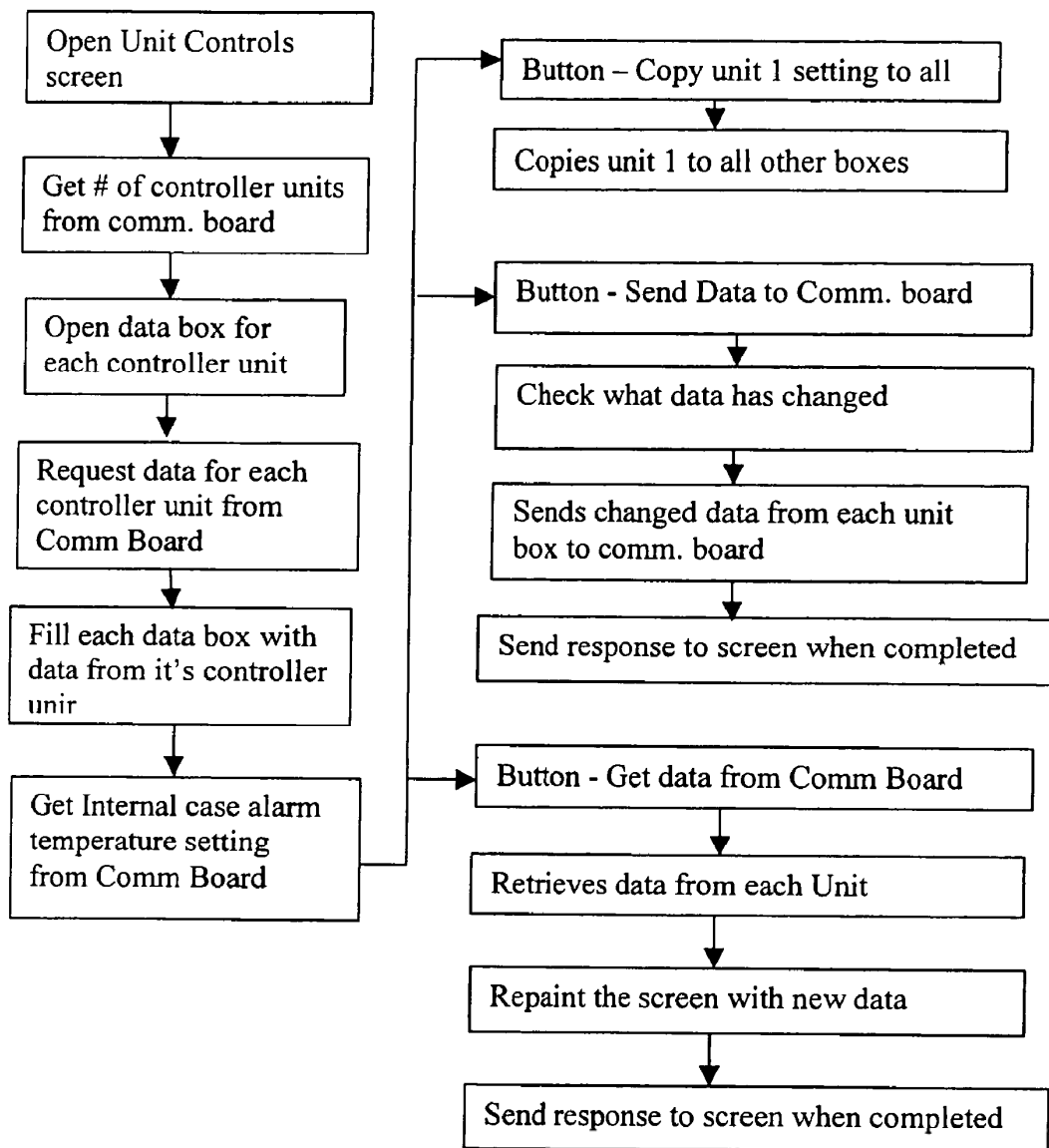


Figure 15g

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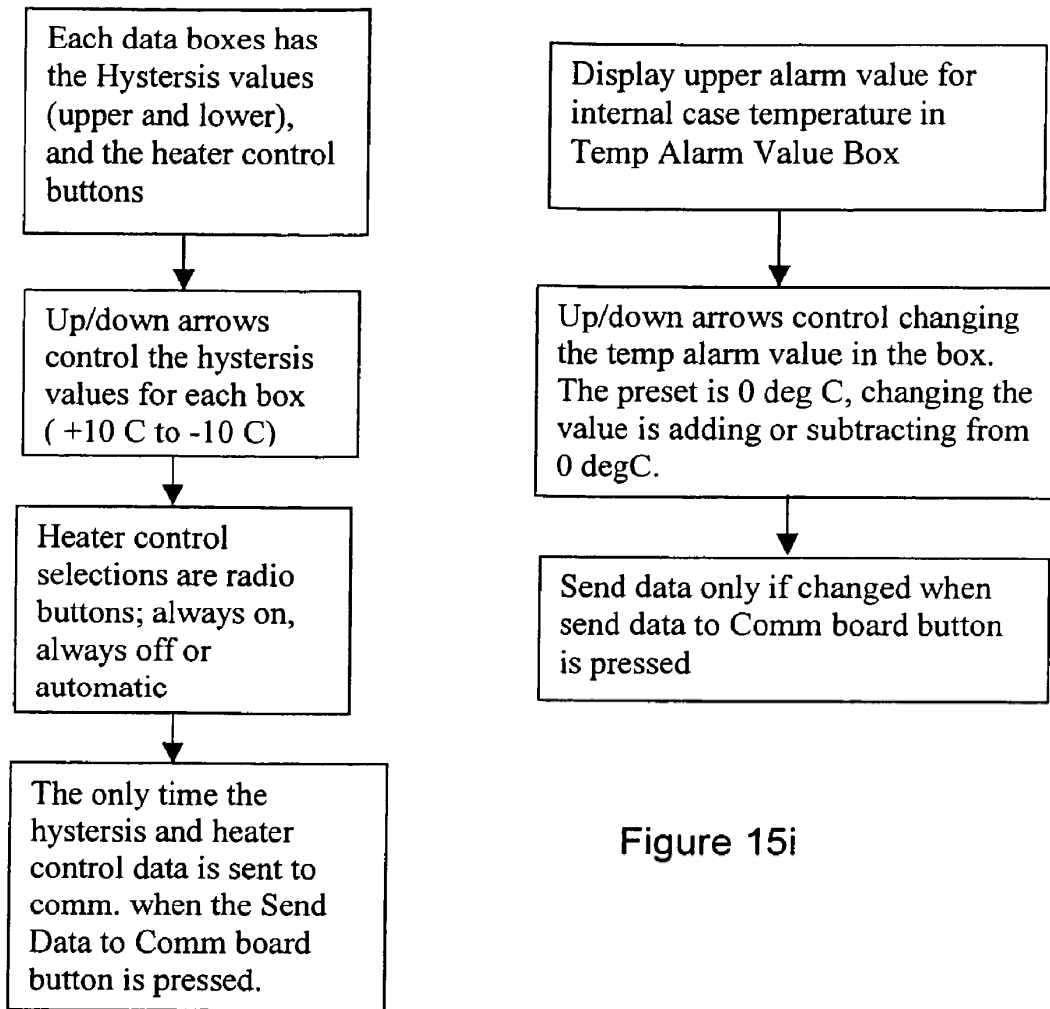


Figure 15i

Figure 15h

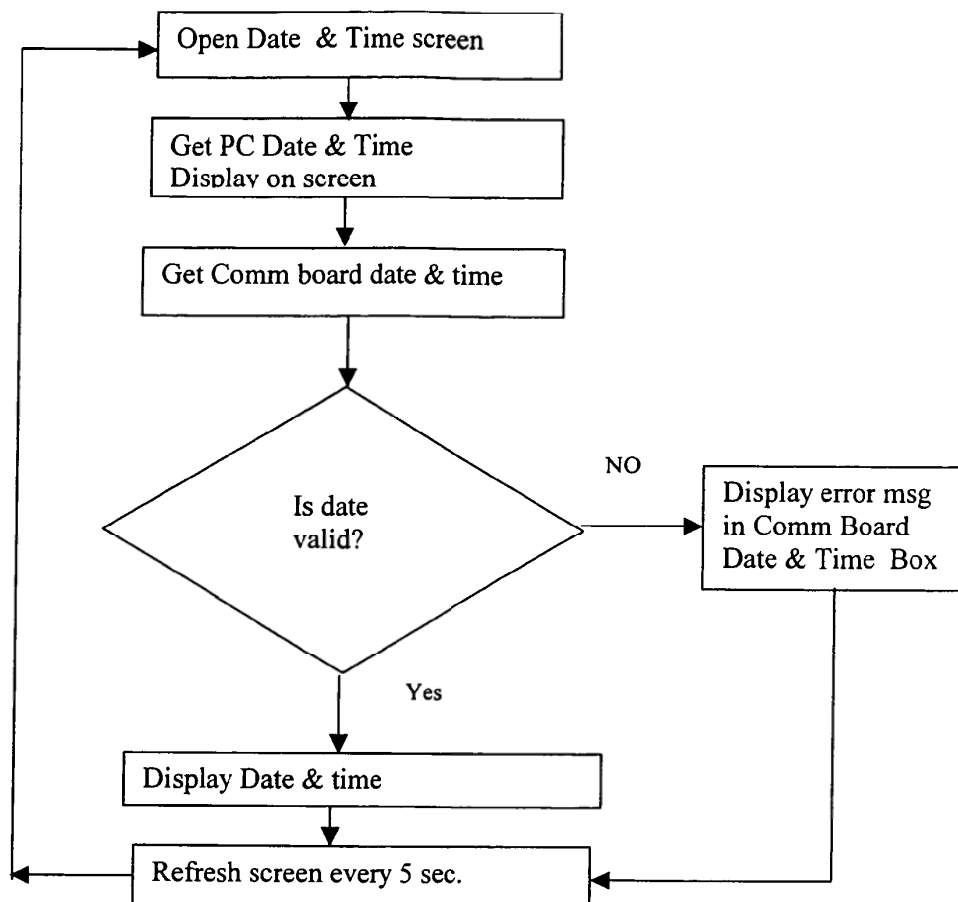
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Figure 15j



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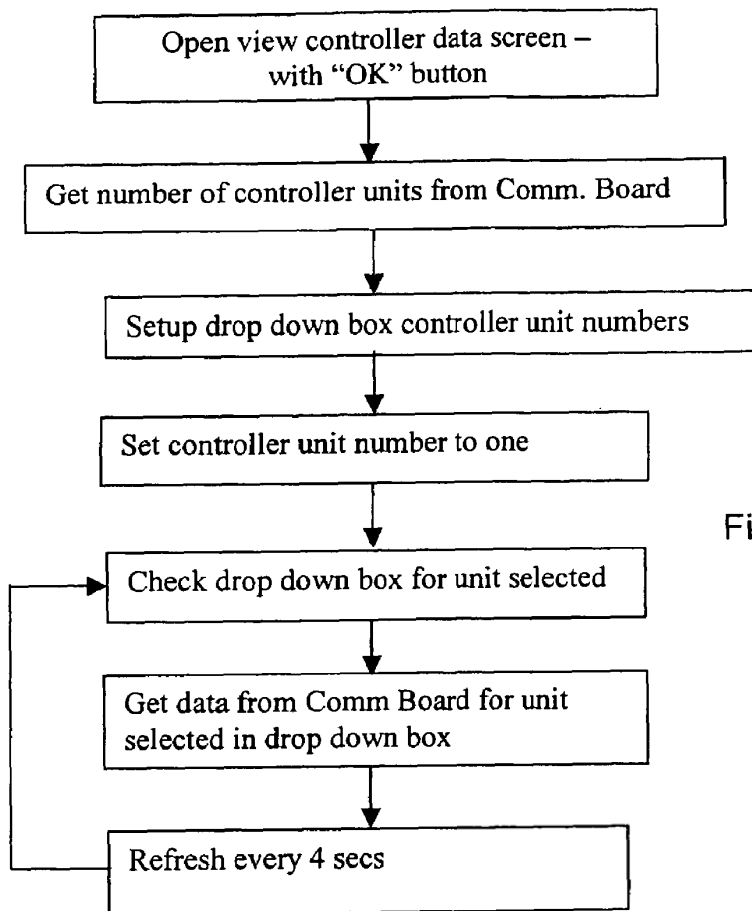


Figure 15k

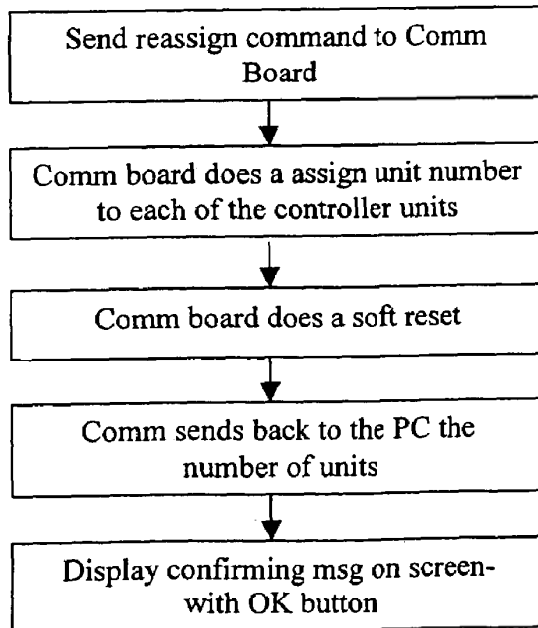


Figure 15l

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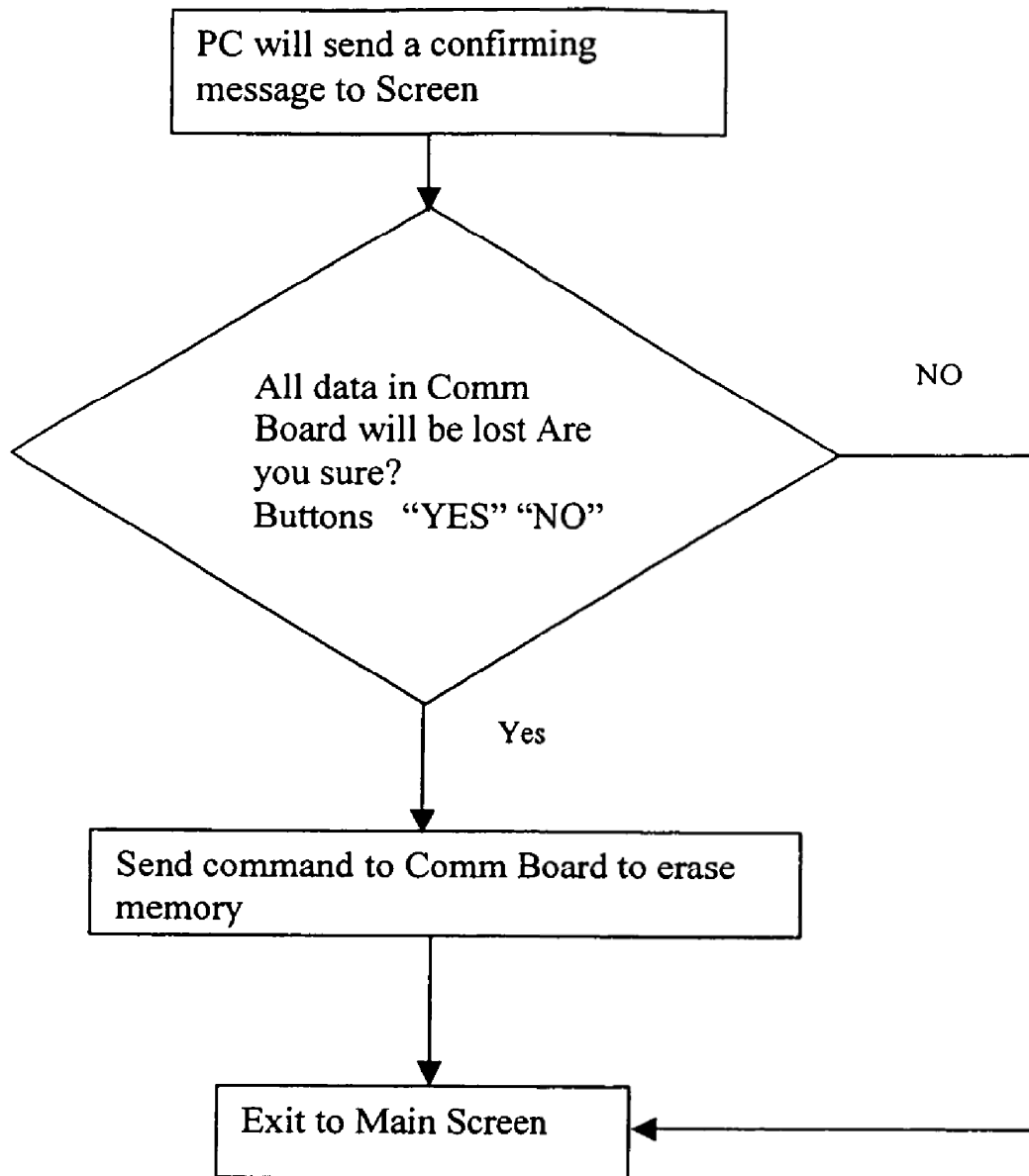


Figure 15m

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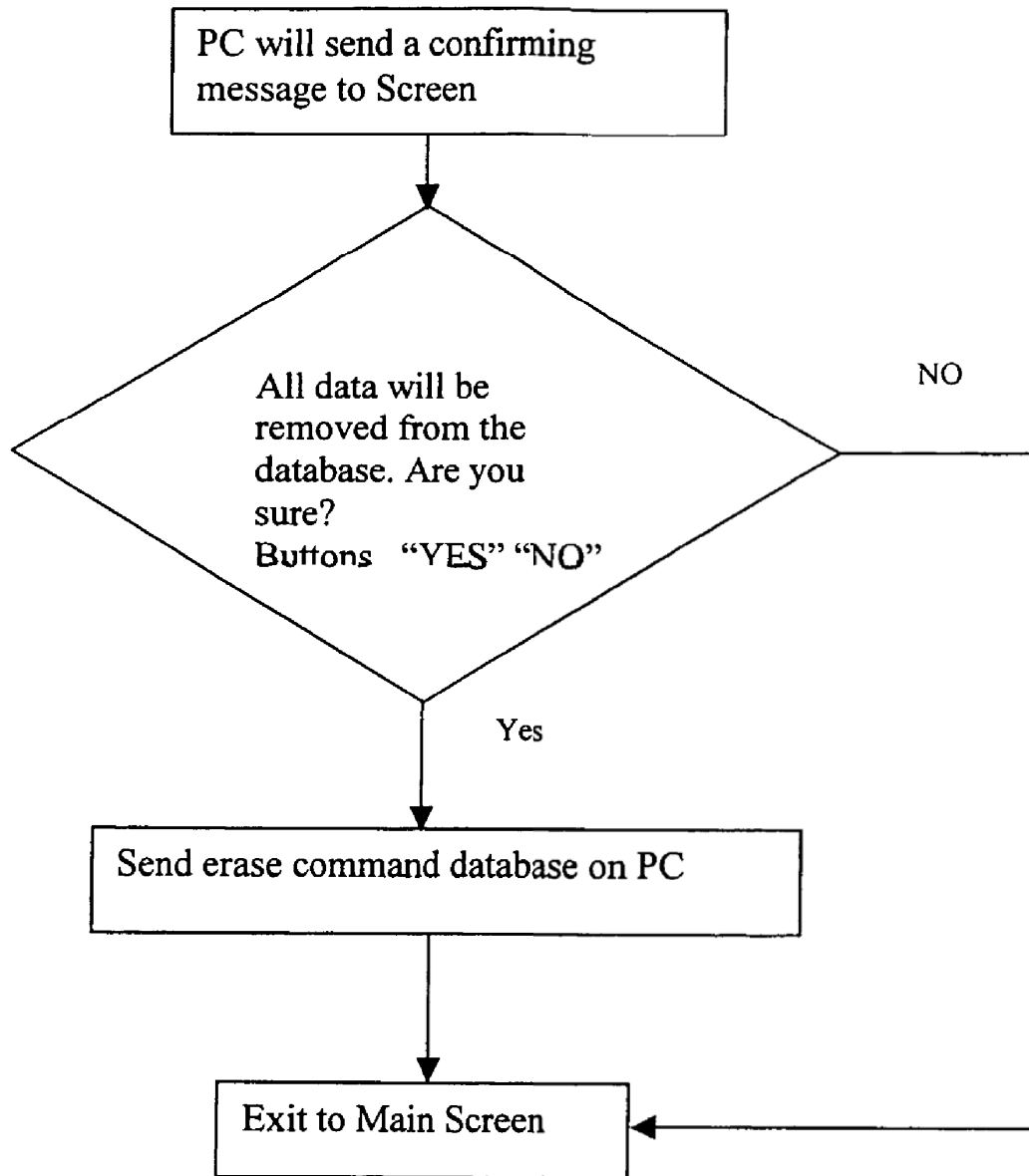


Figure 15n

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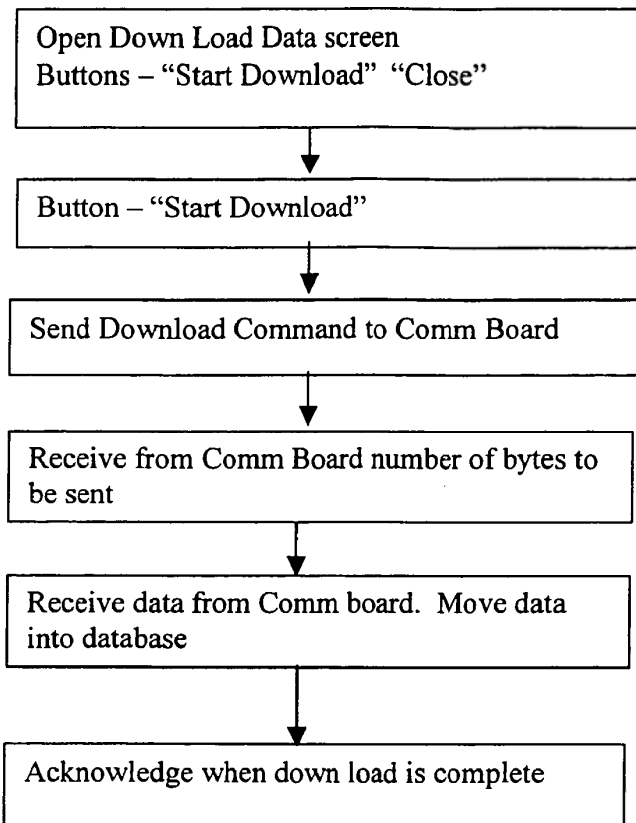


Figure 15o

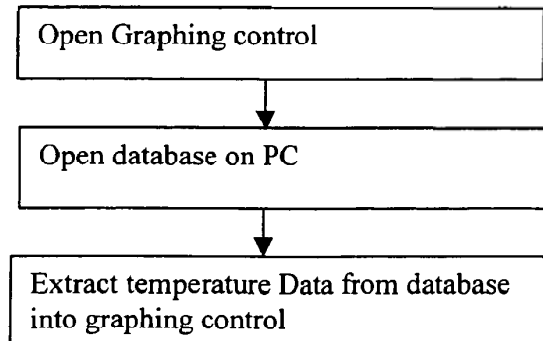


Figure 15p

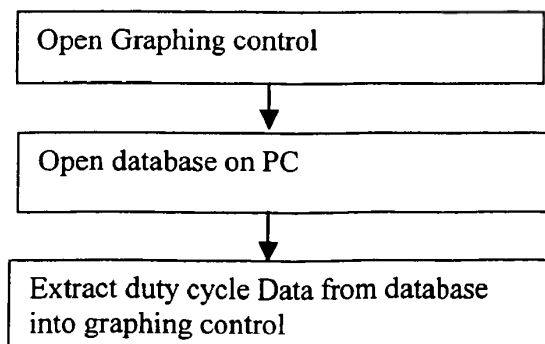


Figure 15q

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**REFRIGERATION UNIT CONDENSATION
PREVENTION****FIELD OF THE INVENTION**

This invention relates to frame and/or door heating to remediate condensation build-up in refrigerated display cases, and, more particularly, relates to sensing and operating devices and methods for activation and deactivation of such heating.

BACKGROUND OF THE INVENTION

Condensation build up on commercial refrigeration display case doors can cause door damage and presents a safety hazard if runoff from the door(s) and/or case frames accumulates on adjacent floors. Currently, in most commercial installations, in order to prevent excessive condensation build-up at display case doors and frames, the doors and frames are heated utilizing internal frame heaters operating at 100% duty cycle time (and incurring correspondingly high energy costs).

Devices have been heretofore suggested and/or utilized to control condensation without running heaters at 100% duty cycle times. One approach has utilized a detector to directly sense the presence of condensation on the freezer door or frame and, responsive thereto, activate the internal frame/door heaters when condensation is sensed. The heaters then are run for a fixed duration or until moisture has evaporated. These devices have, however, not always proven successful. For example, detector failure due to environmental contamination or poor manufacturing tolerances of moisture sensors in general is common. Such detector failure can result in either frame/door heaters remaining off (thus failing to inhibit dangerous condensation build-up and runoff) or the heaters remaining on (thereby achieving no energy savings). Moreover, such devices are merely reactive, activating heaters only after potentially damaging and dangerous condensation has formed. (see the DOOR MISER XP by Door Miser, LLC and U.S. Pat. No. 5,899,078, for examples).

Other devices have suggested condensation control utilizing dew point calculation. Monitoring air temperature, relative humidity and surface temperatures to initiate condensation control events has been utilized in a variety of applications including refrigeration (see, for example, U.S. Patent Publication No. US 2004/0050072 A1 and U.S. Pat. Nos. 6,470,696, 5,778,689, 5,778,147, and 4,127,765). Some such devices or systems have utilized temperature sensing of both cold surfaces and the surrounding ambient air in condensation control response calculations. As is known, when a cold surface temperature is equal to or lower than the dew point of the ambient air, condensation forms on the cold surface.

Such devices and systems have not proven altogether successful, however, due to inaccuracy of temperature readings, particularly where both cold and warm environments are adjacent one another such as is found at commercial freezer/refrigeration display cases. Failure to configure such systems to enhance accuracy of readings has resulted in erratic condensation control, on some occasions wasting energy unduly heating frames/doors, on other occasions responding late or otherwise inadequately to condensation formation, and/or on still other occasions failing to control appropriate heater cycling (i.e., shut-off) with consequent loss of efficiencies. Some such systems, utilized in fields not related to the problem of condensation at freezer doors, have addressed the problem of erratic temperature readings by

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artificially cooling the temperature sensors while heaters are powered on to counter the affect. This approach, however, is not feasible in large commercial freezer display installations where size and space are limited and where the cost for such counter measures are not easily absorbed (and not likely to be tolerated). Finally, most heretofore known systems employing dew point sensors for condensation control remain reactive, not proactively based on anticipation of condensation events. Further improvement could thus still be utilized

SUMMARY OF THE INVENTION

The purpose of the apparatus, systems and methods of this invention is to efficiently eliminate door and frame condensation at widely utilized commercial freezer/refrigeration display cases. The invention is proactive in preventing condensation from forming by activating frame/door heaters before the dew point temperature at frame and door surfaces is reached. Power is then cycled off at a set point above dew point to save energy. This is accomplished by configuring apparatus of this invention to provide highly accurate sensing of frame temperature and dew point by thermally isolating temperature sensors and constantly updating data to reliably provide the ability to accurately anticipate condensation at case surfaces. The invention eliminates door damage and runoff safety hazards due to condensation build-up, efficiently cycles duty time of frame/door heaters thus lowering the installation's energy costs, and requires no expensive countermeasures to maintain accuracy and efficacious performance.

The condensation control apparatus of this invention includes a frame temperature sensing unit adapted for monitoring temperature of either the door or case of a display case. The frame temperature sensing has temperature sensor mounted on a carrier. A dew point sensing unit is adapted for monitoring ambient air temperature and relative humidity outside of the display case and includes a carrier having at least one dew point sensing component thereat.

A control unit is connected with the sensing units and includes a processor connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity. The processor also deactivates the frame/door heater when monitored display case door or frame temperature rises above a second preselected set point above the dew point value. Housing for locating the sensing units includes structure establishing thermal isolation of the sensing units by minimizing heat transfer contacts with the housing. The temperature sensor and the dew point sensing component are located amid insulating air pockets formed by the structure of the housing. The housing and control unit are mountable at the display case.

The system of this invention further includes the sensing and control apparatus located at each display case in an array of display cases. An internal case temperature sensing unit is positionable inside the display case and connected with the control unit processor. The processor stores data related to readings at the sensing units and operation of the frame/door heater, and a communication control unit associated with the processor enables coordination of programming and data download access to the processor.

The method of this invention is for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater. The steps of the method include placing a temperature sensing unit in contact

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with the display case frame to monitor case frame temperature and mounting a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case. The monitored case frame temperature, ambient air temperature and relative humidity are utilized to anticipate formation of condensation at the display case and activate and deactivate the frame/door heater responsive thereto.

It is therefore an object of this invention to provide apparatus, systems and methods for efficient elimination of door and frame condensation at widely utilized commercial freezer/refrigeration display cases.

It is another object of this invention to provide apparatus, systems and methods for elimination of door and frame condensation at freezer/refrigeration display cases that proactively prevents condensation from forming by activating frame/door heaters before dew point temperature at frame and door surfaces is reached.

It is still another object of this invention to provide apparatus for efficient elimination of door and frame condensation at freezer/refrigeration display cases that are configured to accurately sense frame temperature and dew point by thermally isolating temperature sensors and that are constantly data updated to reliably provide the ability to accurately anticipate condensation at case surfaces.

It is yet another object of this invention to provide apparatus, systems and methods utilized with freezer/refrigeration display cases that eliminate door damage and runoff safety hazards due to condensation build-up, efficiently cycle duty time of frame/door heaters thus lowering the installation's energy costs, and require no expensive countermeasures to maintain accuracy and performance of the apparatus and systems.

It is another object of this invention to provide condensation control apparatus for a refrigerated display case having at least one door, a frame and at least one frame/door heater, the apparatus including a frame temperature sensing unit adapted for monitoring temperature of one of the display case door or display case frame and including a carrier having a temperature sensor thereat, a dew point sensing unit adapted for monitoring ambient air temperature and relative humidity outside of the display case and including a carrier having at least one dew point sensing component thereat, a control unit connected with the sensing units and including processing means connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity, and housing means for locating the sensing units including structure establishing thermal isolation of the sensing units by minimizing heat transfer contacts between the sensing units and the housing means and locating the temperature sensor and the at least one dew point sensing component amid insulating air pockets formed by the structure of the housing means.

It is still another object of this invention to provide a system for condensation control at an array of refrigerated display cases, the cases each having at least one door, a frame and at least one frame/door heater, the system including sensing and control apparatus configured for location at each display case in the array of display cases, the apparatus including a frame temperature sensing unit adapted for mounting at the display case for monitoring temperature of one of the display case door or display case frame, a dew point sensing unit adapted for mounting at the display case for monitoring ambient air temperature and relative humid-

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ity outside of the display case, an internal case temperature sensing unit positionable inside the display case, and processing means mountable at the display case and connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a first preselected set point above a dew point value derived from monitored ambient temperature and relative humidity, for deactivating the frame/door heater when monitored display case door or frame temperature rises above a second preselected set point above the dew point value, and for storing data related to readings at the sensing units and operation of the frame/door heater, and a communication control unit associated with the processing means for coordinating programming and data download access to the processing means of the apparatus.

It is yet another object of this invention to provide a method for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, the method including the steps of placing a temperature sensing unit in contact with the display case frame to monitor case frame temperature, mounting a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case, and utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.

With these and other objects in view, which will become apparent to one skilled in the art as the description proceeds, this invention resides in the novel construction, combination, and arrangement of parts and method substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that changes in the precise embodiment of the herein disclosed invention are meant to be included as come within the scope of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate a complete embodiment of the invention according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a diagrammatic illustration of one embodiment of the condensation prevention apparatus and system of this invention;

FIG. 2 is an exploded view of the local controller unit of the apparatus of this invention;

FIG. 3 is a perspective view of the case temperature sensor and housing of the apparatus of this invention;

FIG. 4 is an exploded view of the sensor/housing of FIG. 3;

FIG. 5 is a sectional view of the sensor/housing of FIG. 3;

FIG. 6 is an illustration showing positioning of the sensor/housing of FIG. 3;

FIG. 7 is an exploded view of the dew point sensor and housing of the apparatus of this invention;

FIG. 8 is a reverse exploded view of the sensor/housing of FIG. 7;

FIG. 9 is an illustration showing positioning of the sensor/housing of FIG. 7;

FIG. 10 is an exploded view of an alternative locational, housing and mounting configuration for the sensors/housings illustrated in FIGS. 3 and 7;

FIG. 11 is a sectional illustration of the sensors/housing of FIG. 10 in a first mounting;

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FIG. 12 is an illustration showing positioning of the sensors/housing of FIG. 10 in an alternative mounting;

FIG. 13 is an electronics block diagram of the apparatus of this invention;

FIGS. 14a through 14j are flow diagrams illustrating program control of local controller components and communications modules of the apparatus of this invention; and

FIGS. 15a through 15g are flow diagrams illustrating program control at centralized processing (an on- or off-site personal computer for example).

DESCRIPTION OF THE INVENTION

The system of this invention is illustrated in FIG. 1 in association with a common commercial freezer/cooler display unit 21 including a display container 23 having a frame (not shown in this FIGURE) and doors 25 in frame 27 (hereinafter, refrigeration case(s)). Up to fifteen such cases 21 can be served by the system as currently configured (though greater or fewer cases could be accommodated). Each case 21 is provided with a local controller unit 31 connected with an array of case sensors including internal case temperature sensor 33, external case frame temperature sensor 35 and dew point sensor 37. The array of sensors may be hard wired (as shown herein) to unit 31 at each case 21 through frame members, or may be configured to function wirelessly utilizing known technologies. While separate frame temperature and dew point sensors 35 and 37 are shown in this FIGURE, an alternate configuration that combines both sensors into one housing is shown hereinafter. Sensor mounting positions may be selected as desired, though the configuration illustrated in FIG. 1 is preferred where the sensors are separately housed.

Controller unit 31 is illustrated in FIG. 2. AC power connector 41, switching relay 43, transformer 45, internal case temperature sensor connection (an RJ-22 connector for example) 47, frame temperature sensor and dew point sensor connectors (RJ-11 type connectors, for example) 49 are located on circuit board 51. Microprocessor 53 is located on board 51, as are in-coming and out-going connectors 55 (RJ-45 type connectors, for example) utilized so that a number of serially connected control units 31 are connectable with a single communication board/transmitter/receiver 57 in communication with receiver/transmitter/centralized processing 59 (FIG. 1). LED's 65 and 67 (preferably green and red, respectively) on board 51 flash to indicate a status update from central processing 59 to microprocessor 53 (LED 65) and to indicate that relay 43 has switched power on to frame/door heaters (LED 67). Reset/programming interface 71 is mounted between LED's 65/67 at board 51.

Board 51 is maintained in housing 75 including first and second housing portion 77 and 79, respectively, with all connectors, LED's and user interfaces provided with access openings therethrough. Housing 75 is configured to be mounted between freezer door frame mullions where case lighting is typically located (thus providing AC power routing access). The housing is designed to be less than the height and width of a typical heretofore known and utilized mullion lighting lens cover adapted for such cases 21.

Controller unit microprocessor 53 can be calibrated to initiate operations anywhere above or below calculated dew point. Adjustments can be made from central processing 59 with wireless communication via the communications board/transmitter/receiver 57 connected to controller unit 31. Central processing 59 (a PC for example) receives data from units 31 via communications board/transmitter/receiver 57, including data enabling tracking, storing and

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making available reports of the history of ambient air temperature and humidity from dew point sensor 37, case frame and internal case temperatures from sensors 35 and 33, respectively, and power consumption of door heaters (all as shown herein in FIG. 15). This information can be used to improve energy efficiency by recalibrating operating ranges of the apparatus and system of this invention, as well as for improved operational cost accounting.

The internal case temperature must remain below FDA approved levels or food will spoil, such being both a health concern as well as an expense to the installation for potential loss of goods. It has heretofore been difficult to determine if temperature are within guidelines 24 hours a day. Utilization of the apparatus and system of this invention, however, and particularly utilization of internal case temperature monitoring by sensor 33 through controller unit 31, allows such detailed tracking and reporting. Moreover, the apparatus and system are configured to automatically send an alarm (one or both locally and by autodialer to a responsible technician) if maximum allowable internal case temperature as programmed is exceeded. If central processing 59 receives an alarm message from any of the local control units 31 in the system, an alarm or auto dial via a modem is initiated and a message is sent with regard thereto, including the exact case in the system wherein temperature has deviated (see FIGS. 14 and 15).

Temperature sensors 33 and 35 are similar and are housed as illustrated in FIGS. 3 through 6 (for purposes of description herein, only the housing of sensor 35 will be described since sensor 33 is much simpler to implement and maintain). Temperature sensor 35 housing 83 includes cover 85, sensor locating base 87 and circuit board/carrier 89 locating temperature sensor 35 including temperature sensing chip 91 at one surface thereof. This assembly is mounted to case frame unit or door frame unit 93 of display case 21 utilizing screws or adhesive, with base 87 adjacent frame unit 93 as shown in FIG. 5. Cabling from controller unit 31 is routed through cable protector 95 at base 87.

Temperature sensing chip 91 is located on board/carrier 89 so that when received in housing 83 it is located through sensor opening 99 at base 87. With proper materials sizing, chip 91 will be in direct contact with the surface of unit 93 being monitored when base 87 is mounted on frame unit 93. Housing 83 should be located at the coldest spot on the exterior of the freezer. That spot is usually in the center of the case between the bottom of a door 25 and door or case frame unit 93 (see FIG. 6). Door and frame heaters 103 are located inside doors and/or frames of cases 21.

Housing 83 is configured at cover 85 and base 87 to thermally isolate sensing chip 91 from the warming effects of ambient air temperature in the vicinity of the chip and transfer thereof by the housing to the chip. Air space pockets 105 and 107 above and around chip 91, respectively, and limited housing contact (see FIG. 5 wherein only a single locating post 109 maintains board/carrier 89 at its position in housing 83) isolate chip 91 from the housing. By thus configuring board/carrier 89 (made typically of FIBER-GLASS material) and housing 83 (preferably made of plastic such as acrylonitrile butadiene styrene polycarbonate) little transfer of heat to sensor chip 91 occurs, assuring accurate measurement of surface temperature of unit 93 unaffected by inaccuracies introduced as artifact into the measurement by ambient air temperature conditions in the vicinity of housing 83 (accuracy of frame temperature measurements has been documented by testing to be within 1 or 2 degrees Centigrade).

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Air space pocket 105 is created by the depth of cover 85 adjacent board/carrier 89, the cover also insulating the sensor chip from the ambient. Air space pocket 107 is created by opening 99 having an opening area greater than surface area of chip 91. These improvements allow accurate tracking and monitoring of case frame temperature, used not only for precisely timed heater activation, but also for better timing of heater deactivation given the fast rise in frame temperature after frame/door heaters 103 are activated to prevent condensation.

Turning now to FIGS. 7 through 9, dew point sensor 37 is housed in housing 115 including cover 117 and mounting base 119. Circuit board/carrier 121 maintains sensor 37 circuitry including dew point sensing chip 123. Dew point sensing chip 123 is located, when assembled, in opening 129 in the face of cover 117, opening 129 including protective shield 131 having gaps 133 along the sides thereof to allow airflow over sensing chip 123 for measuring humidity and ambient air temperature. A membrane 141 covers opening 143 at sensing chip 123 to protect internal humidity and temperature sensing components from foreign matter such as cleansers and the like. The design of cover 117 protects membrane 141 without preventing airflow to sensing chip 123.

Housing base 119 includes cabling routing protector 145 for introducing and stabilizing cabling to sensor 37. Spacer ribs 147 at base 119 assure an insulating air gap between housing 115 and its adjacent mounting surface. Housing 115 is preferably mounted to door or case frame unit 151 located at the top of case 21, as shown in FIG. 9, and between the frame unit and door 25 so that the cold air exiting the case when a door is opened will not affect the sensor readings.

Housing 115 is configured to thermally isolate dew point sensor 37 so that accuracy of the dew point sensor is maintained within to 1 to 3 degrees Centigrade. First, by assuring that sensor 37 is held away from the unnaturally heated frame (either cooled by the freezer or heated by frame heaters) with spacer ribs 147, the frame temperature will not influence the relevant dew point readings (primarily ambient air temperature). The air pocket (155 in FIG. 9) behind board/carrier 121 and extending all the way to the mounting surface at unit 151 prevents thermal transfer through housing 115 from the mounting surface of frame unit 151. The cover includes openings 157 at opposite ends thereof to provide room temperature airflow at air pocket 155 of room temperature air. Housing mounting surface 159 is perpendicular to the dew point sensor board/carrier 121, and may be mounted by screws or (preferably) adhesive.

By thus configuring board/carrier 121 (made typically of FIBERGLASS material) and housing 115 (preferably made of plastic such as acrylonitrile butadiene styrene polycarbonate) little transfer of heat to sensor chip 123 occurs, assuring accurate measurement of ambient air temperature and humidity unaffected by inaccuracies introduced as artifact into the measurement by freezer case 21 frame temperature conditions in the vicinity of housing 115. Housing 115 is configured utilizing board support protrusions 163 defining retainer pockets 165 having minimal contact surface along the outer edges of board/carrier 121 to maintain board positioning, thus further reducing thermal transfer. Depth of housing 115 behind pockets 165 establishes air pocket 155.

When door and frame heaters are activated it is important that they do not affect the reading from sensor 37 of actual room air temperature. This design sufficiently isolates sensor 37 from door and frame temperature swings, thereby preserving accuracy of readings of ambient air temperature and

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thus accuracy of dew point calculation. Absent such thermal isolation, it is possible for shut-off of heaters to be delayed indefinitely. For example, under the influence of heaters, if temperature readings were to rise at an insufficiently isolated dew point sensor then calculated dew point would increase. In such case, the doors would have to be heated further as the dew point is chased. Heating the doors further would raise the dew point still more in this scenario, thereby beginning an upwardly spiraling cycle until the heaters reach their maximum temperature and finally power off.

Turning now to FIGS. 10 through 12, an alternative embodiment for sensors 35 and 37 housing is illustrated wherein housing 115 is utilized to house both sensors. Thus all elements of the housing as heretofore described are the same unless otherwise specified hereinbelow. Sensor 35 is maintained at cabling routing protector 145 at retainer pockets 175 (one on each side, though only one side is shown in the drawings) defining ledges having minimal contact surface with board/carrier 89 to maintain the board, thus reducing thermal transfer through the housing to the board. A single locating post 177 may be utilized to further stabilize the board if necessary. As shown in FIG. 11, sensor 91 and board/carrier 89 are completely surrounded by an insulating dead air pocket established by the depth of protector 145. This housing may be mounted either above (FIG. 11) or below (FIG. 12) door 25 of a case 21, and retains all the thermal isolation advantages discussed for the individually housed units as discussed above.

FIG. 13 illustrates the electronics utilized by the apparatus of this invention. Incoming AC power is provided to relay 43 and is transformed at input/transformer 41/45 (12 volt DC output) for use by controller unit 31 and sensors 33, 35 and 37. Sensors 33 and 35 inputs are A/D converted and input to the central processing unit microprocessor 53 embodying the various comparitors and look up tables utilized (Sensor 37 is A/D converted at the sensor). LED's 65/67 are controlled in response to microprocessor functions, and microprocessor programming can be conducted on-site through connector/interface 71. Communications flow between microprocessor 53 and central processing 59 is monitored and controlled by communications board 57 in cooperation with microprocessor 53 and central processing 59. Relay activity is monitored and controlled by microprocessor 53 in response to set point achievement as specified in software and as sensed by the sensor array.

Thermal isolation of sensors 35 and 37 thus insure the accuracy of the sensors and thus the efficacy of the apparatus both in terms of its ability to anticipate condensation formation as well as its ability to save on energy expenses due to overheating of doors and frames or improper cycling of heaters. Overall functioning of the apparatus and system of this invention are as illustrated in FIGS. 14a through 14j and 15a through 15q. Heaters are activated just above dew point and thus just before moisture appears on freezer surfaces. Controller unit 31 may utilize any known sensor(s) 37 for monitoring ambient air temperature (for example, thermistors may be utilized for the temperature sensors herein, including by sensors 33 and 35) and relative humidity (capacitive polymer or thin film type sensor, for example, may be utilized wherein capacitance is proportional to the relative humidity of surrounding air). Combination sensors providing relatively accurate dew point sensing are known and commercially available. Microprocessor 53 looks up the dew point value from a stored table. Input from monitored dew point sensor 37 and frame temperature sensor 35 are utilized in conjunction therewith to determine when to relay on the frame/door heaters as the frame temperature

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approaches the dew point (once the monitored frame temperature drops below a preselected set point above the dew point). Once the monitored frame temperature rises to a preselected set point above the dew point, the heaters are relayed off. On-board software builds a table of over 600 values into the dew point lookup table, set points, as well as other values, being updatable in real time from central processing. The look up table can be reprogrammed through interface 71.

The entire system preferably includes wireless communication for receiving data from multiple control units 31 at different cases 21. Controller unit 31 and communications board/transmitter/receiver 59 transfer data to central processing 59 for data viewing, tracking and report preparation. Central processing 59 is capable of printing efficiency reports, remote recalibration of heater operations and dial up warning programs should any freezer have a failure. Each controller unit 31 tracks internal case temperatures and will warn of unsafe temperatures or freezer failure. Unit/system calibration or recalibration is typically only required when sensors might be influenced by freezer temperatures. Freezer temperatures primarily influence sensor readings dependent on where sensors are mounted at installation. The case frame is not as cold at the top of the freezer as the bottom, so the operating range of the sensors and unit 31 in the combined sensor housing configuration of FIG. 10 are calibrated for the alternative locations.

What is claimed is:

1. Condensation control apparatus for a refrigerated display case having at least one door, a frame and at least one frame/door heater, said apparatus comprising:

a frame temperature sensing unit adapted for monitoring temperature of one of the display case door or display case frame and including a carrier having a temperature sensor thereat;

a dew point sensing unit adapted for monitoring ambient air temperature and relative humidity outside of the display case and including a carrier having at least one dew point sensing component thereat;

a control unit communicating with said sensing units and including processing means connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity; and

housing means for locating said sensing units including structure establishing thermal isolation of said sensing units by minimizing heat transfer contacts between said sensing units and said housing means and locating said temperature sensor and said at least one dew point sensing component amid insulated air pockets formed by said structure of said housing means.

2. The apparatus of claim 1 wherein said housing means includes a frame temperature sensing unit housing, said frame temperature sensing unit housing including a base and a cover, said cover having a depth creating a first one of said air pockets at one side of said temperature sensing unit and said base including an opening for receiving said temperature sensor therethrough, said opening having an opening area greater than surface area of said temperature sensor thus establishing a second one of said air pockets around said temperature sensor.

3. The apparatus of claim 2 wherein said frame temperature sensing unit housing includes a single locating post at said cover for securing position of said temperature sensing unit relative to said cover.

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4. The apparatus of claim 1 wherein said housing means includes a dew point sensing unit housing, said dew point sensing unit housing including a mounting base and cover, said cover including a cover face opening therethrough for receiving said at least one dew point sensing component therein, said cover face opening including a protective shield thereover having air gaps therearound allowing air flow between said protective shield and said cover and thus over said at least one dew point sensing component.

5. The apparatus of claim 4 wherein said cover of said dew point sensing unit housing includes opposite end openings to establish ambient air flow through said dew point sensing unit housing.

6. The apparatus of claim 4 wherein said mounting base of said dew point sensing unit housing includes protrusions establishing retaining pockets receiving said carrier of said dew point sensing unit at outer edges of said carrier and further establishing a first one of said air pockets amid said protrusions and adjacent to said carrier.

7. The apparatus of claim 1 wherein said housing means includes a cover and a base, said cover including a cover face opening therethrough for receiving said at least one dew point sensing component therein, said cover face opening including a protective shield thereover having air gaps therearound allowing air flow between said protective shield and said cover and thus over said at least one dew point sensing component, and said base having depth creating a first one of said air pockets at least at one side of said temperature sensing unit and a second one of said air pockets at one side of said dew point sensing unit.

8. A system for condensation control at an array of refrigerated display cases, the cases each having at least one door, a frame and at least one frame/door heater, said system comprising:

sensing and control apparatus configured for location at each display case in the array of display cases, said apparatus including a frame temperature sensing unit adapted for mounting at the display case for monitoring temperature of one of the display case door or display case frame, a dew point sensing unit adapted for mounting at the display case for monitoring ambient air temperature and relative humidity outside of the display case, an internal case temperature sensing unit positionable inside the display case, and processing means mountable at the display case and connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a first preselected set point above a dew point value derived from monitored ambient temperature and relative humidity, for deactivating the frame/door heater when monitored display case door or frame temperature rises above a second preselected set point above said dew point value, and for storing data related to readings at said sensing units and operation of the frame/door heater; and

a communication control unit associated with said processing means for coordinating programming and data download access to said processing means of said apparatus.

9. The system of claim 8 further comprising a central processing unit and wherein said communication control unit includes a transmitter/receiver for wireless communication with said central processing unit.

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10. The system of claim 8 wherein said processing means of said apparatus is separately housed in a housing having dimensions selected so that said housing is mountable between standard door frame mullions provided at the display case.

11. The system of claim 8 wherein said processing means of said apparatus includes a reset/programming interface.

12. The system of claim 8 wherein said frame temperature sensing unit and said dew point sensing unit are mounted together in a housing.

13. The system of claim 8 further comprising housing means for locating said temperature sensing unit and said dew point sensing unit and including structure establishing thermal isolation of said sensing units by minimizing heat transfer contacts between said temperature sensing unit and said dew point sensing unit and said housing means and locating said temperature sensing unit and said dew point sensing unit amid insulating air pockets formed by said structure of said housing means.

14. A system for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, said system comprising:

a temperature sensing unit in contact with the display case frame to monitor case frame temperature;

a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case; and

control means for receiving data from said sensing units and utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate

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formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.

15. The system of claim 14 further comprising means for thermally isolating said dew point sensing unit from variations in temperature of the display case frame or display case door.

16. The system of claim 14 further comprising means for thermally isolating said temperature sensing unit from variations in temperature of ambient air.

17. The system of claim 14 further comprising an internal case temperature sensing unit mounted inside the display case and communicating with said control means for monitoring internal case temperature.

18. The system of claim 17 further comprising data storing means communicating with said control means for storing data related to readings at said sensing units and operation of the frame/door heater.

19. The system of claim 18 further comprising means for wirelessly accessing stored data at said data storing means.

20. The system of claim 14 wherein said means for wirelessly accessing data is configured for remotely updating control parameters at said control means utilized for monitoring case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater.

* * * * *

EXHIBIT 2



US007421847B2

(12) **United States Patent**
Murray et al.

(10) **Patent No.:** **US 7,421,847 B2**

(45) **Date of Patent:** **Sep. 9, 2008**

(54) **REFRIGERATION UNIT CONDENSATION PREVENTION**

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Patrick M. Bertsch, Thornton, CO (US); **Robert A. Majzner**, Broomfield, CO (US)

(73) Assignee: **Bradley W. Geuke**, Ault, CO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/788,453**

(22) Filed: **Apr. 20, 2007**

(65) **Prior Publication Data**

US 2007/0193294 A1 Aug. 23, 2007

Related U.S. Application Data

(62) Division of application No. 11/069,378, filed on Mar. 1, 2005, now Pat. No. 7,207,181.

(51) **Int. Cl.**
A47F 3/04 (2006.01)

(52) **U.S. Cl.** **62/80; 62/150; 62/176.6; 62/248**

(58) **Field of Classification Search** **62/80, 62/150, 176.2, 176.6, 248, 275**
See application file for complete search history.

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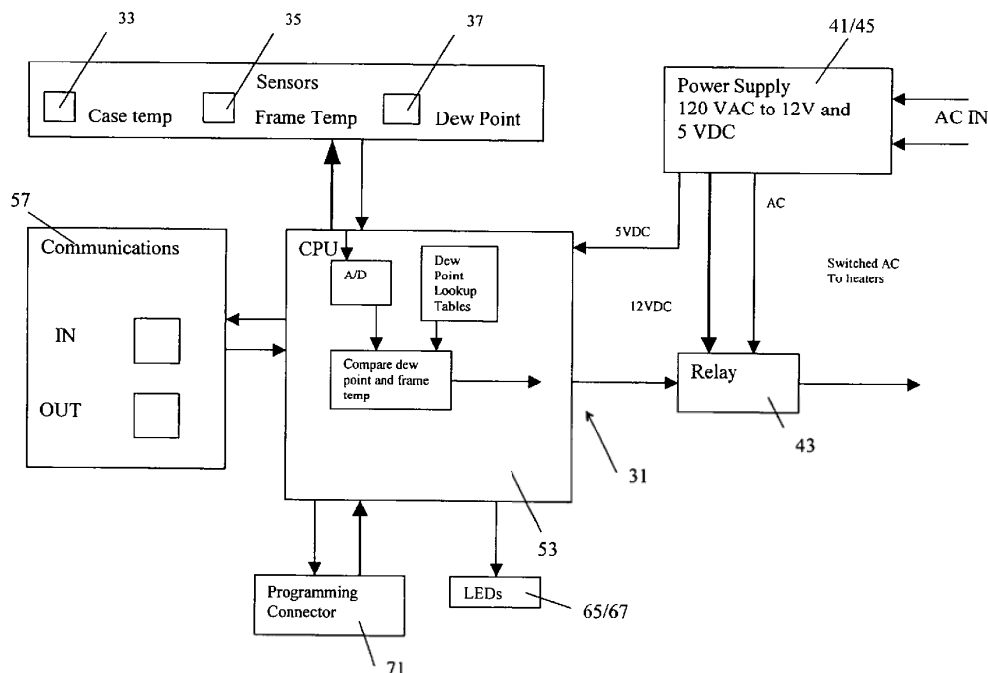
Primary Examiner—William E Tapolcai

(74) *Attorney, Agent, or Firm*—Harold A. Burdick

(57) **ABSTRACT**

Apparatus, systems and methods are disclosed for efficient elimination of door and frame condensation at widely utilized commercial freezer/refrigeration display cases. The apparatus includes a local controller unit connected with an array of case sensors including an internal case temperature sensor, an external case frame temperature sensor and a dew point sensor. The case frame temperature sensor and dew point sensor are housed to thermally isolate sensing elements thereof from effects of frame temperature changes and ambient air temperature in the vicinity of a sensing element, and to limit heat transfer by the housing to the sensing elements thereby improving sensing accuracy and apparatus performance.

20 Claims, 29 Drawing Sheets



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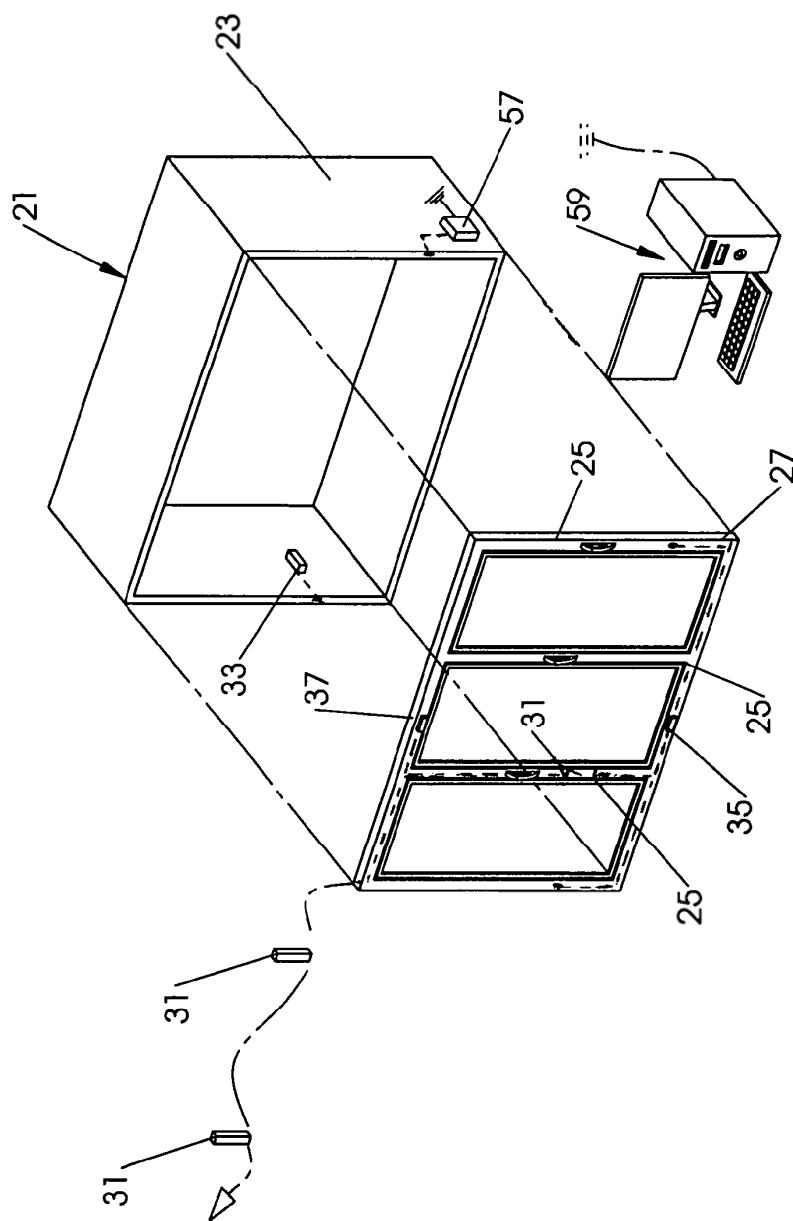


FIGURE 1

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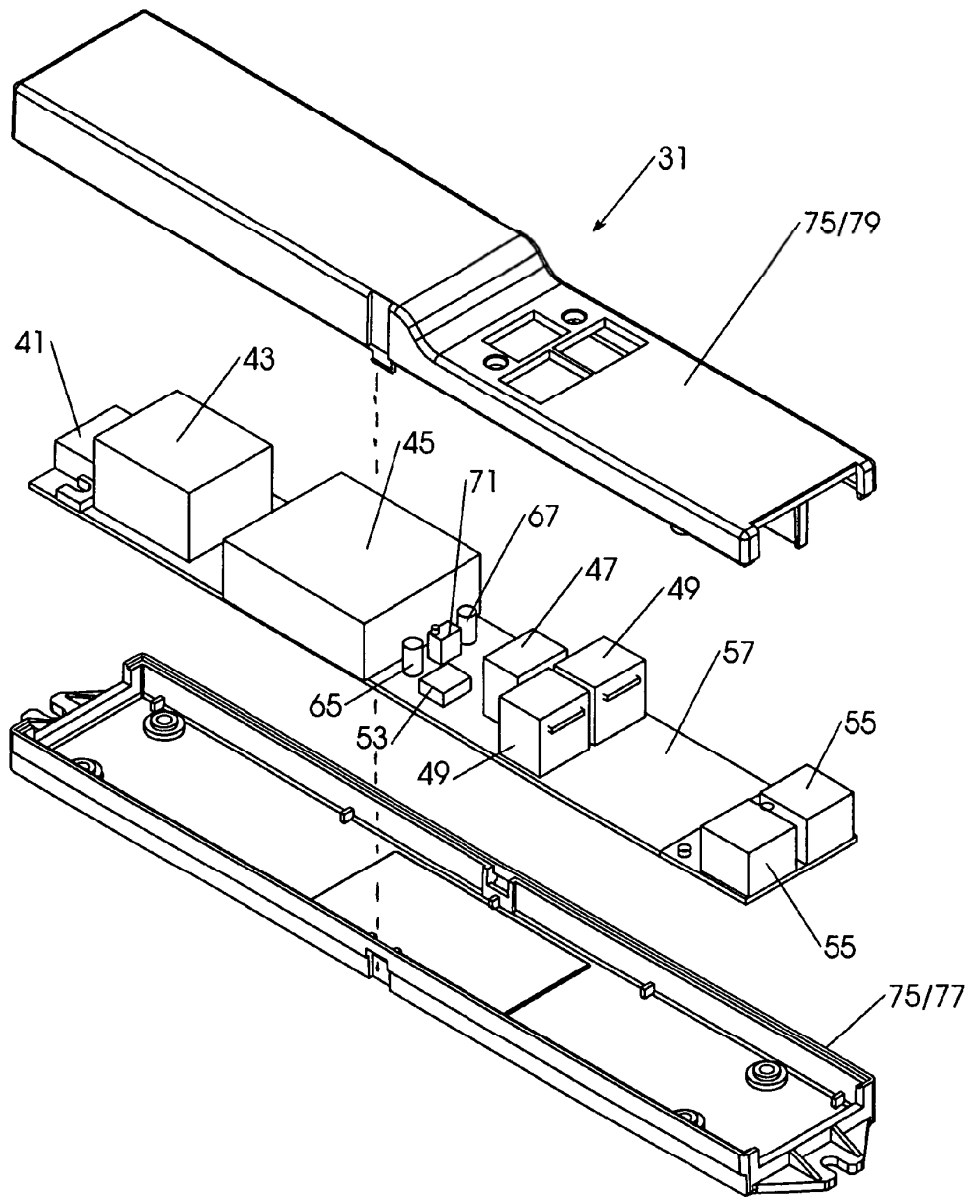


FIGURE 2

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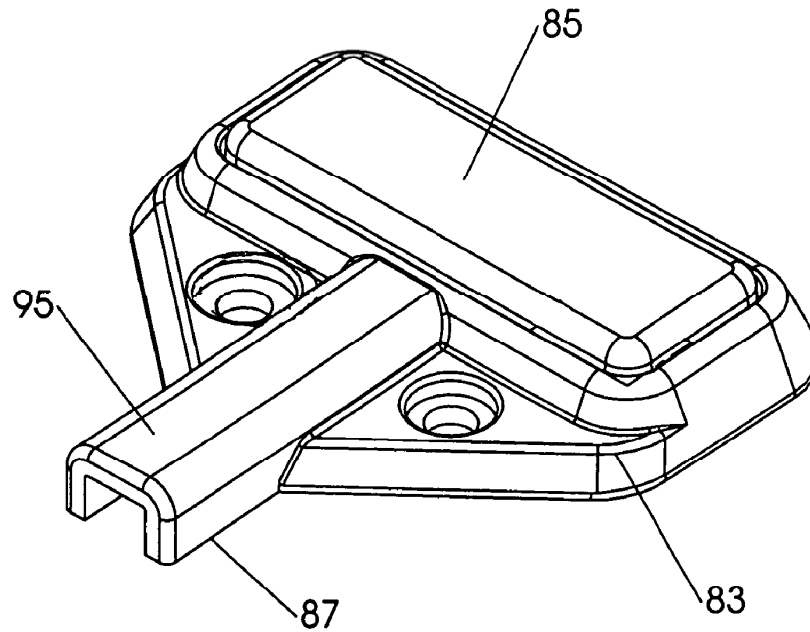


FIGURE 3

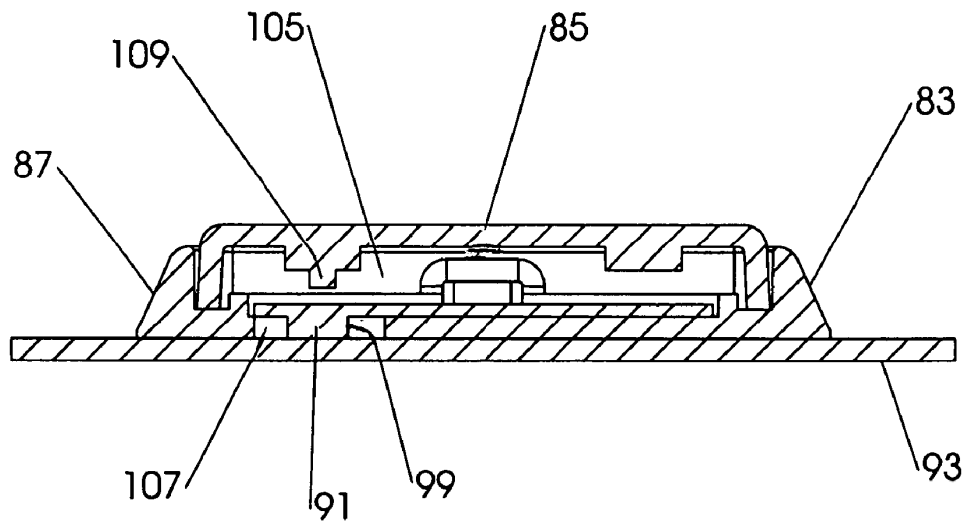


FIGURE 5

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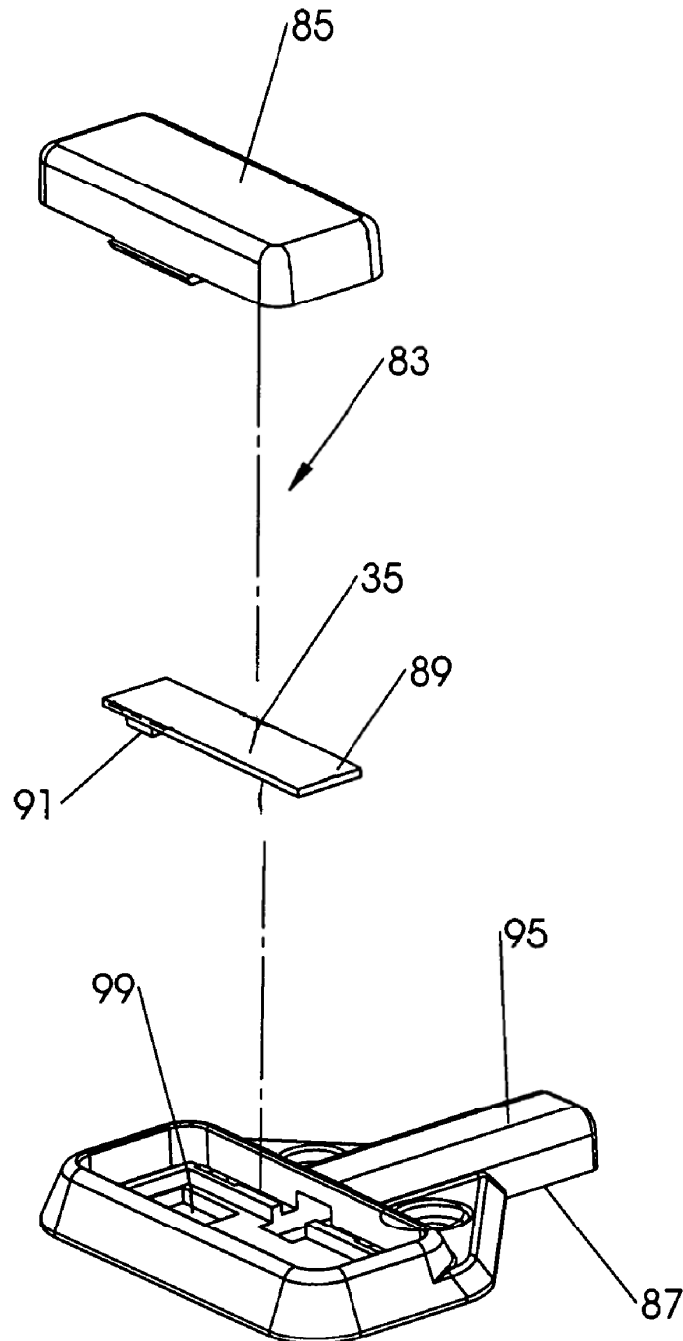


FIGURE 4

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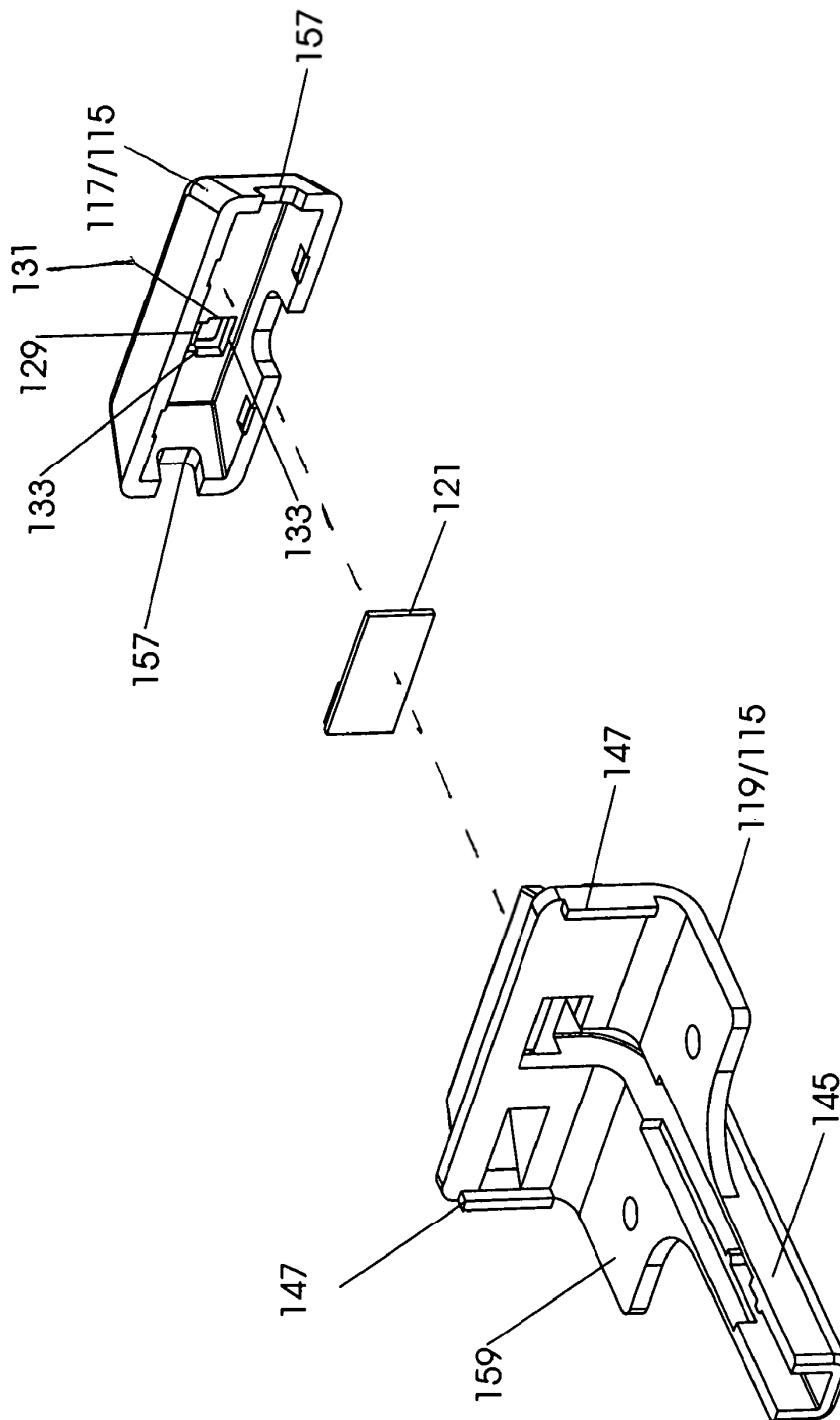


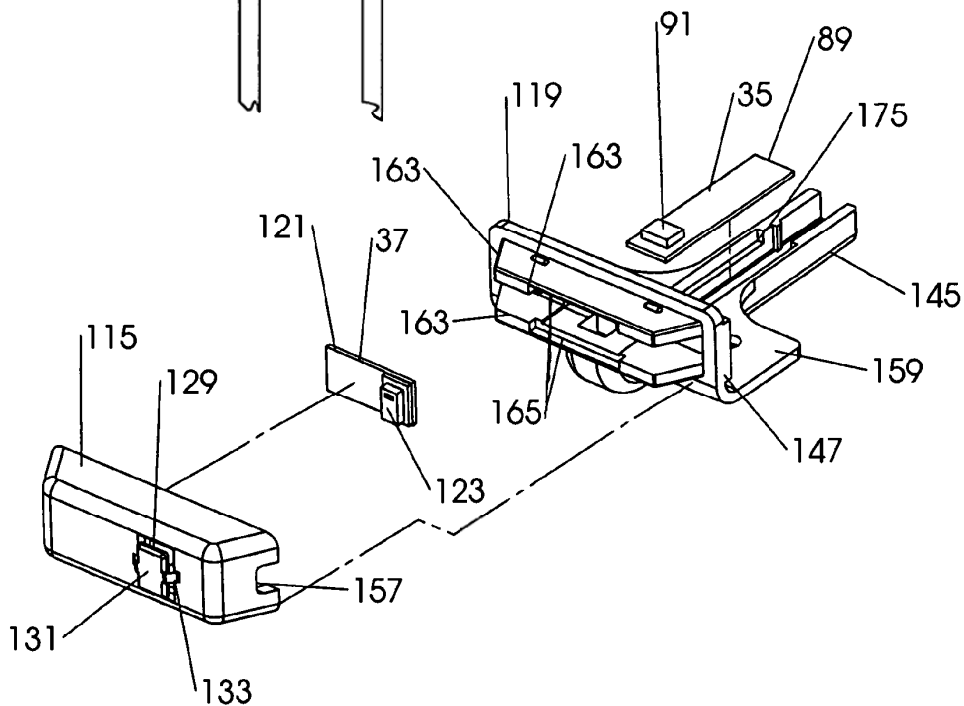
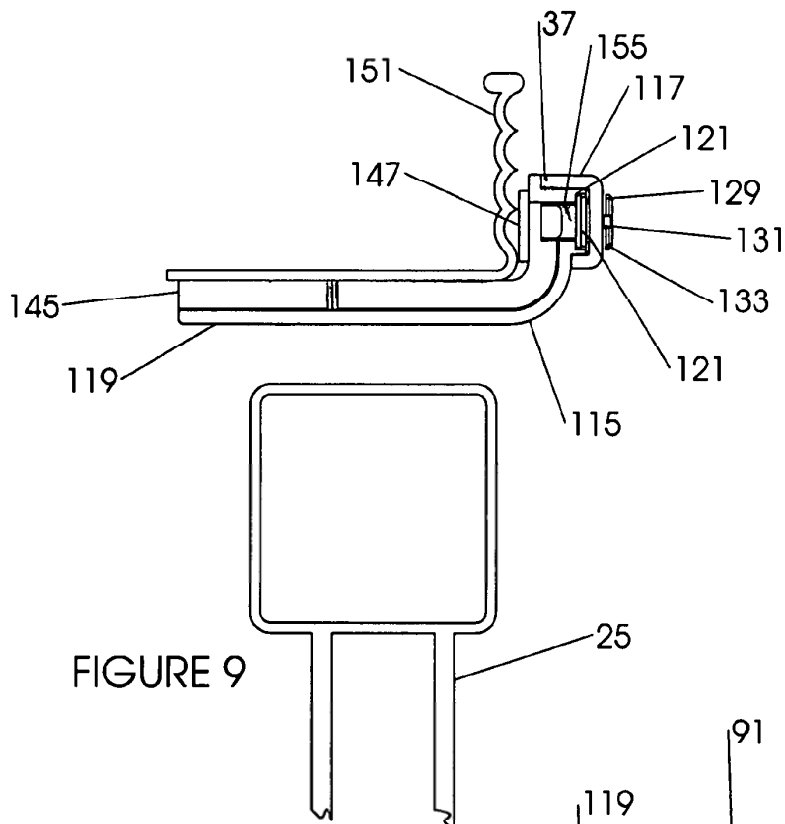
FIGURE 8

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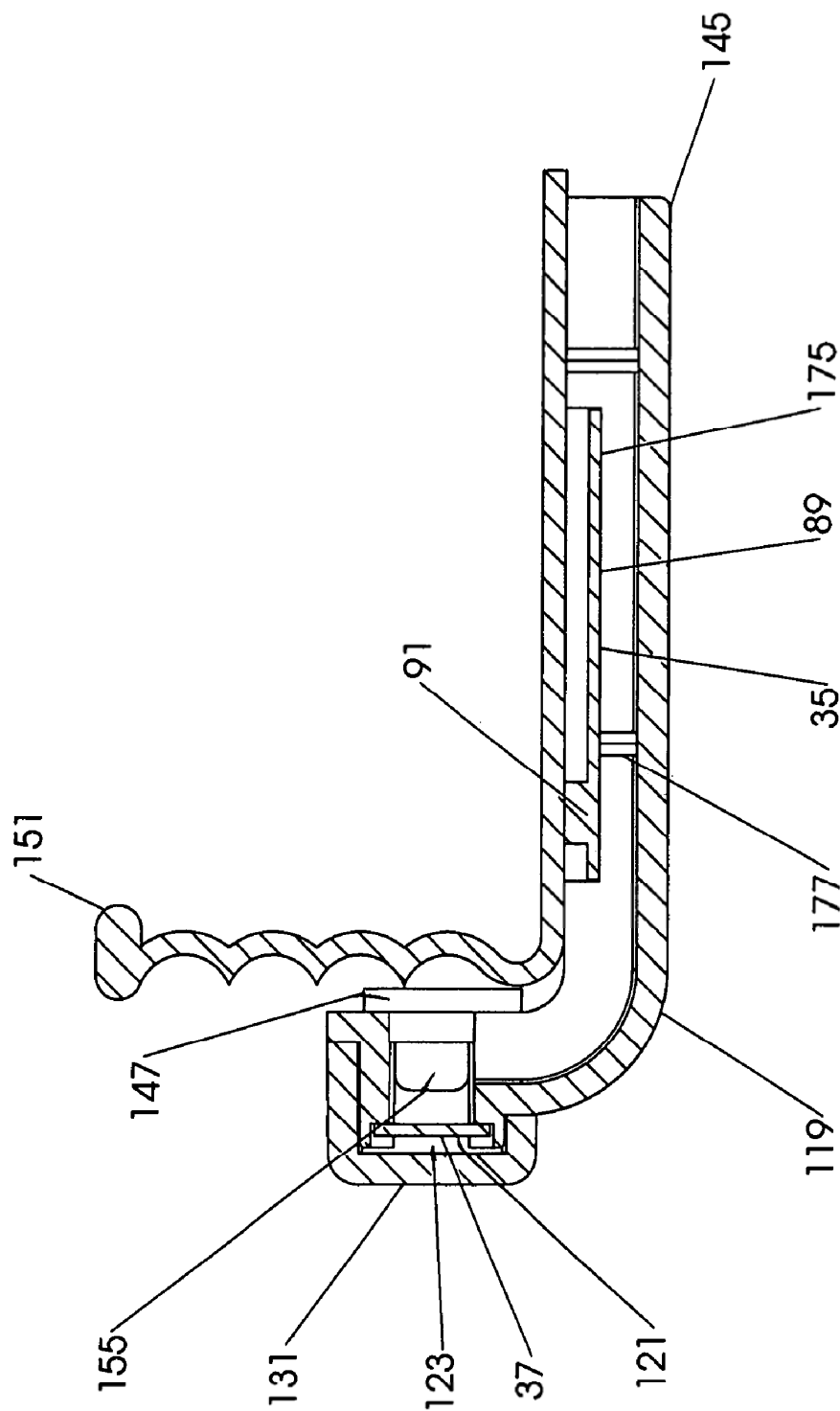


FIGURE 11

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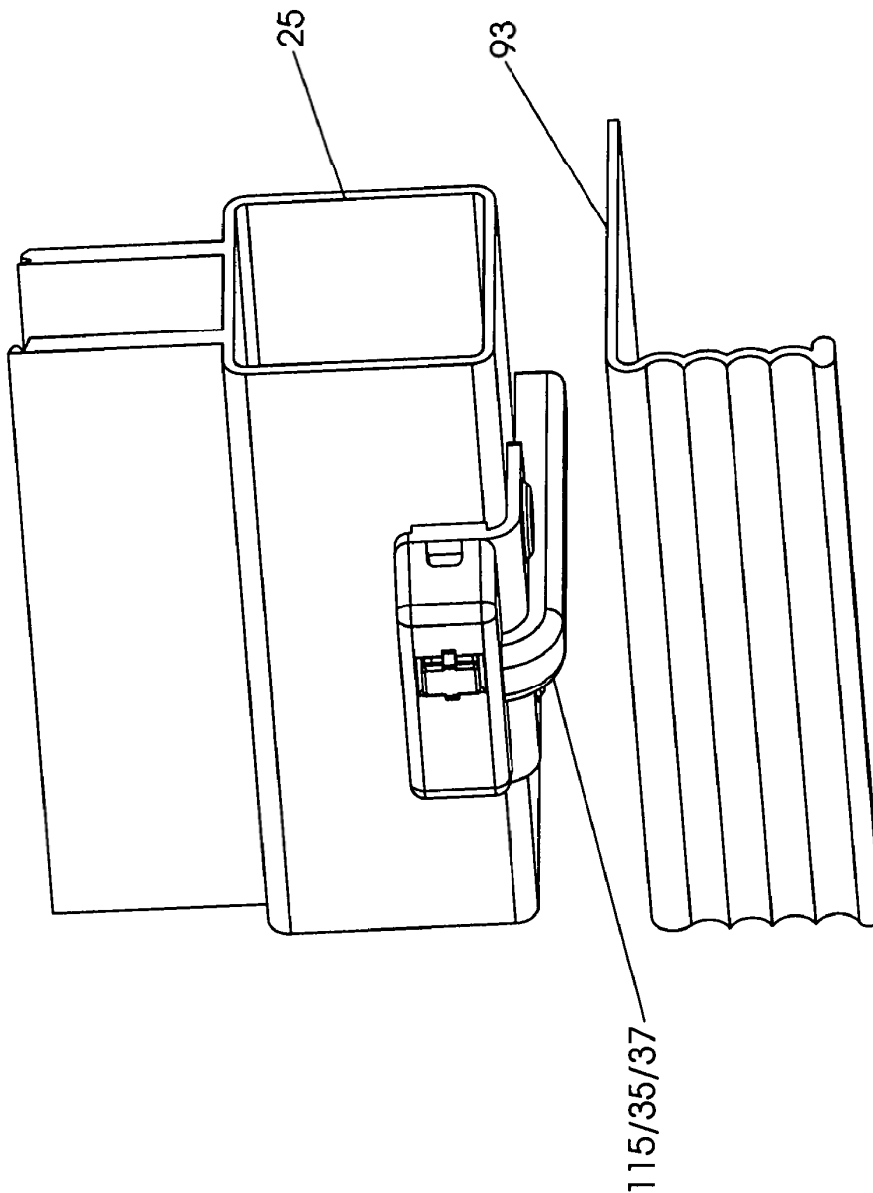


FIGURE 12

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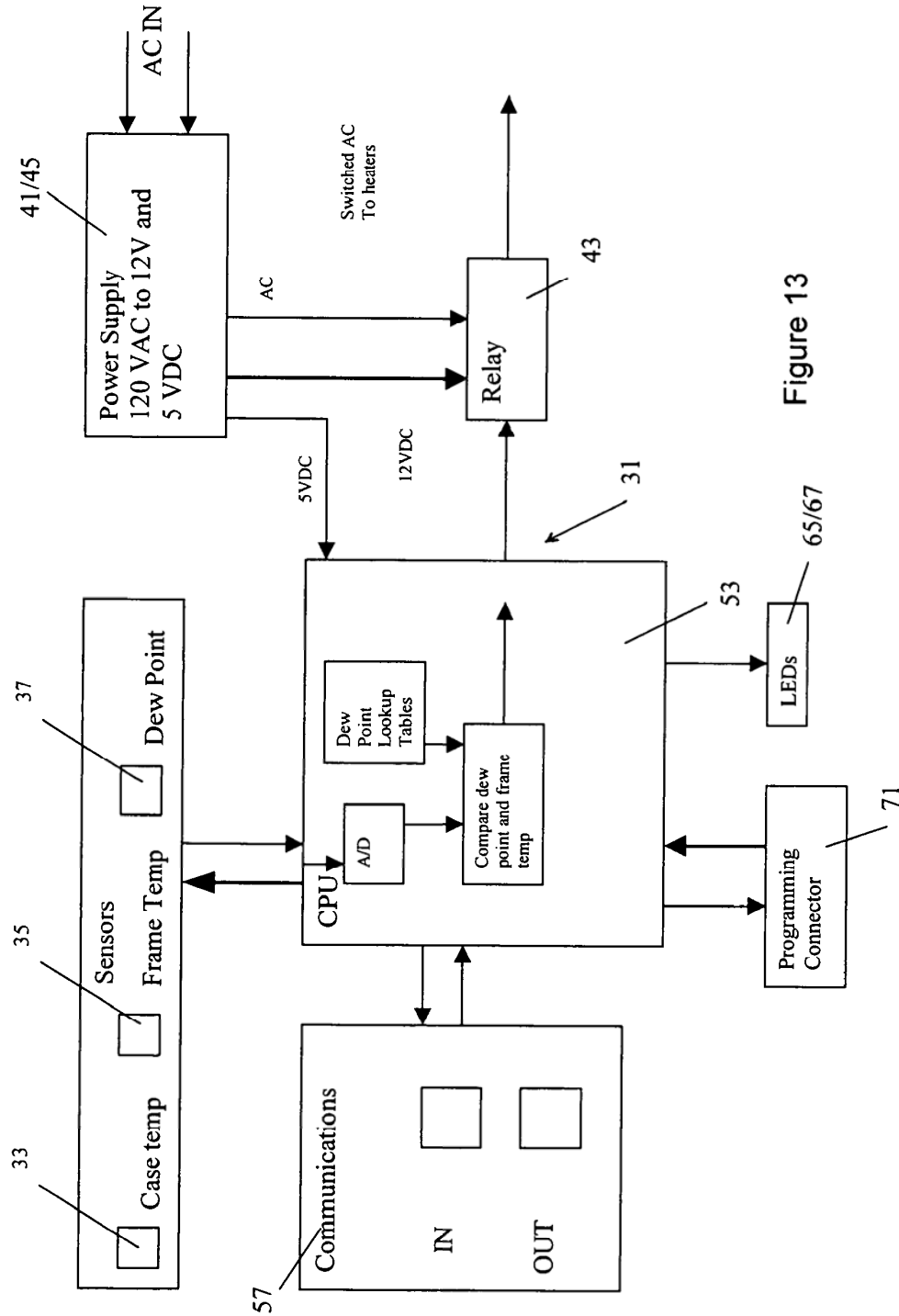


Figure 13

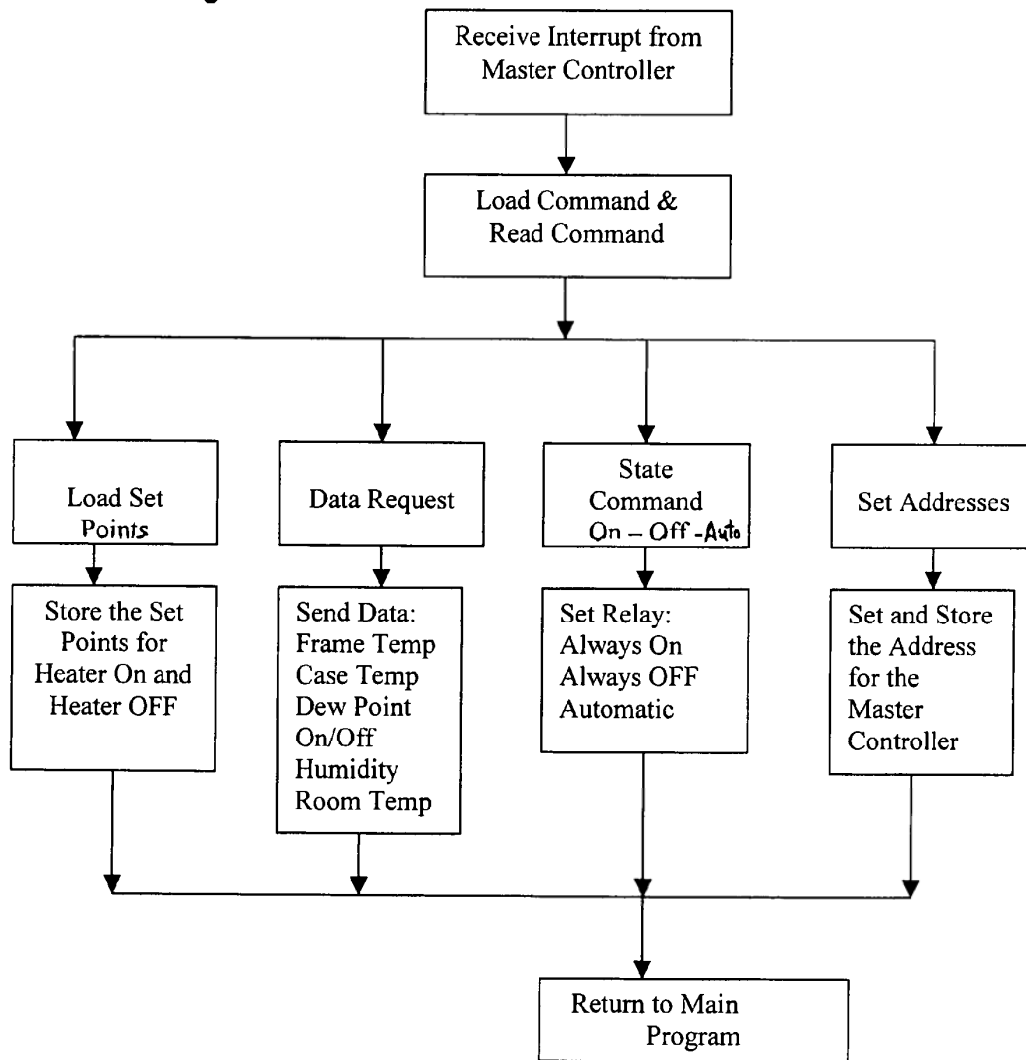
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Figure 14a



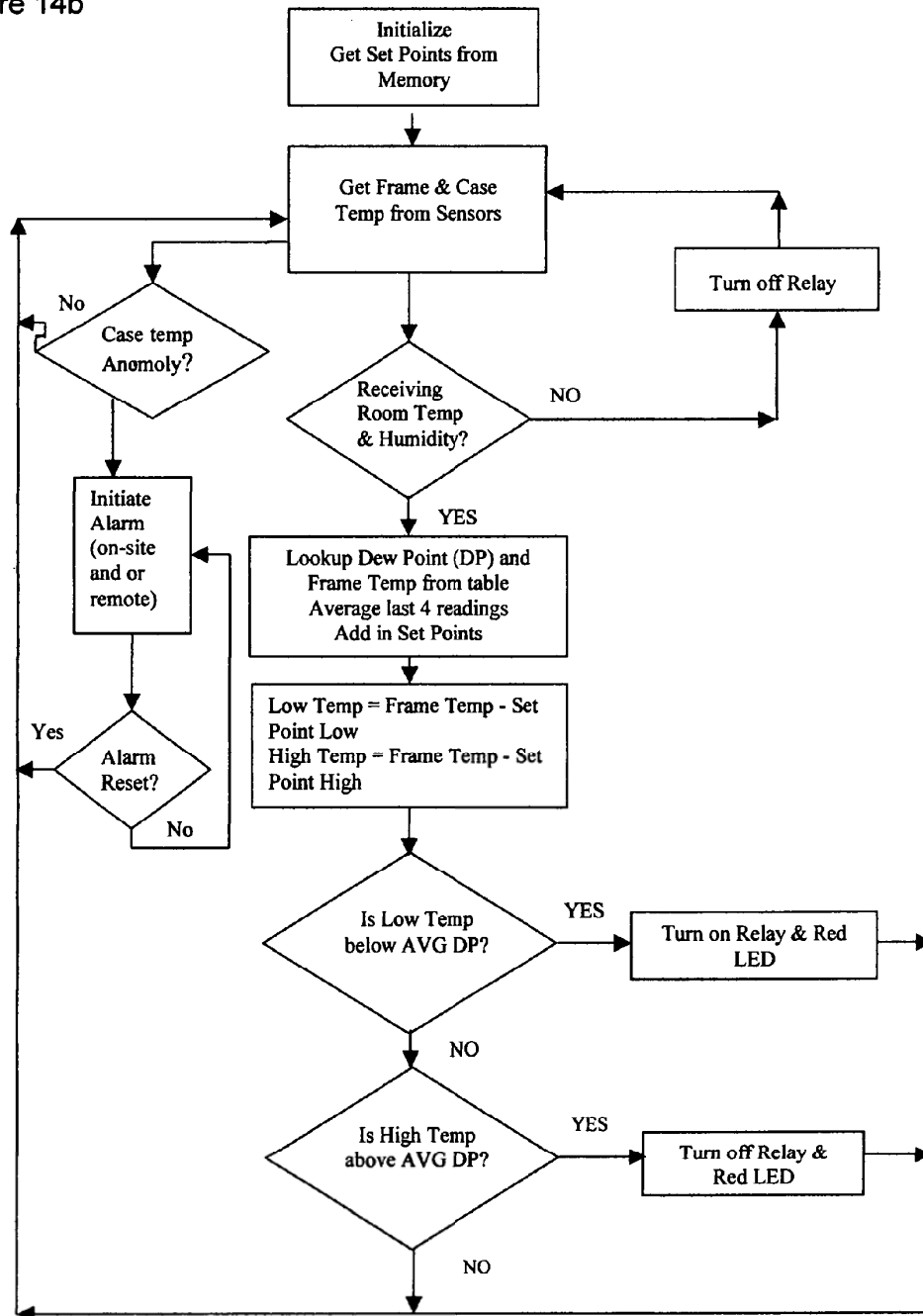
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Figure 14b



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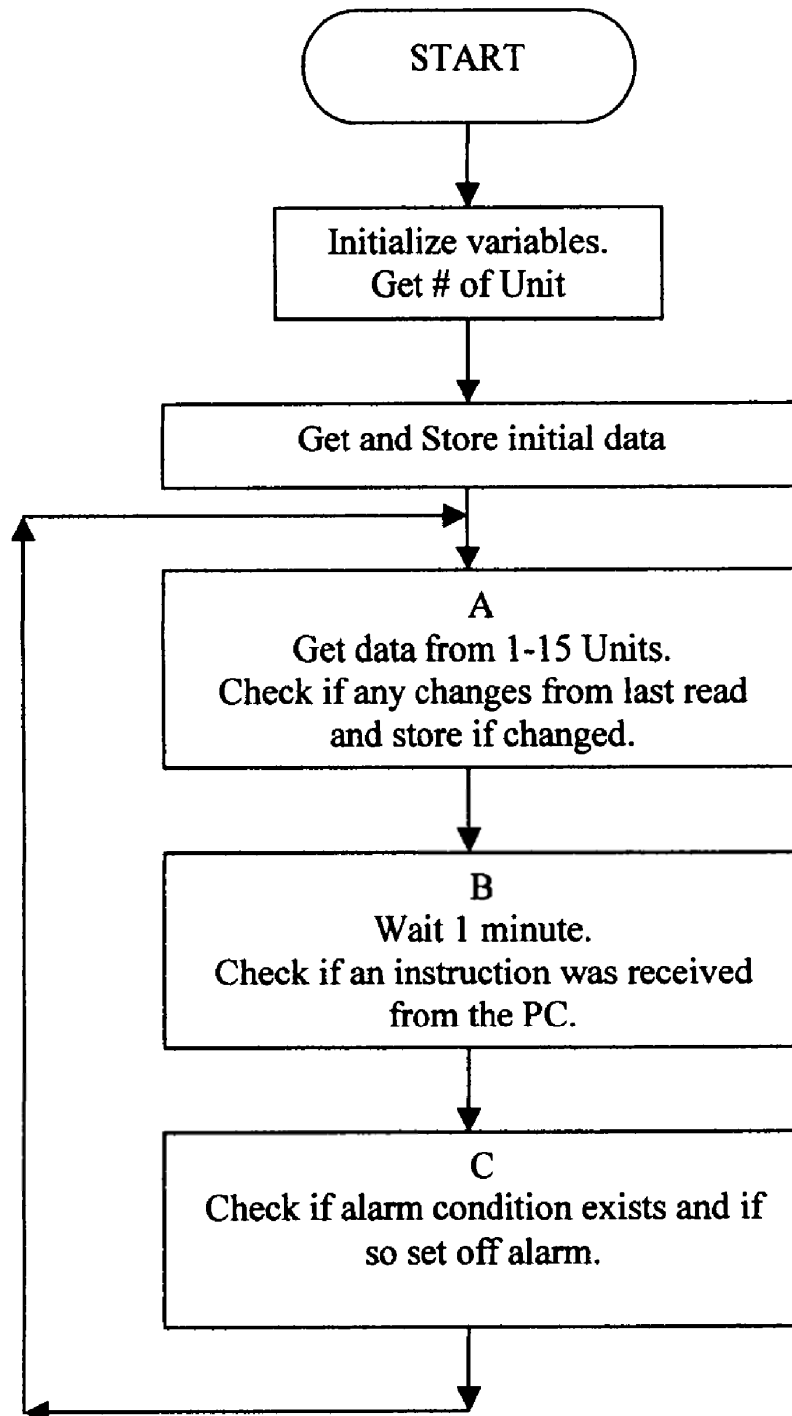


Figure 14c

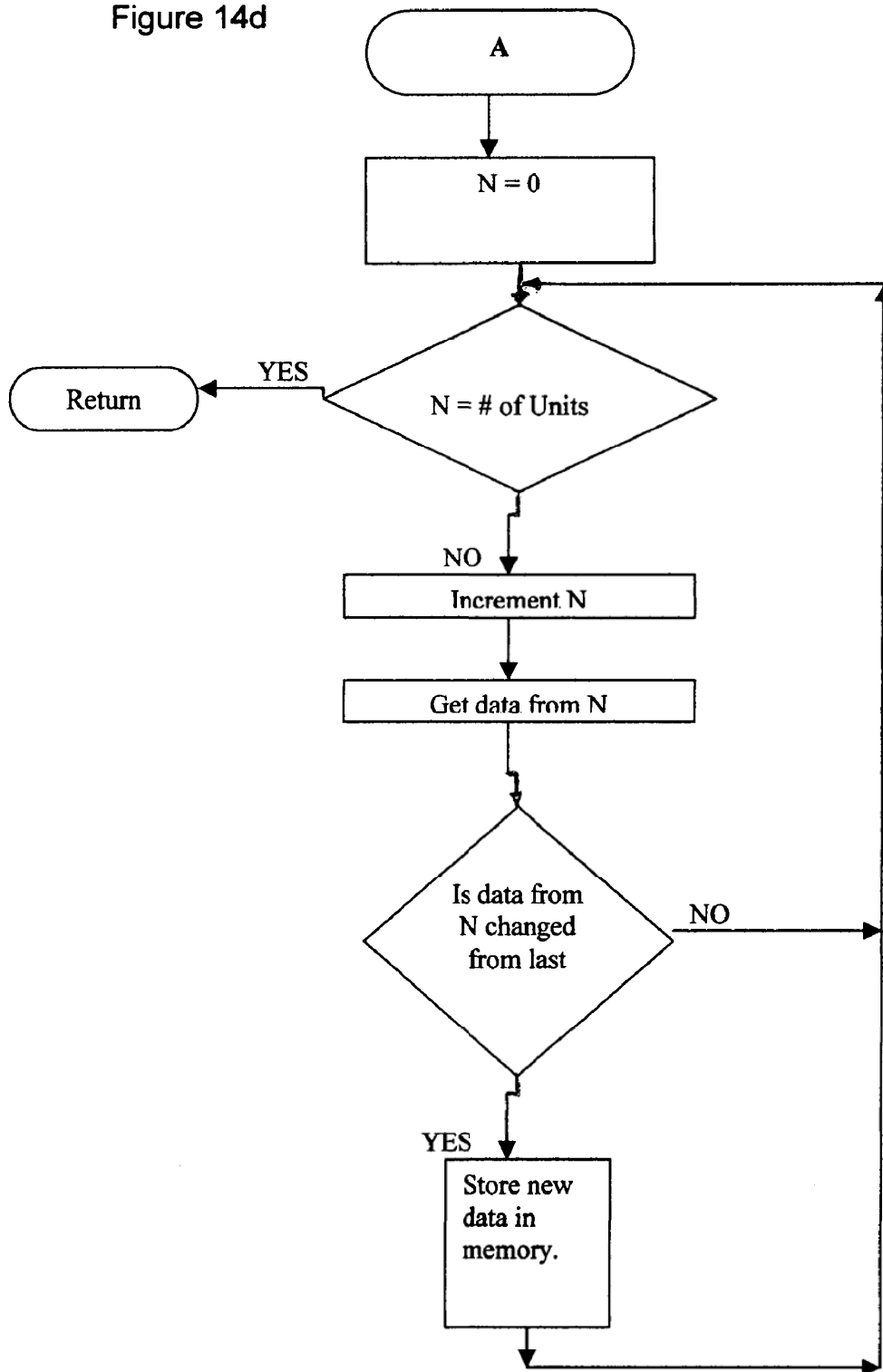
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Figure 14d



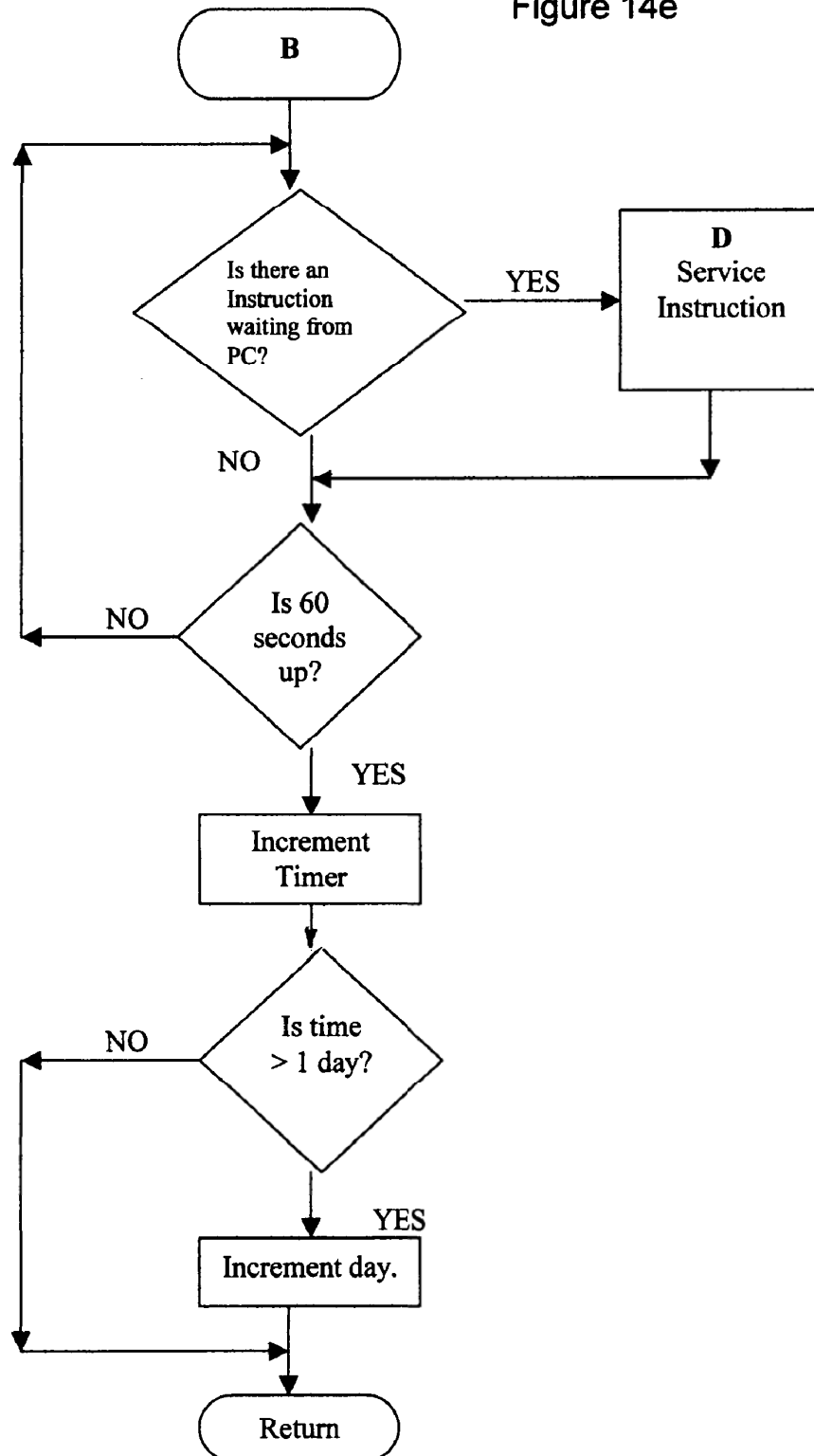
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Figure 14e



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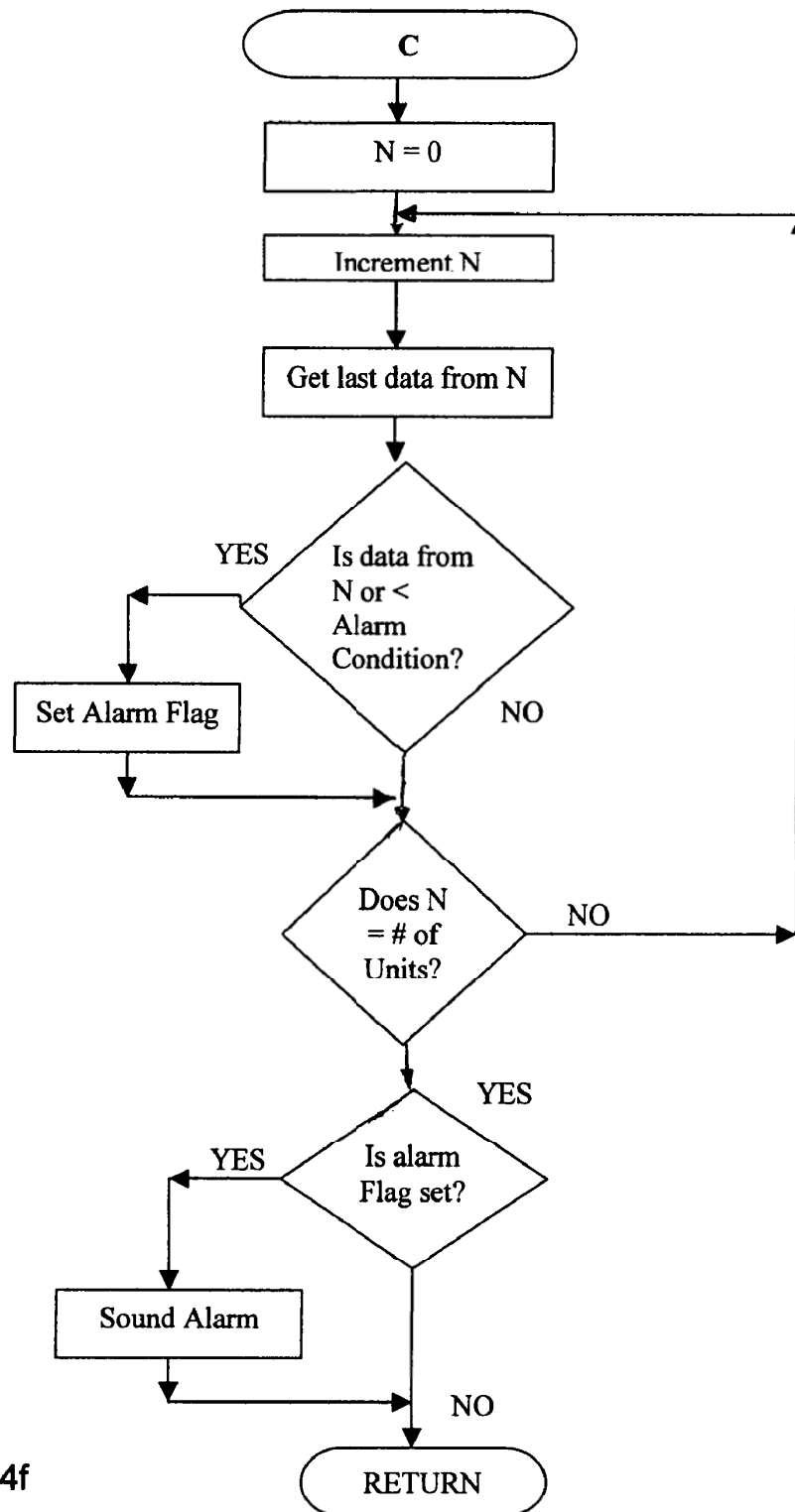


Figure 14f

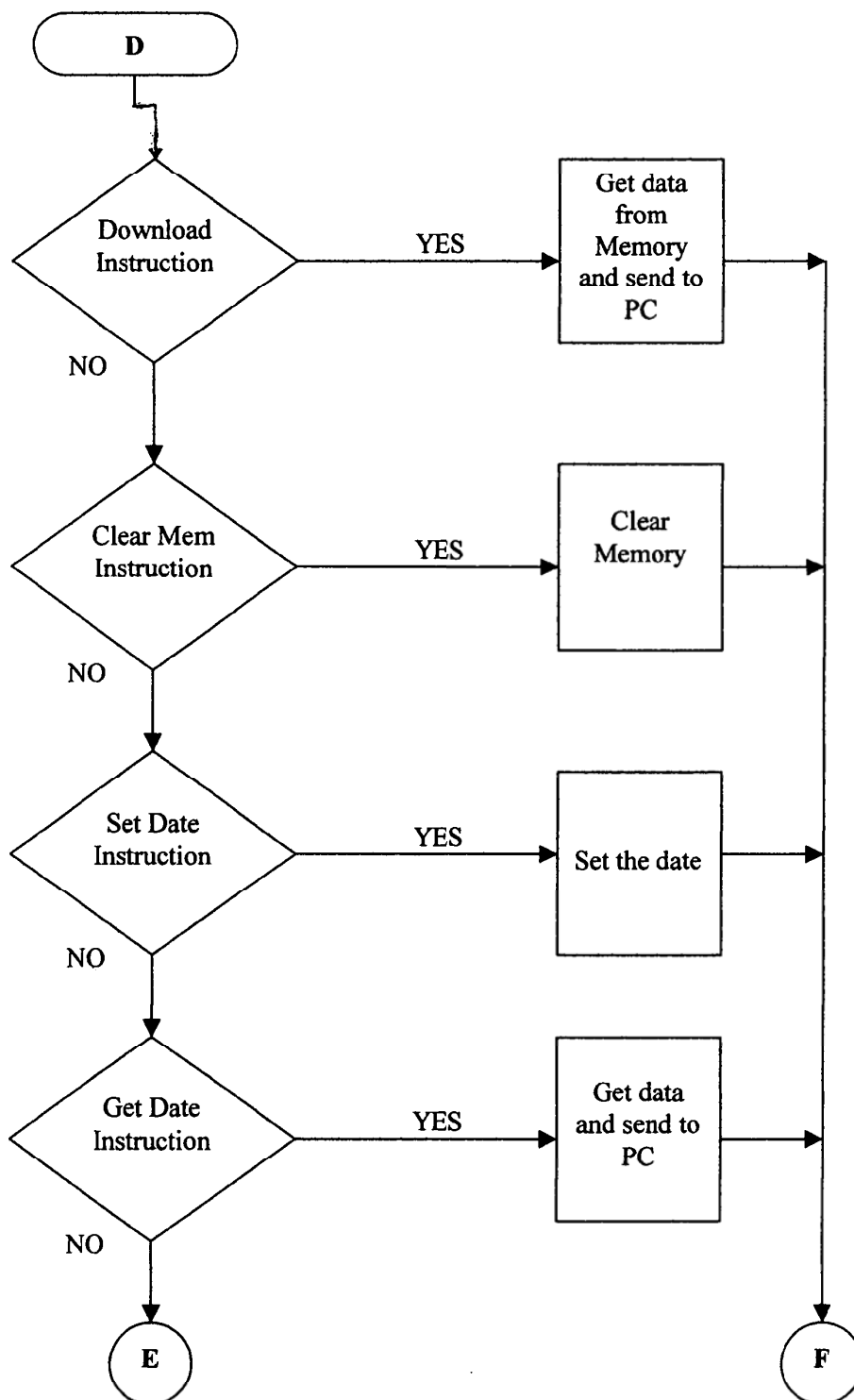
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Figure 14g



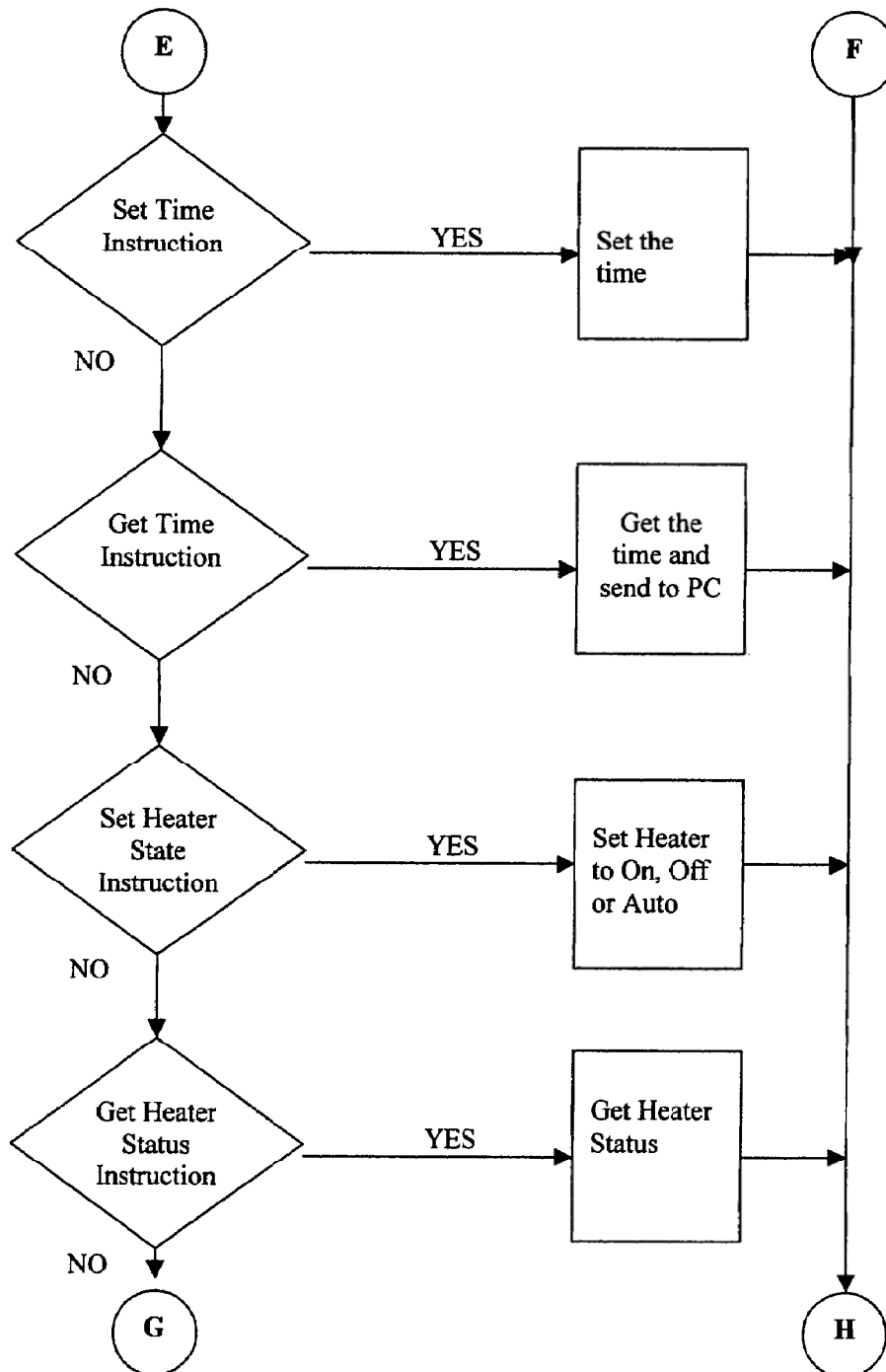
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FIGURE 14h



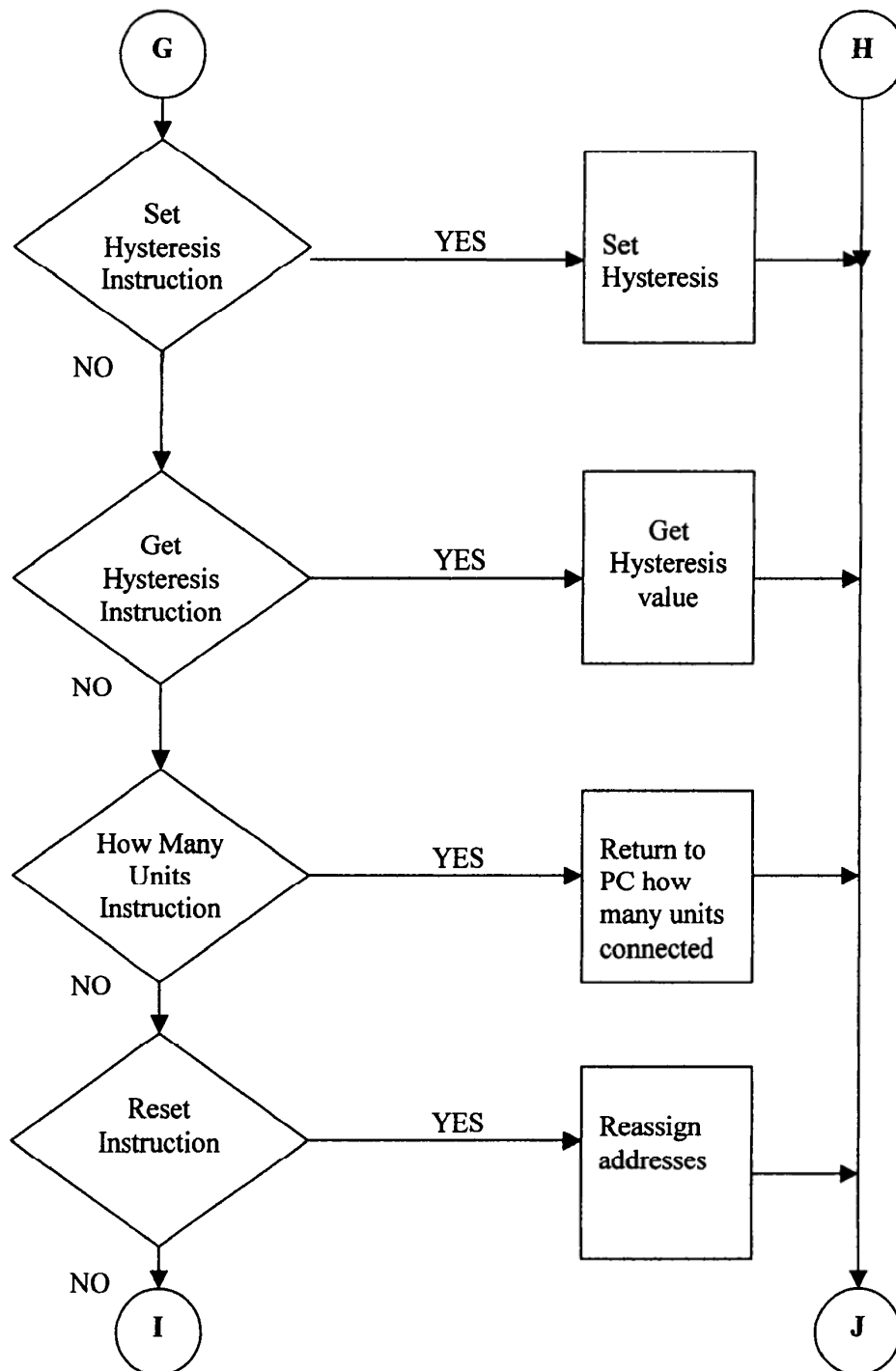
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FIGURE 14i



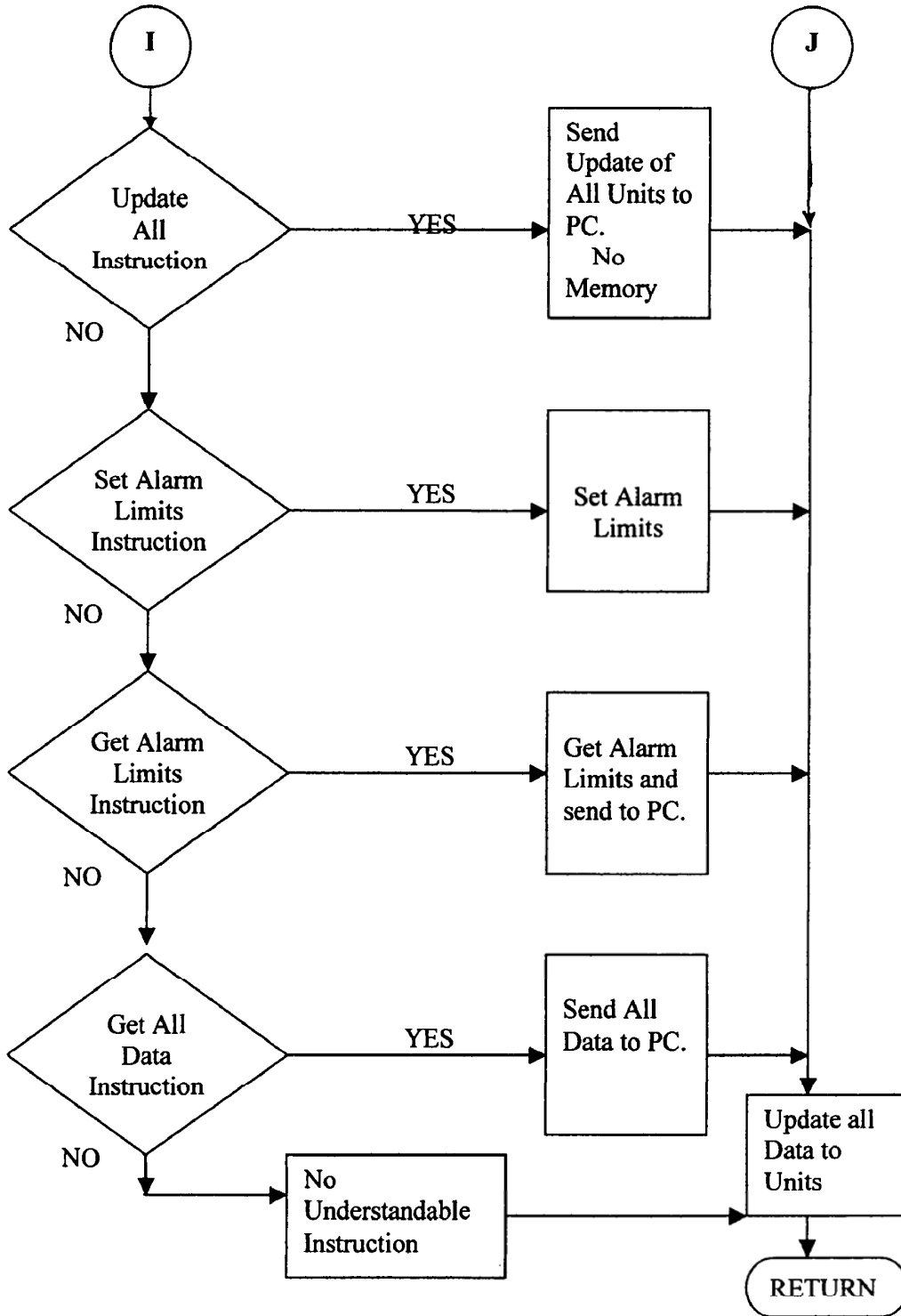
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FIGURE 14j



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Figure 15a

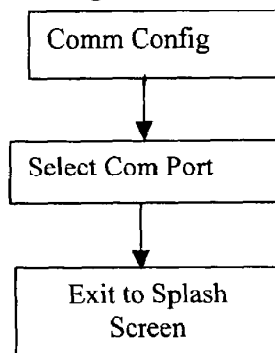


Figure 15c

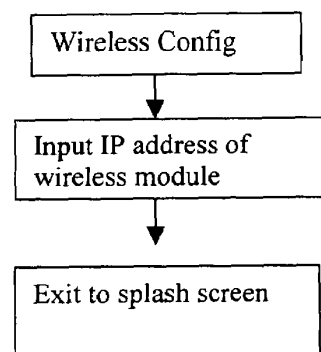


Figure 15b

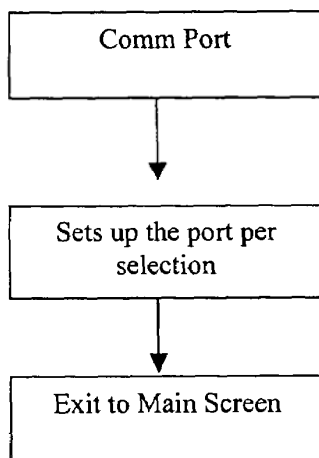
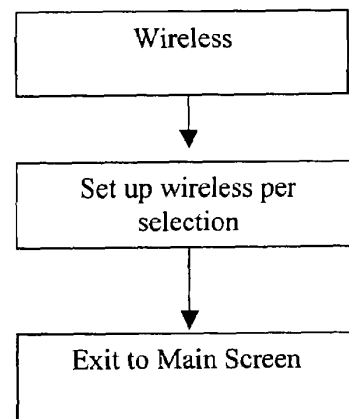


Figure 15d



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Figure 15e

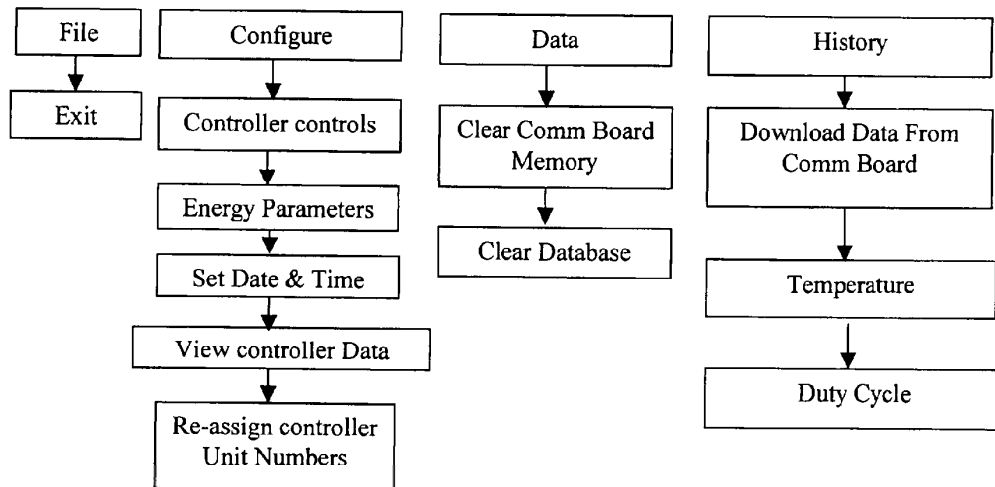
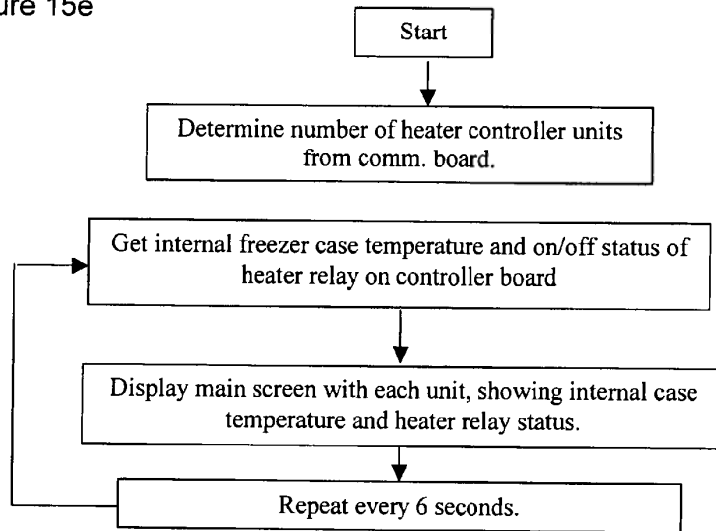


Figure 15f

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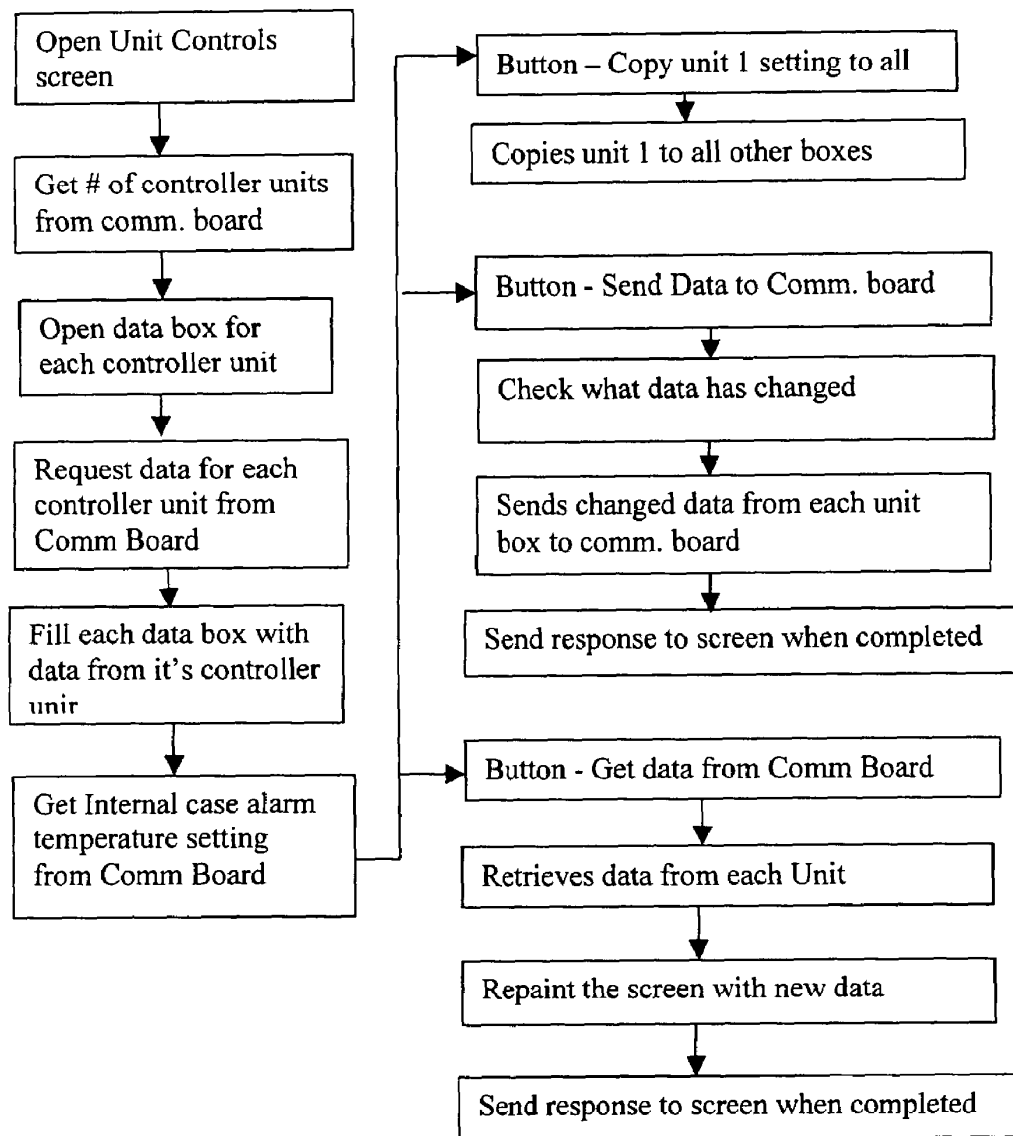


Figure 15g

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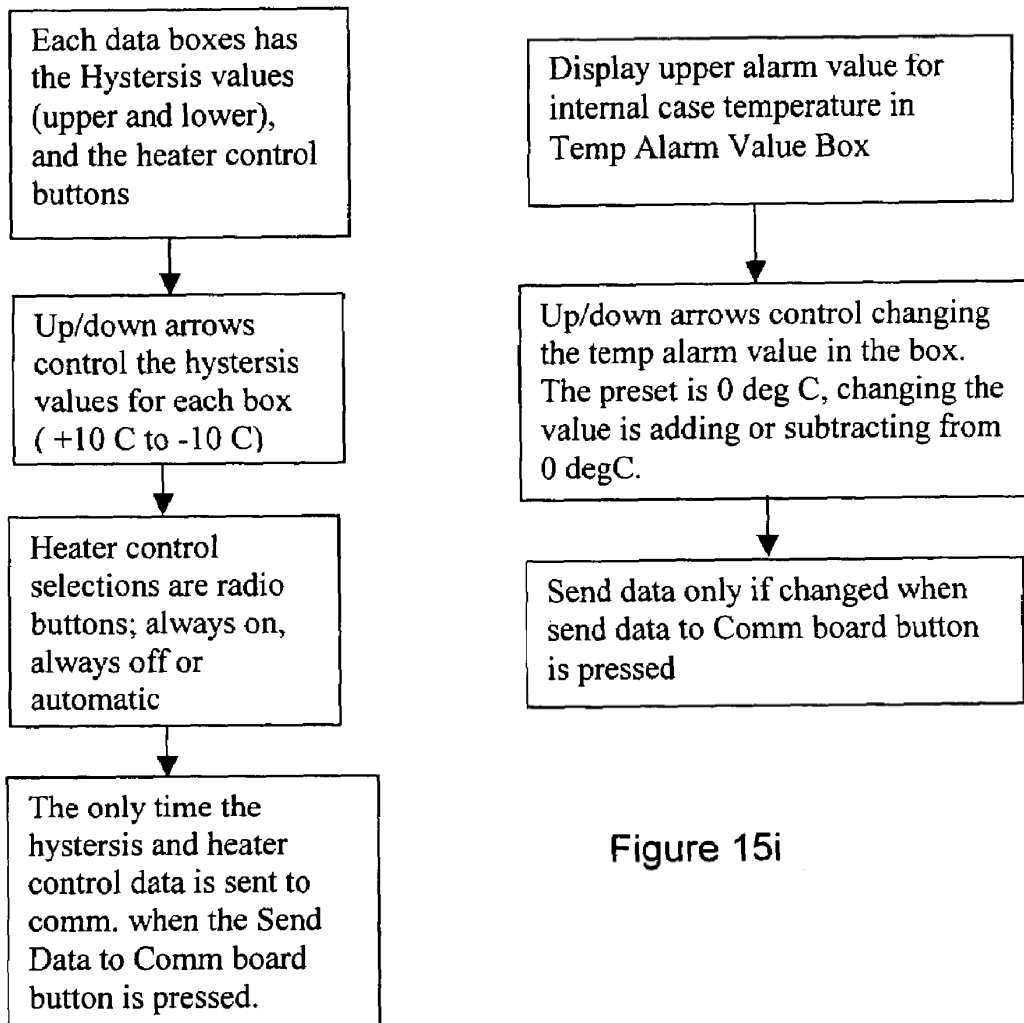


Figure 15i

Figure 15h

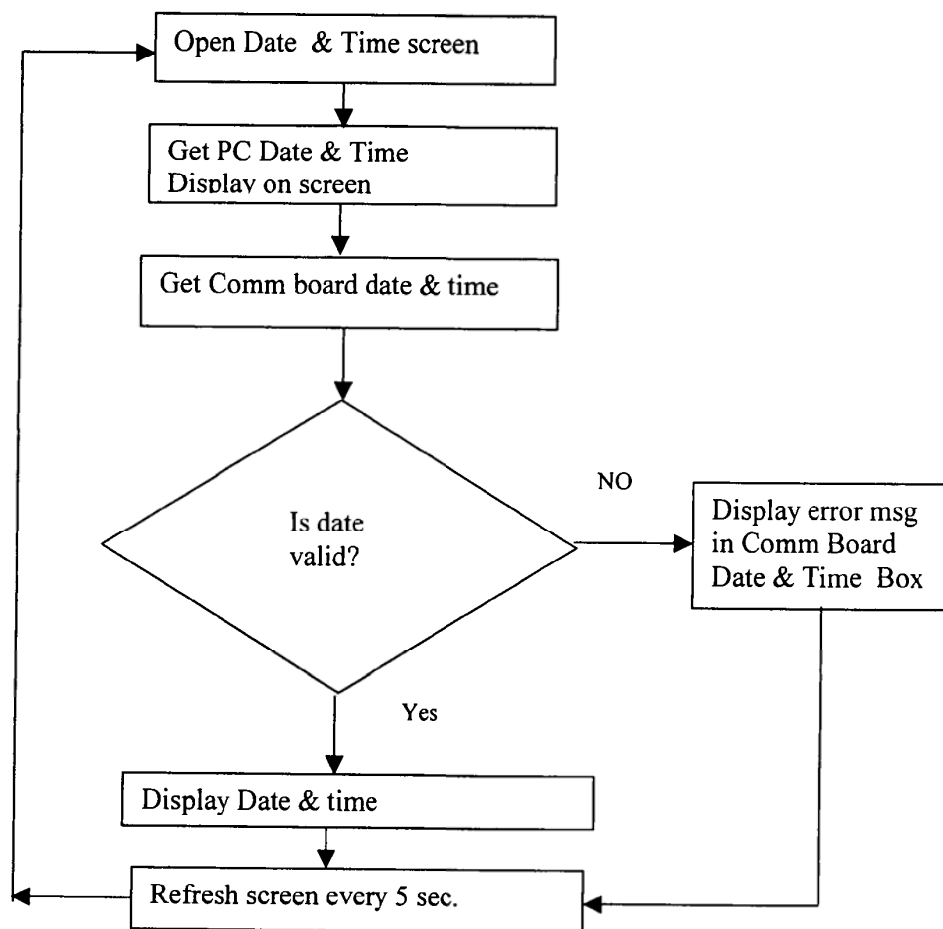
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Figure 15j



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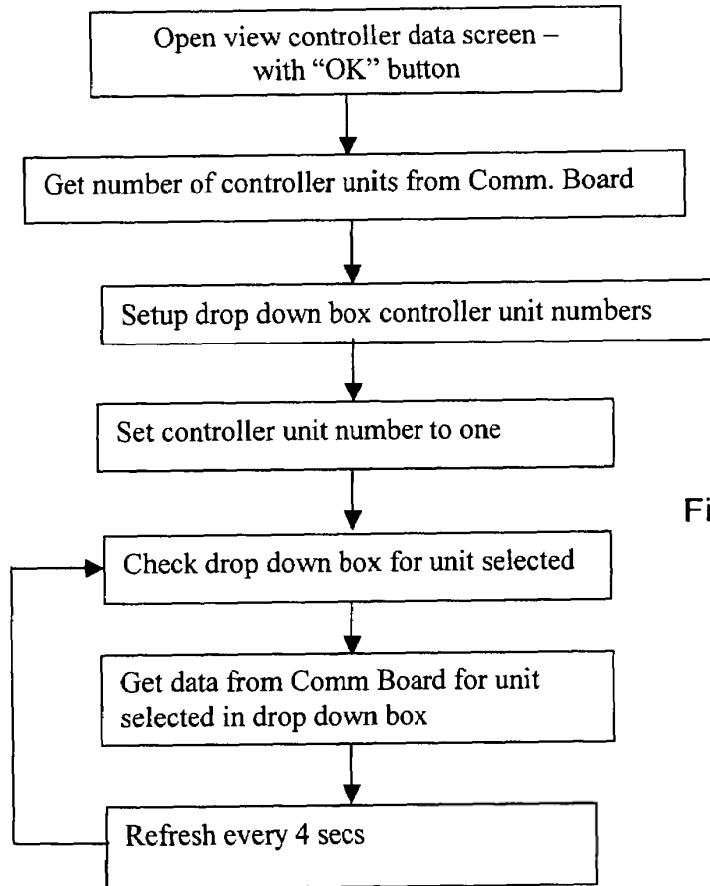


Figure 15k

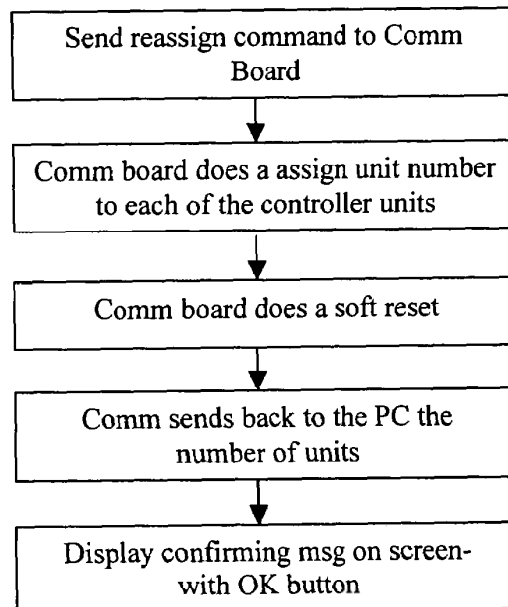


Figure 15l

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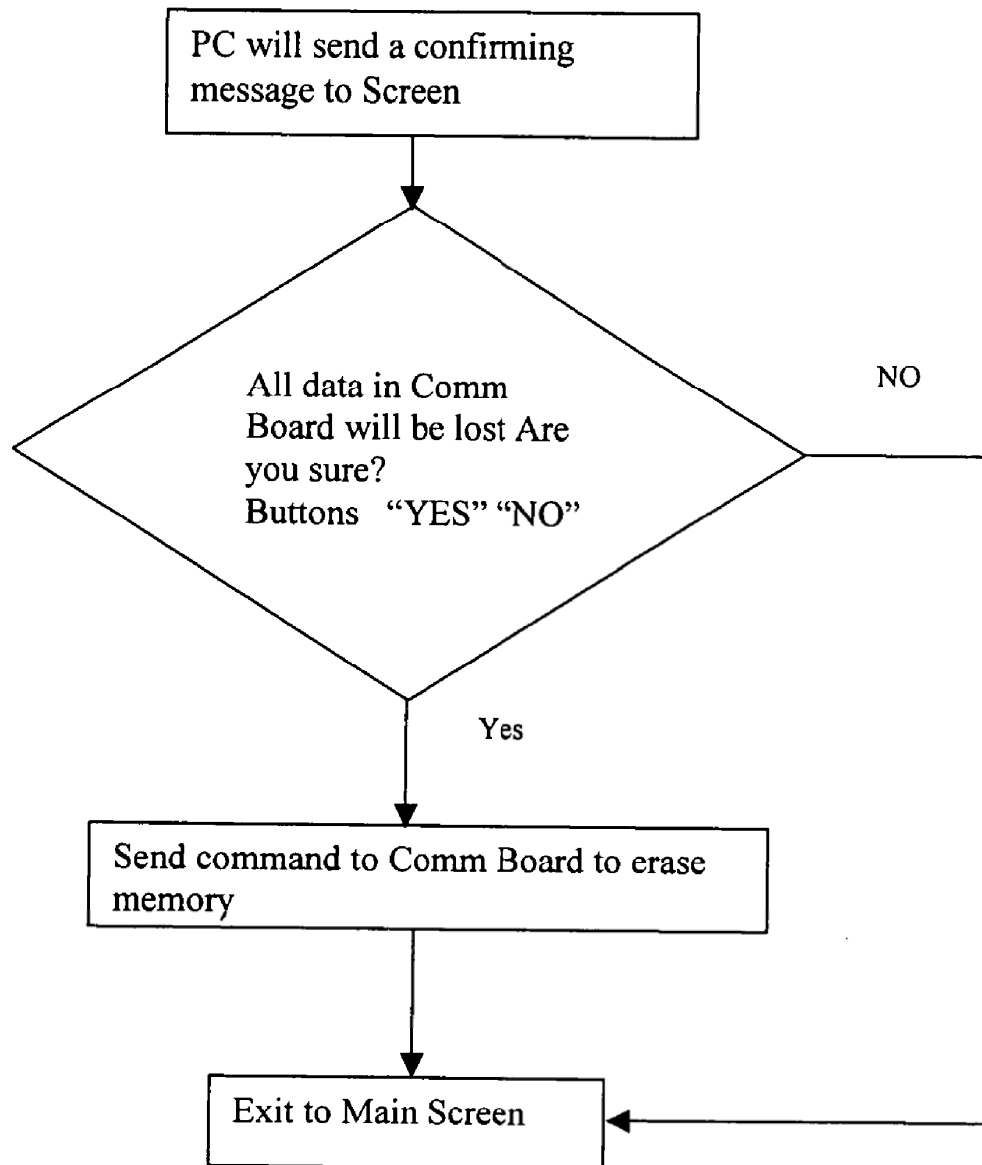


Figure 15m

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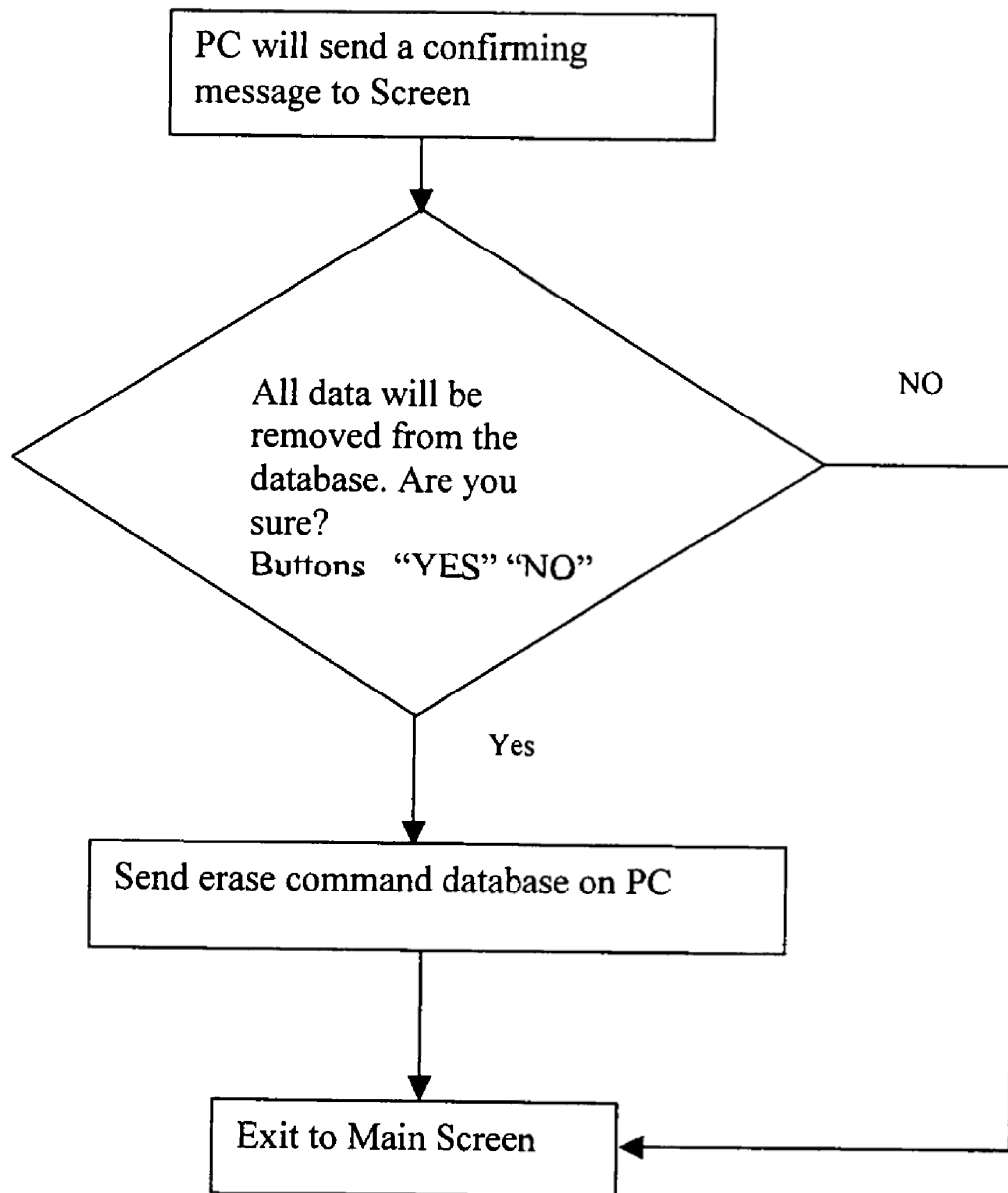


Figure 15n

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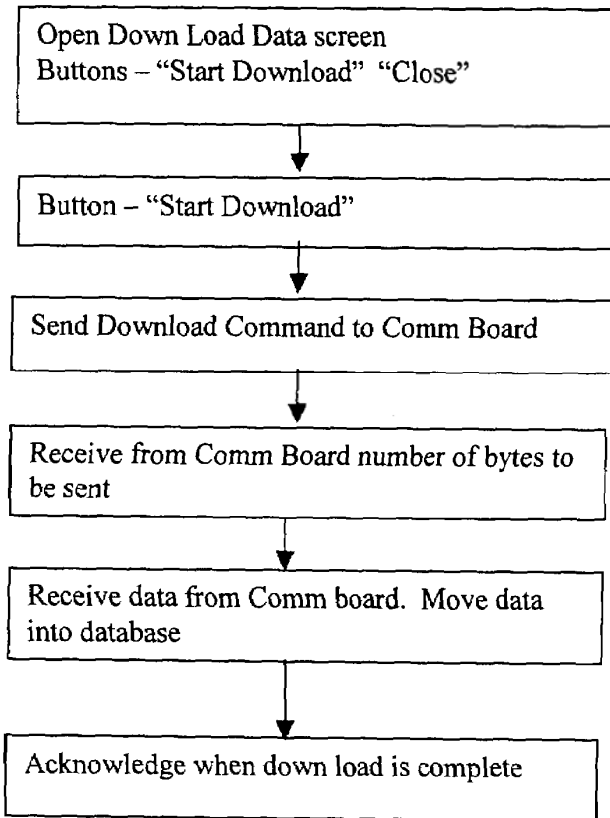


Figure 15o

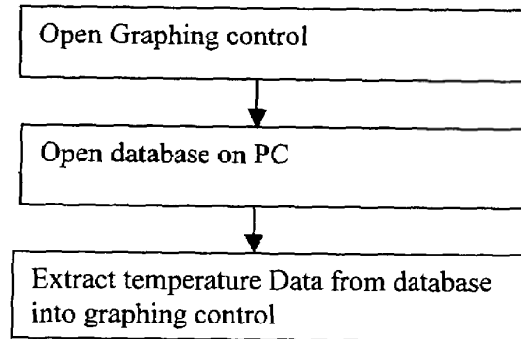


Figure 15p

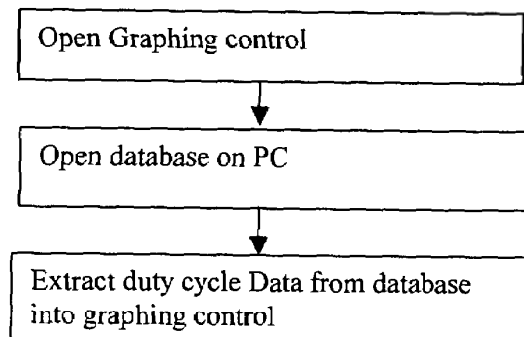


Figure 15q

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**REFRIGERATION UNIT CONDENSATION
PREVENTION****RELATED APPLICATION**

This application is a divisional application of U.S. patent application Ser. No. 11/069,378 Filed on Mar. 1, 2005 by Murray et al. and entitled "Refrigeration Unit Condensation Prevention" which will issue as U.S. Pat. No. 7,207,181 on Apr. 24, 2007.

FIELD OF THE INVENTION

This invention relates to frame and/or door heating to remediate condensation build-up in refrigerated display cases, and, more particularly, relates to sensing and operating devices and methods for activation and deactivation of such heating.

BACKGROUND OF THE INVENTION

Condensation build up on commercial refrigeration display case doors can cause door damage and presents a safety hazard if runoff from the door(s) and/or case frames accumulates on adjacent floors. Currently, in most commercial installations, in order to prevent excessive condensation build-up at display case doors and frames, the doors and frames are heated utilizing internal frame heaters operating at 100% duty cycle time (and incurring correspondingly high energy costs).

Devices have been heretofore suggested and/or utilized to control condensation without running heaters at 100% duty cycle times. One approach has utilized a detector to directly sense the presence of condensation on the freezer door or frame and, responsive thereto, activate the internal frame/door heaters when condensation is sensed. The heaters then are run for a fixed duration or until moisture has evaporated. These devices have, however, not always proven successful. For example, detector failure due to environmental contamination or poor manufacturing tolerances of moisture sensors in general is common. Such detector failure can result in either frame/door heaters remaining off (thus failing to inhibit dangerous condensation build-up and runoff) or the heaters remaining on (thereby achieving no energy savings). Moreover, such devices are merely reactive, activating heaters only after potentially damaging and dangerous condensation has formed. (see the DOOR MISER XP by Door Miser, LLC and U.S. Pat. No. 5,899,078, for examples).

Other devices have suggested condensation control utilizing dew point calculation. Monitoring air temperature, relative humidity and surface temperatures to initiate condensation control events has been utilized in a variety of applications including refrigeration (see, for example, U.S. Patent Publication No. US 2004/0050072 A1 and U.S. Pat. Nos. 6,470,696, 5,778,689, 5,778,147, and 4,127,765). Some such devices or systems have utilized temperature sensing of both cold surfaces and the surrounding ambient air in condensation control response calculations. As is known, when a cold surface temperature is equal to or lower than the dew point of the ambient air, condensation forms on the cold surface.

Such devices and systems have not proven altogether successful, however, due to inaccuracy of temperature readings, particularly where both cold and warm environments are adjacent one another such as is found at commercial freezer/refrigeration display cases. Failure to configure such systems to enhance accuracy of readings has resulted in erratic condensation control, on some occasions wasting energy unduly

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heating frames/doors, on other occasions responding late or otherwise inadequately to condensation formation, and/or on still other occasions failing to control appropriate heater cycling (i.e., shut-off) with consequent loss of efficiencies. Some such systems, utilized in fields not related to the problem of condensation at freezer doors, have addressed the problem of erratic temperature readings by artificially cooling the temperature sensors while heaters are powered on to counter the affect. This approach, however, is not feasible in large commercial freezer display installations where size and space are limited and where the cost for such counter measures are not easily absorbed (and not likely to be tolerated). Finally, most heretofore known systems employing dew point sensors for condensation control remain reactive, not proactively based on anticipation of condensation events. Further improvement could thus still be utilized

SUMMARY OF THE INVENTION

The purpose of the apparatus, systems and methods of this invention is to efficiently eliminate door and frame condensation at widely utilized commercial freezer/refrigeration display cases. The invention is proactive in preventing condensation from forming by activating frame/door heaters before the dew point temperature at frame and door surfaces is reached. Power is then cycled off at a set point above dew point to save energy. This is accomplished by configuring apparatus of this invention to provide highly accurate sensing of frame temperature and dew point by thermally isolating temperature sensors and constantly updating data to reliably provide the ability to accurately anticipate condensation at case surfaces. The invention eliminates door damage and runoff safety hazards due to condensation build-up, efficiently cycles duty time of frame/door heaters thus lowering the installation's energy costs, and requires no expensive countermeasures to maintain accuracy and efficacious performance.

The condensation control apparatus of this invention includes a frame temperature sensing unit adapted for monitoring temperature of either the door or case of a display case. The frame temperature sensing has temperature sensor mounted on a carrier. A dew point sensing unit is adapted for monitoring ambient air temperature and relative humidity outside of the display case and includes a carrier having at least one dew point sensing component thereat.

A control unit is connected with the sensing units and includes a processor connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity. The processor also deactivates the frame/door heater when monitored display case door or frame temperature rises above a second preselected set point above the dew point value. Housing for locating the sensing units includes structure establishing thermal isolation of the sensing units by minimizing heat transfer contacts with the housing. The temperature sensor and the dew point sensing component are located amid insulating air pockets formed by the structure of the housing. The housing and control unit are mountable at the display case.

The system of this invention further includes the sensing and control apparatus located at each display case in an array of display cases. An internal case temperature sensing unit is positionable inside the display case and connected with the control unit processor. The processor stores data related to readings at the sensing units and operation of the frame/door heater, and a communication control unit associated with the

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processor enables coordination of programming and data download access to the processor.

The method of this invention is for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater. The steps of the method include placing a temperature sensing unit in contact with the display case frame to monitor case frame temperature and mounting a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case. The monitored case frame temperature, ambient air temperature and relative humidity are utilized to anticipate formation of condensation at the display case and activate and deactivate the frame/door heater responsive thereto.

It is therefore an object of this invention to provide apparatus, systems and methods for efficient elimination of door and frame condensation at widely utilized commercial freezer/refrigeration display cases.

It is another object of this invention to provide apparatus, systems and methods for elimination of door and frame condensation at freezer/refrigeration display cases that proactively prevents condensation from forming by activating frame/door heaters before dew point temperature at frame and door surfaces is reached.

It is still another object of this invention to provide apparatus for efficient elimination of door and frame condensation at freezer/refrigeration display cases that are configured to accurately sense frame temperature and dew point by thermally isolating temperature sensors and that are constantly data updated to reliably provide the ability to accurately anticipate condensation at case surfaces.

It is yet another object of this invention to provide apparatus, systems and methods utilized with freezer/refrigeration display cases that eliminate door damage and runoff safety hazards due to condensation build-up, efficiently cycle duty time of frame/door heaters thus lowering the installation's energy costs, and require no expensive countermeasures to maintain accuracy and performance of the apparatus and systems.

It is another object of this invention to provide condensation control apparatus for a refrigerated display case having at least one door, a frame and at least one frame/door heater, the apparatus including a frame temperature sensing unit adapted for monitoring temperature of one of the display case door or display case frame and including a carrier having a temperature sensor thereat, a dew point sensing unit adapted for monitoring ambient air temperature and relative humidity outside of the display case and including a carrier having at least one dew point sensing component thereat, a control unit connected with the sensing units and including processing means connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity, and housing means for locating the sensing units including structure establishing thermal isolation of the sensing units by minimizing heat transfer contacts between the sensing units and the housing means and locating the temperature sensor and the at least one dew point sensing component amid insulating air pockets formed by the structure of the housing means.

It is still another object of this invention to provide a system for condensation control at an array of refrigerated display cases, the cases each having at least one door, a frame and at least one frame/door heater, the system including sensing and control apparatus configured for location at each display case in the array of display cases, the apparatus including a frame

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temperature sensing unit adapted for mounting at the display case for monitoring temperature of one of the display case door or display case frame, a dew point sensing unit adapted for mounting at the display case for monitoring ambient air temperature and relative humidity outside of the display case, an internal case temperature sensing unit positionable inside the display case, and processing means mountable at the display case and connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a first preselected set point above a dew point value derived from monitored ambient temperature and relative humidity, for deactivating the frame/door heater when monitored display case door or frame temperature rises above a second preselected set point above the dew point value, and for storing data related to readings at the sensing units and operation of the frame/door heater, and a communication control unit associated with the processing means for coordinating programming and data download access to the processing means of the apparatus.

It is yet another object of this invention to provide a method for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, the method including the steps of placing a temperature sensing unit in contact with the display case frame to monitor case frame temperature, mounting a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case, and utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.

With these and other objects in view, which will become apparent to one skilled in the art as the description proceeds, this invention resides in the novel construction, combination, and arrangement of parts and method substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that changes in the precise embodiment of the herein disclosed invention are meant to be included as come within the scope of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate a complete embodiment of the invention according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a diagrammatic illustration of one embodiment of the condensation prevention apparatus and system of this invention;

FIG. 2 is an exploded view of the local controller unit of the apparatus of this invention;

FIG. 3 is a perspective view of the case temperature sensor and housing of the apparatus of this invention;

FIG. 4 is an exploded view of the sensor/housing of FIG. 3;

FIG. 5 is a sectional view of the sensor/housing of FIG. 3;

FIG. 6 is an illustration showing positioning of the sensor/housing of FIG. 3;

FIG. 7 is an exploded view of the dew point sensor and housing of the apparatus of this invention;

FIG. 8 is a reverse exploded view of the sensor/housing of FIG. 7;

FIG. 9 is an illustration showing positioning of the sensor/housing of FIG. 7;

FIG. 10 is an exploded view of an alternative locational, housing and mounting configuration for the sensors/housings illustrated in FIGS. 3 and 7;

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FIG. 11 is a sectional illustration of the sensors/housing of FIG. 10 in a first mounting;

FIG. 12 is an illustration showing positioning of the sensors/housing of FIG. 10 in an alternative mounting;

FIG. 13 is an electronics block diagram of the apparatus of this invention;

FIGS. 14a through 14f are flow diagrams illustrating program control of local controller components and communications modules of the apparatus of this invention; and

FIGS. 15a through 15g are flow diagrams illustrating program control at centralized processing (an on- or off-site personal computer for example).

DESCRIPTION OF THE INVENTION

The system of this invention is illustrated in FIG. 1 in association with a common commercial freezer/cooler display unit 21 including a display container 23 having a frame (not shown in this FIGURE) and doors 25 in frame 27 (hereinafter, refrigeration case(s)). Up to fifteen such cases 21 can be served by the system as currently configured (though greater or fewer cases could be accommodated). Each case 21 is provided with a local controller unit 31 connected with an array of case sensors including internal case temperature sensor 33, external case frame temperature sensor 35 and dew point sensor 37. The array of sensors may be hard wired (as shown herein) to unit 31 at each case 21 through frame members, or may be configured to function wirelessly utilizing known technologies. While separate frame temperature and dew point sensors 35 and 37 are shown in this FIGURE, an alternate configuration that combines both sensors into one housing is shown hereinafter. Sensor mounting positions may be selected as desired, though the configuration illustrated in FIG. 1 is preferred where the sensors are separately housed.

Controller unit 31 is illustrated in FIG. 2. AC power connector 41, switching relay 43, transformer 45, internal case temperature sensor connection (an RJ-22 connector for example) 47, frame temperature sensor and dew point sensor connectors (RJ-11 type connectors, for example) 49 are located on circuit board 51. Microprocessor 53 is located on board 51, as are in-coming and out-going connectors 55 (RJ-45 type connectors, for example) utilized so that a number of serially connected control units 31 are connectable with a single communication board/transmitter/receiver 57 in communication with receiver/transmitter/centralized processing 59 (FIG. 1). LED's 65 and 67 (preferably green and red, respectively) on board 51 flash to indicate a status update from central processing 59 to microprocessor 53 (LED 65) and to indicate that relay 43 has switched power on to frame/door heaters (LED 67). Reset/programming interface 71 is mounted between LED's 65/67 at board 51.

Board 51 is maintained in housing 75 including first and second housing portion 77 and 79, respectively, with all connectors, LED's and user interfaces provided with access openings therethrough. Housing 75 is configured to be mounted between freezer door frame mullions where case lighting is typically located (thus providing AC power routing access). The housing is designed to be less than the height and width of a typical heretofore known and utilized mullion lighting lens cover adapted for such cases 21.

Controller unit microprocessor 53 can be calibrated to initiate operations anywhere above or below calculated dew point. Adjustments can be made from central processing 59 with wireless communication via the communications board/transmitter/receiver 57 connected to controller unit 31. Central processing 59 (a PC for example) receives data from units 31 via communications board/transmitter/receiver 57,

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including data enabling tracking, storing and making available reports of the history of ambient air temperature and humidity from dew point sensor 37, case frame and internal case temperatures from sensors 35 and 33, respectively, and power consumption of door heaters (all as shown herein in FIG. 15). This information can be used to improve energy efficiency by recalibrating operating ranges of the apparatus and system of this invention, as well as for improved operational cost accounting.

The internal case temperature must remain below FDA approved levels or food will spoil, such being both a health concern as well as an expense to the installation for potential loss of goods. It has heretofore been difficult to determine if temperature are within guidelines 24 hours a day. Utilization of the apparatus and system of this invention, however, and particularly utilization of internal case temperature monitoring by sensor 33 through controller unit 31, allows such detailed tracking and reporting. Moreover, the apparatus and system are configured to automatically send an alarm (one or both locally and by autodialer to a responsible technician) if maximum allowable internal case temperature as programmed is exceeded. If central processing 59 receives an alarm message from any of the local control units 31 in the system, an alarm or auto dial via a modem is initiated and a message is sent with regard thereto, including the exact case in the system wherein temperature has deviated (see FIGS. 14 and 15).

Temperature sensors 33 and 35 are similar and are housed as illustrated in FIGS. 3 through 6 (for purposes of description herein, only the housing of sensor 35 will be described since sensor 33 is much simpler to implement and maintain). Temperature sensor 35 housing 83 includes cover 85, sensor locating base 87 and circuit board/carrier 89 locating temperature sensor 35 including temperature sensing chip 91 at one surface thereof. This assembly is mounted to case frame unit or door frame unit 93 of display case 21 utilizing screws or adhesive, with base 87 adjacent frame unit 93 as shown in FIG. 5. Cabling from controller unit 31 is routed through cable protector 95 at base 87.

Temperature sensing chip 91 is located on board/carrier 89 so that when received in housing 83 it is located through sensor opening 99 at base 87. With proper materials sizing, chip 91 will be in direct contact with the surface of unit 93 being monitored when base 87 is mounted on frame unit 93. Housing 83 should be located at the coldest spot on the exterior of the freezer. That spot is usually in the center of the case between the bottom of a door 25 and door or case frame unit 93 (see FIG. 6). Door and frame heaters 103 are located inside doors and/or frames of cases 21.

Housing 83 is configured at cover 85 and base 87 to thermally isolate sensing chip 91 from the warming effects of ambient air temperature in the vicinity of the chip and transfer thereof by the housing to the chip. Air space pockets 105 and 107 above and around chip 91, respectively, and limited housing contact (see FIG. 5 wherein only a single locating post 109 maintains board/carrier 89 at its position in housing 83) isolate chip 91 from the housing. By thus configuring board/carrier 89 (made typically of FIBERGLASS material) and housing 83 (preferably made of plastic such as acrylonitrile butadiene styrene polycarbonate) little transfer of heat to sensor chip 91 occurs, assuring accurate measurement of surface temperature of unit 93 unaffected by inaccuracies introduced as artifact into the measurement by ambient air temperature conditions in the vicinity of housing 83 (accuracy of frame temperature measurements has been documented by testing to be within 1 or 2 degrees Centigrade).

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Air space pocket 105 is created by the depth of cover 85 adjacent board/carrier 89, the cover also insulating the sensor chip from the ambient. Air space pocket 107 is created by opening 99 having an opening area greater than surface area of chip 91. These improvements allow accurate tracking and monitoring of case frame temperature, used not only for precisely timed heater activation, but also for better timing of heater deactivation given the fast rise in frame temperature after frame/door heaters 103 are activated to prevent condensation.

Turning now to FIGS. 7 through 9, dew point sensor 37 is housed in housing 115 including cover 117 and mounting base 119. Circuit board/carrier 121 maintains sensor 37 circuitry including dew point sensing chip 123. Dew point sensing chip 123 is located, when assembled, in opening 129 in the face of cover 117, opening 129 including protective shield 131 having gaps 133 along the sides thereof to allow airflow over sensing chip 123 for measuring humidity and ambient air temperature. A membrane 141 covers opening 143 at sensing chip 123 to protect internal humidity and temperature sensing components from foreign matter such as cleansers and the like. The design of cover 117 protects membrane 141 without preventing airflow to sensing chip 123.

Housing base 119 includes cabling routing protector 145 for introducing and stabilizing cabling to sensor 37. Spacer ribs 147 at base 119 assure an insulating air gap between housing 115 and its adjacent mounting surface. Housing 115 is preferably mounted to door or case frame unit 151 located at the top of case 21, as shown in FIG. 9, and between the frame unit and door 25 so that the cold air exiting the case when a door is opened will not affect the sensor readings.

Housing 115 is configured to thermally isolate dew point sensor 37 so that accuracy of the dew point sensor is maintained within to 1 to 3 degrees Centigrade. First, by assuring that sensor 37 is held away from the unnaturally heated frame (either cooled by the freezer or heated by frame heaters) with spacer ribs 147, the frame temperature will not influence the relevant dew point readings (primarily ambient air temperature). The air pocket (155 in FIG. 9) behind board/carrier 121 and extending all the way to the mounting surface at unit 151 prevents thermal transfer through housing 115 from the mounting surface of frame unit 151. The cover includes openings 157 at opposite ends thereof to provide room temperature airflow at air pocket 155 of room temperature air. Housing mounting surface 159 is perpendicular to the dew point sensor board/carrier 121, and may be mounted by screws or (preferably) adhesive.

By thus configuring board/carrier 121 (made typically of FIBERGLASS material) and housing 115 (preferably made of plastic such as acrylonitrile butadiene styrene polycarbonate) little transfer of heat to sensor chip 123 occurs, assuring accurate measurement of ambient air temperature and humidity unaffected by inaccuracies introduced as artifact into the measurement by freezer case 21 frame temperature conditions in the vicinity of housing 115. Housing 115 is configured utilizing board support protrusions 163 defining retainer pockets 165 having minimal contact surface along the outer edges of board/carrier 121 to maintain board positioning, thus further reducing thermal transfer. Depth of housing 115 behind pockets 165 establishes air pocket 155.

When door and frame heaters are activated it is important that they do not affect the reading from sensor 37 of actual room air temperature. This design sufficiently isolates sensor 37 from door and frame temperature swings, thereby preserving accuracy of readings of ambient air temperature and thus accuracy of dew point calculation. Absent such thermal isolation, it is possible for shut-off of heaters to be delayed

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indefinitely. For example, under the influence of heaters, if temperature readings were to rise at an insufficiently isolated dew point sensor then calculated dew point would increase. In such case, the doors would have to be heated further as the dew point is chased. Heating the doors further would raise the dew point still more in this scenario, thereby beginning an upwardly spiraling cycle until the heaters reach their maximum temperature and finally power off.

Turning now to FIGS. 10 through 12, an alternative embodiment for sensors 35 and 37 housing is illustrated wherein housing 115 is utilized to house both sensors. Thus all elements of the housing as heretofore described are the same unless otherwise specified hereinbelow. Sensor 35 is maintained at cabling routing protector 145 at retainer pockets 175 (one on each side, though only one side is shown in the drawings) defining ledges having minimal contact surface with board/carrier 89 to maintain the board, thus reducing thermal transfer through the housing to the board. A single locating post 177 may be utilized to further stabilize the board if necessary. As shown in FIG. 11, sensor 91 and board/carrier 89 are completely surrounded by an insulating dead air pocket established by the depth of protector 145. This housing may be mounted either above (FIG. 11) or below (FIG. 12) door 25 of a case 21, and retains all the thermal isolation advantages discussed for the individually housed units as discussed above.

FIG. 13 illustrates the electronics utilized by the apparatus of this invention. Incoming AC power is provided to relay 43 and is transformed at input/transformer 41/45 (12 volt DC output) for use by controller unit 31 and sensors 33, 35 and 37. Sensors 33 and 35 inputs are A/D converted and input to the central processing unit microprocessor 53 embodying the various comparators and look up tables utilized (Sensor 37 is A/D converted at the sensor). LED's 65/67 are controlled in response to microprocessor functions, and microprocessor programming can be conducted on-site through connector/interface 71. Communications flow between microprocessor 53 and central processing 59 is monitored and controlled by communications board 57 in cooperation with microprocessor 53 and central processing 59. Relay activity is monitored and controlled by microprocessor 53 in response to set point achievement as specified in software and as sensed by the sensor array.

Thermal isolation of sensors 35 and 37 thus insure the accuracy of the sensors and thus the efficacy of the apparatus both in terms of its ability to anticipate condensation formation as well as its ability to save on energy expenses due to overheating of doors and frames or improper cycling of heaters. Overall functioning of the apparatus and system of this invention are as illustrated in FIGS. 14a through 14j and 15a through 15g. Heaters are activated just above dew point and thus just before moisture appears on freezer surfaces. Controller unit 31 may utilize any known sensor(s) 37 for monitoring ambient air temperature (for example, thermistors may be utilized for the temperature sensors herein, including by sensors 33 and 35) and relative humidity (capacitive polymer or thin film type sensor, for example, may be utilized wherein capacitance is proportional to the relative humidity of surrounding air). Combination sensors providing relatively accurate dew point sensing are known and commercially available. Microprocessor 53 looks up the dew point value from a stored table. Input from monitored dew point sensor 37 and frame temperature sensor 35 are utilized in conjunction therewith to determine when to relay on the frame/door heaters as the frame temperature approaches the dew point (once the monitored frame temperature drops below a preselected set point above the dew point). Once the monitored frame

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temperature rises to a preselected set point above the dew point, the heaters are relayed off. On-board software builds a table of over 600 values into the dew point lookup table, set points, as well as other values, being updatable in real time from central processing. The look up table can be reprogrammed through interface 71.

The entire system preferably includes wireless communication for receiving data from multiple control units 31 at different cases 21. Controller unit 31 and communications board/transmitter/receiver 59 transfer data to central processing 59 for data viewing, tracking and report preparation. Central processing 59 is capable of printing efficiency reports, remote recalibration of heater operations and dial up warning programs should any freezer have a failure. Each controller unit 31 tracks internal case temperatures and will warn of unsafe temperatures or freezer failure. Unit/system calibration or recalibration is typically only required when sensors might be influenced by freezer temperatures. Freezer temperatures primarily influence sensor readings dependent on where sensors are mounted at installation. The case frame is not as cold at the top of the freezer as the bottom, so the operating range of the sensors and unit 31 in the combined sensor housing configuration of FIG. 10 are calibrated for the alternative locations.

What is claimed is:

1. A method for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, said method comprising the steps of:

monitoring case frame temperature and providing first output data related thereto;

monitoring ambient air temperature and relative humidity outside the display case and providing second output data related thereto;

processing said first and second output data at said display case to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto; and

communicating said first and second output data related to monitored case frame temperature, ambient air temperature and relative humidity and a record of display case frame/door heater activation and deactivation to a remote centralized processing location.

2. The method of claim 1 wherein said communicating step includes wirelessly receiving said first and second output data and said record from a selected one of a plurality of refrigerated display cases and wirelessly communicating with said processing location.

3. The method of claim 1 wherein said monitoring steps include reducing data inaccuracy by thermally isolating units utilized for monitoring.

4. The method of claim 1 further comprising accumulating said data and said record at said processing location to provide at least one of selective data/record viewing and data/record reporting.

5. The method of claim 1 further comprising accumulating a history of said record of display case frame/door heater activation and deactivation and selectively compiling efficiency reports related thereto at said processing location.

6. The method of claim 1 further comprising remotely recalibrating frame/door heater activation or deactivation based on data acquisition.

7. The method of claim 1 further comprising establishing constantly updatable on-site automated control parameters for the step of processing said first and second output data to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater.

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8. A method for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, said method comprising the steps of:

placing a temperature sensing unit in contact with the display case frame to monitor case frame temperature;

mounting a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case; and

utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.

9. The method of claim 8 further comprising thermally isolating said dew point sensing unit from variations in temperature of the display case frame or display case door.

10. The method of claim 8 further comprising thermally isolating said temperature sensing unit from variations in temperature of ambient air.

11. The method of claim 8 further comprising mounting an internal case temperature sensing unit inside the display case and monitoring internal case temperature.

12. The method of claim 11 further comprising storing data related to readings at said sensing units and operation of the frame/door heater.

13. The method of claim 12 further comprising wirelessly accessing said stored data.

14. A method for condensation control at any of a plurality of refrigerated display cases, each of the display cases having at least one door, a frame and at least one frame/door heater, said method comprising the steps of:

monitoring selected parameters related to each of the display cases in the plurality of display cases and providing output data related thereto;

collecting said output data;

anticipating from said collected output data condensation formation status at any of the display cases and establishing an output indicative thereof;

establishing measures to address said condensation formation status at any of the display cases responsive to said output indicative of condensation formation status; and compiling a record of said data and said measures.

15. The method of claim 14 wherein said monitoring step includes monitoring temperature of display case doors or display case frames of each of the display cases and monitoring dew point at each of the display cases by monitoring ambient air temperature and relative humidity outside of each of the display cases, and wherein said step of establishing measures to address said condensation formation status includes the step of activating a selected display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity.

16. The method of claim 14 wherein said monitoring step includes monitoring temperature of display case doors or display case frames of each of the display cases and monitoring dew point at each of the display cases by monitoring ambient air temperature and relative humidity outside of each of the display cases, and wherein said step of establishing measures to address said condensation formation status includes the step of deactivating a selected display case frame/door heater when monitored display case door or frame temperature rises above a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity.

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17. The method of claim **14** further comprising the steps of monitoring internal case temperatures of said plurality of display cases and compiling a record thereof.

18. The method of claim **14** further comprising the step of communicating said record to a remote processing location.

19. The method of claim **14** further comprising the step of reducing output data inaccuracy by thermally isolating units utilized for monitoring.

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20. The method of claim **14** further comprising the step of establishing constantly updatable automated control parameters for the steps of anticipating condensation formation status and establishing measures to address said condensation formation status at any of the display cases.

* * * * *

EXHIBIT 3

ASSIGNMENT BY INVENTOR

THIS ASSIGNMENT, made this 23rd day of June, 2024, by Bradley W. Geuke, an individual residing at 39553 Rangeview Drive, Ault, Colorado 80610 (hereinafter referred to as Assignors);

WHEREAS, Assignors have invented certain new and useful improvements in **REFRIGERATION UNIT CONDENSATION PREVENTION**, set forth in a utility patent application for Letters Patent of the United States, filed on April 20, 2007, as U.S. Application No. 11/788,453, now Patent No. 7,421,847; and

WHEREAS, ControlTec LLC, a company organized under and pursuant to the laws of the United States of America, having its principal place of business at 2613 Knadler Street, Laramie, WY 82072 (hereinafter referred to as Assignee), is desirous of acquiring the entire right, title and interest in and to said inventions and said Application for Letters Patent of the United States, and in and to any Letters Patent of the United States to be obtained therefore and thereon.

NOW, THEREFORE, in consideration of One Dollar (\$1.00) and other good and sufficient consideration, the receipt of which is hereby acknowledged, Assignors have sold, assigned, transferred and set over, and by these presents does sell, assign, transfer and set over, unto Assignee, its successors, legal representatives and assigns, the entire right, title and interest in and to the above-mentioned inventions and application for Letters Patent, and in and to any and all related United States provisional patent applications, any and all direct and indirect divisions, continuations and continuations-in-part of said application, and any and all Letters Patent in the United States and all foreign countries which may be granted therefore and thereon, and reissues, reexaminations and extensions of said Letters Patent, all rights under the International Convention for the Protection of Industrial Property, the same to be held and enjoyed by Assignee, for its own use and benefit and the use and benefit of its successors, legal representatives and assigns, to the full end of the term or terms for which Letters Patent may be granted and/or extended, as fully and entirely as the same would have been held and enjoyed by Assignors, had this sale and assignment not been made, and all damages, royalties, or other money due resulting from the assigned right, title and interest in and to the above-mentioned inventions and application for Letters Patent.

AND for the same consideration, Assignors hereby represent and warrant to Assignee, its successors, legal representatives and assigns, that, at the time of execution and delivery of these presents, except for any rights, titles and/or interests that have arisen to Assignee under law or that have already been transferred to Assignee, Assignors are the lawful owners of the entire right, title and interest in and to the said inventions and application for Letters Patent above-mentioned, and that the same are unencumbered and that Assignors have good and full right and lawful authority to sell and convey the same in the manner herein set forth.

AND for the same consideration, Assignors hereby covenant and agree to and with Assignee, its successors, legal representatives and assigns, that Assignors will sign all papers and documents, take all lawful oaths and do all acts necessary or required to be done for the procurement, maintenance, enforcement and defense of any Letters Patent and applications for Letters Patent for said inventions, without charge to Assignee, its successors, legal representatives and assigns, whenever counsel of Assignee, or counsel of its successors, legal representatives and assigns, shall advise: that any proceeding in connection with said inventions, or said Provisional application for Letters Patent, or any proceeding in connection with any Letters Patent or applications for Letters Patent for said inventions in any country, including but not limited to interference proceedings, is lawful and desirable; or, that any division, continuation or continuation-in-part of any application for Letters Patent, or any reissue, reexamination or extension of any Letters Patent, to be obtained thereon, is lawful and desirable.

AND Assignors hereby request the Commissioner for Patents and Trademarks to issue said Letters Patent of the United States to Assignee, as Assignee of said inventions and the Letters Patent to be issued thereon, for the sole use and benefit of Assignee, its successors, legal representatives and assigns.

AND Assignors hereby grant the following individuals the power to insert on this Assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office for recordation of this document:

HAYNES AND BOONE, LLP

All practitioners at Customer Number 27683

Attorney Docket:

AND Assignors acknowledge an obligation of assignment of this invention to Assignee at the time the invention was made.

Date: June 23, 2024

DocuSigned by:
Signature: *Bradley W. Geuke*
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Bradley W. Geuke

ASSIGNMENT BY INVENTOR

THIS ASSIGNMENT, made this 23rd day of June, 2024, by Bradley W. Geuke, an individual residing at 39553 Rangeview Drive, Ault, Colorado 80610 (hereinafter referred to as Assignors);

WHEREAS, Assignors have invented certain new and useful improvements in **REFRIGERATION UNIT CONDENSATION PREVENTION**, set forth in a utility patent application for Letters Patent of the United States, filed on April 20, 2007, as U.S. Application No. 11/069,378, now Patent No. 7,207,181; and

WHEREAS, ControlTec, LLC, a company organized under and pursuant to the laws of the United States of America, having its principal place of business at 2613 Knadler Street, Laramie, WY 82072 (hereinafter referred to as Assignee), is desirous of acquiring the entire right, title and interest in and to said inventions and said Application for Letters Patent of the United States, and in and to any Letters Patent of the United States to be obtained therefore and thereon.

NOW, THEREFORE, in consideration of One Dollar (\$1.00) and other good and sufficient consideration, the receipt of which is hereby acknowledged, Assignors have sold, assigned, transferred and set over, and by these presents does sell, assign, transfer and set over, unto Assignee, its successors, legal representatives and assigns, the entire right, title and interest in and to the above-mentioned inventions and application for Letters Patent, and in and to any and all related United States provisional patent applications, any and all direct and indirect divisions, continuations and continuations-in-part of said application, and any and all Letters Patent in the United States and all foreign countries which may be granted therefore and thereon, and reissues, reexaminations and extensions of said Letters Patent, all rights under the International Convention for the Protection of Industrial Property, the same to be held and enjoyed by Assignee, for its own use and benefit and the use and benefit of its successors, legal representatives and assigns, to the full end of the term or terms for which Letters Patent may be granted and/or extended, as fully and entirely as the same would have been held and enjoyed by Assignors, had this sale and assignment not been made, and all damages, royalties, or other money due resulting from the assigned right, title and interest in and to the above-mentioned inventions and application for Letters Patent.

AND for the same consideration, Assignors hereby represent and warrant to Assignee, its successors, legal representatives and assigns, that, at the time of execution and delivery of these presents, except for any rights, titles and/or interests that have arisen to Assignee under law or that have already been transferred to Assignee, Assignors are the lawful owners of the entire right, title and interest in and to the said inventions and application for Letters Patent above-mentioned, and that the same are unencumbered and that Assignors have good and full right and lawful authority to sell and convey the same in the manner herein set forth.

AND for the same consideration, Assignors hereby covenant and agree to and with Assignee, its successors, legal representatives and assigns, that Assignors will sign all papers and documents, take all lawful oaths and do all acts necessary or required to be done for the procurement, maintenance, enforcement and defense of any Letters Patent and applications for Letters Patent for said inventions, without charge to Assignee, its successors, legal representatives and assigns, whenever counsel of Assignee, or counsel of its successors, legal representatives and assigns, shall advise: that any proceeding in connection with said inventions, or said Provisional application for Letters Patent, or any proceeding in connection with any Letters Patent or applications for Letters Patent for said inventions in any country, including but not limited to interference proceedings, is lawful and desirable; or, that any division, continuation or continuation-in-part of any application for Letters Patent, or any reissue, reexamination or extension of any Letters Patent, to be obtained thereon, is lawful and desirable.

AND Assignors hereby request the Commissioner for Patents and Trademarks to issue said Letters Patent of the United States to Assignee, as Assignee of said inventions and the Letters Patent to be issued thereon, for the sole use and benefit of Assignee, its successors, legal representatives and assigns.

AND Assignors hereby grant the following individuals the power to insert on this Assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office for recordation of this document:

HAYNES AND BOONE, LLP

All practitioners at Customer Number 27683

Attorney Docket:

AND Assignors acknowledge an obligation of assignment of this invention to Assignee at the time the invention was made.

Date: June 23, 2024

Signature: _____

DocuSigned by:
Bradley W. Geuke
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Bradley W. Geuke

EXHIBIT 4

Infringement Chart for United States Patent No. 7,207,181

This claim chart details Defendants' infringement of the '181 Patent by making, using, selling, or offering for sale the Accused Anti-Sweat Controlled Products, which include the Anthony Energy Controller, in the United States.¹

When sold or installed as directed by Defendants, the Accused Anti-Sweat Controlled Products literally infringe the claims of the '181 Patent. If any claim limitation is found to be not present literally, however, such limitation is present under the doctrine of equivalents because the differences between the claimed inventions and Defendants' infringement, if any, are insubstantial and the Accused Anti-Sweat Controlled Products perform the same function in the same way to achieve the same result as such limitations. ControlTec expects to discover additional details regarding the Accused Anti-Sweat Controlled Products during discovery. ControlTec reserves the right to amend its infringement chart and to specifically assert infringement by the doctrine of equivalents following the discovery of additional information during discovery or claim construction.

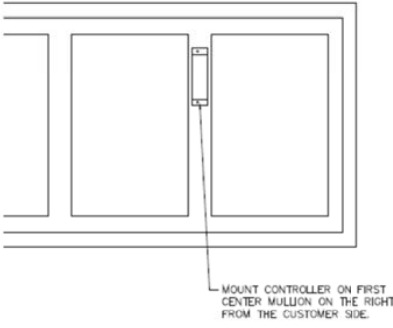
When sold or used as directed by Defendants, the Accused Anti-Sweat Controlled Products directly infringe the claims of the '181 Patent. All aspects of the asserted claims of the '181 Patent are present or performed by or are attributable to Defendants. Defendants direct or control the performance of users of the Accused Anti-Sweat Controlled Products in a manner such that the function of the Accused Anti-Sweat Controlled Products is conditioned on the usage of the patented apparatus. Alternatively, Defendants knowingly induce infringement and possess specific intent to encourage users of the Accused Anti-Sweat Controlled Products to infringe the claims of the '181 Patent.

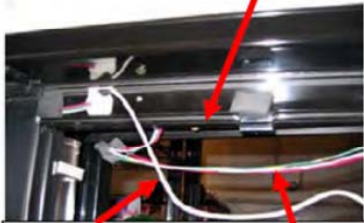
Based on ControlTec's view that certain asserted claims could be infringed by certain of Defendants' accused products in multiple ways, ControlTec's contentions may include alternative theories of infringement, some of which may overlap with other infringement theories in certain respects.

As set forth in the charts below, ControlTec contends that the Accused Anti-Sweat Controlled Products infringe at least claims 1, 4-6, and 14-16 of the '181 Patent.

¹ The capitalized terms not otherwise defined in this claim chart have the same meaning as given to them in ControlTec's Complaint for Patent infringement against Defendants.

Infringement Chart for United States Patent No. 7,207,181

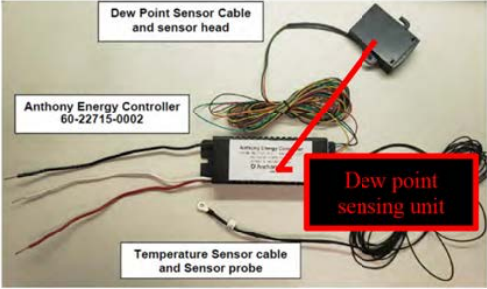
Claim Language	Infringement Contentions
1. Condensation control apparatus for a refrigerated display case having at least one door, a frame and at least one frame/door heater, said apparatus comprising:	If the preamble is considered to be limiting, the Anthony Energy Controller (e.g. part number 60-22715-0002), which is included in the Accused Anti-Sweat Controlled Products, is a system for a condensation control at a refrigerated display case. Page 4 of the Anthony Energy Controller (60-22715-0002) Installation Manual (“Anthony Manual”) depicts installation of the system of a refrigerated display case having a door and a frame.  MOUNT CONTROLLER ON FIRST CENTER MULLION ON THE RIGHT FROM THE CUSTOMER SIDE. Page 5 of the Anthony Manual shows a cutaway view of an exemplary frame, showing the heater wire cables and that the door has a door frame heater.

Claim Language	Infringement Contentions
	FRAME AND RACEWAY  HEATER WIRE CABLES and WIRES The Anthony Energy Control Flyer for the Anthony Energy Controller (“Anthony Flyer”) indicates that the Anthony Energy Controller controls anti-condensate door heaters. Anti-condensate door heaters are resident in the frames of the doors.

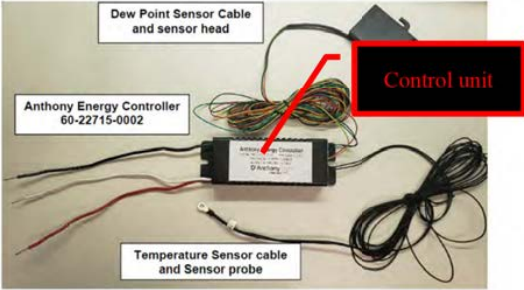
Infringement Chart for United States Patent No. 7,207,181

Claim Language	Infringement Contentions
a frame temperature sensing unit adapted for monitoring temperature of one of the display case door or display case frame and including a carrier having a temperature sensor thereat,	The Anthony Energy Controller includes a frame temperature sensing unit adapted for monitoring temperature of one of the display case door or display case frame and including a carrier having a temperature sensor thereat. Page 3 of the Anthony Manual depicts the temperature sensor cable and sensor probe, which are part of the frame temperature sensing unit. The carrier is the wire shown (“Temperature Sensor cable”). The temperature sensor is the end of the wire (“Sensor probe”). On page 7 of the Anthony Manual, step 6 describes mounting the temperature sensor to the frame.

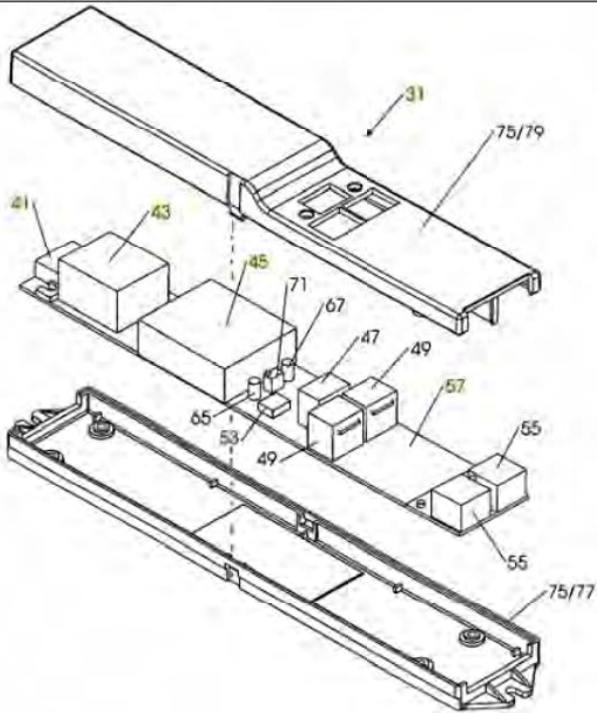
Claim Language	Infringement Contentions
	Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion.

Claim Language	Infringement Contentions
a dew point sensing unit adapted for monitoring ambient air temperature and relative humidity outside of the display case and including a carrier having at least one dew point sensing component thereat;	The Anthony Energy Controller includes a dew point sensing unit adapted for monitoring ambient air temperature and relative humidity outside of the display case and including a carrier having at least one dew point sensing component thereat. Page 3 of the Anthony Manual depicts the dew point sensing unit.  The Anthony Flyer indicates the Anthony Energy Controller activates anti-condensate heat when dew point temperature is sensed, thereby indicating that the ambient air temperature and relative humidity outside the display case is monitored.

Claim Language	Infringement Contentions
	Page 6 of the Anthony Manual depicts mounting the dewpoint sensing unit outside of the refrigerator. Sensor location: upper frame rail above the first door from the right. (See illustration on sheet 8.) 

Claim Language	Infringement Contentions
a control unit communicating with said sensing units and including processing means connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity; and	The Anthony Energy Controller includes a control unit communicating with said sensing units and including processing means connected for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity. Page 3 of the Anthony Manual depicts the control unit.  The Anthony Flyer indicates the “Anthony Energy Controller activates anti-condensate heat when Dew Point Temperature is sensed,” thereby indicating that data is received from both the sensing units and that the system “anticipate(s) formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.” This is because condensation will occur when the dew point temperature is sensed. Therefore, the Anthony Energy Controller performs activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity. The Anthony Energy Controller includes a processing means. This is the microprocessor contained in the Anthony Energy Controller. This microprocessor is visible in the Anthony Energy Controller. An image of the circuit board of an Anthony Energy Controller is shown below. Upon examination of the circuit board, this microprocessor is the only part that may accomplish the decision-making procedure indicated by the Anthony Flyer. Therefore, this limitation is met.

Claim Language	Infringement Contentions
	 If this claim aspect is interpreted as a means plus function claim, looking to the specification of the '181 Patent, at least one processing means is identifiable. Fig. 2 of the '181 Patent shows an exploded view of a local controller unit of the apparatus of the invention. In this figure, call out 53 denotes a controller unit microprocessor. The specification indicates that "Controller unit microprocessor 53 can be calibrated to initiate operations anywhere above or below calculated dew point." ('181 Patent, c. 5, l. 60-62). Therefore, it is clear that this microprocessor is initiating the heating of the door when set points are reached, corresponding to the processing means for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity.

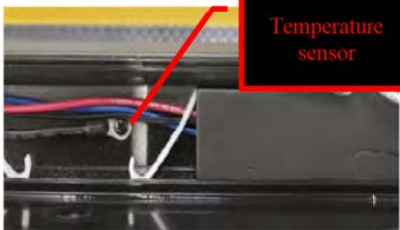
Claim Language	Infringement Contentions
	 The diagram shows an exploded perspective view of a device assembly. At the top is a long, thin rectangular component (31) with a notch and mounting holes (75/79). Below it are several smaller components: a rectangular block (41), a square block (43), a square block (45), a small rectangular block (71), a small rectangular block (67), a small rectangular block (47), a small rectangular block (49), a small rectangular block (57), and a small rectangular block (55). These components are shown in an exploded view, indicating they are assembled together. At the bottom is a long, thin rectangular component (75/77) with mounting holes and a notch. The components are arranged in a way that suggests they are part of a larger assembly. FIGURE 2 If an algorithm is necessary to support the means plus function interpretation of the controller unit microprocessor 53, Fig. 14b of the specification provides an algorithm flow chart. As previously indicated, the Anthony Flyer indicates the “Anthony Energy Controller activates anti-condensate heat

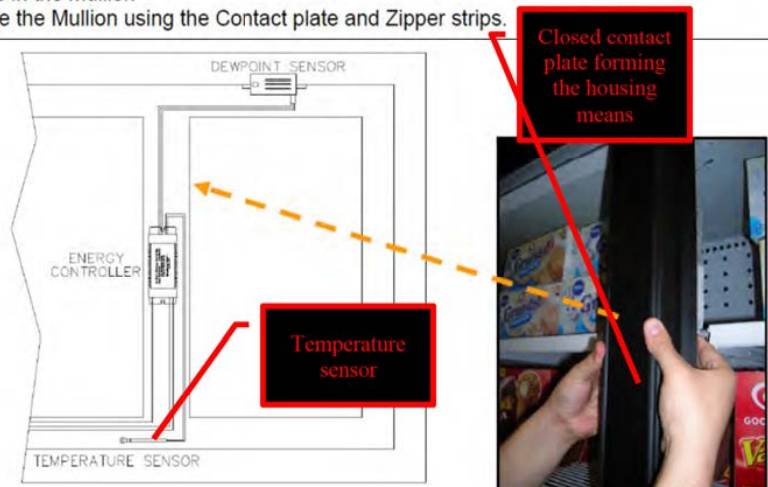
Claim Language	Infringement Contentions
	when Dew Point Temperature is sensed,” thereby indicating that data is received from both the sensing units and that the system “anticipate(s) formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.” In order to perform such an action there must be trigger points or set point in memory. In order to operate, the Anthony Energy Controller must retrieve those set points and determine whether the frame and case temperatures are high or low. The Anthony Energy Controller must also retrieve humidity information and accordingly determine whether activation of heating is needed by turning on the relay. Figure 14b <pre>graph TD Start([Initialize Get Set Points from Memory]) --> GetTemp[Get Frame & Case Temp from Sensors] GetTemp --> RecvTemp{Receiving Room Temp & Humidity?} RecvTemp -- No --> TurnOffRelay[Turn off Relay] RecvTemp -- Yes --> LookupDP[Lookup Dew Point (DP) and Frame Temp from table Average last 4 readings Add in Set Point] LookupDP --> CalcTemp[Low Temp = Frame Temp - Set Point Low High Temp = Frame Temp - Set Point High] CalcTemp --> IsLowTemp{Is Low Temp below AVG DP?} IsLowTemp -- YES --> TurnOnRelay[Turn on Relay & Red LED] IsLowTemp -- NO --> IsHighTemp{Is High Temp above AVG DP?} IsHighTemp -- YES --> TurnOffRelayLED[Turn off Relay & Red LED] IsHighTemp -- NO --> Start GetTemp --> CaseAnomaly{Case temp Anomaly?} CaseAnomaly -- No --> GetTemp CaseAnomaly -- Yes --> InitAlarm[Initiate Alarm (on-site and/or remote)] InitAlarm --> AlarmReset{Alarm Reset?}</pre> Get Temperatures from sensors Get Humidity from sensors Determine if Temperature is too low Turn on heating Relay in response to Low Temperature

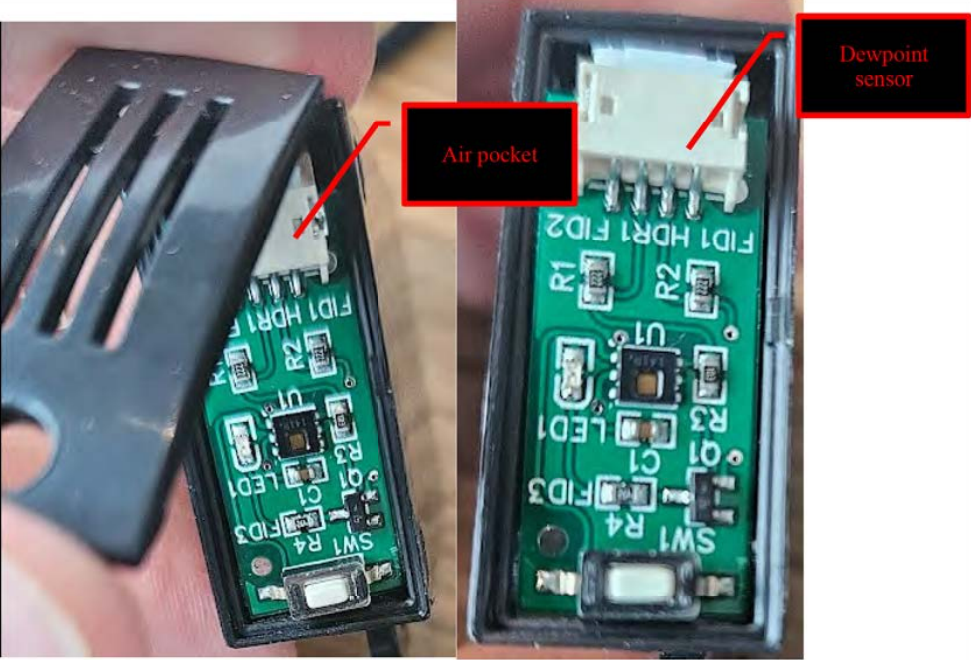
Infringement Chart for United States Patent No. 7,207,181

Claim Language	Infringement Contentions
	The microprocessor in the Anthony Energy Controller means performs (1) identical function, (2) in substantially the same way, (3) with substantially the same result, as the controller unit microprocessor 53 of the '181 Patent.

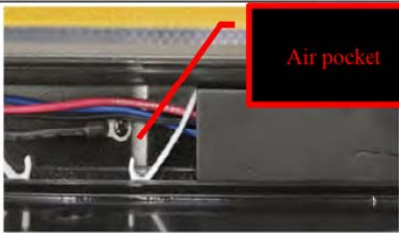
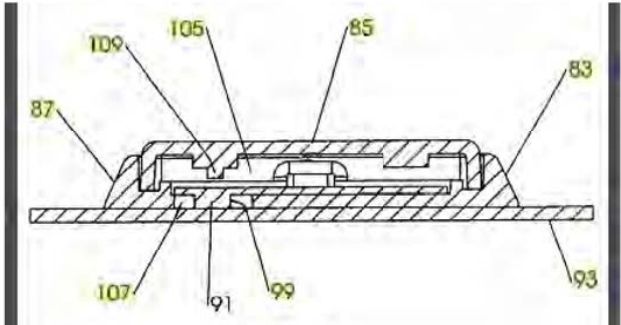
Infringement Chart for United States Patent No. 7,207,181

Claim Language	Infringement Contentions
housing means for locating said sensing units including structure establishing thermal isolation of said sensing units by minimizing heat transfer contacts between said sensing units and said housing means and locating said temperature sensor and said at least one dew point sensing component amid insulated air pockets formed by said structure of said housing means.	The Anthony Energy Controller includes a housing means for locating sensing units including structure establishing thermal isolation of said sensing units by minimizing heat transfer contacts between said sensing units and said housing means and locating said temperature sensor and said at least one dew point sensing component amid insulated air pockets formed by said structure of said housing means. The Anthony Energy Controller, when installed according to its instructions, includes such a housing means. For the dew point sensing component, the housing means includes a plastic shell around the dew point sensor. This makes up part of the housing means. An image of the dew point sensing unit housing is shown below.  Dew point sensing unit housing For the temperature sensor, the housing means includes the plastic shell of the mullion and the contact plate of the cooler. This makes up part of the housing means for the temperature sensor. An image of the dew point sensing unit housing is shown below from pages 7 and 8 of the Anthony Manual:  Temperature sensor Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion.

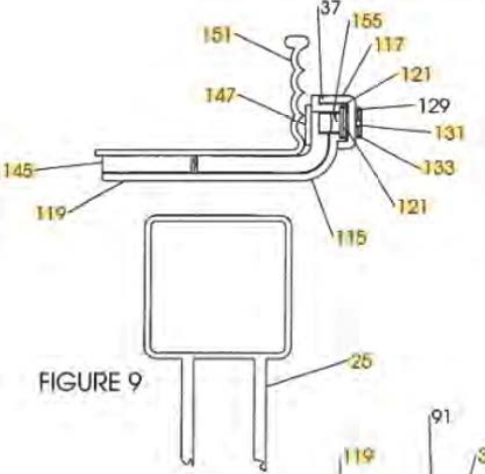
Claim Language	Infringement Contentions
	Step 7 ➤ Make sure all the Energy Controller Cables are retained in the mullion along with all other wires in the mullion ➤ Close the Mullion using the Contact plate and Zipper strips.  The diagram shows a cross-section of a housing assembly. It includes a 'DEWPOINT SENSOR' at the top, an 'ENERGY CONTROLLER' in the center, and a 'TEMPERATURE SENSOR' at the bottom. A red box labeled 'Temperature sensor' points to the bottom sensor. A red box labeled 'Closed contact plate forming the housing means' points to the top of the assembly. A dashed orange arrow points from the top sensor area down to the bottom sensor area. A photograph on the right shows a person's hands closing a black plastic housing, with a red box labeled 'Closed contact plate forming the housing means' pointing to the top edge of the housing. The claim states that the sensors are located “amid insulated air pockets formed by said structure of said housing means.” By opening up the enclosures, it is clear that the dewpoint sensing component and the temperature sensing component are amid insulated air pockets formed by said structure of said housing means. For the dew point sensor, by opening the enclosure, an insulated air pocket is visible in the opened housing shown below.

Claim Language	Infringement Contentions
	 Air pocket Dewpoint sensor For the temperature sensor, by opening the enclosure, an insulated air pocket is visible in the opened housing shown below.

Infringement Chart for United States Patent No. 7,207,181

Claim Language	Infringement Contentions
	 Air pocket Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion. If this claim aspect is interpreted as a means plus function claim, looking to the specification of the '181 Patent, a housing means is provided for each of the sensors. For the temperature sensor, housing 83 is shown in Fig. 5 and includes air space pocket 105 (described in '181 Patent c. 7, l. 1-10). For the dew point sensor, Fig. 9 shows air pocket 155 and the specification, c. 7, l. 40-43 describes how the air pocket provides an insulated air pocket, stating "The air pocket (155 in FIG. 9) behind board/carrier 121 and extending all the way to the mounting surface at unit 151 prevents thermal transfer through housing 115 from the mounting surface of frame unit 151."  FIGURE 5

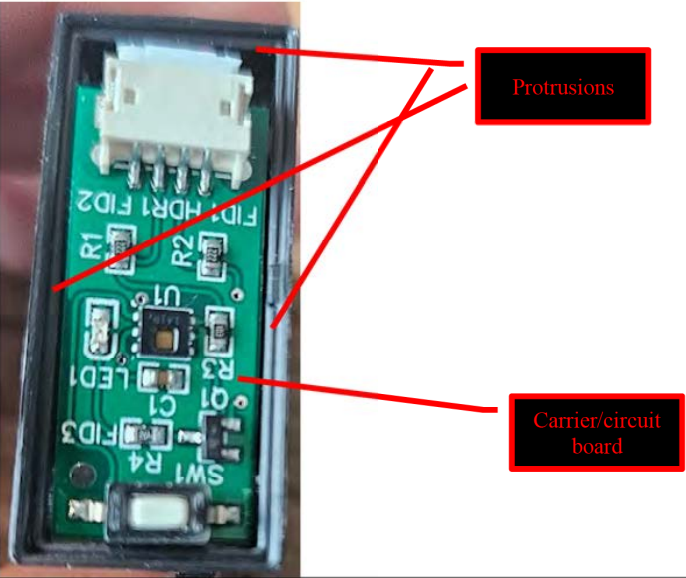
Infringement Chart for United States Patent No. 7,207,181

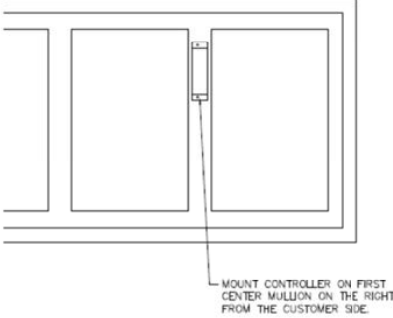
Claim Language	Infringement Contentions
	 FIGURE 9 Based on these means disclosed, housings of the Anthony Energy Controller having the various air pockets, means perform (1) identical function, (2) in substantially the same way, (3) with substantially the same result, as the controller unit microprocessor 53 of the '181 Patent. The point of the housings in the means disclosed in the '181 Patent appear to be to provide insulating air pockets. The function of the housing and their air pockets in the disclosed means and the Anthony Energy Controller in fact have identical function: to isolate the sensors in a managed air pocket. The way in which this is provided is by having a housing around the sensors. The result is the same, in that an insulated air pocket is provided.

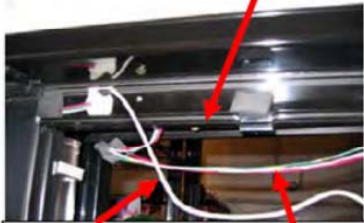
Claim Language	Infringement Contentions
4. The apparatus of claim 1 wherein said housing means includes a dew point sensing unit housing, said dew point sensing unit housing including a mounting base and cover, said cover including a cover face opening therethrough for receiving said at least one dew point sensing component therein, said cover face opening including a protective shield thereover having air gaps therearound allowing air flow between said protective shield and said cover and thus over said at least one dew point sensing component.	The Anthony Energy Controller includes a dew point sensing unit housing, shown below. The dew point sensing unit housing includes a base and a cover, which is shown in the below image of the Anthony Energy Controller. 

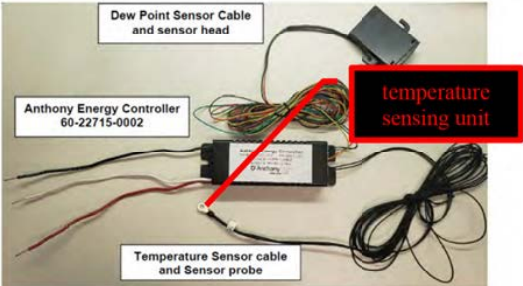
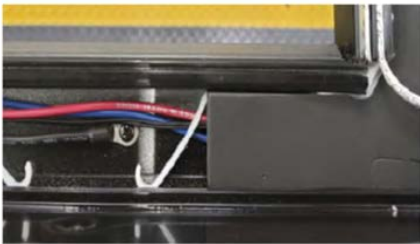
Claim Language	Infringement Contentions
	The Anthony Energy Controller includes a cover face opening therethrough for receiving said at least one dew point sensing component therein, said cover face opening including a protective shield thereover having air gaps therearound allowing air flow between said protective shield, and said cover and thus over said at least one dew point sensing component. The slats shown in the image of the back side of the Anthony Energy Controller cover below serve as a protective shield and provide for air flow between the protective shield and the cover, providing air flow over the dew point sensing unit.  Cover Face Opening Protective Shield

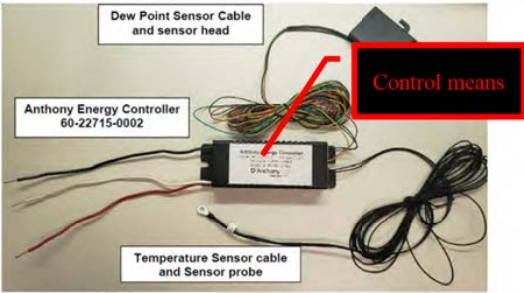
Claim Language	Infringement Contentions
5. The apparatus of claim 4 wherein said cover of said dew point sensing unit housing includes opposite end openings to establish ambient air flow through said dew point sensing unit housing.	The Anthony Energy Controller includes cover of said dew point sensing unit housing includes opposite end openings to establish ambient air flow through said dew point sensing unit housing. In the image of the back side of the Anthony Energy Controller below, the opposite end openings are shown.  Opposite end opening Opposite end opening

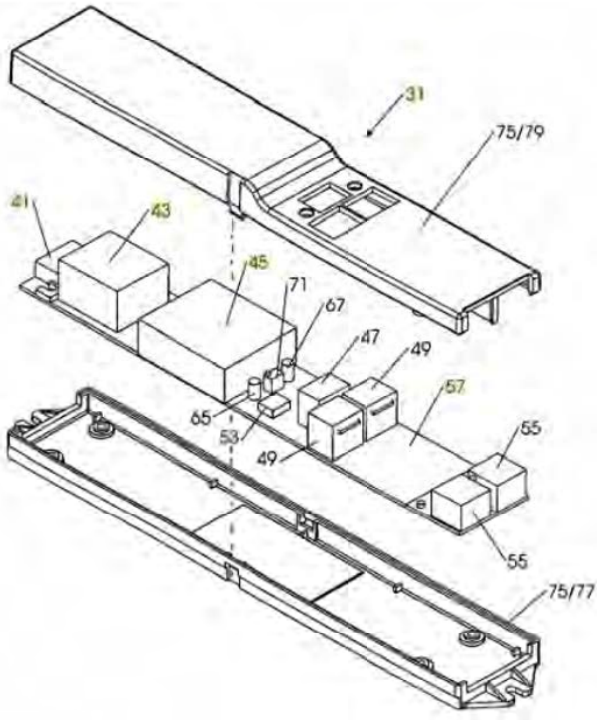
Claim Language	Infringement Contentions
6. The apparatus of claim 4 wherein said mounting base of said dew point sensing unit housing includes protrusions establishing retaining pockets receiving said carrier of said dew point sensing unit at outer edges of said carrier and further establishing a first one of said air pockets amid said protrusions and adjacent to said carrier in the mounting base of the dew point sensing unit housing. These protrusions from the based provide for the cover to be offset from the base forming an air pocket and receive the carrier of the dewpoint sensing unit which in this case is the circuit board it is mounted on. This is shown in the below image of the Anthony Energy Controller.	The Anthony Energy Controller includes protrusions establishing retaining pockets receiving said carrier of said dew point sensing unit at outer edges of said carrier and further establishing a first one of said air pockets amid said protrusions and adjacent to said carrier in the mounting base of the dew point sensing unit housing. These protrusions from the based provide for the cover to be offset from the base forming an air pocket and receive the carrier of the dewpoint sensing unit which in this case is the circuit board it is mounted on. This is shown in the below image of the Anthony Energy Controller. 

Claim Language	Infringement Contentions
Claim 14. A system for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, said system comprising:	If the preamble is considered to be limiting, the Anthony Energy Controller (e.g. part number 60-22715-0002), which is included in the Accused Anti-Sweat Controlled Products, is a system for a condensation control at a refrigerated display case. Page 5 of the Anthony Manual depicts installation of the system of a refrigerated display case having a door and a frame.  MOUNT CONTROLLER ON FIRST CENTER MULLION ON THE RIGHT FROM THE CUSTOMER SIDE. Page 5 of the Anthony Manual shows a cutaway view of an exemplary frame, showing the Heater Wire Cables and that the door has a door frame heater.

Claim Language	Infringement Contentions
	FRAME AND RACEWAY  HEATER WIRE CABLES and WIRES The Anthony Flyer indicates that the Anthony Energy Controller controls anti-condensate door heaters. Anti-condensate door heaters are resident in the frames of the doors.

Claim Language	Infringement Contentions
a temperature sensing unit in contact with the display case frame to monitor case frame temperature;	The Anthony Energy Controller includes a temperature sensing unit in contact with the display case frame to monitor case frame temperature. Page 3 of the Anthony Manual depicts the temperature sensor cable and sensor probe.  On page 7 of the Anthony Manual, step 6 describes mounting the temperature sensor to the frame. 

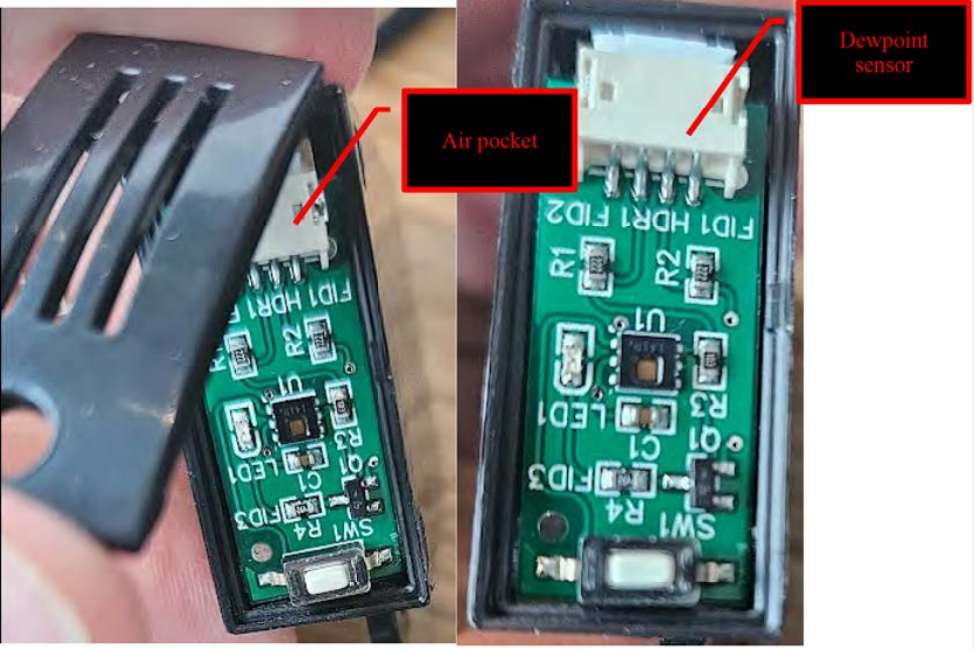
Claim Language	Infringement Contentions
	Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion.
control means for receiving data from said sensing units and utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.	The Anthony Energy Controller includes a control means on the display case to monitor ambient air temperature and relative humidity outside the display case. Page 3 for the Anthony Manual depicts the dew point sensing unit.  The Anthony Flyer indicates the “Anthony Energy Controller activates anti-condensate heat when Dew Point Temperature is sensed,” thereby indicating that data is received from both the sensing units and that the system “anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.” This is because condensation will occur when the dew point temperature is sensed. If this claim aspect is interpreted as a means plus function claim, looking to the specification of the '181 Patent, at least one control means is identifiable. Fig. 2 of the '181 Patent shows an exploded view of a local controller unit of the apparatus of the invention. In this figure, call out 53 denotes a controller unit microprocessor. The specification indicates that “Controller unit microprocessor 53 can be calibrated to initiate operations anywhere above or below calculated dew point.” ('181 Patent, c. 5, l. 60-62). Therefore, it is clear that this microprocessor is initiating the heating of the door when set points are

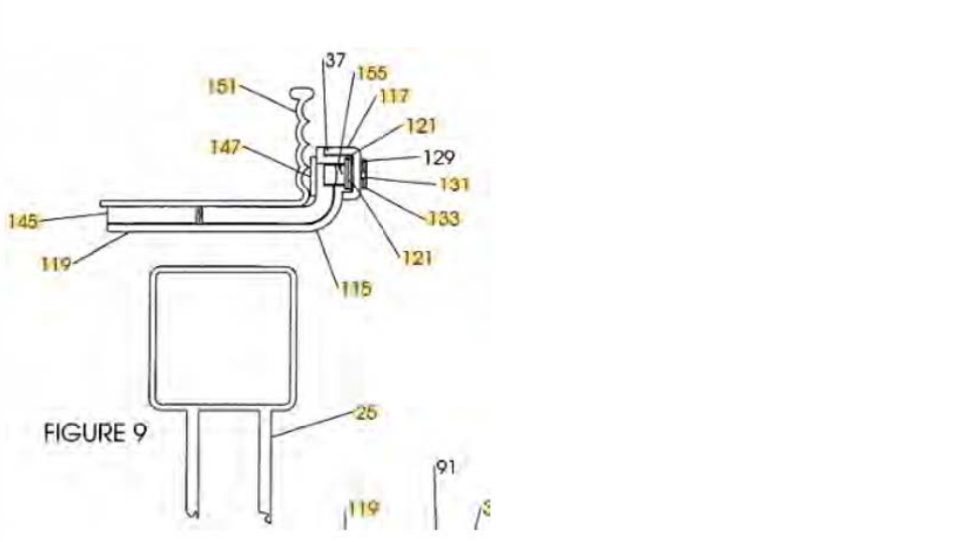
Claim Language	Infringement Contentions
	reached, corresponding to the processing means for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity.  The diagram is an exploded perspective view of a display case frame assembly. It shows several components: a top frame member (31) with a recessed area (75/79); a bottom frame member (75/77) with a channel; a central panel (41) with a rectangular cutout (43); a rectangular block (45) with a protrusion (71); a small rectangular component (67); a rectangular component (47) with a protrusion (49); a rectangular component (57) with a protrusion (55); and a rectangular component (55) with a protrusion (53). The components are arranged in a way that suggests they are assembled together to form the display case frame. FIGURE 2

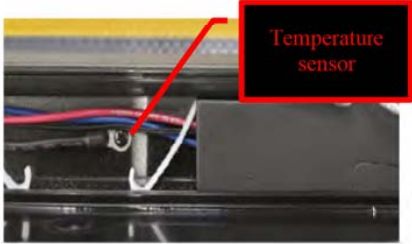
Claim Language	Infringement Contentions
	If an algorithm is necessary to support the means plus function interpretation of the controller unit microprocessor 53, Fig. 14b of the specification provide an algorithm flow chart. As previously indicated, the Anthony Flyer indicates the “Anthony Energy Controller activates anti-condensate heat when Dew Point Temperature is sensed,” thereby indicating that data is received from both the sensing units and that the system “anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.” To perform such an action there must be trigger points or set point in memory. In order to operate, the Anthony Energy Controller must retrieve those set points and determine whether the frame and case temperatures are high or low. The Anthony Energy Controller must also retrieve humidity information and accordingly determine whether activation of heating is needed by turning on the relay.

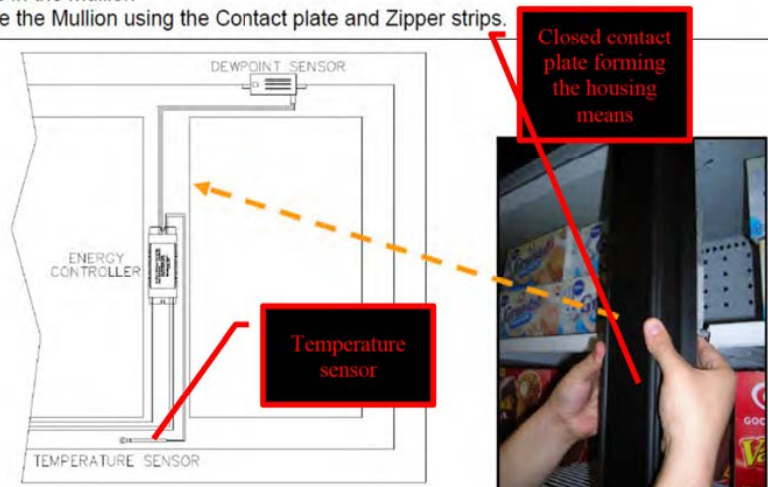
Claim Language	Infringement Contentions
	Figure 14b <pre>graph TD Init[Initialize Get Set Points from Memory] --> GetFrame[Get Frame & Calc Temp from Sensors] GetFrame --> RecvTemp{Receiving Room Temp & Humidity?} RecvTemp -- No --> GetFrame RecvTemp -- Yes --> LookupDP[Lookup Dew Point (DP) and Frame Temp from table Average last 4 readings Add in Set Point] LookupDP --> CalcLow[Low Temp = Frame Temp - Set Point Low High Temp = Frame Temp - Set Point High] CalcLow --> IsLow{Is Low Temp below AVG DP?} IsLow -- YES --> TurnOnRelay[Turn on Relay & Red LED] IsLow -- NO --> IsHigh{Is High Temp above AVG DP?} IsHigh -- YES --> TurnOffRelay[Turn off Relay & Red LED] IsHigh -- NO --> GetFrame GetFrame --> CaseTemp{Case temp Anomaly?} CaseTemp -- No --> GetFrame CaseTemp -- Yes --> InitAlarm[Initiate Alarm (on-site and/or remote)] InitAlarm --> TurnOffRelay TurnOffRelay --> GetFrame</pre> Get Temperatures from sensors Get Humidity from sensors Determine if Temperature is too low Turn on heating Relay in response to Low Temperature The microprocessor in the Anthony Energy Controller means performs (1) identical function, (2) in substantially the same way, (3) with substantially the same result, as the controller unit microprocessor 53 of the '181 Patent.

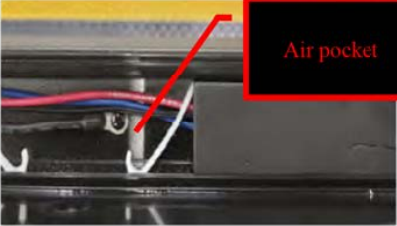
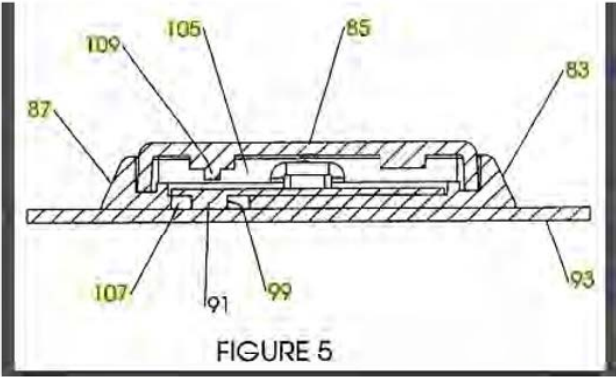
Claim Language	Infringement Contentions
15. The system of claim 14 further comprising means for thermally isolating said dew point sensing unit from variations in temperature of the display case frame or display case door.	The Anthony Energy Controller includes a housing means for locating sensing units including structure establishing thermal isolation of said sensing units by minimizing heat transfer contacts between said sensing units and said housing means and locating said temperature sensor and said at least one dew point sensing component amid insulated air pockets formed by said structure of said housing means. The Anthony Energy Controller, when installed according to its instructions, includes such a means for thermally isolating the dew point sensing component. For the dew point sensing component, the means for thermally isolating includes a plastic shell around the dew point sensor. This makes up part of the housing means. An image of the dew point sensing unit housing is shown below.  Dew point sensing unit housing For the dew point sensor, by opening the enclosure, an insulated air pocket is visible in the opened housing shown below.

Claim Language	Infringement Contentions
	 In the event this claim aspect is interpreted as a means plus function claim, looking to the specification of the '181 Patent, a housing means is provided for each of the sensors. For the dew point sensor, Fig. 9 shows air pocket 155 and the specification, c. 7, l. 40-43 describes how the air pocket provides an insulated air pocket, stating “The air pocket (155 in FIG. 9) behind board/carrier 121 and extending all the way to the

Claim Language	Infringement Contentions
	mounting surface at unit 151 prevents thermal transfer through housing 115 from the mounting surface of frame unit 151.”  FIGURE 9 Based on these means disclosed, housings of the Anthony Energy Controller a similar means for thermally isolating, such that it performs (1) identical function, (2) in substantially the same way, (3) with substantially the same result, as the controller unit microprocessor 53 of the '181 Patent. Both the housing in the '181 Patent and the housing in the Anthony Energy Controller function in the same way to provide thermal isolation. The way in which this is provided is by having a housing around the sensors that provides an air pocket. The result is the same, in that an insulated air pocket is provided that isolates the sensor.

Claim Language	Infringement Contentions
16. The system of claim 14 further comprising means for thermally isolating said temperature sensing unit from variations in temperature of ambient air.	The Anthony Energy Controller includes a means for thermally isolating said temperature sensing unit from variations in temperature of ambient air. The Anthony Energy Controller, when installed according to its instructions, for the temperature sensor, includes a means for thermally isolating said temperature sensing unit from variations in temperature of ambient air. The plastic shell of the mullion and the contact plate of the cooler for this means for thermally isolating. An image of the dew point sensing unit housing is shown below from page 7 and 8 of the Anthony Manual.  Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion.

Claim Language	Infringement Contentions
	Step 7 ➤ Make sure all the Energy Controller Cables are retained in the mullion along with all other wires in the mullion ➤ Close the Mullion using the Contact plate and Zipper strips.  For the temperature sensor, by opening the enclosure, an insulated air pocket is visible in the opened housing shown below.

Claim Language	Infringement Contentions
	 A photograph showing a temperature sensor assembly. A red arrow points to a gap labeled "Air pocket" in a red box. Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion. If this claim aspect is interpreted as a means plus function claim, looking to the specification of the '181 Patent, a housing means is provided for the temperature sensor. For the temperature sensor, housing 83 is shown in Fig. 5 and includes air space pocket 105 (described in '181 Patent c. 7, l. 1-10).  A cross-sectional diagram of a housing assembly. The diagram shows a housing 83 mounted on a base 93. A temperature sensor 85 is mounted within the housing. An air space pocket 105 is formed between the sensor and the housing. Other labeled parts include 109, 87, 107, 91, 99, and 93. FIGURE 5 Based on these means disclosed, therefore the identified means for thermally isolating perform (1) identical function, (2) in substantially the same way, (3) with substantially the same result, as the controller unit microprocessor 53 of the '181 Patent. The point of the housings in the means disclosed in the '181

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Infringement Chart for United States Patent No. 7,207,181

Claim Language	Infringement Contentions
	Patent appear to be to provide insulating air pockets. The function of the housing and their air pockets in the disclosed means and the Anthony Energy Controller, in fact have identical function, to isolate the sensors in a managed air pocket. The way in which this is provided is by having a housing around the sensors. The result is the same, in that an insulated air pocket is provided.

EXHIBIT 5

This claim chart details Defendants' infringement of the '847 Patent by making, using, selling, or offering for sale the Accused Anti-Sweat Controlled Products, which include the Anthony Energy Controller, in the United States.¹

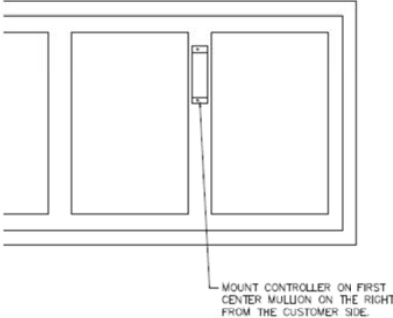
When sold or installed as directed by Defendants, the Accused Anti-Sweat Controlled Products literally infringe the claims of the '847 Patent. If any claim limitation is found to be not present literally, however, such limitation is present under the doctrine of equivalents because the differences between the claimed inventions and Defendants' infringement, if any, are insubstantial and the Accused Anti-Sweat Controlled Products perform the same function in the same way to achieve the same result as such limitations. ControlTec expects to discover additional details regarding the Accused Anti-Sweat Controlled Products during discovery. ControlTec reserves the right to amend its infringement chart and to specifically assert infringement by the doctrine of equivalents following the discovery of additional information during discovery or claim construction.

When sold or used as directed by Defendants, the Accused Anti-Sweat Controlled Products directly infringe the claims of the '847 Patent. All aspects of the asserted claims of the '847 Patent are present or performed by or are attributable to Defendants. Defendants direct or control the performance of users of the Accused Anti-Sweat Controlled Products in a manner such that the function of the Accused Anti-Sweat Controlled Products is conditioned on the usage of the patented apparatus. Alternatively, Defendants knowingly induce infringement and possess specific intent to encourage users of the Accused Anti-Sweat Controlled Products to infringe the claims of the '847 Patent.

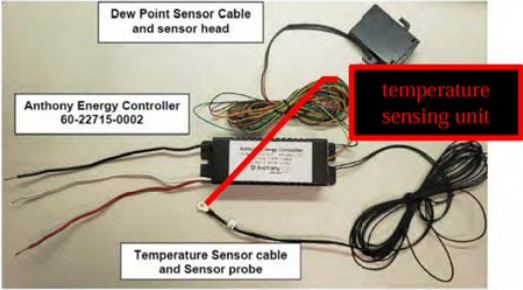
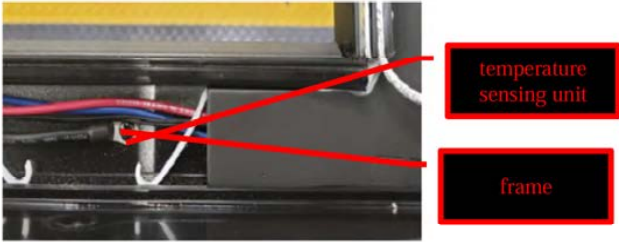
Based on ControlTec's view that certain asserted claims could be infringed by certain of Defendants' accused products in multiple ways, ControlTec's contentions may include alternative theories of infringement, some of which may overlap with other infringement theories in certain respects.

As set forth in the charts below, ControlTec contends that the Accused Anti-Sweat Controlled Products infringe at least claims 8-10 of the '847 Patent.

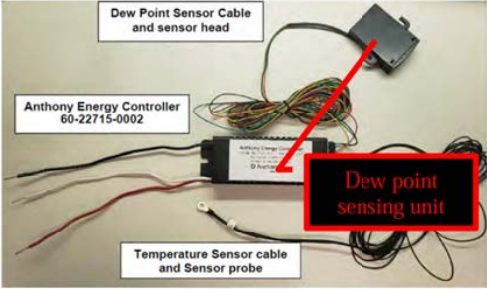
¹ The capitalized terms not otherwise defined in this claim chart have the same meaning as given to them in ControlTec's Complaint for Patent infringement against Defendants.

Claim Language	Infringement Contentions
8. A method for condensation control at a refrigerated display case having at least one door, a frame and at least one frame/door heater, said method comprising the steps of:	If the preamble is considered to be limiting, the Anthony Energy Controller (e.g. part number 60-22715-0002), which is included in the Accused Anti-Sweat Controlled Products, is a system for a condensation control at a refrigerated display case. Page 4 of the Anthony Energy Controller (60-22715-0002) Installation Manual ("Anthony Manual") depicts installation of the system of a refrigerated display case having a door and a frame.  Page 5 of the Anthony Manual shows a cutaway view of an exemplary frame, showing the heater wire cables, showing that the door has a door frame heater.

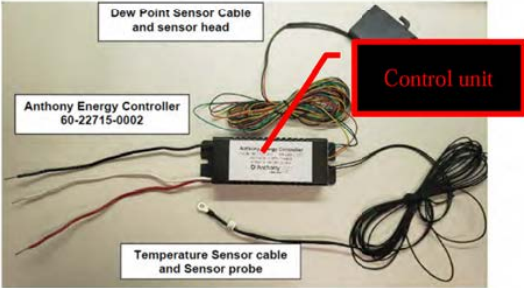
Claim Language	Infringement Contentions
	FRAME AND RACEWAY  HEATER WIRE CABLES and WIRES The Anthony Energy Control Flyer for the Anthony Energy Controller ("Anthony Flyer") indicates that the Anthony Energy Controller controls anti-condensate door heaters. Anti-condensate door heaters are resident in the frames of the doors.

Claim Language	Infringement Contentions
placing a temperature sensing unit in contact with the display case frame to monitor case frame temperature;	The Anthony Energy Controller and the instructions for installation include a temperature sensing unit adapted for monitoring temperature of one of the display case door or display case frame. The Anthony Manual instructs the placing of the temperature sensing using in contact with the display case frame to monitor the case frame temperature. Page 3 for the Anthony Manual depicts the temperature sensor cable and sensor probe which are part of the frame temperature sensing unit. The carrier is the wire shown ("Temperature Sensor cable"). The temperature sensor is the end of the wire ("Sensor probe").  On page 7 of the Anthony Manual, step 6 describes mounting the Temperature sensor to the frame. 

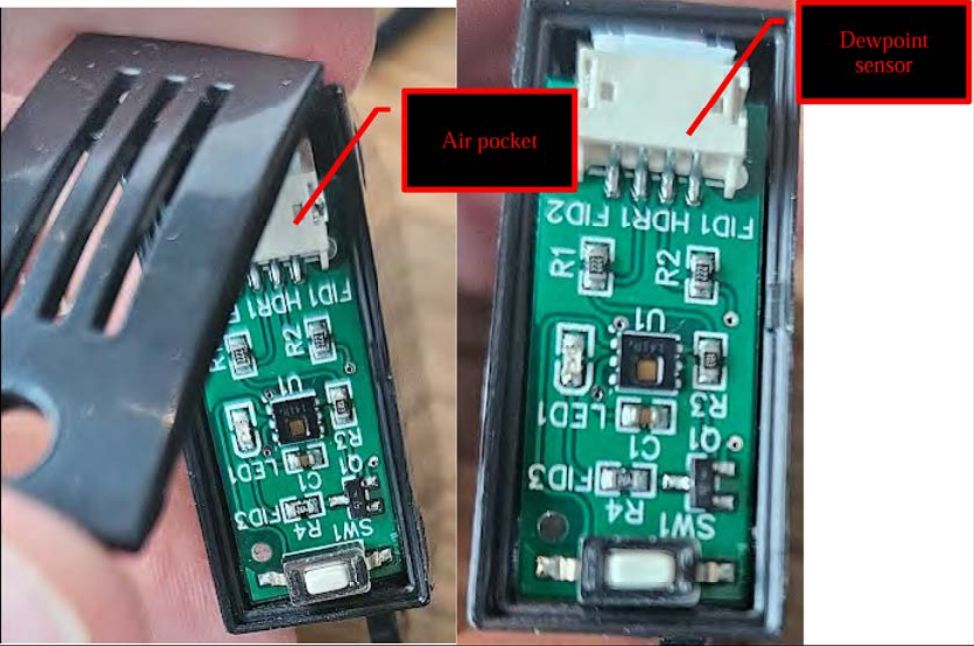
Claim Language	Infringement Contentions
	Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion.

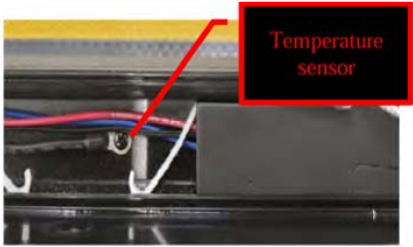
Claim Language	Infringement Contentions
mounting a dew point sensing unit on the display case to monitor ambient air temperature and relative humidity outside the display case; and	The Anthony Energy Controller includes a dew point sensing unit adapted for monitoring ambient air temperature and relative humidity outside of the display case. The Anthony Manual instructs the user to perform a mounting of the dew point sensing unit outside the display case. Page 3 of the Anthony Manual depicts the dew point sensing unit.  The Anthony Flyer indicates the Anthony Energy Controller activates anti-condensate heat when dew point temperature is sensed, thereby indicating that the ambient air temperature and relative humidity outside the display case is monitored.

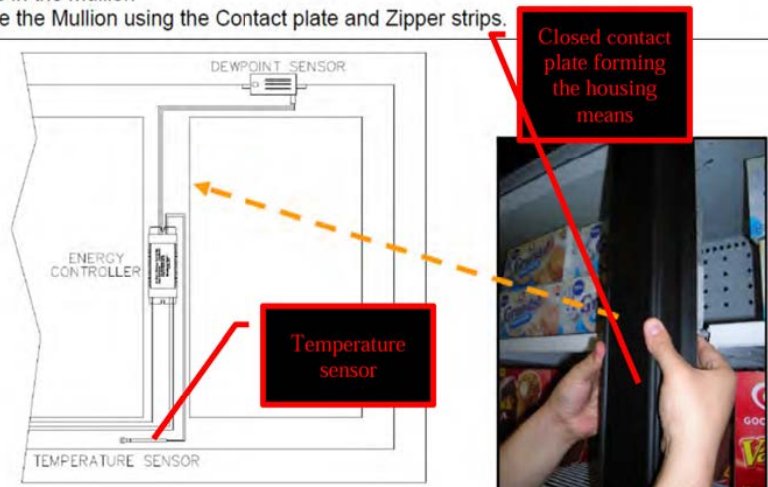
Claim Language	Infringement Contentions
	Page 6 of the Anthony Manual depicts mounting the dewpoint sensing unit outside of the display case. Sensor location: upper frame rail above the first door from the right. (See illustration on sheet 8.) 

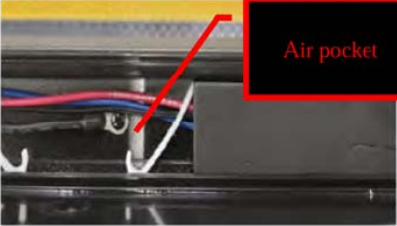
Claim Language	Infringement Contentions
utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.	The Anthony Energy Controller, when used in the Accused Anti-Sweat Controlled Products as Defendants direct, performs utilizing monitored case frame temperature, ambient air temperature and relative humidity to anticipate formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto. The Anthony Energy Controller includes a control unit communicating with said sensing units for activating the display case frame/door heater when monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity. Page 3 for the Anthony Manual depicts the control unit.  The Anthony Flyer indicates the “Anthony Energy Controller activates anti-condensate heat when Dew Point Temperature is sensed,” thereby indicating that data is received from both the sensing units and that the system “anticipate(s) formation of condensation at the display case and activating and deactivating the frame/door heater responsive thereto.” This is because condensation will occur when the dew point temperature is sensed. Therefore, the Anthony Energy Controller performs activating the display case frame/door heater when the monitored display case door or frame temperature drops below a preselected set point above a dew point value derived from monitored ambient temperature and relative humidity.

Claim Language	Infringement Contentions
9. The method of claim 8 further comprising thermally isolating said dew point sensing unit from variations in temperature of the display case frame or display case door.	The Anthony Energy Controller, when used in the Accused Anti-Sweat Controlled Products as directed in the Anthony Manual, performs thermally isolating said dew point sensing unit from variations in temperature of the display case frame or display case door. The Anthony Energy Controller, when installed according to its instructions, includes such a housing for the dew point sensing unit. For the dew point sensing component, the housing means includes a plastic shell around the dew point sensor. This makes up part of the housing means. An image of the dew point sensing unit housing is shown below.  Dew point sensing unit housing For the dew point sensor, by opening the enclosure, an insulated air pocket is visible in the opened housing shown below. This air pocket thermally isolates the dew point sensor from variations in temperature of the display case frame or display case door.

Claim Language	Infringement Contentions
	

Claim Language	Infringement Contentions
10. The method of claim 8 further comprising thermally isolating said temperature sensing unit from variations in temperature of ambient air.	The Anthony Energy Controller includes performing thermally isolating said temperature sensing unit from variations in temperature of ambient air. The Anthony Energy Controller, when installed according to its instructions, includes a means for thermally isolating said temperature sensing unit from variations in temperature of ambient air. The plastic shell of the mullion and the contact plate of the cooler provide the means for thermally isolating. An image of the dew point sensing unit housing is shown below from page 7 and 8 of the Anthony Manual.  Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion.

Claim Language	Infringement Contentions
	Step 7 ➤ Make sure all the Energy Controller Cables are retained in the mullion along with all other wires in the mullion ➤ Close the Mullion using the Contact plate and Zipper strips.  For the temperature sensor, by opening the enclosure, an insulated air pocket is visible in the opened housing shown below.

Claim Language	Infringement Contentions
	 Step 6 Route the Temperature sensor through the mullion to the bottom of the frame and using Screw 40-12665-3003 (Qty 1) mount it approximately 4 inches from the mullion.

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON NEXT PAGE OF THIS FORM.)

I. (a) PLAINTIFFS

CONTROLTEC, LLC

(b) County of Residence of First Listed Plaintiff _____
(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorneys (Firm Name, Address, and Telephone Number)

Brian P. Egan; Morris, Nichols, Arsht & Tunnell LLP
1201 North Market Street; P.O. Box 1347; Wilmington, DE 19899
(302) 658-9200

DEFENDANTS

ANTHONY, INC. and HILL PHOENIX, INC.

County of Residence of First Listed Defendant _____
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF
THE TRACT OF LAND INVOLVED.

Attorneys (If Known)

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- ☐ 1 U.S. Government Plaintiff
- ☒ 3 Federal Question (U.S. Government Not a Party)
- ☐ 2 U.S. Government Defendant
- ☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)

- | | PTF | DEF | | PTF | DEF |
|---|----------------------------|----------------------------|---|----------------------------|----------------------------|
| Citizen of This State | ☐ 1 | ☐ 1 | Incorporated or Principal Place of Business In This State | ☐ 4 | ☐ 4 |
| Citizen of Another State | ☐ 2 | ☐ 2 | Incorporated and Principal Place of Business In Another State | ☐ 5 | ☐ 5 |
| Citizen or Subject of a Foreign Country | ☐ 3 | ☐ 3 | Foreign Nation | ☐ 6 | ☐ 6 |

IV. NATURE OF SUIT (Place an "X" in One Box Only)

Click here for: [Nature of Suit Code Descriptions.](#)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES	
☐ 110 Insurance ☐ 120 Marine ☐ 130 Miller Act ☐ 140 Negotiable Instrument ☐ 150 Recovery of Overpayment & Enforcement of Judgment ☐ 151 Medicare Act ☐ 152 Recovery of Defaulted Student Loans (Excludes Veterans) ☐ 153 Recovery of Overpayment of Veteran's Benefits ☐ 160 Stockholders' Suits ☐ 190 Other Contract ☐ 195 Contract Product Liability ☐ 196 Franchise	PERSONAL INJURY ☐ 310 Airplane ☐ 315 Airplane Product Liability ☐ 320 Assault, Libel & Slander ☐ 330 Federal Employers' Liability ☐ 340 Marine ☐ 345 Marine Product Liability ☐ 350 Motor Vehicle ☐ 355 Motor Vehicle Product Liability ☐ 360 Other Personal Injury ☐ 362 Personal Injury - Medical Malpractice	PERSONAL INJURY ☐ 365 Personal Injury - Product Liability ☐ 367 Health Care/ Pharmaceutical Personal Injury Product Liability ☐ 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY ☐ 370 Other Fraud ☐ 371 Truth in Lending ☐ 380 Other Personal Property Damage ☐ 385 Property Damage Product Liability	☐ 625 Drug Related Seizure of Property 21 USC 881 ☐ 690 Other LABOR ☐ 710 Fair Labor Standards Act ☐ 720 Labor/Management Relations ☐ 740 Railway Labor Act ☐ 751 Family and Medical Leave Act ☐ 790 Other Labor Litigation ☐ 791 Employee Retirement Income Security Act IMMIGRATION ☐ 462 Naturalization Application ☐ 465 Other Immigration Actions	☐ 422 Appeal 28 USC 158 ☐ 423 Withdrawal 28 USC 157 PROPERTY RIGHTS ☐ 820 Copyrights ☒ 830 Patent ☐ 835 Patent - Abbreviated New Drug Application ☐ 840 Trademark SOCIAL SECURITY ☐ 861 HIA (1395ff) ☐ 862 Black Lung (923) ☐ 863 DIWC/DIWW (405(g)) ☐ 864 SSID Title XVI ☐ 865 RSI (405(g)) FEDERAL TAX SUITS ☐ 870 Taxes (U.S. Plaintiff or Defendant) ☐ 871 IRS—Third Party 26 USC 7609	☐ 375 False Claims Act ☐ 376 Qui Tam (31 USC 3729(a)) ☐ 400 State Reapportionment ☐ 410 Antitrust ☐ 430 Banks and Banking ☐ 450 Commerce ☐ 460 Deportation ☐ 470 Racketeer Influenced and Corrupt Organizations ☐ 480 Consumer Credit ☐ 490 Cable/Sat TV ☐ 850 Securities/Commodities/Exchange ☐ 890 Other Statutory Actions ☐ 891 Agricultural Acts ☐ 893 Environmental Matters ☐ 895 Freedom of Information Act ☐ 896 Arbitration ☐ 899 Administrative Procedure Act/Review or Appeal of Agency Decision ☐ 950 Constitutionality of State Statutes
REAL PROPERTY ☐ 210 Land Condemnation ☐ 220 Foreclosure ☐ 230 Rent Lease & Ejectment ☐ 240 Torts to Land ☐ 245 Tort Product Liability ☐ 290 All Other Real Property	CIVIL RIGHTS ☐ 440 Other Civil Rights ☐ 441 Voting ☐ 442 Employment ☐ 443 Housing/Accommodations ☐ 445 Amer. w/Disabilities - Employment ☐ 446 Amer. w/Disabilities - Other ☐ 448 Education	PRISONER PETITIONS Habeas Corpus: ☐ 463 Alien Detainee ☐ 510 Motions to Vacate Sentence ☐ 530 General ☐ 535 Death Penalty Other: ☐ 540 Mandamus & Other ☐ 550 Civil Rights ☐ 555 Prison Condition ☐ 560 Civil Detainee - Conditions of Confinement			

V. ORIGIN (Place an "X" in One Box Only)

- ☒ 1 Original Proceeding
- ☐ 2 Removed from State Court
- ☐ 3 Remanded from Appellate Court
- ☐ 4 Reinstated or Reopened
- ☐ 5 Transferred from Another District (specify)
- ☐ 6 Multidistrict Litigation - Transfer
- ☐ 8 Multidistrict Litigation - Direct File

VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity):
35 U.S.C. § 271

Brief description of cause:
Patent Infringement

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION UNDER RULE 23, F.R.Cv.P.

DEMAND \$

CHECK YES only if demanded in complaint:

JURY DEMAND: ☒ Yes ☐ No**VIII. RELATED CASE(S) IF ANY**

(See instructions):

JUDGE

DOCKET NUMBER

DATE

07/26/2024

SIGNATURE OF ATTORNEY OF RECORD

/s/ Brian P. Egan

FOR OFFICE USE ONLY

RECEIPT #

AMOUNT

APPLYING IFP

JUDGE

MAG. JUDGE