A control system and method for a wood stove adjustably operates in accordance with operational characteristics of the wood stove. The system adjusts air vents to the combustion chamber of the stove to control operating temperatures of the stove. The air vents are adjusted proportionally to changes in temperature of the stove. The temperature of the stove may be controlled to achieve desired operational and burn characteristics. The system further includes a heat exchange fan. The system controls the speed of the heat exchange fan based upon the operational characteristics of the stove.
Figure 3

Mode 4 (Max heat output)

Mode 2,3 (Max efficiency)

Mode 1 (Max burn time, low heat)
Mode 4 (Max heat output)  
Mode 2,3 (Max efficiency)  
Mode 1 (Max burn time, low heat)  

Figure 4
Mode 4 (Max heat output)
Mode 3 (Max combustion efficiency, high fan)
Mode 2 (Max heating efficiency, mod fan)
Mode 1 (Max burn time, low heat)

Figure 5
INTELLIGENT AND ADAPTIVE CONTROL SYSTEM AND METHOD FOR WOOD BURNING STOVE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention
[0002] The present invention relates to controllers for wood burning stoves or furnaces. More particularly, it relates to an intelligent and adaptive wood combustion controller for adjusting combustion airflow and heat transfer airflow for improved performance.

[0003] 2. Discussion of Related Art
[0004] Control of a wood stove can be complex and difficult. Typically, a wood stove includes a number of manual controls for controlling the combustion and heat transfer processes. The controls can be difficult to set and must be adjusted periodically to keep the fire in the stove burning well and to provide heat from the stove to the surrounding area. Typically, a wood stove includes two types of controls. A first type of control provides air to the combustion process. The amount of air available for combustion determines the strength of the fire. Incomplete combustion results from too little air. However, too much air will lead to overheating of the stove, leading to excessive draft, making it nearly impossible to limit the combustion. Furthermore, the amount of air which is too much or too little depends upon the amount of fuel in the stove, the current temperature of the fire, and length of time the fire has been burning. In order to keep a fire operating at the desired performance, the draft air flow must be adjusted repeatedly during the combustion process.

[0005] Typically, a wood stove installed in a fireplace opening will include a fan or fans causing air to pass around the combustion chamber to provide heated air to the room. The speed of the heat exchange fan controls the amount of heat extracted from the fire and provided to the room. To get more heat into the room, the speed of the fan is increased. Furthermore, the speed of the fan also has an effect on the combustion process. As more air is forced through the stove, it removes more heat from the combustion process. Although a faster speed fan allows heat to transfer more quickly into a room, it also will reduce the temperature of the inner wall and the fire itself, reducing the draft air supplying the fire. If too much heat is removed through the heat transfer process, the fire may overcool and burn poorly.

[0006] Various mechanisms have been devised to automate parts of the control processes for wood stoves. Such mechanisms typically include a thermostat or similar device for determining the temperature of the stove or the room. The level of combustion air and the speed of the heat exchange fan are adjusted to maintain a desired temperature. However, such systems do not account for differences in the operation of a fire with respect to time or offer variations in operating modes. Through improved control, the stove can be operated more efficiently, providing superior heating characteristics and convenience to the user.

SUMMARY OF THE INVENTION

[0007] According to one aspect, the present invention includes a system for controlling operation of a wood stove. The system monitors the temperature of the stove over time. Air vents to the combustion chamber serve as a draft air control and are adjusted based upon temperature changes. According to another aspect of the invention, the system adjusts the air vents to achieve desired operational characteristics for the wood stove. According to aspects of the invention, the air vents are adjusted to achieve one of a maximum burn time for a fire, a maximum heat output, a maximum efficiency, or ambient room temperature control. According to other aspects of the invention, the system adjusts automatically to achieve desired operation of the wood stove. The system monitors operation of the stove and adjusts the air vents in accordance with the desired performance of the stove.

[0008] According to another aspect of the invention, the system includes a training mode for learning operational performance of the wood stove. The system monitors the temperature and air vent openings periodically during manual operation of the wood stove. The system uses information generated during the training mode for controlling the air vents during automatic operation of the wood stove.

[0009] According to another aspect of the invention, the system can control a heat exchange fan on the wood stove. The speed of the heat exchange fan is adjusted based upon the temperature of the stove, the operation of stove, and desired operational characteristics for the stove.

[0010] According to another aspect of the invention, a method for operation of a wood stove is based upon operational characteristics of the wood stove and performance of the stove. According the method, air vents are proportionally adjusted based upon changes in temperature of the stove. According to another aspect of the invention, the method the air vents are adjusted based upon rates of temperature change. According to another aspect of the invention, the method includes control of a heat exchange fan based upon operational characteristics of the stove. According to another aspect of the invention, the method controls the stove to achieve a desired operation for the wood stove. Desired operations include maximum burn time with a quiet fan (Mode 1), maximum heating efficiency with moderate fan speed (Mode 2), maximum heating efficiency with high fan speed (Mode 3), maximum heat output with a maximized fan speed and shorter burn time (Mode 4), and ambient room temperature control (Mode 5).

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a front view of a wood stove and controller according to an embodiment of the present invention.

[0012] FIG. 2 is a cross sectional view of the wood stove of FIG. 1.

[0013] FIG. 3 is a graph of temperature of a wood stove showing various temperature profiles depending upon a selected operating mode.

[0014] FIG. 4 is a graph for the vent opening calculated according to the temperature profile in FIG. 3 and the selected operating mode.

[0015] FIG. 5 is a graph of the fan speed calculated according to the temperature profile in FIG. 3 and the selected operating mode.

DETAILED DESCRIPTION

[0016] The present invention provides a controller for improved performance of a wood stove. FIG. 1 illustrates a typical configuration of a wood stove 10 to which the
controller of the present invention may be applied. The wood stove 10 is of typical construction. It includes a combustion chamber 20 in which wood is burned. A door (not shown) operates to allow wood to be placed within the combustion chamber 20 of the wood stove 10. According to current governmental regulations, the door provides an airtight seal to separate the combustion chamber 20 from the surrounding air of the stove. A flue 15 is connected to the combustion chamber 20 to allow smoke and gases to exit the combustion chamber 20.

The stove 10 further includes a pair of spaced apart walls 22, 23. An inner wall 22 surrounds the combustion chamber 20. An outer wall 23 surrounds the inner wall. A heat transfer space 31 is formed between the two walls 22, 23. FIG. 2 is a cross sectional view of the stove. It illustrates the heat transfer space 31. A fan 30 is connected to the wood stove 10 and operates to force air into the heat transfer space 31 between the walls. The fan operates to pass air from the area surrounding the stove into the heat transfer space 31. A set of openings 32 in an upper front portion of the outer wall 23 provides an exit location for air being forced into the heat transfer space 31. During operation of the wood stove 10, the combustion chamber 20 and inner wall 22 are heated from the combustion process. The air within the heat transfer space 31 is heated through contact with the inner wall 22. The air is then forced from the heat transfer space 31 to heat the area around the stove 10. The airflow within the heat transfer space 31 is illustrated in FIG. 2.

A set of vents 24 provide an opening to the combustion chamber for control of draft air. As combustion occurs, smoke, heat and air are exhausted through the chimney. This causes a draft, whichpulls air through the vents 24 into the combustion chamber. Sufficient air is necessary for combustion. The amount of air available can be controlled by the opening of the vents 24 by a damper on the chimney, which controls the amount exhausted. While the present invention is described with respect to control of vents, it may also include control of a damper. Additionally, a fan can be used to force air into the combustion chamber. Any of these mechanisms control the amount of air in the combustion chamber which is available for combustion and control of the draft air.

The vents 24 include closures (not shown) for adjusting the opening size of the vents 24. With the vents open, more air is available in the combustion chamber 20 for the combustion process. The amount of air available controls the combustion process. According to an embodiment of the present invention, the vents are controlled with an electro-mechanical servo-controlled actuator. The actuator is connected to vents so that the vents can be opened and closed through signals provided to the actuator. A low-cost, commonly available, off-the-shelf actuator typically used for radio controlled airplanes, cars, boats and other toys can be used for the actuator.

FIGS. 1 and 2 illustrate a known configuration of a wood stove to which the controller of the present invention can be applied. However, the present invention is not limited to such a construction. It may be used with any wood stove or furnace which allows control of draft air and/or heat transfer air.

The present invention further includes a controller 40 for controlling operation of the fan 30 and the vents 24 in a manner to achieve desired performance. Preferably, the controller 40 includes a microprocessor or other device for receiving inputs (as discussed below) and provide outputs to control the stove. A non-volatile memory is connected to the microprocessor. The memory includes a program executable by the microprocessor to perform the control desired with respect to the present invention. The memory is capable of being reprogrammed with an updated program to improve performance further or to add new features.

A thermocouple 41 or similar device is connected to the stove. As illustrated in FIG. 1, the thermocouple 41 may be connected to the inner wall 22 to provide an accurate temperature of the stove. Alternatively, the thermocouple 41 could be attached to the outer wall 23 to provide a more accurate temperature reading or to another location in the room. More than one thermocouple can be used to provide temperatures at different locations throughout the room to allow different kinds of control.

The controller 40 is connected to the thermocouple 41 to receive an input regarding the temperature of the fire and/or room. The controller uses the information regarding temperature 40 to control the opening of the vents 24 and the speed of the heat transfer fan 30 to achieve desired results. One advantage of the present invention is the flexibility provided by the controller 40. The flexibility is provided by the programming of the controller. Under prior art systems, a current temperature is used to control operation of the wood stove. The programmable controller of the present invention allows the history and condition of the fire to be used, in connection with the current temperature to provide control. This allows more complete control to be provided.

FIG. 3 illustrates a typical temperature profile for a wood stove over time. When started, the fire takes some time for the wood to dry and to begin producing heat. It then has a fairly constant high temperature level for a period of time. As the fuel supply begins to be exhausted, the temperature starts to drop off. The amount of air needed for combustion, illustrated in FIG. 4, depends not only on the temperature of the fire, but also on the rate of change of the temperature and the position of the fire within the combustion cycle illustrated in FIG. 3. Similarly, the speed of the air passing through the heat transfer space 31 to achieve desired performance will also depend upon the combustion cycle. FIG. 5 illustrates a desired fan velocity profile in connection with the combustion cycle in FIG. 3. The controller of the present invention uses the temperature of the stove, obtained from the thermocouple 41, in connection with programming relating to prior temperatures, desired performance or operation of the stove, and current changes in temperatures to provide the necessary control.

Operational characteristics of the controller are discussed below. These only represent examples of how the controller of the present invention may be operated. Other programming can be used for providing different operations for the controller to achieve different results for control of the stove.

The controller monitors the temperature of the stove and adjusts the vents as necessary to control the fire. When a fire is started, the user will press a button on the controller to indicate a start in the fire monitoring process. The controller will fully open the vents. The controller monitors the temperature until a threshold temperature is exceeded. When the threshold is reached, the controller waits a predetermined time, typically one minute, and checks the temperature again. If the temperature has risen, then the vents are closed by an amount that is proportional
to the temperature rise. If the temperature is unchanged, the vents remain the same. If the temperature drops, the vents are opened an amount proportional to the change in temperature in order to restore combustion. The wait, check and adjust process is then continuously repeated until the temperature of the fire falls below a threshold. While control of the vents is described as being proportional to the temperature rise, the present invention does not require just a linear relationship. The proportional relationship may depend upon other factors, such as the absolute temperature. Since the controller is programmable, multiple factors can be used to determine the desired opening level for the vents.

[0027] According to an embodiment of the present invention, the adjustments made to the vent openings by the controller can be varied based upon desired operational characteristics of the stove. Upon starting a fire, the user selects a desired type of operation. Adjustments to the vents are made in order to meet the objectives of the type of operation. The user may change the desired type of operation at any time during operation. The objective of the control algorithm under any type of operation is to maintain the efficient burn of the fire and maintain a consistent volume of draft air to the fire as the temperature increases such that the stove temperature reaches an acceptable peak temperature, rather than overheating and burning up all the fuel prematurely, or smoldering and producing little heat. The different types of operation depend upon the desired rate of temperature increase and peak temperature. According to a preferred embodiment of the invention, several different types of operation are possible:

[0028] In a first type of operation, Mode 1, a maximum burn time is desired. The objective is to utilize the fire to heat the house as long as possible. Burn time is maximized in order to keep from overheating a home. It can also be used to extend the time that the fire will last so that it does not require monitoring, such as overnight or when the home is unoccupied for a period of time. A lower temperature and heat output are accepted in order to extend the burn time. The stove is kept at a low temperature with a restricted vent setting. In this mode, the vents are closed more than in the other modes of operation as the stove heats up. When the maximum desired temperature is reached, the vents are adjusted to maintain that temperature.

[0029] The second type of operation is maximum heat. The objective of this operation is to get as much heat as possible from the stove in a short period of time. It may be used when the home is cold and needs to be heated quickly. Heat output is maximized with a shorter burn time by increasing the air supply and allowing a higher peak temperature. Combustion efficiency may be reduced to extract as much heat as possible in a short period of time.

[0030] The third type of operation is likely to be the most common. Its objective is to maximize heating efficiency of the stove. Efficiency is maximized to realize a maximum heat extraction from the fire relative to the fuel consumed. In this condition, the stove peak temperature is limited to a moderate temperature.

[0031] In addition to the different automatic operational modes, the controller allows a manual mode of operation. In this mode, the controller makes no adjustments to the vent openings. The user may adjust the openings manually as desired. However, the controller continues to monitor operation of the stove in order to prevent problems due to undesirable operation. There is a risk that the user will forget the draft air control, leaving it fully open, creating a condition where the stove becomes hotter than it should. To protect against this happening, the controller will monitor for an “over-temperature” condition in which the temperature of the stove exceeds a preset temperature. If the over-temperature condition exists, the controller will override the manual mode to limit the stove temperature. Specifically, the controller will fully close the vents. Once the temperature has been reduced to a more normal threshold, the vents will be returned to the prior manual setting. Alternatively, the controller may close the vents to a level less than fully closed in order to reduce the temperature of the stove.

[0032] Combinations of manual and automatic modes of operation can also be used to provide greater flexibility for the user. While the controller is in the automatic mode, the user may open or close the vents. A switch on the controller can be used for manual operation of the vent openings. Once the user has changed the vent openings, the automatic mode can continue with the new opening level as the baseline for the current conditions. Thus, the user can adjust the temperature without having to change to a completely different operational mode.

[0033] In addition to controlling operation of the vents, according to an embodiment of the present invention, the controller can provide self-calibration processes to ensure proper operation in connection with different stoves, actuators, thermocouples and other components.

[0034] According to one embodiment of the invention, the vent openings can be calibrated. In this process, the controller moves the draft control to each extreme of its travel while monitoring the electrical current feeding the servo actuator or a position feedback signal. When the draft control reaches the limit of its travel, the servo actuator motor will stall, and the current will increase significantly. The controller will detect the increased current and identify the travel limit. The travel limits are then stored in non-volatile memory and retrieved after the controller has been turned off. The travel limits are used to determine the amount of adjustment necessary during operation of the system. For new installations, the controller will initially begin with default settings which will be restricted after calibration has succeeded. In the event of a mal-adjusted mechanical linkage where the draft control limits are not reached, or the range of travel is insufficient, the controller will post an error message to the LCD display, insisting on a mechanical adjustment and recalibration.

[0035] According to another embodiment of the invention, the servo current characterization is calibrated. To account for variability between servo actuators, the controller characterizes the change in current draw between stalled and non-stalled conditions and calculates a threshold for determining whether the actuator motor stalled.

[0036] According to another embodiment of the invention, the servo actuator provides a feedback signal to the controller. This feedback signal serves to inform the controller of the position of the vent. This is important so that if the user grasps the vent control and moves it, the controller will be able to detect the change in position and act accordingly. Additionally, if a mechanical problem develops and inhibits the vent control from moving, the controller will be able to detect this and issue an audible alert signal.

[0037] According to another embodiment of the invention, the controller will track it’s fire control performance and
adaptively adjust its internal control parameters such that the draft air control changes are scaled to avoid either stifling the fire, or allowing it to become excessively hot. This is important because the draft air supply is dependent upon the exterior ambient air temperature. When the outside air is very cold, there will be a greater amount of draft available, requiring a larger degree of closure as the stove temperature rises. Conversely, when the outside air is warmer, there will be a less amount of draft air supply, requiring a smaller degree of closure as the stove temperature rises.

[0038] According to another embodiment of the invention, the controller will include an exterior temperature sensor which will provide a direct measurement of exterior ambient temperature and enable the controller to directly calculate the proper control parameters for the current conditions.

[0039] According to another embodiment of the invention, the controller calibrates to the thermocouple amplifier gain. To account for variability between thermocouple and thermocouple amplifier gains, the controller gathers data to learn the desired operation. The controller can be taught through manual operation of the stove. During a training phase, typically the first fire during which the controller is used, the controller monitors the temperature of the fire and the manual adjustments to the vents made by the user. This allows the system to account for differences in stoves and in desired conditions. Furthermore, the controller will have preset temperature thresholds to define when the draft air control should be adjusted. The preset thresholds are used if the training has not occurred.

[0040] According to another embodiment of the invention, a small fan is positioned at the vents to force additional air into the combustion chamber. Current air-light, high efficiency wood stoves operate very efficiently when they have reached a proper operating temperature. However, prior to reaching an optimum operating temperature and consequently adequate draft air, they may lack the ability to burn properly. The door to the combustion chamber is often left slightly ajar by the user to permit additional air to enter the chamber. When a fire is started, the controller will activate the fan to provide additional air to the combustion chamber. This eliminates the need to leave the door slightly open. The fan is disabled after the combustion chamber temperature has reached a temperature threshold. Of course, the fan can be used at any time during operation of the stove to provide additional control for the draft air.

[0041] The system of the present invention includes various power monitoring and control capabilities. The draft control is closed upon the occurrence of a power loss. The controller also saves the current operating state in non-volatile memory for recovery when power is restored. In order to allow for power loss control, the controller hardware includes a super-capacon which stores enough energy to maintain control long enough to close the draft air control. The super-capacitor acts like a small rechargeable battery, yet without the reliability, cost and size issues associated with a Ni-CAD battery pack.

[0042] During operation, the microprocessor constantly monitors the power supply voltage. If the AC power is lost, the microcontroller immediately detects this and takes several measures:

[0043] a. Posts a “POWER LOSS” message to the LCD display.

[0044] b. Stores the current operating state in non-volatile memory, particularly the current stove temperature and the position of the draft air control.

[0045] c. Closes the draft air control.

[0046] d. Waits to see if the power is restored.

[0047] e. If the power is restored while the microcontroller is still running, then it will return the draft air control to the prior setting and return to normal operation.

[0048] f. If the power is restored after the microcontroller shuts down, then the controller will read the stove temperature from memory and compare this against the current stove temperature. If the two temperatures are close together, then the damper control will be returned to the setting stored in memory. If the current temperature is very low, suggesting that there is no longer any fire, then the damper is closed. If the current temperature is significantly lower than the temperature from memory, but high enough to indicate a remaining fire, then the damper will be fully opened to attempt to restore the fire and resume heating.

[0049] According to another embodiment of the present invention, an uninterruptible power feature may be provided that maintains full power and control for a duration of hours or days to support remote installations where power losses are common. This uninterruptible power supply may consist of small batteries, rechargeable or otherwise, that continue operation until such time as power is restored. In the event of extended operation and such time that battery power becomes reduced, the controller will sense the low power condition and post a message to the LCD display. If the battery power becomes critically low, then the system will shut down as described above.

[0050] According to another embodiment of the present invention, the controller determines when more fuel is required and activates an alert. As the controller monitors the temperature of the stove, eventually all fuel will be consumed, requiring additional wood to be added. When the temperature reaches a predetermined level, which cannot be increased through draft air control, an audible alert is activated to inform the user that the fire has declined to the proper point where wood should be added.

[0051] In addition to control draft air, the controller of the present invention adjusts the heat transfer fan base upon the desired operation. According to a preferred embodiment, the draft air and circulating fan are controlled jointly to achieve the desired operating characteristics. In automatic mode (independent of the selected operation), the controller adjusts the circulation fan(s) in proportion to the stove temperature. As the temperature increases or drops, the speed of the circulating fan will be adjusted similarly. The level of adjustment to the fan will depend upon the operating mode of the system. In the maximum burn mode, the fan will be kept at a low speed in order to minimize fan noise. In the maximum heat transfer mode, the fan is operated at the maximum fan speed once operating temperature has been reached. In the maximum efficiency mode, the fan is operated at a middle level.

[0052] As with operation of the draft air control, in manual mode, the fan speed is specified by the user. If the stove reaches an over-temperature condition, the controller will override the manual mode and set the fans to maximum speed until the temperature drops. Once the temperature has reached a desired operating temperature again, the fan will be returned to the manually set level.
According to another embodiment of the invention, the controller provides an alert for an extreme over-temperature condition. If the temperature of the stove exceeds an extreme threshold level, even with the over-temperature adjustments, it is likely that a mechanical failure exists. In such event, the controller will activate an audible alarm so the user can address the problem immediately. With added electronic controls, the controller can be programmed to call a pager or cell phone under this condition to provide an alert to a user who is not present at the home.

According to another embodiment of the invention, the controller includes electronic controls to keep track of the time, and in such case where the operating mode and temperature defines that the fan should be set at a high speed, but user-defined time settings have specified an overriding “Quiet Time”, the controller will maintain a slower speed to reduce ambient fan noise until such Quiet Time has expired, whereupon the controller will reset the fan to such higher speed as required by the current temperature and operating mode. This Quiet Time may consist of a range of times whereupon the controller must operate quietly between the two times, or a single specification of a time duration beginning with the present time.

In addition to controlling operation of the stove, according to an embodiment of the invention, the controller maintains a log of operation of the stove. The controller logs temperature measurements, draft air control settings, and circulation fan speeds in non-volatile memory, such as an EEPROM. A computer interface allows the data from the memory to be downloaded to a computer for review and analysis. The computer interface may also be used to adjust the thresholds for greater control of operation of the stove.

Having disclosed at least one embodiment of the present invention, various adaptations, modifications, additions, and improvements will be readily apparent to those of ordinary skill in the art. Such adaptations, modifications, additions and improvements are considered part of the invention which is only limited by the several claims attached hereto.

1. A method for controlling operation of a wood stove having at least one adjustable vent for controlling an amount of air entering a combustion chamber of the wood stove and at least one temperature sensor, the method comprising the steps of:
   determining a change in temperature; and
   adjusting the at least one adjustable vent based upon the change in temperature.

2. The method for controlling operation of a wood stove according to claim 1, wherein an extent of adjustment of the adjustable vent is proportional to the change in temperature.

3. The method for controlling operation of a wood stove according to claim 1, wherein an extent of adjustment of the adjustable vent depends upon a rate of temperature change.

4. The method for controlling operation of a wood stove according to claim 1, further comprising the step of receiving an input representing an operational mode for the wood stove; and wherein an extent of adjustment of the adjustable vent depends upon the an operational mode for the wood stove.

5. The method for controlling operation of a wood stove according to claim 4, wherein the operational mode includes at one of a maximum burn time mode, a maximum heat output mode, and a heating efficiency mode.

6. The method for controlling operation of a wood stove according to claim 1, further comprising the steps of:
   determining a rate of temperature change for a vent opening level; and
   wherein the adjusting step includes adjusting the at least one adjustable vent based upon the rate of temperature change.

7. The method for controlling operation of a wood stove according to claim 1, wherein the adjusting step includes adjusting the at least one adjustable vent based upon an external temperature.

8. The method for controlling operation of a wood stove according to claim 1, further comprising the steps of:
   determining temperature of the wood stove at periodic intervals during manual operation of the stove;
   determining vent opening levels for the at least one adjustable vent at the periodic intervals during manual operation of the stove;
   storing the determined temperature and vent opening levels; and
   wherein the adjusting step includes adjusting the at least one adjustable vent based upon the stored determined temperatures and vent opening levels.

9. The method for controlling operation of a wood stove according to claim 1, further comprising the step of forcing air into the combustion chamber of the wood stove based upon the change in temperature.

10. The method for controlling operation of a wood stove according to claim 1, wherein the wood stove includes a fan for moving air to transfer heat from the stove to a room, the method further comprising the step of:
   adjusting a speed of the fan based upon the change in temperature.

11. The method for controlling operation of a wood stove according to claim 10, wherein the speed of the fan is adjusted based upon a selected mode of operation of the wood stove.

12. A method for controlling operation of a wood stove having a fan for moving air to transfer heat from the stove to a room and at least one temperature sensor, the method comprising the steps of:
   determining a change in temperature; and
   adjusting a speed of the fan based upon the change in temperature.

13. The method for controlling operation of a wood stove according to claim 12, further comprising the step of receiving an input representing a operational mode for the wood stove; and wherein an extent of adjustment of the adjustable vent depends upon the an operational mode for the wood stove.

14. A system for controlling a wood stove having at least one adjustable vent for controlling an amount of air entering a combustion chamber of the wood stove, the system comprising:
   a temperature sensor for sensing a temperature of the wood stove;
   an actuator connected to the at least one adjustable vent for changing an opening of the at least one adjustable vent; and
   a programmable controller connected to the temperature sensor and the actuator for controlling the actuator based upon an output from the temperature sensor and operational characteristics of the wood stove.
15. The system for controlling a wood stove according to claim 14, wherein the programmable controller includes a training mode for determining operational characteristics of the wood stove.

16. The system for controlling a wood stove according to claim 14, further comprising:
   a external temperature sensor for sensing an external air temperature connected to the programmable controller; and
   wherein the programmable controller controls the actuator based upon an output from the external sensor.

17. The system for controlling a wood stove according to claim 14, wherein the programmable controller includes an input representing a desired operational mode of the wood stove.

18. The system for controlling a wood stove according to claim 14, wherein the wood stove includes a fan for moving air to transfer heat from the stove to a room, the system further comprising:
   a second actuator connected to the programmable controller for controlling a speed of the fan; and
   wherein the programmable controller controls the second actuator based upon the output from the temperature sensor and the operational characteristics of the wood stove.

19. A method for controlling operation of a wood stove having at least one adjustable vent for controlling an amount of air entering the combustion chamber of the wood stove and at least one temperature sensor, the method comprising the steps of:
   selecting a operational mode;
   sensing a temperature of the wood stove;
   determining an opening level of the at least one adjustable vent based upon the selected operational mode and the sensed temperature; and
   adjusting the at least one adjustable vent to the determined opening level.

20. A method for controlling operation of a wood stove having at least one adjustable vent for controlling an amount of air entering the combustion chamber of the wood stove and at least one temperature sensor, the method comprising the steps of:
   during a first operational mode:
   sensing changes to an opening level of the at least one adjustable vent made by a user of the wood stove;
   sensing a temperature when a change in the opening level of the at least one adjustable vent is sensed; and
   storing the temperature level and opening level; and
   during a second operational mode:
   sensing a temperature level; and
   adjusting an opening level of the at least one adjustable vent based upon the sensed temperature level and the stored temperature level and opening level.

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