Nov. 30, 1948. W. W. HALLINAN 2,455,250

HEATING SYSTEM

Filed March 1, 1946 2 Sheets-Sheet 1

Fig. 1

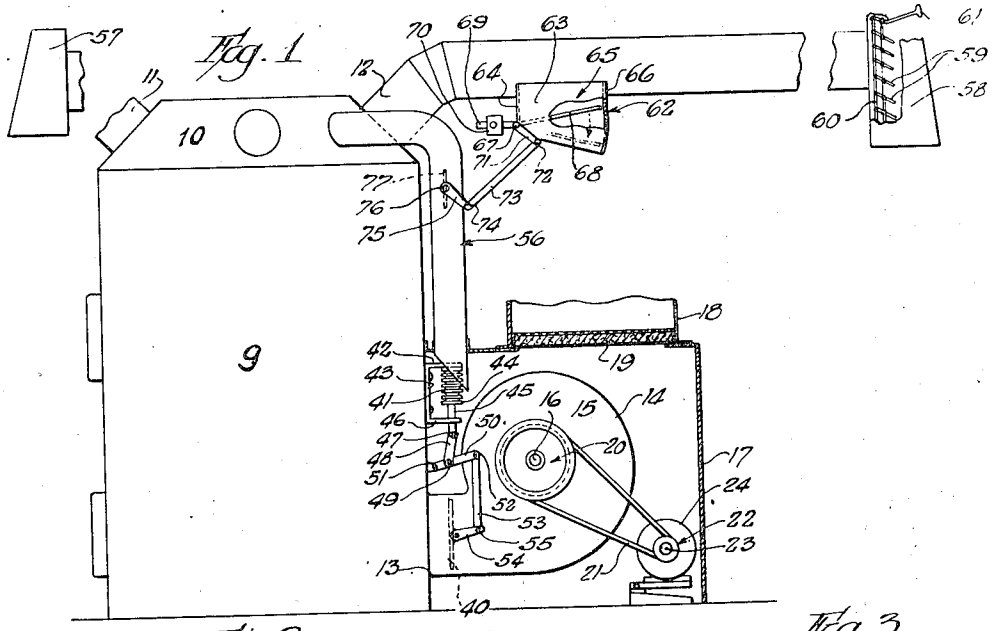


Fig. 2

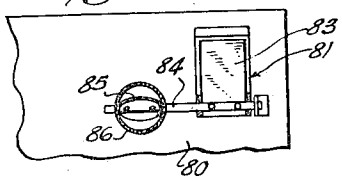


Fig. 3

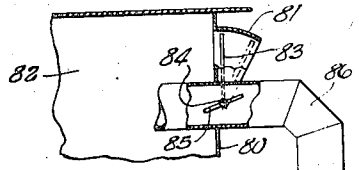
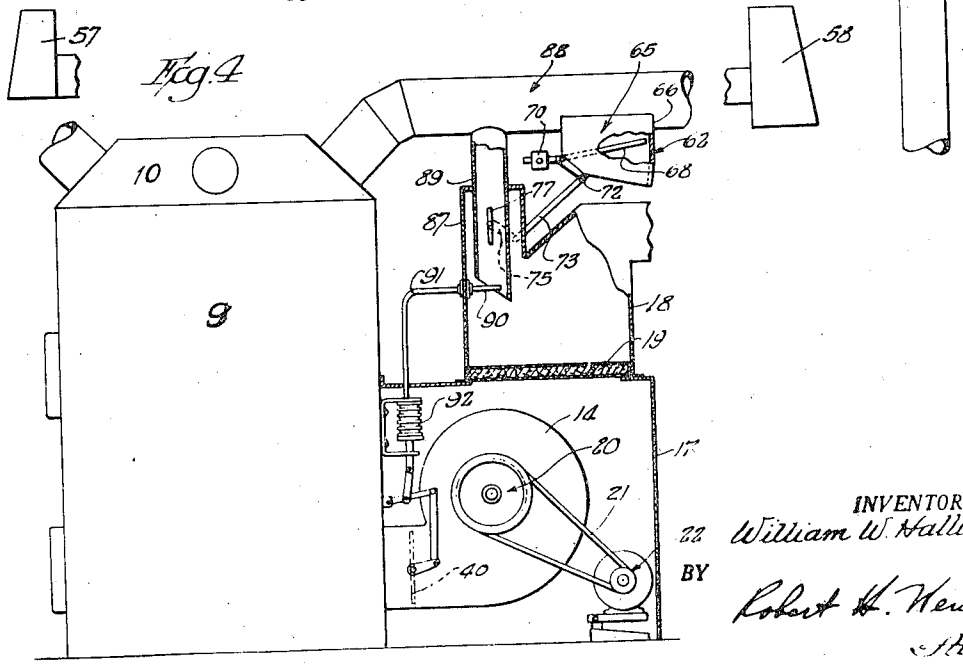


Fig. 4



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HEATING SYSTEM

Filed March 1, 1946 2 Sheets-Sheet 2

Fig. 5

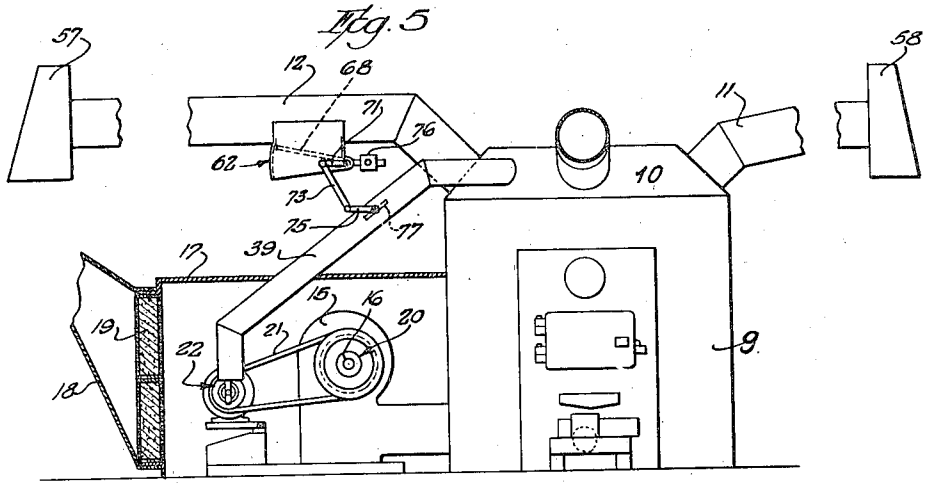


Fig. 6

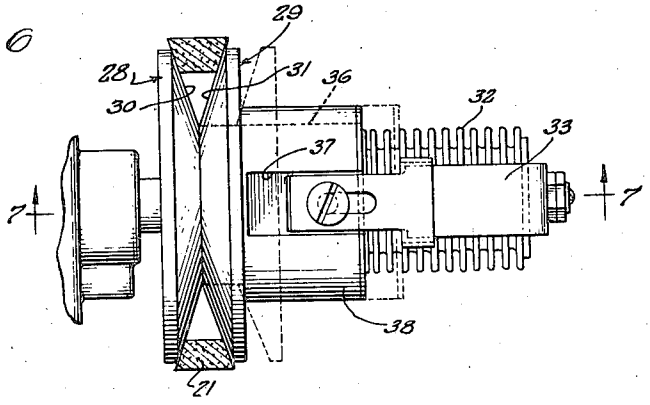
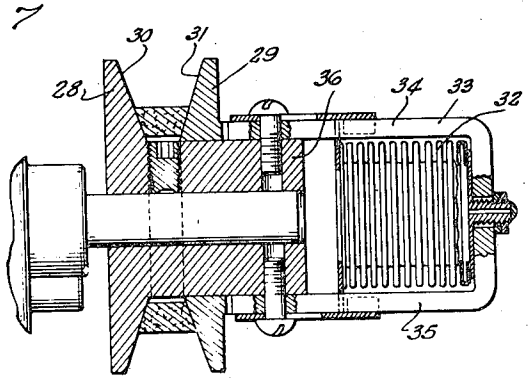


Fig. 7



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UNITED STATES PATENT OFFICE

2,455,250

HEATING SYSTEM

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Application March 1, 1946, Serial No. 651,177

5 Claims. (Cl. 237—2)

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The present invention relates to heating systems, and is particularly concerned with heating systems of the type employing a warm air furnace or other source of heated air. In the warm air furnace installations of the prior art the size of the furnace, the number, and size of hot or cold air ducts are proportioned with respect to the size and character of the rooms that are to be heated and their location, number of windows, etc. Thus, when the installation is completed, the size of the ducts is so proportioned that when all of the registers are open, the system is balanced and each room will receive its predetermined amount of warm air, which is calculated to keep the rooms all at the desired temperature.

Although such systems are balanced when all of the registers are open, they are not balanced when any registers are closed; and this is particularly bad, as the blower is adapted to provide the volume of hot air which is necessary for all of the rooms, and this condition continues even though the user has closed a number of registers. The housewife may, and does, often close off the registers leading to the sleeping rooms or to parlors or other rooms which are not used frequently or which she may desire to keep cool.

This causes a large volume of hot air, which was intended to heat the rooms that have been shut off, to be poured out into the remaining rooms, giving a condition of high, uncomfortable air velocity and overheating.

One of the objects of the present invention is the provision of an improved heating system wherein the closing of any of the registers at the hot air output into the rooms will regulate the conditions existing at the furnace so that the volume of air passing through the bonnet of the furnace is constantly proportioned to the number of registers which may be open, thus keeping the system in a balanced condition at all times.

Another object of the invention is the provision of an improved heating system in which the volume of air passing through the furnace bonnet is constantly proportioned to the number of registers which may be open at any time and in which the opening of a register correspondingly increases the volume of air passing through the furnace bonnet so as to supply that register with its proper amount of air, while still supplying all of the others.

Another object of the invention is the provision of an improved system wherein the closing of any register is adapted to bring about a chain of events which results in the reduction of the volume of the air passing through the furnace

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bonnet by an amount which is substantially equal to that which would be required by the register or registers which are closed.

Another object of the invention is the provision of a modified, improved system in which the volume of air that is driven through a furnace bonnet by means of a blower is constantly proportioned to the temperature of the air which is being supplied by the furnace.

Another object of the invention is the provision of an improved heating system in which the blower is adapted to be driven by a thermostatically controlled variable diameter pulley on the shaft of a constant speed motor and in which the volume of air supplied to the furnace bonnet is proportioned to the number of registers that is open at any time.

Another object of the invention is the provision of improved heat control devices of the class described which are simple, capable of being installed in the existing heating systems, and adapted to be used for a long period of time without necessity for repair or replacement.

Another object of the invention is the provision of an improved heating system in which the volume of air delivered through the registers is controlled by both its temperature and its pressure.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings, of which there are two sheets, Fig. 1 is a diagrammatic elevational view of a heating system embodying the present invention;

Fig. 2 is a fragmentary elevational view, with a hot air pipe in section, showing the application of the mechanism of this system installed in the partition of a standard winter air conditioning unit, with the two dampers mounted upon a single shaft;

Fig. 3 is a fragmentary sectional side elevational view of the mechanism of Fig. 2;

Fig. 4 is a similar view to Fig. 1 of a modification in which the damper, which regulates the volume of cold air, is regulated by the temperature of the air in the bonnet or being discharged from the hot air ducts of the bonnet;

Fig. 5 is a diagrammatic elevational view of another modified heating system, in which the speed of drive of a blower is regulated proportionately to the number of registers that may be open by varying the amount of hot air delivered

to a thermostatically controlled variable diameter pulley on the shaft of a constant speed motor;

Fig. 6 is a side elevational view of a variable diameter pulley of the type used in Fig. 5;

Fig. 7 is a similar view in partial section, taken on the plane of the line 7—7 of Fig. 6, looking in the direction of the arrows, showing the details of construction of the pulley.

Referring to Fig. 1, this is a diagrammatic illustration of a heating system embodying my invention. In this figure 10 indicates the bonnet of a hot air furnace including any suitable source of heat, such as gas, oil, or coal burner, and this bonnet is provided with a plurality of hot air discharge conduits 11, 12 at the top and with a cold air inlet 13 at the bottom.

The cold air inlet connects with a housing 14 of a centrifugal blower 15, which has its intake located at either or both ends of the shaft 16. The centrifugal blower 15 is located in a cold air duct or housing 17, which communicates with a cold air inlet duct 18 and may be provided with the usual air filter 19. The centrifugal blower 15 has the usual centrifugal impeller on the shaft 16, which is driven by a V pulley 20 of the type shown in Fig. 7. The pulley 20 is driven by means of V belt 21, which also engages the V drive pulley 22 on the shaft 23 of a constant speed motor 24.

The present blower system is preferably provided with a damper 40 located in the inlet to the furnace bonnet 10 that is the outlet from the blower housing 14.

In other embodiments of the invention the damper 40 may be located in the inlet to the housing 14 or the hot air ducts 11, 12, or the inlet conduit 13 to the cold air duct 17. This damper 40 is adapted to effect a control of the volume of air being driven through the furnace bonnet 10 responsive to the action of a thermostat 41. This thermostat may consist of a closed metallic bellows filled with a suitable supply of refrigerant, such as Freon, one end of the bellows being secured to the upper arm 42 of a supporting frame 43.

The lower end of the bellows may be carried by the circular plate 44 of a plunger 45 that is slidably mounted in a bore in the lower arm 46 of the frame 43.

The plunger 45 is pivotally connected at 47 to a link 48, which is pivotally connected at 49 to a lever 50. The lever 50 has one end pivoted at 51 to a bracket carried by the wall of the furnace casing 9 and the other end is pivotally connected at 52 to a link 53, which is pivotally connected to the bellcrank arm 54 at 55.

The bellcrank arm 54 is fixedly secured to the damper 40. The damper 40 is preferably arranged in such a position that it is closed or almost closed when the thermostat 41 is cold; but, when the thermostat 41 is heated, it moves the plunger 45 downward, acting on the lever 50 and link 53, moving the damper 40 in a clockwise direction in Fig. 1 to effect an opening of the inlet 13.

The thermostat 41 may be subjected to the temperature of air discharged from the furnace bonnet 10 by having another conduit 56 extending from the top of the furnace bonnet down into the cold air duct 17.

In this case the end of the conduit 56 partially surrounds the thermostat 41, which may be accomplished by merely beveling off the end of the conduit 56 so that the end does not interfere with the bracket 43. In other embodiments the end of the conduit 56 may be slotted for the bracket arm 42 and extended to surround the bellows 41 so as to bring the warm air into closer contact with the thermostat 41.

Thus, the contraction of the bellows 41 tends to maintain the cold air inlet 13 closed except when the furnace is heated and hot air discharged from the furnace bonnet 10 is of such temperature as to cause expansion of the thermostat 41, tending to open the inlet 13.

The hot air ducts 11 and 12 are each provided with a suitable register 57, 58, preferably of the type having a plurality of louvers 59 joined by an actuating bar 60, which can be actuated by means of a hand lever 61 to open or close the louvers. Any type of register, however, may be employed which is provided with a closure, such as an automatic temperature-controlled register operated by a room thermostat.

One of the hot air ducts, such as the air duct 12, is preferably provided with a pressure responsive device of the type indicated at 62. This consists of a laterally extending housing 63, which is provided with an end wall 64 that is curved to fit the pipe or conduit 12 at its upper edge, two side walls 65, and an end wall 66.

Like the end wall 64, the upper edge of the end wall 66 is curved to fit the pipe 12, but the end wall 66 is formed to be partially cylindrical upon a center which corresponds to the center of pivot 67 of a pressure vane 68.

The pressure vane 68 is pivoted at 67 upon the lower edge of the wall 64 and is provided with a rearwardly extending balance arm 69, carrying an adjustable weight 70. The housing 65 is preferably rectangular in bottom plan, and the vane 68 in complementary in shape, that is, rectangular, so that its edges are only silghtly spaced from the side walls 65 and from the cylindrically curved end wall 66.

Thus, the vane 68 may move pivotally with a minimum amount of friction and a minimum amount of air leakage. It may be actuated by very slight changes in pressure in the entire system, which includes the furnace bonnet 10 and air ducts 11, 12. The pivot shaft 67 for the vane 68 preferably has a laterally extending crank arm 71, which is pivotally connected at 72 to a link 73 that is pivotally connected at 74 to a damper arm 75.

The damper arm 75 is fixedly secured to a damper shaft 76, which carries a butterfly damper 77 located in the hot air pipe 56 that conducts the hot air to the thermostat 41. The operation of this form of mechanism is as follows:

When the heating system is installed, the sizes of the furnace bonnet and the various conduits are made such that each room gets the desired amount of heat when all of the registers are open. Were it not for the mechanism of the present invention, when one or more of the registers is closed, the system would be out of balance; and the hot air, which would otherwise go to the room where the register is now closed, would be conducted to other rooms, with the result that, although one register is closed, a larger amount of hot air pours out of the other hot air ducts, creating high air velocities and overheating the other rooms.

When one of the registers is closed, this naturally causes an increase in the static pressure in the various ducts of the heating system. Such an increase of pressure may amount to only a

few ounces or a fraction of an ounce, but the vane 68 is quite sensitively balanced by means of an adjustable weight 70.

According to my invention, any increase in the static pressure in the conduit 12 causes the vane 68 to be moved downward from the full line position to the dotted line position or to some intermediate position.

As the vane 68 moves downward, the crank arms and links 71, 75, 73 tend to turn the butterfly damper 77 so as to throttle the amount of hot air that is fed to the thermostat 41. Ordinarily the butterfly damper 40 is closed when the furnace is cold and opened as the furnace comes up to proper heat, so that the heating of the thermostat 41 tends to open the damper 40.

Any throttling of the heated air in the conduit 56 diminishes the hot air that pours upon the thermostat 41, and this hot air, being mixed with cold air in the housing 17, the heating effect on the thermostat 41 is diminished. Thus, whenever, a register is closed, the vane 68 is actuated to a predetermined degree, closing the damper 77 to a predetermined degree, diminishing the heat on the thermostat 41 and tending to close the damper 40 to a predetermined degree.

Closing of a register thus diminishes the amount of air which is driven through the heating system by the blower. Closing of two registers will diminish this amount of air still more and causes the damper 40 to close still further, diminishing the volume of air which passes through the system in a proportionate amount.

Closing of all of the registers will effect a substantial closure of the damper 40, keeping, in the bonnet, the heat which is generated in the furnace; and of course the furnace will be shut off by the temperature limit switch, thus saving the fuel, which would otherwise be lost by the furnace heating up in spite of the registers being closed.

The present system is thus adapted to regulate the amount of air passing through the system and out of the registers in proportion to the number of registers that are open, and to diminish the amount of air in proportion to the number of registers that have been closed.

Referring now to Figs. 2 and 3, these are modifications in which the pressure responsive vane and the butterfly damper which it actuates are directly mounted on the same shaft, as may be done when this mechanism is installed in the partition of a standard winter air conditioning unit.

In this case the partition is indicated by the numeral 80, and it is provided with a laterally projecting housing 81, similar to the housing 65, previously described, and communicating with the space 82 on the hot air side of the partition 80. The vane 83 operates similar to the vane 68, but it is fixedly mounted on the shaft 84, which also supports the butterfly valve 85 located in the conduit 86 that is adjacent to the conduit 81.

The hot air pipe 86 is again used to direct hot air from the top of the furnace bonnet on a thermostat 41 like that of Fig. 1, and all of the other details of the system may be exactly as described in Fig. 1.

The operation of the device of Fig. 3 is practically the same as that of Fig. 1, except that the vane 83 actuates the damper 85 directly through the shaft 84.

Referring now to Fig. 4, this is another diagrammatic illustration of a modification which is similar to Fig. 1, but instead of having the pipe, which conducts a sample of the hot air from the

furnace casing, discharge on the bellows thermostat, this pipe may be located anywhere and may have a bulb containing the expansible fluid in it, the bulb being connected by a tube to the bellows. In this embodiment the hot air pipe 88 has a small pipe 89 which communicates with the cold air inlet 18, and which is provided with the same damper 77. The pipe 87 contains a bulb 90 which communicates by means of tube 91 with bellows 92. In some cases the bulb 90 might be located in the furnace bonnet 10.

The operation of this modified form of the heating system is substantially the same as described with respect to Fig. 1.

I desire it to be understood that where thermoplastic bellows are disclosed throughout the present application, other types of thermostats, such as bimetallic thermostats or the wafer type of thermostats may also be employed.

Referring now to Fig. 5, this is an additional improvement over the heating system disclosed in my prior Patent No. 2,275,429, Variable speed pulley, which issued March 10, 1942.

In this modification a thermostatically controlled variable diameter pulley is employed for effecting a zone control, as achieved by the system of Fig. 1.

The thermostatically controlled pulley 22 includes a fixed pulley section 28, upon which is slidably mounted a movable pulley section 29, both of these pulley sections having the opposed frusto-conical surfaces 30, 31 for engaging the V belt 21. The pulley sections 28 and 29 are controlled by a thermostat 32, which may be of the bellows type, and which has its right or fixed end carried by a frame 33 or housing of substantially U shape.

The legs 34, 35 are fixedly secured to the hub 36 of the fixed pulley section 28. The movable pulley section 29 has a slot 37 for receiving the legs of the frame so that this section may slide, but cannot rotate relative to the fixed pulley section 28.

The thermostat 32 reacts against the frame 33 and acts on the end of the hub 38 on the movable pulley section to urge the two pulley sections together.

Referring to Figs. 6 and 7, Fig. 6 shows the pulley in its position of maximum diameter, the thermostat having expanded to force the two pulley sections together, the belt riding outward on the frusto-conical surfaces 30 and 31 to the position shown.

Fig. 7 shows the position of the parts when the thermostat is contracted and the belt has forced the sections apart until it almost rides on the hub 38.

The bellows thermostat 32 is preferably filled with a suitable supply of volatile refrigerant, which begins to vaporize at a predetermined temperature and is sufficient in amount so that all is vaporized when the thermostat has expanded to the maximum pulley diameter.

Thus the thermostat will not be ruptured by additional expansion of the refrigerant, which takes place merely on superheating, and will not be excessive. Various types of refrigerant may be used, as described in my prior application; but for an air conditioning installation I prefer to use trichloromonofluoromethane (F11). The refrigerant selected would depend upon the range of temperatures desired.

The thermostat 32 of the variable diameter pulley 22 is preferably subjected to the action of a sample or specimen of air from the top of the

furnace bonnet 10, and this may be accomplished by extending a small hot air conduit 39 from the top of the furnace bonnet down into the housing 17 into a position where the axially turned end of the conduit 39 surrounds the thermostat of the pulley 22.

Thus, when the blower is being driven, there will be a circulation of hot air from the furnace bonnet directly to the thermostat 32 so that the variable diameter pulley 22 is actuated responsive to the temperature of the air which is being discharged from the furnace bonnet.

The operation of this part of the system so far may be substantially as described in my prior Patent No. 2,275,429; the details of the thermostatic pulley may also be as described therein.

As the temperature of the air increases, the thermostat 32 expands, driving the pulley sections together and increasing the effective diameter of the driving pulley 22. This increases the speed of rotation of the blower shaft 16 and increases the volume of air passing through the furnace bonnet 10.

As the temperature of the furnace increases, a greater volume of air may be blown through it. As the temperature of the air discharged from the furnace bonnet decreases, the blower is slowed down, and thus there are no cold drafts of air blown into the room when the present system is used, although the blower is driven by a constant speed motor.

In addition to this result, the present modification is adapted to effect a zone control of the hot air which is discharged from the furnace bonnet 10. For this purpose the conduit 39, which extends from the top of the bonnet 10 and conducts air to the thermostat 32, is again provided with a damper 77 adapted to be actuated by a pressure responsive vane 68 in a manner similar to that disclosed in Fig. 1. All of the same interconnecting mechanism may be employed, as shown in Fig. 1; or, when this device is installed in the partition of a standard winter air conditioning unit, the vane may be connected to the damper, as shown in Figs. 2 and 3.

The operation of this modification is as follows: When a register is closed, there is an increase of the static pressure in all of the hot air ducts, including the one in which the pressure responsive device is located. It does not matter which register is closed, as the closure of one of the registers introduces a restriction to the outlet of the hot air from the system so that there is necessarily an increase in static pressure in all of the hot air ducts.

This tends to move the vane 68 downward in Fig. 5 and tends to close the damper 77. This diminishes the amount of hot air which is discharged on the thermostat 32 of the variable diameter pulley and causes the thermostat to contract slightly. The contraction of the thermostat diminishes the effective diameter of the pulley, comprising the two sections 25, 26, so that the blower is driven more slowly.

The speed of the blower may thus be made proportional to the number or size of registers which are closed, and the amount of air which is driven through the system will thus be made responsive to the number of registers that are left open.

It will thus be observed that I have invented an improved heating system in which there is effected an automatic zone control for regulating the amount of air that is driven through the system by the blower, in accordance with the number of registers that may be open at any time.

My improved heating system may be embodied in any of the modern existing installations by merely adding the devices which are necessary to effect this control, while still utilizing the same blower and the same constant speed motor and other equipment of the heating system.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a heating system, the combination with a hot air furnace having a furnace housing for circulation of air to be heated by the furnace, said housing having a cold air inlet, a blower connected to said inlet, and a substantially constant speed motor for driving said blower, said housing also having a plurality of outlets and conduits leading to the various rooms to be heated, each of said rooms being provided with adjustable register openings and conduits of suitable proportion to the size of the room, whereby at the full register opening and full air circulation by the blower, each room receives a predetermined amount of heat, a damper located to throttle the supply of air by the blower to the furnace housing, and a thermostat for controlling said damper, said thermostat being connected to the damper in such manner that an increase in temperature of the thermostat, resulting in its expansion, tends to open the damper, and contraction of the thermostat, due to lack of heat and reduced temperature of the thermostat, tends to close the damper, a conduit leading from a point in the housing and conduit system, which is filled with hot air, for conducting hot air to the space surrounding the thermostat, and a pressure responsive flap pivotally mounted on one of the hot air conduits of the system, and forming a movable wall which moves responsive to pressure of the hot air in the system, said flap being mechanically connected to a damper located in the latter conduit between the thermostat and the source of hot air, the said flap being so connected to said latter damper that upon closing of a register in a room, the increase in pressure near the hot air end of the system causes the flap to move to effect a partial closure of said damper, said partial closure throttling the hot air, which influences the temperature of the thermostat, and the relative cooling of the thermostat effecting a partial closure of the damper throttling the cold air inlet, to reduce the total volume of air circulated through the system responsive to the closure of a register, so that the hot air supplied will still be in suitable volume for the remaining registers.

2. In a heating system, the combination with a hot air furnace having a furnace housing for circulation of air to be heated by the furnace, said housing having a cold air inlet, a blower connected to said inlet, and a substantially constant speed motor for driving said blower, said housing also having a plurality of outlets and conduits leading to the various rooms to be heated, each of said rooms being provided with adjustable register openings and conduits of suitable proportion to the size of the room, whereby at the full register opening and full air circulation

by the blower, each room receives a predetermined amount of heat, a damper located to throttle the supply of air by the blower to the furnace housing, and a thermostat for controlling said damper, said thermostat being connected to the damper in such manner that an increase in temperature of the thermostat, resulting in its expansion, tends to open the damper, and contraction of the thermostat, due to lack of heat and reduced temperature of the thermostat, tends to close the damper, a conduit leading from a point in the housing and conduit system, which is filled with hot air, for conducting hot air to the space surrounding the thermostat, and a pressure responsive flap pivotally mounted on one of the hot air conduits of the system, and forming a movable wall which moves responsive to pressure of the hot air in the system, said flap being mechanically connected to a damper located in the latter conduit between the thermostat and the source of hot air, the said flap being so connected to said latter damper that upon closing of a register in a room, the increase in pressure near the hot air end of the system causes the flap to move to effect a partial closure of said damper, said partial closure throttling the hot air, which influences the temperature of the thermostat, and the relative cooling of the thermostat effecting a partial closure of the damper, throttling the cold air inlet, to reduce the total volume of air circulated through the system responsive to the closure of a register, so that the hot air supplied will still be in suitable volume for the remaining registers, said flap being pivotally mounted in a flat sided box attached to and in communication with a hot air conduit, and the weight of the said flap being counter-balanced by an oppositely extending arm carrying a balance weight.

3. In a heating system, the combination of a hot air furnace having a housing and having a cold air inlet and a plurality of hot air outlets, a blower having its outlet connected to the cold air inlet, and having a throttling valve interposed between the blower and said inlet, a substantially constant speed motor for driving said blower, a cold air inlet housing surrounding the blower and motor, a thermostat located in said cold air inlet housing, a plurality of conduits leading from the hot air outlets of the furnace housing to various rooms, and closable registers at the ends of said conduits in said rooms, each room having its conduit and register proportionate in opening size to the size of the room, an auxiliary conduit leading from a point in the system having a supply of hot air under pressure, and extending to a point adjacent said thermostat to discharge hot air on the thermostat, said thermostat being connected to the throttling valve in the cold air inlet in such manner as to close said valve when the thermostat is cold and to open the valve as the thermostat becomes heated in proportion to its temperature, a throttling valve in said auxiliary conduit, a pressure responsive device connected to be subjected to the pressure of the hot air in the upper part of the system, and mechanical connections between said pressure responsive device and said latter throttling valve, to effect a partial closure of said latter throttling valve whenever pressure is increased in the system, the increase in pressure in the upper part of the hot air system closing said latter throttling valve and diminishing the supply of hot air to the vicinity of the thermostat, to reduce the temperature of the thermostat and proportionally to close the throttling valve in the cold air inlet, to reduce the total volume of air circulating in the system, to maintain a substantially constant air pressure in the system.

4. In a heating system, the combination of a hot air furnace having a housing and having a cold air inlet and a plurality of hot air outlets, a blower having its outlet connected to the cold air inlet, and having a throttling valve interposed between the blower and said inlet, a substantially constant speed motor for driving said blower, a cold air inlet housing surrounding the blower and motor, a thermostat located in said cold air inlet housing, a plurality of conduits leading from the hot air outlets of the furnace housing to various rooms, and closable registers at the ends of said conduits in said rooms, each room having its conduit and register proportionate in opening size to the size of the room, an auxiliary conduit leading from a point in the system having a supply of hot air under pressure, and extending to a point adjacent said thermostat to discharge hot air on the thermostat, said thermostat being connected to the throttling valve in the cold air inlet in such manner as to close said valve when the thermostat is cold and to open the valve as the thermostat becomes heated in proportion to its temperature, a throttling valve in said auxiliary conduit, a pressure responsive device connected to be subjected to the pressure of the hot air in the upper part of the system, and mechanical connections between said pressure responsive device and said latter throttling valve, to effect a partial closure of said latter throttling valve whenever pressure is increased in the system, the increase in pressure in the upper part of the hot air system closing said latter throttling valve and diminishing the supply of hot air to the vicinity of the thermostat, to reduce the temperature of the thermostat and proportionally to close the throttling valve in the cold air inlet, to reduce the total volume of air circulating in the system, to maintain a substantially constant air pressure in the system, the said pressure responsive device comprising a pivoted wall flap open to atmosphere at one side and subjected to the hot air under pressure on the other side, said wall flap having its weight counter-balanced by an oppositely extending arm with a counter-weight.

5. In a heating system, the combination of a hot air furnace having a housing and having a cold air inlet and a plurality of hot air outlets, a blower having its outlet connected to the cold air inlet, and having a throttling valve interposed between the blower and said inlet, a substantially constant speed motor for driving said blower, a cold air inlet housing surrounding the blower and motor, a thermostat located in said cold air inlet housing, a plurality of conduits leading from the hot air outlets of the furnace housing to various rooms, and closable registers at the ends of said conduits in said rooms, each room having its conduit and register proportionate in opening size to the size of the room, an auxiliary conduit leading from a point in the system having a supply of hot air under pressure, and extending to a point adjacent said thermostat to discharge hot air on the thermostat, said thermostat being connected to the throttling valve in the cold air inlet in such manner as to close said valve when the thermostat is cold and to open the valve as the thermostat becomes heated in proportion to its temperature, a throttling valve in said auxiliary conduit, a pressure responsive device connected to be subjected the pressure of the hot air in the upper part of the system, and mechanical connections between said pressure responsive device

and said latter throttling valve, to effect a partial closure of said latter throttling valve whenever pressure is increased in the system, the increase in pressure in the upper part of the hot air system closing said latter throttling valve and diminishing the supply of hot air to the vicinity of the thermostat, to reduce the temperature of the thermostat and proportionally to close the throttling valve in the cold air inlet, to reduce the total volume of air circulating in the system, to maintain a substantially constant air pressure in the system, said system operating responsive to the closure of one or more registers, said closure reducing the outlet area and thus increasing the air pressure in the hot air pipes of the system and moving said flap to reduce the hot air supplied to the thermostat, which in turn closes the throttling valve in the cold air inlet.

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