

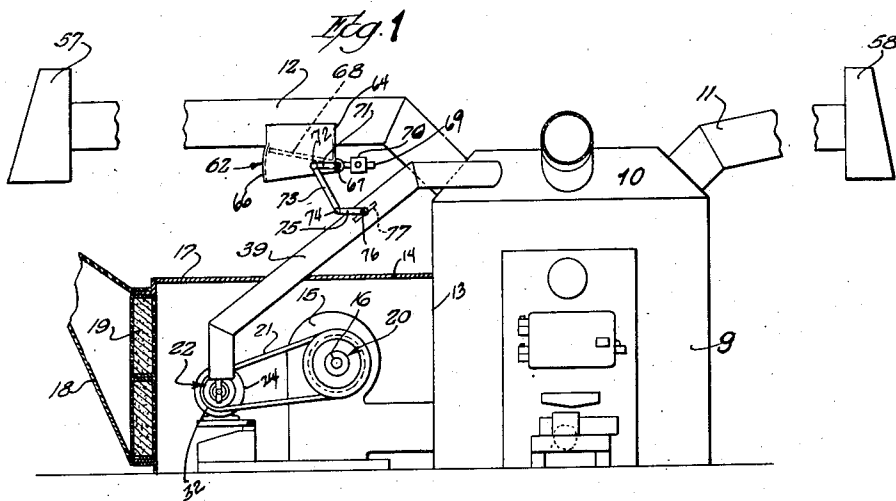
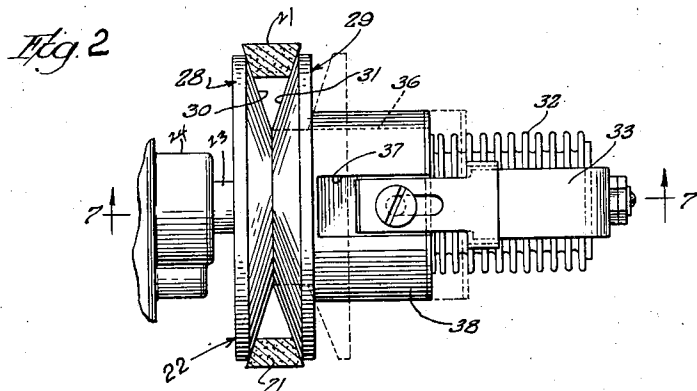
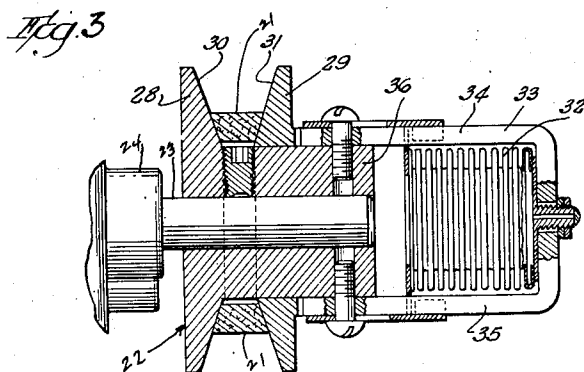
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W. W. HALLINAN

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HEATING SYSTEM

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INVENTOR.
William W. Hallinan
BY Robert W. Wendt.

Att'y

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2,479,069

HEATING SYSTEM

William W. Hallinan, Racine, Wis.

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3 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.

The present application is a division of my prior application on heating systems, Ser. No. 651,177, filed March 1, 1946, Patent No. 2,455,250, issued November 30, 1948.

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

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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 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 is one sheet,

Fig. 1 is a diagrammatic elevational view of a heating system embodying my invention;

Fig. 2 is a side elevational view of a variable diameter, thermostatically controlled pulley which may be used in the present heating system, with the pulley at its maximum diameter;

Fig. 3 is a view similar to Fig. 1, in partial section, showing the same pulley at its minimum diameter.

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 any suitable type. 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 hot air ducts 11 and 12 are each provided with a suitable register 57, 58, preferably of the type having a plurality of louvers which can be actuated by means of a hand lever 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 65, 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 is complementary in shape; that is, rectangular, so that its edges are only slightly 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 39 that conducts the hot air to the thermostat 32, which forms a part of the thermostatically controlled variable diameter pulley 22.

This variable speed pulley may be of the type shown in my prior patent, No. 2,275,429, issued March 10, 1942; and the pulley is mounted herein for effecting a zone control and producing substantially the same results as are attained by the heating system of the parent patent application, of which this is a division.

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. 2 and 3, Fig. 2 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. 3 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 36.

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 super-heating, and will not be excessive. Various types of refrigerant may be used, as described in my prior applications; but for an air conditioning installation I prefer to use trichloromonofluoromethane (F 11). 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 provided with a damper 77 adapted to be actuated by a pressure responsive vane 68.

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 32.

Any throttling of the heated air in the conduit 39 diminishes the hot air that pours upon the thermostat 32; and this hot air, being mixed with cold air in the housing 17, the heating effect on the thermostat 32 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 32 and tending to decrease the size of the pulley 22, which decreases the volume of air accordingly.

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 cause the pulley 22 to diminish its size still further, diminishing the volume of air which passes through the system in a proportionate amount.

Closing all of the registers will effect a substantial closure of the damper 77, 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.

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 of a furnace provided with a casing having a cold-air inlet duct and hot-air outlet ducts, a blower located in the cold-air inlet and driven by a substantially constant speed motor, said blower having a pulley and said motor having a thermally responsive variable diameter pulley, the said pulleys engaging a V-belt, said variable diameter pulley comprising a pair of sections slidably mounted with respect to each other and having thermostatic means carried by one section and reacting against the other section to change the distance between two belt-engaging surfaces, thus changing the effective diameter at which the belt is engaged by said variable diameter pulley, a hot-air duct extending from the furnace casing to the thermostatic means and supplying hot air to control said thermostat, a valve in said latter hot-air duct, a movable vane located in one of the hot-air ducts of the heating system and operatively connected to said valve, the said system being so proportioned that when all of the ducts are open each hot-air duct receives a predetermined amount of hot air from the furnace, but when one of the registers is closed an increase in pressure is caused in the system, acting upon said movable vane to effect a partial closure of the hot-air duct leading to the thermostat, and decreasing the amount of hot air acting on the thermostat, thus causing the thermostat to contract and permitting the pulley sections to separate to reduce the effective diameter of the pulley and thus reducing the speed at which the blower is driven so that the blower is driven at a speed suitable for the number of registers which are open.

2. In a heating system, the combination of a furnace provided with a casing having a cold-air inlet duct and hot-air outlet ducts, a blower located in the cold-air inlet and driven by a substantially constant speed motor, said blower having a pulley and said motor having a thermally responsive variable diameter pulley, the said pulleys engaging a V-belt, said variable diameter pulley comprising a pair of sections slidably mounted with respect to each other and having thermostatic means carried by one section and reacting against the other section to change the distance between two belt-engaging surfaces, thus changing the effective diameter at which the belt is engaged by said variable diameter pulley, a hot-air duct extending from the furnace casing to the thermostatic means and supplying hot air to control said thermostat, a valve in said latter hot-air duct, a movable vane located in one of the hot-air ducts of the heating system and operatively con-

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connected to said valve, the said system being so proportioned that when all of the ducts are open each hot-air duct receives a predetermined amount of hot air from the furnace, but when one of the registers is closed an increase in pressure is caused in the system, acting upon said movable vane to effect a partial closure of the hot-air duct leading to the thermostat, and decreasing the amount of hot air acting on the thermostat, thus causing the thermostat to contract and permitting the pulley sections to separate to reduce the effective diameter of the pulley and thus reducing the speed at which the blower is driven so that the blower is driven at a speed suitable for the number of registers which are open, and the closure of a plurality of registers causing a proportionate additional increase in pressure in the system which further diminishes the hot air supplied to the thermostat and further reduces the effective diameter of the pulley and the speed of operation of the blower to an amount suitable for the registers then open.

3. In a heating system, the combination of a furnace provided with a casing having a cold-air inlet duct and hot-air outlet ducts, a blower located in the cold-air inlet and driven by a substantially constant speed motor, said blower having a pulley and said motor having a thermally responsive variable diameter pulley, the said pulleys engaging a V-belt, said variable diameter pulley comprising a pair of sections slidably mounted with respect to each other and having thermostatic means carried by one section and reacting against the other section to change the distance between two belt-engaging surfaces, thus changing the effective diameter at which the belt

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is engaged by said variable diameter pulley, a hot-air duct extending from the furnace casing to the thermostatic means and supplying hot air to control said thermostat, a valve in said latter hot-air duct, a movable vane located in one of the hot-air ducts of the heating system and operatively connected to said valve, the said system being so proportioned that when all of the ducts are open each hot-air duct receives a predetermined amount of hot air from the furnace, but when one of the registers is closed an increase in pressure is caused in the system, acting upon said movable vane to effect a partial closure of the hot-air duct leading to the thermostat, and decreasing the amount of hot air acting on the thermostat, thus causing the thermostat to contract and permitting the pulley sections to separate to reduce the effective diameter of the pulley and thus reducing the speed at which the blower is driven so that the blower is driven at a speed suitable for the number of registers which are open, the said vane being counterbalanced to render it responsive to minute variations of pressure in its hot-air duct.

WILLIAM W. HALLINAN.

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