Sept. 16, 1924. 1,508,813

J. C. MILES

HOT AIR HEATING SYSTEM

Filed Dec. 13, 1920 2 Sheets-Sheet 1

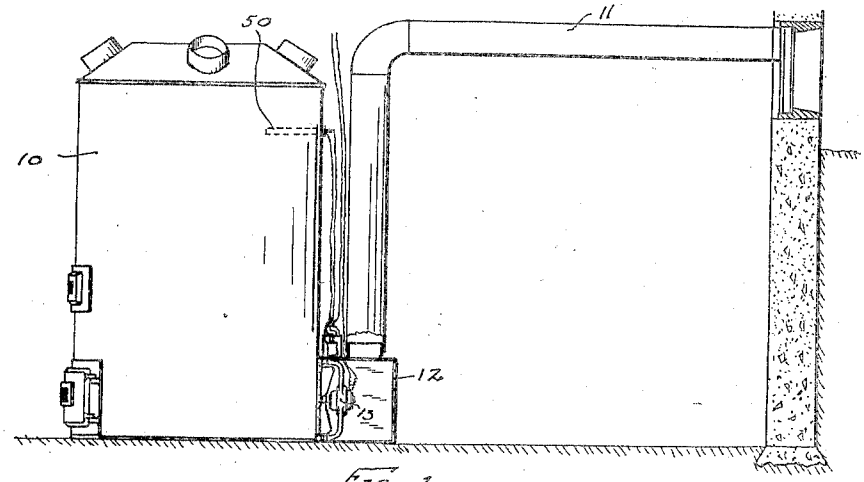



FIG. 1

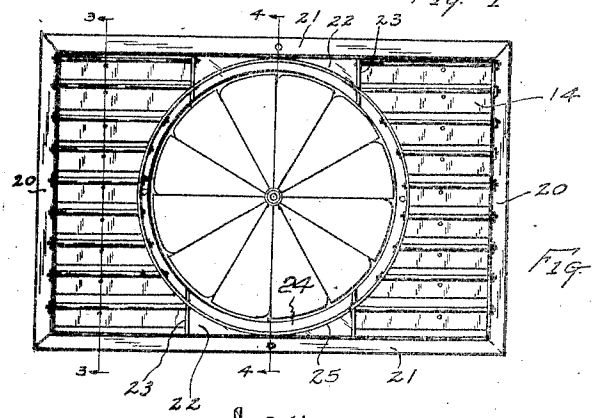



FIG. 2

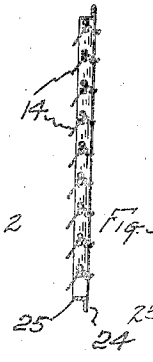



FIG. 3

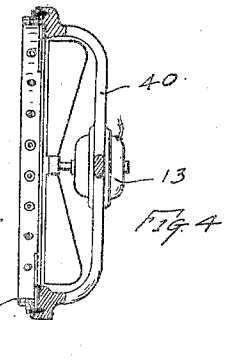



FIG. 4

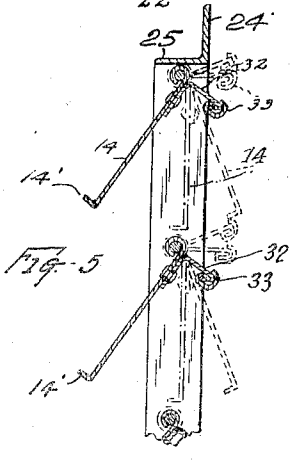



FIG. 5

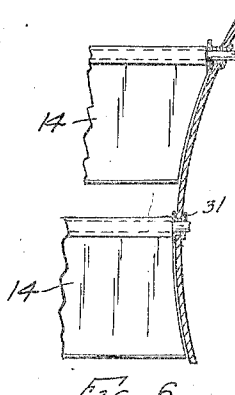



FIG. 6

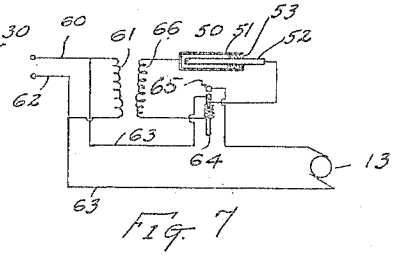



FIG. 7

INVENTOR
James C. Miles,
By Davis & Macklin,
ATTORNEYS

Sept. 16, 1924. 1,508,813

J. C. MILES

HOT AIR HEATING SYSTEM

Filed Dec. 13, 1920 2 Sheets-Sheet 2

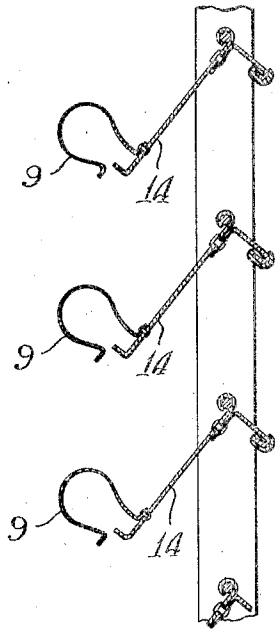



Fig.-8

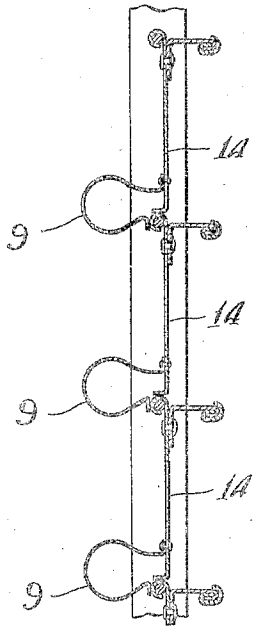



Fig.-9

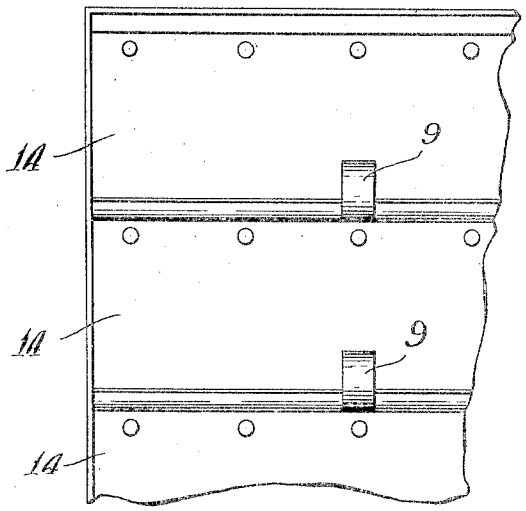



Fig.-10

INVENTOR
James C. Miles,
By Baltis & Macklin
ATTYS

Patented Sept. 16, 1924. 1,508,813

# UNITED STATES PATENT OFFICE.

JAMES C. MILES, OF CLEVELAND, OHIO.

## HOT-AIR HEATING SYSTEM.

Application filed December 13, 1920. Serial No. 430,160.

*To all whom it may concern:*

Be it known that I, JAMES C. MILES, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Hot-Air Heating Systems, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

My invention relates to a hot air heating system, one object being to provide a system with means for mechanically increasing the air pressure so as to insure proper delivery of the heated air from the furnace under all conditions.

Another object is to provide a heating system, which may operate in conjunction with a fan, but so arranged that the air in the system may also properly circulate by gravity when the fan is out of operation.

A further object is the provision of a heat responsive means for automatically stopping the fan when the temperature in the system falls below a predetermined point.

Another object is to provide a combination of a set of resistance dampers with a motor driven fan arranged so that a building up of the resistance or pressure in the system may be relieved at a predetermined point so as to prevent overheating the motor. Another objectis to provide means in such a system whereby the hot air which is allowed to escape by the pressure relieving dampers, may be trapped and returned to the system.

A further object is to provide dampers made of very light material and adapted to permit of accurate adjustment so that the pressure at which the relief takes place may be readily and accurately varied.

A still further object is the provision of a damper which shall be noiseless in operation thereby removing a great objection to the ordinary dampers heretofore employed, which are very apt to squeak as they move.

Further objects of the invention will be apparent in the course of the following specification and claims in which a preferred arrangement of elements embodying my invention is shown in use with a heating system.

Referring to the drawings, Fig. 1 is a view of a heating system arranged in accordance with my invention and partly in section; Fig. 2 is a front view of the fan and dampers showing an approved form of mounting of these members; Fig. 3 is a sectional view on the line 3—3, Fig. 2; Fig. 4 is a section on the line 4—4, Fig. 2; Fig. 5 is a fragmentary view of a portion of Fig. 3 on an enlarged scale; Fig. 6 is a horizontal projection taken from the furnace side of the dampers and shows the dampers in an inward position; Fig. 7 is a diagrammatic showing of electric circuits whereby the heat responsive means may govern the actuation of the fan: Fig. 8 is a section through a portion of the frame and dampers showing the dampers in open position and illustrating a yieldable stop for the dampers; Fig. 9 is a section similar to Fig. 8 showing the closed position of the dampers; and Fig. 10 is an elevation from the heating chamber side of the dampers showing the position of the stops as applied to the dampers.

In order to cause the heating system to be operable by gravity, I preferably arrange my forcing fan and dampers adjacent the ordinary lower inlet of the hot air furnace. 10 illustrates such a furnace; 11 is the conduit leading from the outer air to a chamber 12, in which the fan 13 is mounted, this fan being preferably placed adjacent the opening into the furnace from chamber 12, and having adjacent thereto the system of dampers 14. The dampers 14 as shown are arranged in two series occupying the two ends of the rectangular frame on opposite sides of the central plates 22, later described. While these dampers are shown as surrounding the motor and mounted in a manner which will be presently described, it is evident that the dampers might be placed at points more or less remote therefrom. The fan may also be placed back in the conduit 11 if desired, though the arrangement shown is found to be very convenient and efficient.

In the construction illustrated, the dampers 14 are supported in a frame made up of the angle irons 20, 21, connected at their ends to form a rectangular frame. Adjacent the middle portions of the angle irons 21 are secured the plates 22, having upstanding flanges 23 projecting from the same side of these plates as the upstanding flanges of the angle members 21, while a ring 24 having the upstanding flange 25 is carried on this face of the plates, the flange having its center coincident with the

center of the rectangular frame, and having a diameter equal to the distance between the flanges of the angle irons 21. The flanges 25 and 23 therefore intersect and as shown, the flanges 23 are suitably notched to allow the passage of the flange 25. The upstanding flanges described provide means for holding the pivot rods 30, bushings 31, which are preferably made of brass, being inserted in openings in the flanges, as shown in Fig. 6 to retain these rods. This construction prevents squeak of the dampers as they move. The provision of bushings for seating the pivot rods 30 is found to prevent squeaking of the dampers in operation, and thus do away with one of the disadvantages ordinarily attendant on the use of such dampers. The dampers 14 are preferably made of aluminum so as to be exceedingly light and allow their ready adjustment. These dampers may be made as shown, of sheet aluminum, having their free ends 14′ bent at an angle and the other end portion curled around a rod 30 which serves as a pivot, and adjacent this end is an L-shaped member 32, preferably made of soft metal riveted or otherwise attached thereto, while on the end of this L-shaped member may be secured a weight 33, preferably of lead, which may be securely locked thereon in the manner shown in Fig. 5.

Adjacent the free ends of the dampers 14 they may be bent at an angle, as shown at 14′ so as to extend inwardly, and it will therefore be seen that the dampers must open outwardly to a sufficient extent to allow the members 14′ to pass over the pivot 30 of the adjacent lower damper before an escape of air will be allowed from the furnace. The exact amount of pressure required to thus open the dampers, may be varied by bending the members 32 to a different angular position, and although with the construction of the dampers shown, the dampers will normally lie slightly inclined inwardly and allow passage of air, this effect is incidental, the object being to provide dampers which will prevent outward escape of air, but which will allow its ready passage inward until a certain pressure is obtained on the inner surface of the dampers. It is apparent that this result might be attained by the use of dampers constructed to lie vertically and having a spring means resisting outward but not resisting inward motion, or any similar construction. All such forms and others fulfilling the objects above mentioned come within the scope of my invention.

While the function of the inward opening to allow additional ingress of air might be dispensed with, such an arrangement would prevent the securing of a gravity actuation of my system which I consider important, because heretofore the objection to the use of a fan in connection with a heating chamber of a furnace has been that when the switch was open, so that the fan was inoperative, it was impossible for the heating chamber to secure the requisite amount of air, with the result that furnaces so provided have often been burned out.

It will be seen that by bending the portions 32 at a different angle, the dampers may be caused to operate at a different pressure to release the air from the heating chamber.

Another feature of the inward opening of the dampers is to increase the efficiency of the fan in forcing air into the furnace, though after pressure has been built up in the heating chamber of the furnace the dampers maintain pressure in the chamber.

The spider 40 which carries the fan motor 13, has two of its arms bolted or otherwise fastened to the angle irons 21, the remaining two arms being shown as attached to the ring 24, the center of the spider which carries the motor being centrally mounted on the frame and the fan being surrounded by the systems of dampers described. This fan is preferably of the disk type which serves to positively build up a pressure in the furnace chamber and may be connected to have its operation controlled by means of a heat responsive device 50, which is preferably mounted in the upper portion of the heat chamber of the furnace 10. This heat responsive means 50 may be composed of an outer pipe or tube preferably iron 51, and a smaller rod of brass or the like 52, mounted to extend inward of and nearly in contact with the closed end of tube 51. A bushing 53 of insulating material serves to hold the member 52 in place.

It will be apparent that upon an increase of temperature, on account of the greater co-efficient of expansion of the brass, the end of the member 52 will gradually approach the closed end of member 51 and will eventually contact therewith. This member is connected so as to control the operation of the motor so that whenever the contact is made between members 52 and 51, current is sent through the fan motor to actuate the same.

In Fig. 7 an arrangement of circuits to accomplish this result is shown. The line wire 60 is connected to the primary coil 61 of a transformer, whose other end is connected with the return line 62, while shunted across the primary circuit of the transformer is the circuit 63 leading to the fan 13. The circuit 63, however, is broken when the solenoid rod 64 is out of contact with the contact point 65, which occurs whenever the members 51 and 52 are out of contact with

each other. For this purpose the solenoid 64 is connected in series with the secondary coil 66 of the transformer and with the heat responsive members 51 and 52 of member 50, so that when the contact in member 50 is broken no current passes through the secondary circuit of the transformer and therefore the motor circuit is broken at 65. When, however, the contact is made at 50 current flows through the secondary circuit and pulls the solenoid 64 into contact with the contact 65, thereby sending current through the fan motor. The object in providing a transformer for the member 50 is to prevent destructive sparking, which would be occasioned on account of the slow relative motion of members 51 and 52, if, for instance, an ordinary 110 volt circuit be used for operating the fan, such voltage would quickly burn the end of the member 52 and prevent its correct operation. The voltage in the secondary circuit should therefore be reduced, four to six volts being found very satisfactory. The temperature at which the member 50 should be closed should be in the neighborhood of 200° to 250° Fahrenheit depending somewhat upon the particular heating system, the object being to turn on the fan when the air temperature is in the neighborhood of 140° to 160° Fahrenheit, the latter being the sterilizing temperature for air. On account of conduction of heat from the furnace to the member 50, the temperature at which the connection is made must be considerably greater than the desired temperature to be obtained by the air, because the member 50 will be considerably hotter than the surrounding air.

The pressure relief provided by the dampers is an important feature of my system in allowing the use of a much smaller fan and motor, without danger of overheating and burning out of the motor. If no such relief were provided, the pressure built up would be likely to hold the fan and cause the overheating and burning out of the motor, while with the opening of the dampers outwardly when a certain pressure is obtained, this can not take place. It will be seen, however, that this pressure relief does not involve an undue loss of heat, since all or a large proportion of the escaping air will ordinarily be largely trapped in the chamber 12 and returned to the system by the fan, so that the main result is the mere circulation of the air about the fan. The provision of the adjustable weights on the dampers will also allow a ready adjustment of the amount of pressure required to open the dampers. I have found for heating a six to eight room house, that the dampers should be designed to open outwardly at the pressure of one-fourth of an ounce per square inch approximately. But for larger buildings and when a larger fan is being used, the desired pressure might be somewhat different and this could be readily taken care of by the adjustable arrangement of the weights.

In Fig. 5, I have shown the dampers in normal position by full lines, which position is maintained so long as the force exerted by the weights 33 is greater than the force exerted by air pressure within the chamber 10 upon the vanes 14. However, as the air pressure increases, the vanes are swung to a vertical position as shown in the dot and dash lines and upon further increase, the vanes are swung outwardly, as shown in the dotted lines, whereupon the pressure is relieved, and the load on the fan correspondingly diminished.

In the operation of the device the provision of the heat responsive means prevents actuation of the fan before sufficient heat has been developed in the furnace to warrant it. The turning on of the fan, while the fire is still low, is likely to result in checking or even putting out of the fire, if there is any leak from the fire chamber to the heating chamber. In addition to this, however, the operation of the fan at such a time involves the waste of electrical power.

When the fan is started, the increase of air pressure within the chamber causes the dampers to swing toward a vertical position, thus preventing the escape of air until a predetermined pressure is reached. Thus the starting of the fan automatically changes a gravity system to a forced air system. When the pressure is built up, however, to a sufficient extent to move the bent portions 14′ outwardly away from the pivot of the next lower damper, relief of pressure will be allowed as already explained.

My invention has heretofore been described as embodying a structure having a fan and a damper associated therewith, with the dampers arranged to permit the escape of air in the event of excessive pressure within the heating chamber. In Figs. 8 to 10, however, I have illustrated the dampers as having yieldable members 9′ associated therewith, which members comprise means for stopping the dampers from further movement after they have been moved to closed position. Thus, I provide a positive stop for the dampers and thereby effect a satisfactory closure when the fan is set in motion. Moreover, when the fan is in motion, all of the air entering the chamber is caused to flow through the fan aperture; while when the fan is stopped, sufficient air is still provided for the normal operation of the gravity system.

While I have described a specific form of my invention, it is apparent that many changes may be made therein, and many embodiments of the idea may be devised

and the foregoing description is therefore to be taken as illustrative and not restrictive.

Having thus described my invention, I claim:—

1. In a device of the character described, the combination with a heating chamber, of a fan for forcing air into said chamber, means normally allowing the passage of air into said chamber, said means being arranged to yieldably resist the escape of air therefrom, and adapted at a predetermined pressure to permit the passage of air in a reverse direction.

2. In a heating apparatus, the combination with a heating chamber having an air inlet, of a frame positioned across the inlet, a fan mounted within the frame, dampers intermediate the fan and sides of the frame, said dampers being open when the fan is inoperative, and adapted to be closed when the fan is set in operation.

3. In a heating apparatus, the combination with a heating chamber having an air inlet, of a fan for forcing air into said chamber, a second chamber adjacent said inlet, a passageway between said chambers, a yieldable damper positioned across the passageway, said damper being arranged to allow passage of air from the second chamber into the heating chamber, and to provide for a passage of air in a reverse direction by excess pressure within the heating chamber.

4. In a heating apparatus, the combination with a heating chamber having an air inlet, of a rectangular frame positioned across the inlet, and occupying substantially the entire area thereof, a motor-driven fan mounted within the frame adjacent the central portion thereof, and yieldable dampers carried by the frame and disposed on one side of the fan, whereby air may enter the chamber through the fan opening to the exclusion of the damper opening, when the fan is in operation.

5. In a heating apparatus, the combination with a heating chamber, of means operable to force air into said chamber, said chamber having an air inlet adjacent said means, a damper extending across said inlet and arranged to swing normally toward the chamber for allowing access of air into said chamber when the forcing means is not operating, said damper being also arranged to swing away from the chamber and across the inlet when the fan is set in motion whereby the passage through the fan constitutes the only inlet into the chamber.

6. In a device of the character described, the combination of a chamber, a fan for forcing air into said chamber, dampers adjacent said fan and adapted to allow the passage of additional air into said chamber and to retard its escape until a predetermined pressure is obtained, said dampers being adapted to allow air within the chamber to escape when said pressure is exceeded, and to allow a free inlet of air to the chamber when the fan is not operating.

7. In a device of the character described, the combination with a pressure chamber having an air inlet, of a frame positioned across the inlet, a fan mounted on the frame, for forcing air into said chamber, and a damper associated with the frame, the damper being arranged to operate at a predetermined pressure for permitting the escape of air from said chamber.

8. In a heating apparatus, the combination with a heating chamber having an air inlet, of a conduit leading to said chamber and having a chamber therein adjacent the heating chamber, mechanical means for forcing air from the second chamber into said first mentioned chamber, and a pressure responsive means operable at a predetermined pressure to allow escape of air back into the second chamber.

9. In combination, a pressure chamber having an air inlet, a frame extending across the inlet, a series of dampers pivotally mounted within the frame, a fan in communication with the inlet and means associated with the dampers for inclining them normally in one direction, whereby the inlet of air to the chamber and through the dampers is allowed, said means being arranged to retard the escape of air from the chamber when a predetermined pressure is obtained therein and to permit the entrance of air to the chamber only through the fan.

10. In combination, a pressure chamber having an air inlet, a frame across the inlet, a series of dampers positioned one above the other and pivoted to the frame, means associated with the dampers for inclining them normally toward the chamber, and a fan carried by the frame and positioned adjacent said dampers, whereby the air passageway into the chamber is through both the fan and dampers when the fan is not in motion but is only through the fan when the fan is in motion.

11. In combination, a pressure chamber having an inlet, a series of dampers pivotally mounted across said inlet, means associated with the dampers for normally resisting an outward motion thereof, each of said dampers having inwardly extending portions on the free end thereof, whereby escape of air may be prevented until the dampers have opened outwardly to a predetermined extent.

12. In a device of the character described, the combination with a pressure chamber having an air inlet therein, of a frame mounted adjacent said inlet, a fan carried by the frame, and a series of dampers disposed within the inlet to one side of the fan opening and adapted to yield in one direction,

whereby said dampers afford communication between the chamber and the atmospheric air when open, and whereby communication between the chamber and the atmosphere is provided through the fan opening, when the dampers are closed.

13. In combination, a heating chamber, having an air inlet, a damper, a fan for forcing air into said chamber, said damper being arranged to permit the passage of air into the chamber when the fan is not in operation, and said damper being pneumatically closed by air within the chamber when the fan is in operation.

14. In combination a heating chamber having an air inlet, a fan for forcing air into the chamber through the inlet, a damper associated with the inlet the damper being so positioned that when the fan is not in operation, air passes into the chamber through both the damper opening and the fan opening, said damper being pneumatically closed by air within the chamber when the fan is in operation, whereby all of the air entering the chamber then flows through the fan opening.

In testimony whereof, I hereunto affix my signature.

JAMES C. MILES.