Dec. 10, 1935. W. SHURTLEFF 2,023,447

METHOD AND MECHANISM OF HEATING AND VENTILATING

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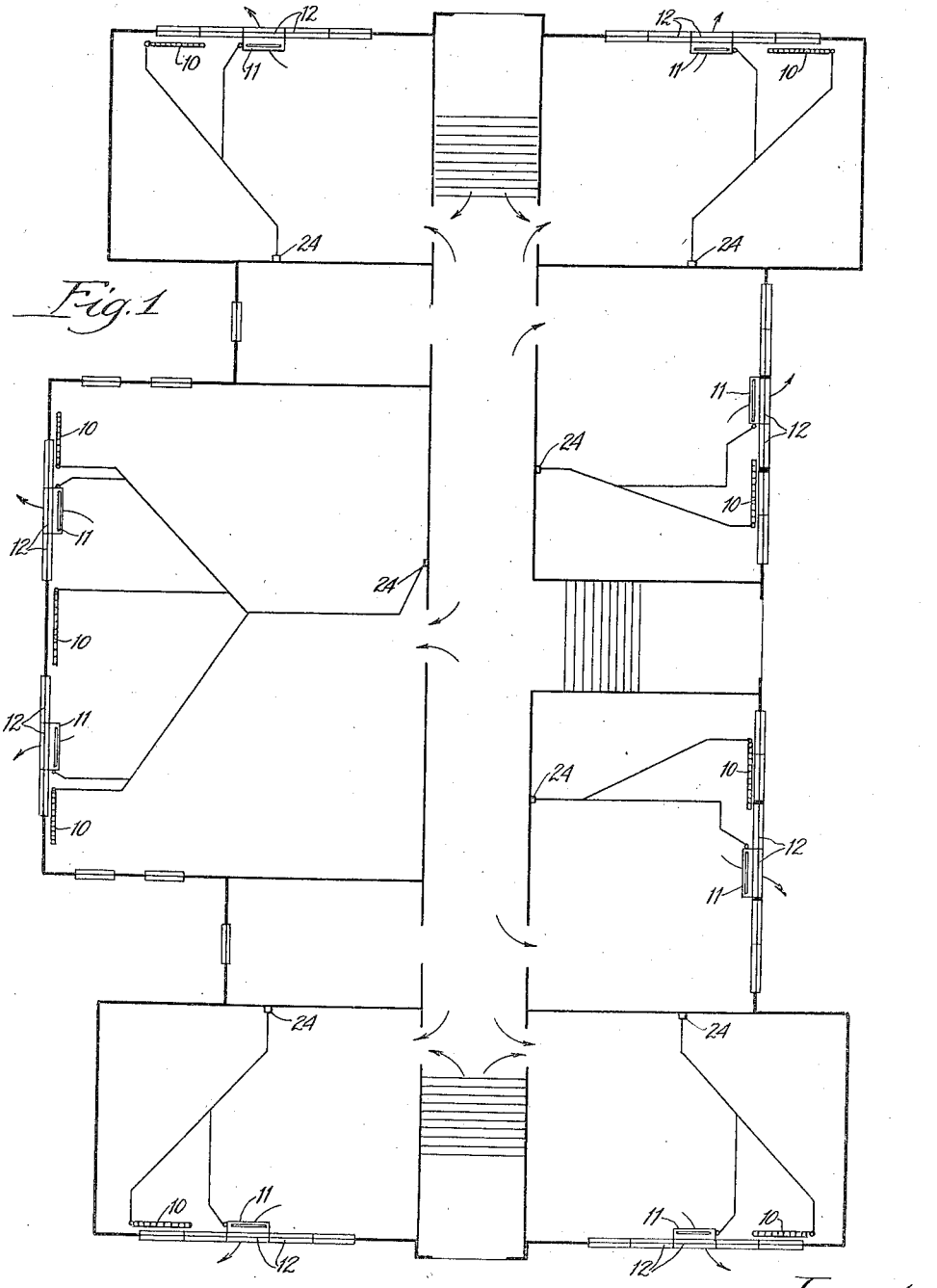


Fig. 1

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Fig. 2

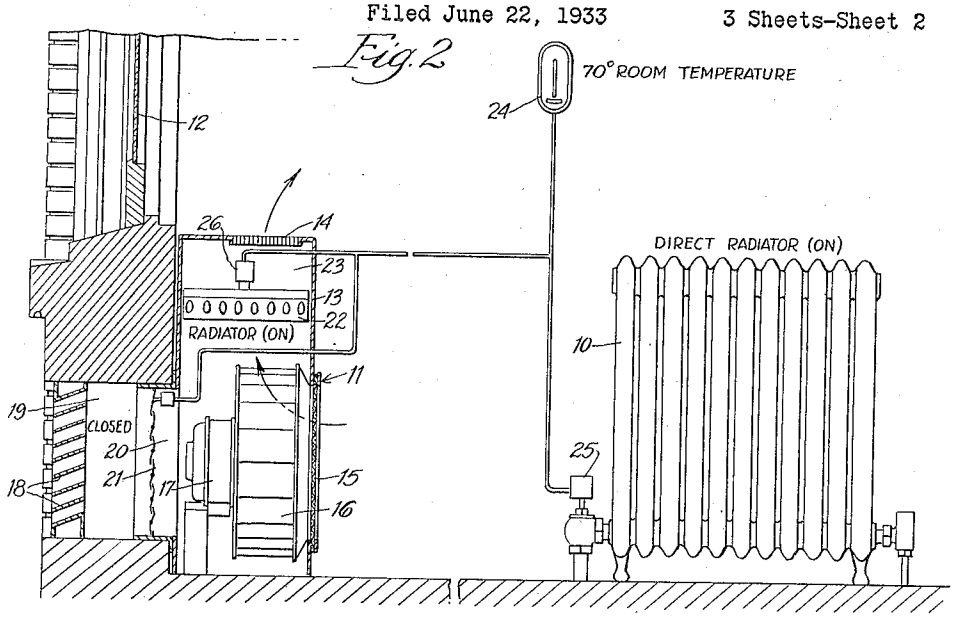
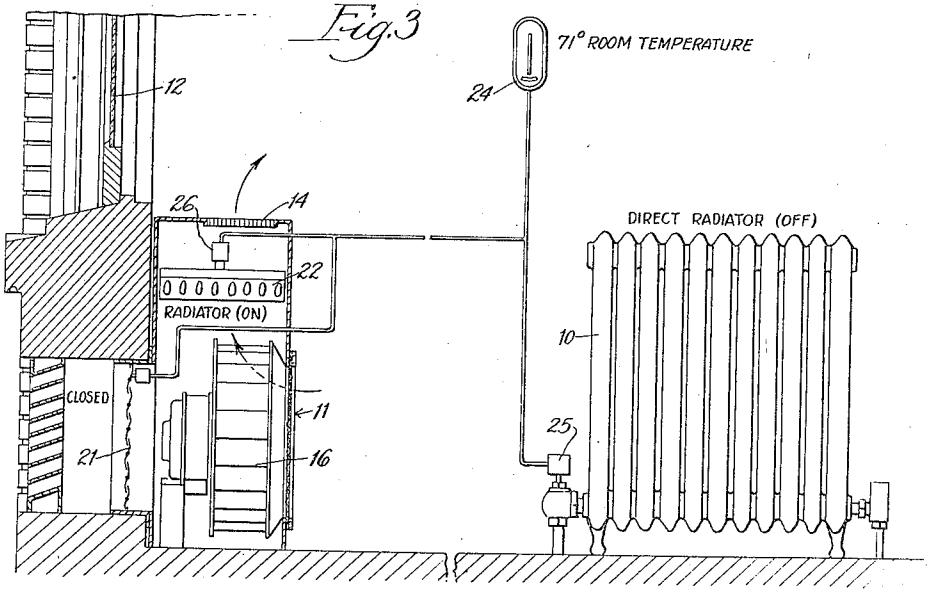


Fig. 3



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Fig. 4

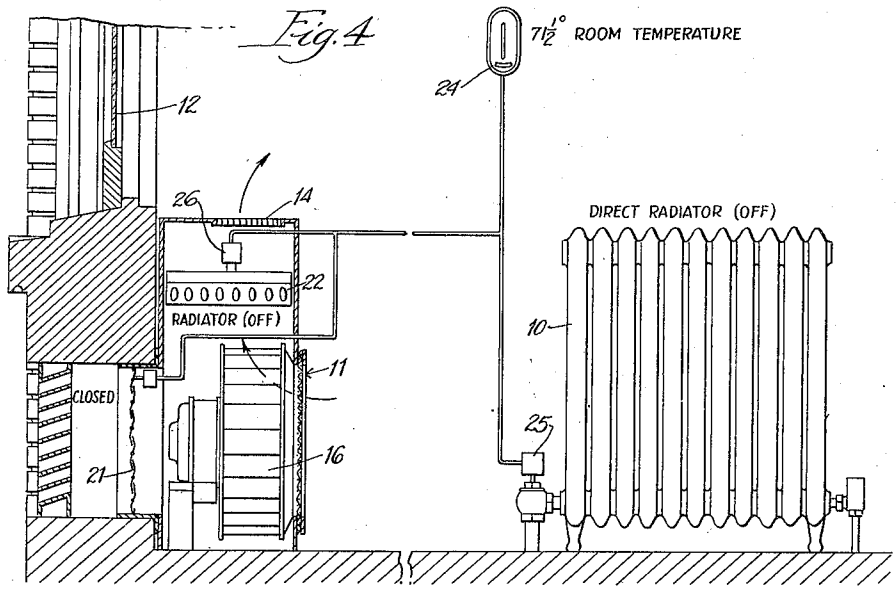
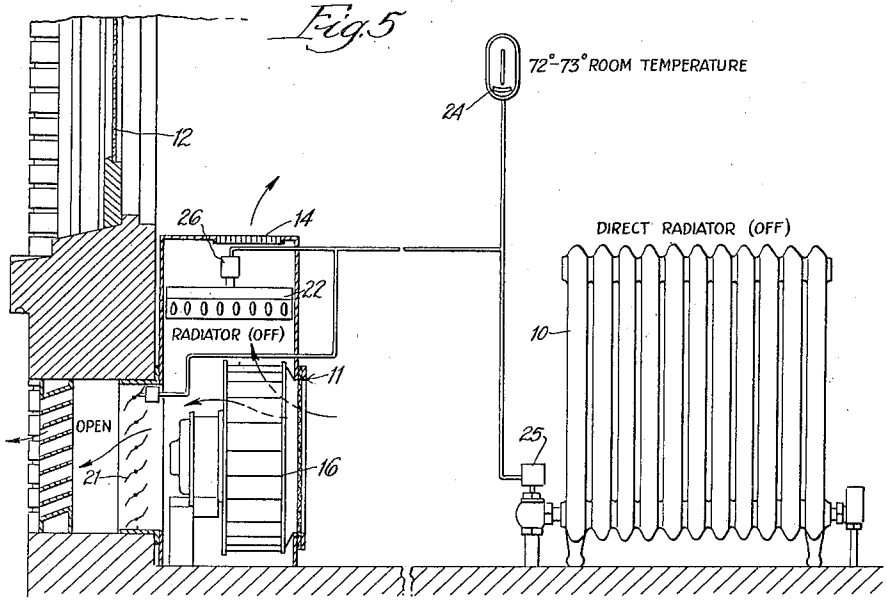


Fig. 5



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UNITED STATES PATENT OFFICE

2,023,447

METHOD AND MECHANISM OF HEATING AND VENTILATING

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Application June 22, 1933, Serial No. 677,027

5 Claims. (Cl. 237—12)

The method and mechanism of the present invention are developed primarily, though not exclusively, to meet the requirements of school rooms or like places of assembly for groups consisting of a considerable number of persons, and wherein it is necessary to make provision for maintenance of comfortable and hygienic conditions in all parts of the room or place of assembly without the creation of drafts or overheated regions in any portion of the room.

Since the invention is peculiarly adapted to school room requirements, the following description will refer to conditions prevailing in school rooms. A school building is ordinarily divided into a considerable number of class rooms of a size to afford accommodations for from thirty to forty pupils in each room.

The rooms occupy the exterior locations in the building and are connected with interior corridors so that there is inter-communication between all parts of the building, which permits the flow, in greater or less extent, of air from one room to another throughout the entire building. Ordinarily, the air in the corridors is cooler than the air in the class rooms, both by reason of the fact that the corridors occupy an interior position and are unoccupied, and by reason of the fact that more complete provision is made for heating the class rooms in which the pupils are seated than the corridors, which are mainly used as passageways.

The method and mechanism of the present invention center upon the idea of inducing a more complete redistribution of air throughout all portions of the rooms of the building and of utilizing the cooler air within the corridors and induced outdoor air infiltration for cooling purposes in rooms which tend to overheat, and of maintaining a gentle circulation of air throughout the class rooms and discharging the overheated air into the atmosphere.

The method and mechanism of the present invention provide for the constant maintenance of circulation of room air in each of the school rooms, with the admission of air only in such quantities as may flow in from out of doors at widely distributed cracks and from the corridors or other interior sources which are replenished by outdoor air only through filtration and admission through distant open doors or the like.

The present invention, therefore, is directed primarily to the idea of advantageously utilizing the interior air within the building during extremely cold weather and to the maintaining of proper comfort conditions within each of the rooms through a process of equalization of temperature rather than to the heating and ventilating of each of the rooms independently through the direct admission of outdoor air without regard to the utilization for cooling purposes of a large volume of air already within the corridors or other portions of the building from which such supply of cooler air might be derived.

In order to maintain proper conditions within each of the school rooms, it is necessary to provide for the artificial heating of air to a comfortable temperature and for the constant circulation of air throughout all portions of the room in order to prevent stratification and to remove the dead air from the immediate vicinity of the bodies of the occupants, and also to prevent odors or excessively humid conditions in any particular region, and to make provision for the discharge of overheated air in order to depress the air pressure at the point of overheating and to induce increased infiltration of cold outdoor air and a flow of air from corridors or cooler portions of the building, which serves not only to cool the rooms which tend to overheat but to the maintenance of uniform temperature conditions throughout the entire building.

The above advantages and others will appear from the following detailed description of the invention in conjunction with the accompanying drawings, wherein,—

Figure 1 is a diagrammatic view showing the customary arrangement of rooms in a school building, with the heating and ventilating appliances installed in conformity with the method of the present invention;

Fig. 2 is a sectional elevation of a cabinet radiator and direct radiator, illustrating the conditions prevalent during the early morning hours when the school room is being heated to the desired temperature;

Fig. 3 is a similar view illustrating the conditions prevailing after the room has reached approximately the desired temperature, and with the direct radiator shut off;

Fig. 4 is a similar view illustrating stabilized conditions in which the room temperature is at the desired degree, and the room air is being recirculated throughout various portions of the room without artificial heating; and

Fig. 5 is a similar view illustrating the conditions prevailing after the room has become overheated, and in which the apparatus is regulated to discharge overheated air from the room at a point near the floor of the room.

For purposes of illustration, the apparatus

shown comprises a direct radiator 10 operating in conjunction with a cabinet heating and ventilating unit 11, which is preferably located immediately below a window 12. The heating and ventilating unit is housed within an enclosing cabinet 13 provided in its top with a discharge outlet 14 for directing the air upwardly toward the ceiling of the room. Air from the room is at all times continuously admitted to the cabinet adjacent to the floor through the recirculating and exhaust air inlet 15 immediately into the eye of the fan 16 which is driven by a motor 17. Air from outdoors is never admitted directly into the cabinet through louvres 18 by way of the duct 19 or into the fan pressure chamber 20, but only over-heated air split from the recirculated air stream is discharged directly outdoors through louvres 18, and the amount of over-heated air discharge from the room is controlled by means of leaf dampers 21. The lower portion of the cabinet thus constitutes a blower pressure chamber above which is located a light weight fin radiator 22 which separates the blower pressure chamber from the recirculation of an air discharge chamber 23 at the top of the cabinet.

A thermostat 24 controls a valve 25 for admitting steam to the direct radiator, and controls a valve 26 for admitting steam to the cabinet radiator, and also controls the operation of the damper 21 which regulates the discharge of overheated air. The thermostat is of the type which operates through a temperature range of several degrees, so that a proper sequential order in the regulation of the heating and ventilating instrumentalities is maintained.

That is to say by way of example, when the room temperature arrives at 70½° F., the direct radiator shuts off; at 71° F., the unit radiator shuts off, and the fan recirculates unheated air at that temperature and diffuses it to all portions of the room.

When the temperature reaches 71½° F., the discharge damper 21 starts to open, and at 72° F. is fully open, so that in this latter adjustment the fan is exhausting large volumes of overheated air directly from the room near the floor thereof and discharging it out of doors, and is also maintaining the circulation of air within the room by the discharge of a limited volume of air through the discharge outlet 14, which maintains sufficient air motion and diffusion throughout the room and assists in causing air to flow from outer corners or pockets within the room toward the fan inlet.

At the same time, the discharge of air from the room through the duct 19 tends to lower the pressure within the room, and this causes an inflow of cooler infiltrated air from out of doors and air from the corridors or from other cooler rooms in the building, which inflow is or may be in the nature of an infiltration from various sources, so that numerous gentle currents of cooler air are admitted to the room and commingled with the currents of air flowing therethrough and are drawn into the fan and recirculated or in part discharged to the out of doors, depending upon the adjustment of the apparatus under thermostatic control.

The arrangement is one which tends, when overheating occurs, to exhaust the air from a point near the floor, which assists in maintaining downflowing currents from regions adjacent to the ceiling, and also assists in discharging air which is contaminated by dust resulting from mud tracked in by the shoes of the occupants, so that at all times downflowing currents are maintained throughout the room, and tend to maintain an equal distribution of temperature.

The discharge of the overheated air in the manner stated also tends to withdraw the cooler air from corridors, or more distant rooms, and to create and maintain circulation and redistribution of air throughout the entire building, so that cool air at a moderate temperature, or intensely cold air from widely separated cracks, is admitted where required for cooling purposes, and the cabinet radiator is relieved from the duty of heating the cold outside air for direct discharge into the room in accordance with the prevalent modern practice.

The present method of heating and ventilating thus performs the following beneficial functions in maintaining comfortable living conditions throughout the school building, or other building within which the system is installed.

It serves to heat each room evenly and afford agreeable air motion which conduces to the comfort of the occupants.

It serves to maintain diffusion of heat and agreeable air motion after all direct heating appliances have been shut off.

It operates to cool each overheated room by the exhausting of heated air directly from the lower occupied section of the room, and accelerates infiltration of cooler air from other portions of the building and from seepage or leakage from out of doors by creating a depression in the room.

It increases the volume of air handled by the fan in discharging heated air, reducing resistance by enlarging the outlet area by the provision of two outlets, one directly outdoors and the other through the discharge outlet into the room.

It tends to eliminate dust from the floors and to assist in the cooling of abnormally overheated rooms during cold weather by drawing out some of the heated air, replacing the heated air by drawing cooler air through doorways and corridors, and thus equalizing the temperature of the air throughout the building, with a resultant conservation of fuel and a tendency to equalize the heating requirements in unfavorably situated rooms during adverse weather conditions. During warm weather, windows may be opened wide, and the fan will circulate controlled induced volumes of air from out of doors.

Although the invention has been described with reference to a particular form of apparatus well adapted to operate in conformity with the present method, it will be understood that the invention is not limited to the use of apparatus of the character described, since numerous modifications in mechanical detail may be introduced without departing from the spirit of the invention.

I claim:

1. The method of heating and ventilating a room under varying weather conditions, which consists in maintaining a forced continuous recirculation of air throughout the room by withdrawing air from the lower part of the room and returning at least a portion of it to the room, heating the circulated air by artificial means adjusted to impart a maximum heating effect when the temperature is below the lower limit of a selected control range of temperatures, reducing the heating effect on a predetermined rise of temperature of the circulated air within said control range, and discharging a portion of the air withdrawn from the room, directly outdoors

upon a continued rise in temperature within said control range whereby the rate of recirculation of room air is reduced and the air pressure within the room is reduced and the inflow into the room of cooler air through widely dispersed numerous openings from regions outside of the room under control is induced.

2. The method of heating and ventilating a room under varying weather conditions, which consists in maintaining a forced continuous recirculation of air throughout the room by withdrawing air from the lower part of the room and returning at least a portion of it to the room, heating the circulated air by artificial means adjusted to impart a maximum heating effect when the temperature is below the lower limit of a selected control range of temperatures, reducing the heating effect on a predetermined rise of temperature of the circulated air within said control range, and discharging a portion of the air withdrawn from the room directly outdoors upon a continued rise in temperature within said control range to reduce the rate of recirculation of room air and reduce the air pressure within the room and induce the inflow into the room of cooler air from numerous and widely separated openings and from regions outside of the room under control, the volume of air discharged directly outdoors from the room being in ratio to the rise and fall of temperatures within a portion of said control range including its upper limit.

3. The method of maintaining a uniform temperature of the air in a room, which consists in constantly agitating the air by forced continuous recirculation by withdrawing air from the lower part of the room and returning at least a portion of it to the room, heating it by controlled artificial means, cooling it by maintaining substantially the same air inlet area while discharging, varying quantities of the air withdrawn from the room and discharging it directly to a region outside the room, thereby reducing the rate of recirculation of room air and creating a depression and accelerating the widely diffused infiltration of cooler air from regions exterior of the room and mechanically mixing the cooler air thus admitted with the warmer room air, using the whole room for a mixing chamber, governing the quantities of air educted and exterior air admitted by the temperature of the mixture, and correlatively regulating the mechanically controlled heating and cooling means to counteract variations in room temperature within a selected range so that all said heating means shall through progressive stages, be ultimately completely throttled during a rising temperature and opened during a falling temperature within said range and so that the quantity of over-heated air educted and discharged and exterior air admitted will be gradually increased on a rising temperature and gradually decreased on a falling temperature within said range.

4. The method of heating and ventilating a plurality of rooms within a single building connected by interior corridors, which consists in maintaining a uniform temperature of the air within each room by constantly agitating it by withdrawing air from the lower part of the room and returning at least a portion of it to the room, by upward discharge and forced recirculation of the room air only, heating it by controlled artificial means, cooling it by educting and discharging to a region outside the room varying quantities of the air withdrawn from the room while maintaining substantially the same air inlet area, thereby reducing the rate of recirculation of room air and creating a depression and accelerating the widely diffused natural inflow of cooler air from the corridors and other regions within the building and mixing the cooler air thus admitted with the warmer room air, using the whole room as a mixing chamber, governing said quantities of air so admitted by the temperature of the mixture, and in correlatively regulating the mechanically controlled heating and cooling means to counteract variations in its temperature within a selected range so that all said heating means shall through progressive stages, be ultimately completely throttled during a rising temperature and opened during a falling temperature within said range and so that the quantity of over-heated air educted and discharged and exterior air admitted will be gradually increased on a rising temperature and gradually decreased on a falling temperature within said range.

5. The method of ventilating a room where an individual unit is placed with each room to be ventilated, which consists in maintaining a maximum forced rate of recirculation of the air in the room while at normal temperature or below, and cooling the room by educting and discharging varying quantities of the recirculated room air directly out of doors before admixture of the remainder with the room air, thereby reducing the rate of recirculation of room air and creating a depression and accelerating the natural inflow of cooler air from exterior regions while using the remainder of said discharge to maintain a proportionately reduced recirculation of air within the room for mixing the cooler air thus admitted with the warmer room air.

WILFRED SHURTLEFF.