March 18, 1941. F. A. KITCHEN 2,235,500

HEATING AND VENTILATING APPARATUS

Filed Oct. 3, 1938 2 Sheets-Sheet 1

FIG. 1.

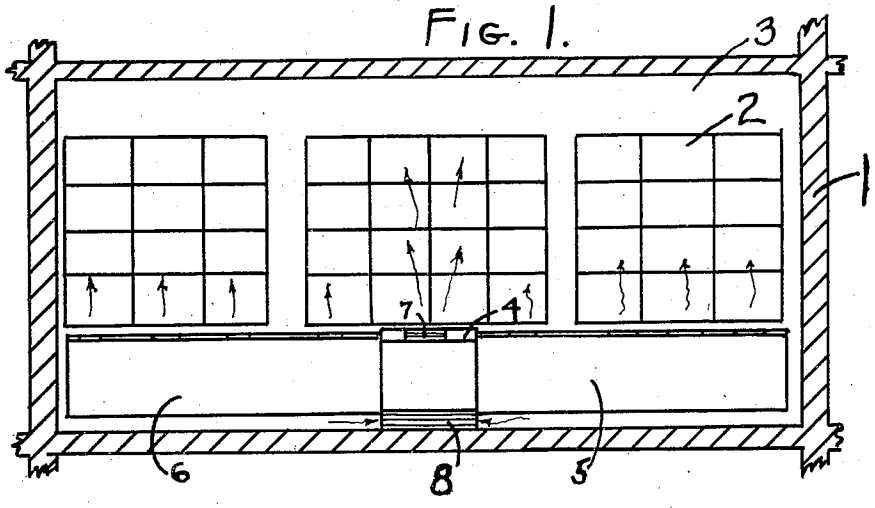
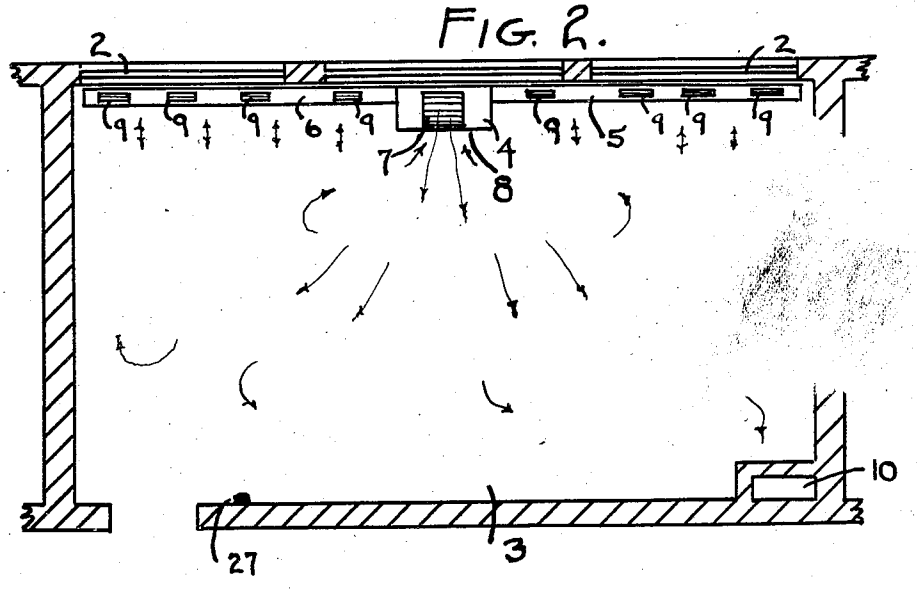


FIG. 2.



FRANCIS A KITCHEN INVENTOR.

BY Thos. E. Scofield

ATTORNEY.

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FIG. 3.

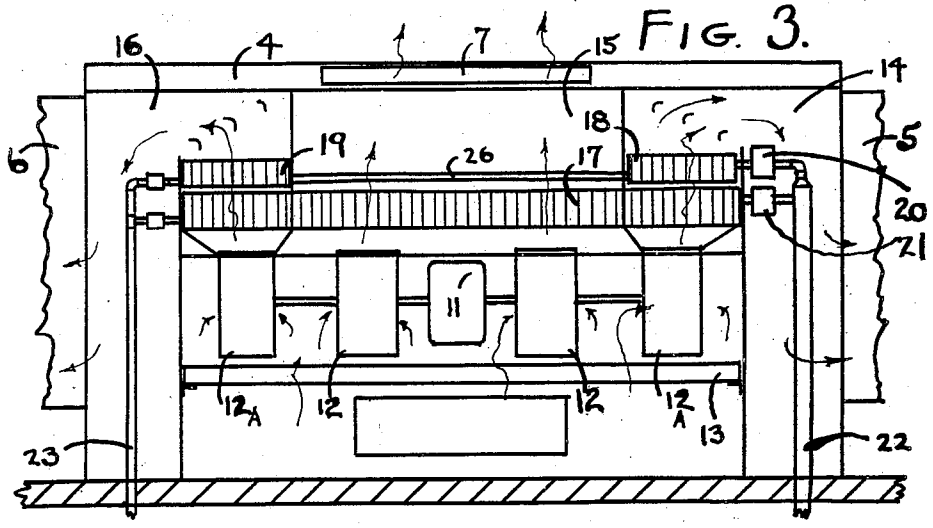


FIG. 4.

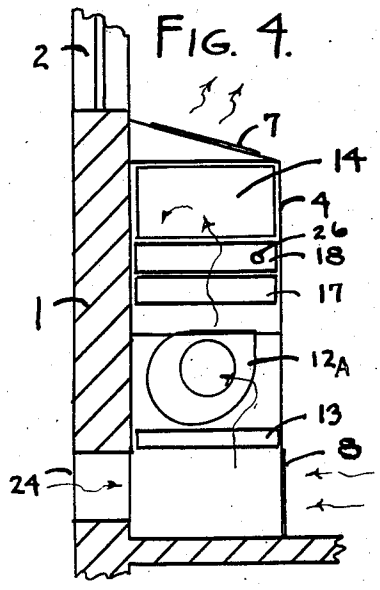
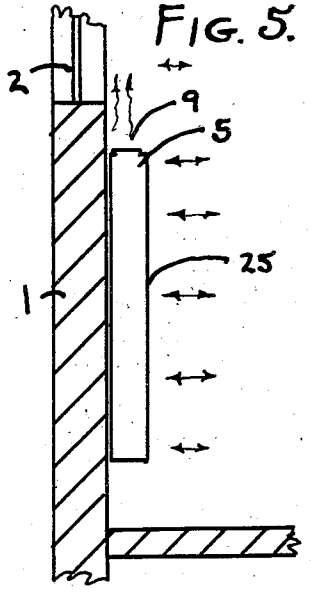


FIG. 5.



FRANCIS A KITCHEN INVENTOR.

BY Thos. E. Penfield

ATTORNEY.

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UNITED STATES PATENT OFFICE

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HEATING AND VENTILATING APPARATUS

Francis A. Kitchen, Cleveland, Ohio

Application October 3, 1938, Serial No. 233,134

7 Claims. (Cl. 237—2)

This invention relates to improvements in an apparatus for heating and ventilating, and refers more particularly to an apparatus for circulating air for ventilation to occupants in the interior of a room from a unit circulating and heating device, and from the same device to provide means to circulate heated air over the exposed window areas of the room at a different temperature and in such a manner as to form a heat radiant surface for occupants near such outside exposed window area.

A further object of this invention is to provide an improved apparatus for circulating air and providing heat radiant surface near exposed surfaces which can control the temperature more acccurately throughout the room when the temperature control thermostat is placed on the interior of the room.

A further object of the invention is to provide an improved apparatus for circulating air and providing a combination heat radiant surface and forced circulation below window area at a different temperature and air pressure, both being equipped from a single motor unit, with the arrangement of the elements to be of small and compact size.

The heating and circulating unit placed in a room is so constructed that it will draw air from the inside as well as from the outside of the building. The unit forces the air by a mechanical means through a single heat exchange surface, and part of the air through an additional heat exchange surface to a temperature radiant surface so placed that the air currents are directed over the glass areas above the zone of occupancy, while the radiant surfaces are directed towards and into the zone of occupancy; the excess air being directed above the zone of occupancy towards the interior of the room. The zone of occupancy is considered to be below four feet above the level of the floor.

Fig. 1 is a vertical sectional view of a room in a building showing the more important elements of the system.

Fig. 2 is a plan view of a room in a building showing the location of the important elements of the system.

Fig. 3 is an enlarged view of the circulating and heating unit showing the arrangement of the parts and spaces provided for circulating air to the heat radiant surfaces.

Fig. 4 is a sectional view of the ventilating unit placed as shown in Fig. 3 showing a portion of the outside wall and floor of the building.

Fig. 5 is a sectional view of the combination air circulating unit and temperature radiant surface located under exposed glass area and connected to the unit shown in Figs. 3 and 4.

Referring to the drawings, in 1 is shown a portion of the building structure consisting of a second floor room 3 with outside glass areas 2. A unit heater is shown placed near the outside wall and a flat surfaced duct 5 is placed under the window area connecting to said heater 4. An additional flat surfaced duct 6 is shown connected to said heater 4. The unit circulator has openings from it to the room at 7 and 8.

The flat surfaced ducts 5 and 6 are shown in Fig. 2 with a series of openings 9 extending across the room. The double arrows indicate the effect of radiant heat from the flat surfaced ducts 5 and 6 to occupants situated three or four feet away from the outside wall.

The single arrows over the glass areas in Fig. 1 show the travel of the heated air from openings 9 in Fig. 2.

The single arrows in Fig. 2 show the travel of air from discharge opening 7 towards the interior of the room and around thermostat 27 usually placed on an inside wall. The air currents then travel back to the unit through opening 8 or are exhausted from the room through opening 10.

The enlarged heating and ventilating unit 4 shown in Fig. 3 consists of a motor 11 connected by shaft to blowers 12 and 12A. Blowers 12A are connected at their outlets through heat exchange surface 17 and thence through secondary heat exchange surface 18 and 19 to chambers 14 and 16 which open into flat surfaced ducts 5 and 6.

Blowers 12 are connected at their outlets through a portion of extended heat transfer surface 17 into chamber 15 and thence through opening 7 into the room.

A motorized valve 20 actuated by thermostat 27 is connected to steam supply line 22 and to heat transfer surface 18 and 19 which are connected by pipe 26. An additional motorized valve 21 also actuated by thermostat 27 is connected to steam supply line 22 and to heat transfer surface 17. Heat surfaces 17, 18 and 19 are drained by openings through traps to return pipe 23.

The heating and ventilating unit 4 in Fig. 4 is connected to the outside of the room through opening 24 and to the inside of the room through opening 8.

The combination air duct and temperature radiant surface 5 is shown in Fig. 5 under exposed glass area. Single arrows indicate the air travel above the zone of occupancy and opposing the natural air currents over glass area 2. Double

arrows indicate the temperature radiant effect into zone of occupancy.

This improved apparatus for circulating air and providing temperature radiant surfaces results in more comfortable conditions for all occupants of a classroom or other space filled with human beings. It is well known that the human body loses heat in three ways, i. e., conduction, convection and radiation.

Heretofore it has been common practice to provide unit ventilators with separate steam radiators as auxiliary heaters whose main purpose was to provide a large amount of heat by convection with a small amount of high temperature radiant energy. Such equipment resulted in very unequal heating and ventilating of a room, and unpleasant reactions from those placed close to the high temperature radiators.

Ordinary classrooms filled with occupants sometimes require ventilation air to be below room temperature and directed towards the interior of the room while at the same time requiring a medium temperature (100° to 130°) air and radiant surface near the outside walls and windows, so that the occupants near those areas can be made comfortable.

It is well known that the human body becomes uncomfortably chilled when seated in 72° air and near to a cold wall or window. This is largely due to the increased radiation of heat from the body to the walls. When a warm radiant surface is so positioned that it will counterbalance the area and position of the cold walls and glass, the loss of heat from the body by radiation becomes more normal and consequently more comfortable.

A small amount of warmed air is used for the purpose of heating a fairly large exposed surface of steel or similar material to a temperature of approximately 100° to 175° and provides the needed radiant surface. The air so circulated is further used to oppose the natural air currents which fall towards the floor, thus resulting in uniform air temperature around, and heat balance for, human bodies near these areas.

The improved apparatus for combining this system of producing comfort near outside walls with an apparatus for circulating the air towards the interior of the room which may require temperatures below the room temperature to maintain comfort, is considered new and novel from a single unit ventilator. Such an apparatus reduces the cost of equipment and results in body comfort in all parts of the occupied zone.

An important part of this apparatus for heating and ventilating lies in the control of the two essential functions by automatic means. It is preferred that the thermostat first control the temperature of the air used for ventilating the interior of the room, and, second, control the radiant effect of air circulation over the window area. This is needed because the interior of a typical room may hold as many as thirty human bodies whose combined heating capacity may exceed the normal heat loss of the room, while those sitting near the cold wall are exposed to a constant radiant heat loss irrespective of the temperature of the interior of the room.

It is evident that the air pressures required to force air through two heat transfer surfaces and through a duct are much greater than the pressures required to force air through a single heat transfer surface and opening into a room. A new and novel apparatus for accomplishing this result from a single motive power supply is herewith disclosed. The separation into chambers of the series of blowers used in a unit ventilator permits definite pressure to be set up for both functions of the unit.

The limiting of the air temperature leaving chambers 15, 14 and 16 to a predetermined point to avoid cold drafts would be considered an optional part of the system.

The use of a humidifying source for the air passing through chamber 15 would be considered an optional part of the system.

Having thus described my invention, I claim:

1. A unit assembly for heating and ventilating rooms in buildings, having outside walls including in combination a heat exchange surface positioned adjacent the outside wall of a room, a flattened duct positioned adjacent said outside wall and extending across the zone of occupancy of said room, said duct being formed with upwardly directed air outlet openings adjacent its upper portion, means for blowing air over said heat exchange surface and into said flattened duct, the construction being such that air circulation currents over said outside wall areas will be set up and said duct will become heated to radiate heat energy into the zone of occupancy.

2. An assembly as in claim 1 including means for directing a portion of the air blown over said heat exchange surface directly into the room being heated.

3. An assembly as in claim 1 including means for introducing air from the exterior of the room being heated to said heat exchange surface.

4. An assembly as in claim 1 in which said room is provided with an exhaust opening adapted to remove air from the room.

5. An assembly as in claim 1 including in combination an auxiliary heating surface adapted to reheat the air passing over said first heat exchange surface before it is introduced into said flattened duct.

6. An assembly as in claim 1 in which said heat exchange surface is provided with heating means, means for introducing a heating medium to said heating means and thermostatic means responsive to the temperature of the room for controlling said heating medium.

7. An assembly as in claim 1 including in combination an auxiliary heat exchange surface positioned in the path of the air leaving said first heat exchange surface and passing into said flattened duct, said heat exchange surface being provided with heating means, including means for introducing a heating medium to said heating means and thermostatic means responsive to the temperature of the room for controlling said heating medium.

FRANCIS A. KITCHEN.