

May 18, 1943.

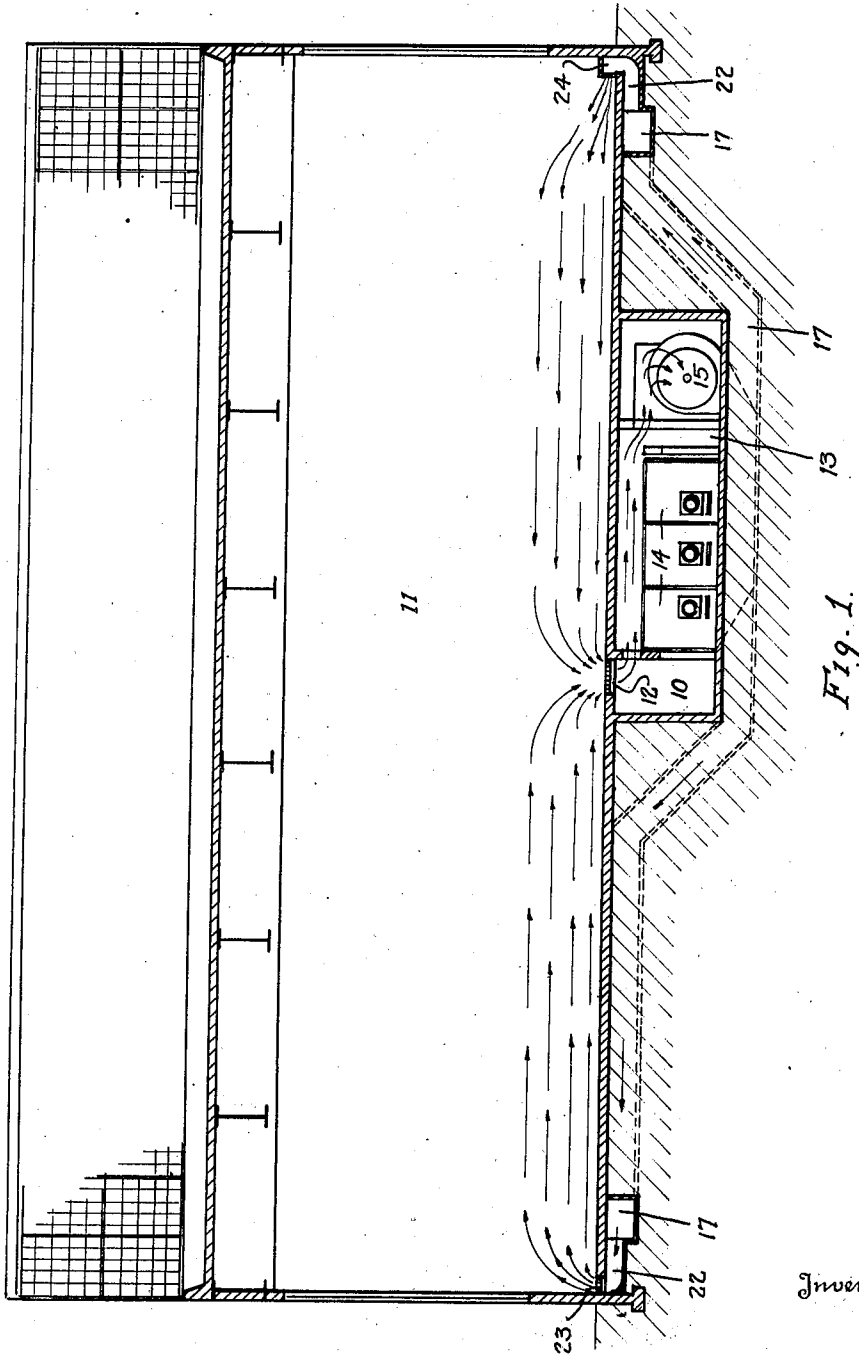
A. A. OLSON

2,319,703

METHOD OF HEATING AND VENTILATING

Filed Dec. 17, 1938

2 Sheets-Sheet 1



Inventor

ARTHUR A. OLSON

Francis J. Klemm

Attorney

By

May 18, 1943.

A. A. OLSON

2,319,703

METHOD OF HEATING AND VENTILATING

Filed Dec. 17, 1938

2 Sheets-Sheet 2

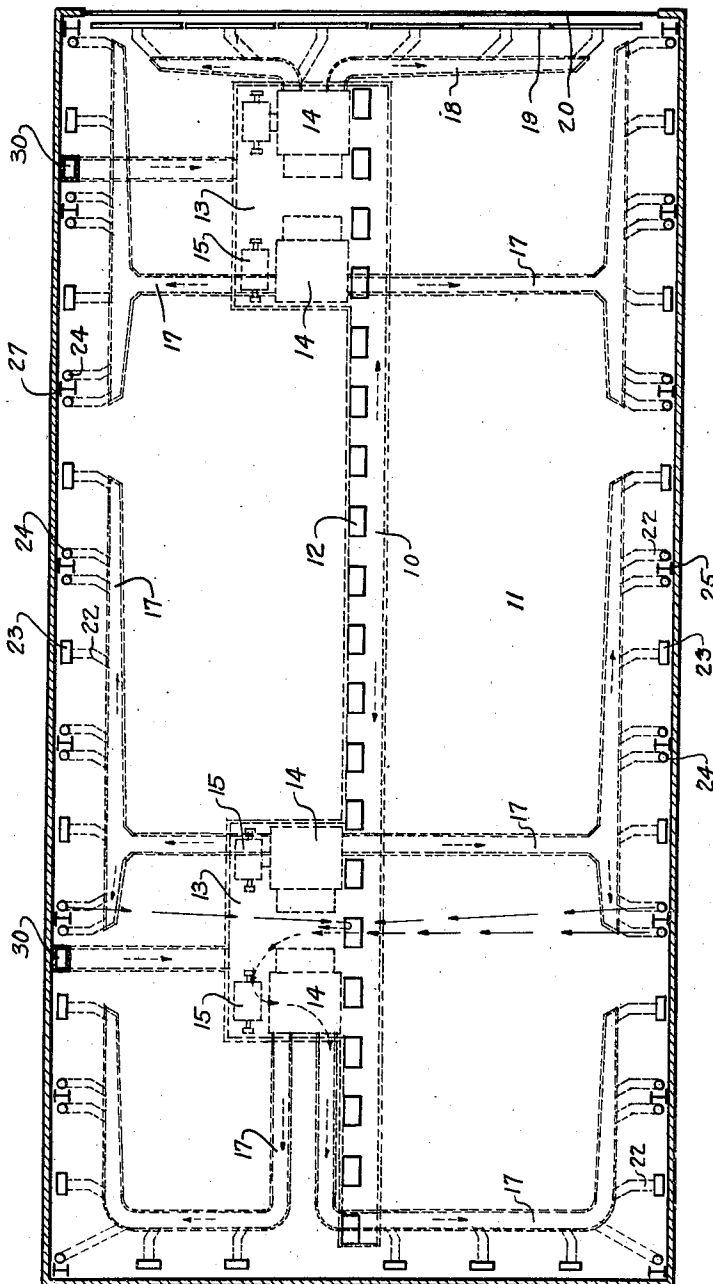


Fig. 2.

Inventor

ARTHUR A. OLSON

By

Francis J. Kump

Attorney

UNITED STATES PATENT OFFICE

2,319,703

METHOD OF HEATING AND VENTILATING

Arthur A. Olson, Youngstown, Ohio

Application December 17, 1938, Serial No. 246,343

4 Claims. (Cl. 98—33)

The present invention relates to the art of space heating and ventilating and more particularly to method and apparatus for heating and ventilating large rooms or enclosures such as factory buildings and aircraft assembly bays or hangars. The invention is particularly applicable, although not necessarily limited in its adaptability, to the last mentioned uses and accordingly the invention will therefore be described in connection with such structures.

In the design and construction of buildings for the purpose stated, functional considerations require that enclosures of maximum clear span and often of great height be provided and it is now practicable to construct aircraft assembly rooms and hangars having a minimum span of over three hundred feet and a ceiling or roof height of approximately seventy-five feet. The satisfactory and economical heating and ventilating of an enclosure of these proportions presents substantial difficulties as it is inefficient and structurally impractical to suspend any heating equipment from the already overburdened roof trusses and to utilize any space on the floor or inwardly of the encircling walls would defeat the primary purpose of the large clear span. In addition, it is desirable and common practice, by building a saw-tooth, monitor or comparable type of roof, to incorporate in the roof large areas of glazed sash to provide an abundance of daylight within the enclosure. Since the metal of the sash is a good heat conductor and since considerable leakage occurs around the sash, large glazed areas result in enormous heat losses particularly where such areas are positioned in the ceiling or upper portions of large rooms having high ceilings. The heated air within the room, being of less density, ordinarily rises rapidly to the ceiling into contact with the cold surfaces of the glass or other structural units and filters through any existing crevices or openings. The rising heated air results in temperature stratification with a substantial differential between a zone adjacent the ceiling and a zone adjacent the floor. Inasmuch as attendants, workmen and other persons using the building are usually on or adjacent the floor, a comfortable temperature must be maintained at the floor which necessarily results in excess temperature in the higher regions with consequently greater heat losses and lower over-all efficiency.

Additional problems have been encountered when enclosures of the kind described have been used to house air-craft particularly of the larger sizes as the large wing surfaces interfere with the normal and intended flow of heating and ventilating streams of air.

The present invention seeks to overcome the problems above enumerated and the primary

object of the invention is accordingly the provision of an improved economical method for the heating and ventilating of large clear span structures whereby heat losses are reduced to a practicable minimum and even temperature and adequate ventilation are attained in the inhabited zone. A further object of the invention is the provision of an arrangement whereby the objectives stated immediately above are accomplished without interfering with the normal and intended use of the entire space made available by the structure and without placing any limitations or loads on the structural elements of the buildings. A further object of the invention is the provision of a heating and ventilating system for a structure the operation of which system is not materially affected by aircraft and other large objects being housed therein and which will not be injurious to the aircraft or other objects so housed.

The above objects are collectively accomplished according to the present invention by positioning both the hot air outlets and the cold air return grills in or adjacent the floor of the structure being heated and ventilated and creating sufficient circulative effect to insure the confinement of the air flow to a low zone immediately above the floor level. By way of example, the invention has been illustrated as applied to an aircraft hangar of conventional design, and in the drawings:

Figure 1 is a cross section of a structure including a heating and ventilating system according to the invention; and

Figure 2 is a floor plan of the structure of Figure 1.

In carrying out the invention it is proposed to construct a return air tunnel 10 below the level of the floor of the enclosure (designated 11) and to provide communication between the enclosure and tunnel by means of the grills 12. The tunnel 10 extends centrally of the enclosure and in practice may also be utilized for the passage of compressed air lines, electrical conduits and other service connections. One or more heater rooms 13 are provided adjacent to and in communication with the tunnel 10 and in large installations the heater rooms are preferably located beneath the floor of the enclosure to conserve space and to reduce the length of the return and hot air ducts to a minimum. Each heater room 13 contains one or more large capacity air heating furnaces 14 which are of the high speed type and preferably fired with liquid or gaseous fuel. A blower 15 is associated with each of the furnaces and is adapted to force air from within the heater room through the contiguous furnace and into the hot air distribution duct system.

Extending outwardly from each of the air heating furnaces 14 are one or more main ducts

17 which take off from beneath the furnaces and extend under the floor to regions in the vicinity of the outer walls of the enclosure. Leading from the main ducts 17 are the branch ducts 22 which extend through the floor of the enclosure at positions immediately adjacent the outer walls of the enclosure. Grills 23 provide communication between the certain of the ducts 22 and the enclosure while flow directing mushrooms 24 provide communication between the chamber and the other of said branch ducts 22. The mushrooms 24 are preferably positioned immediately adjacent the supporting columns 27 where they are protected from impingement by the wheels of vehicles or other objects moving within the enclosure.

If, in accordance with the usual practice, the enclosure is provided with a large entrance door as indicated at 20, a series of grills 19 extending longitudinally of the door opening and connecting with one of the air heating furnaces 14 through a duct system 18 may be provided to blanket any inrush of cold air through the opening when the door is open, as more fully explained in my U. S. Patent No. 2,218,404 dated October 15, 1940. Fresh air is normally supplied to the enclosure by the ducts 30 which connect the outside atmosphere with the furnace rooms 13 and which may be provided with suitable dampers (not shown). In operation air coming into the heater rooms 13 through the tunnel 10 and fresh air ducts 30 will be drawn into the circulators 15 and forced through the heaters 14 and ducts 17 and 18 to the grills 23 and 19 and mushrooms 24 and thus discharged into the space within the enclosure. A substantial low pressure will be developed in the region of the grills 12 in the upper wall of the tunnel 10 which will draw the air issuing from the grills 19 and 23 and mushrooms 24 across the floor and into the grills 12. By properly designing the areas and arrangement of the various ducts involved and the capacity of the heaters 14 and blowers 15 it is possible to confine the movement of the heated air to a region or zone immediately above the floor, thereby preventing the rapid upward flow of heated air into regions where higher losses are prevalent, thus preventing stratification of the air in the high ceilinged enclosure and reducing heat losses to a minimum. In actual practice it has been found possible to operate the system herein described in such manner that the normally inhabited zone of the enclosure is maintained at a comfortable and healthful temperature while maintaining a temperature differential of less than 3 degrees between the floor and ceiling areas thereof. Because of the nature and path of travel of the air within the enclosure minimum interference with such flow is caused by objects having wide extending surfaces such as the wings of aircraft housed within the enclosure and therefore the invention has particular merit when applied to structures housing aircraft. It can thus be seen that the invention provides a method and arrangement whereby the objectives initially set out are accomplished. Heat losses are reduced to a minimum, adequate heating and ventilation in the inhabited zone is insured and these characteristics are retained without reducing any of the usable space within the enclosure or placing any limitations of design or load on the structural elements of the building.

The above specifically described embodiment

of the invention should be considered as illustrative only as obviously many changes may be made therein without departing from the spirit or scope of the invention, the extent of which is indicated in the subjoined claims.

What I claim is:

1. A heating and ventilating system for a relatively large enclosure comprising a tunnel extending substantially centrally beneath the floor of the enclosure, a series of grills between said tunnel and enclosure, an air heating furnace, ducts positioned beneath said floor and extending outwardly to positions adjacent the outer wall of said enclosure, means in said floor providing communication between the enclosure and said ducts, and air circulating means adapted to withdraw return air from said tunnel and propel the same through said furnace and ducts.

2. A heating and ventilating system for a relatively large enclosure comprising a tunnel extending substantially centrally of said enclosure and beneath the floor thereof, a series of grills in said floor providing communication between the space within the enclosure and said tunnel, a heater room positioned beneath said floor adjacent said tunnel and being in communication therewith, an air heating furnace within said room, an air circulating means within said room and adapted to force the air within said room through said furnace, an outlet for said furnace and ducts extending beneath said floor connected with said outlet and extending in the direction of the outer walls of said enclosure to conduct heated air to said enclosure in the vicinity of said outer walls.

3. A heating and ventilating system for a relatively large enclosure comprising a tunnel extending substantially centrally of said enclosure beneath the floor thereof, said tunnel being in communication with said enclosure at a multiplicity of spaced points, ducts positioned beneath said floor and extending outwardly towards the outer walls of said enclosure and adapted to conduct heated air to said enclosure, means to withdraw air from said tunnel and discharge the same into said ducts and means to heat said air.

4. A heating and ventilating system for a relatively large enclosure having a floor and side walls comprising in combination a main duct positioned intermediate the side walls of said enclosure and beneath the floor thereof, said main duct being in communication with said enclosure at a multiplicity of spaced points intermediate said side walls, a multiplicity of warm air outlets positioned and spaced along said side walls and adapted to discharge warm air above said floor in a direction extending substantially parallel with said floor and toward said spaced points, a duct system for supplying air to said outlets, an air heating device having its air inlet connected with said main duct and its air outlet connected with said duct system, and means to circulate air through said main duct, air heating device, duct system, warm air outlets and the lower zone of said enclosure in series with sufficient velocity to confine the flow of air within said enclosure to a zone immediately above said floor whereby the blanket of warm air substantially uninterrupted throughout the horizontal extent of said enclosure is caused to move in close proximity to said floor and substantially parallel therewith.

ARTHUR A. OLSON.