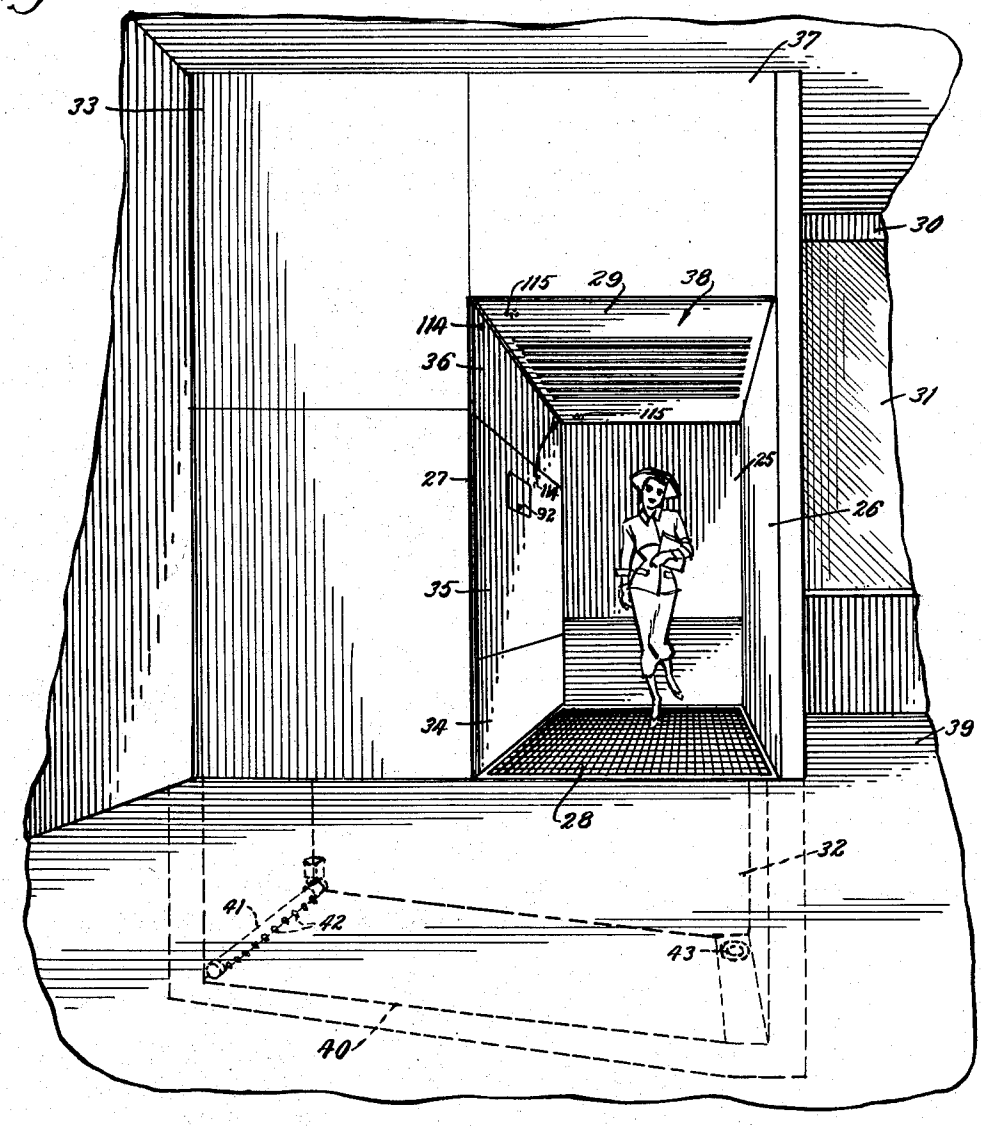
Oct. 11, 1960 E. J. KUREK 2,955,521

AIR SCREEN DOOR

Filed July 26, 1957 7 Sheets-Sheet 1

Fig-1



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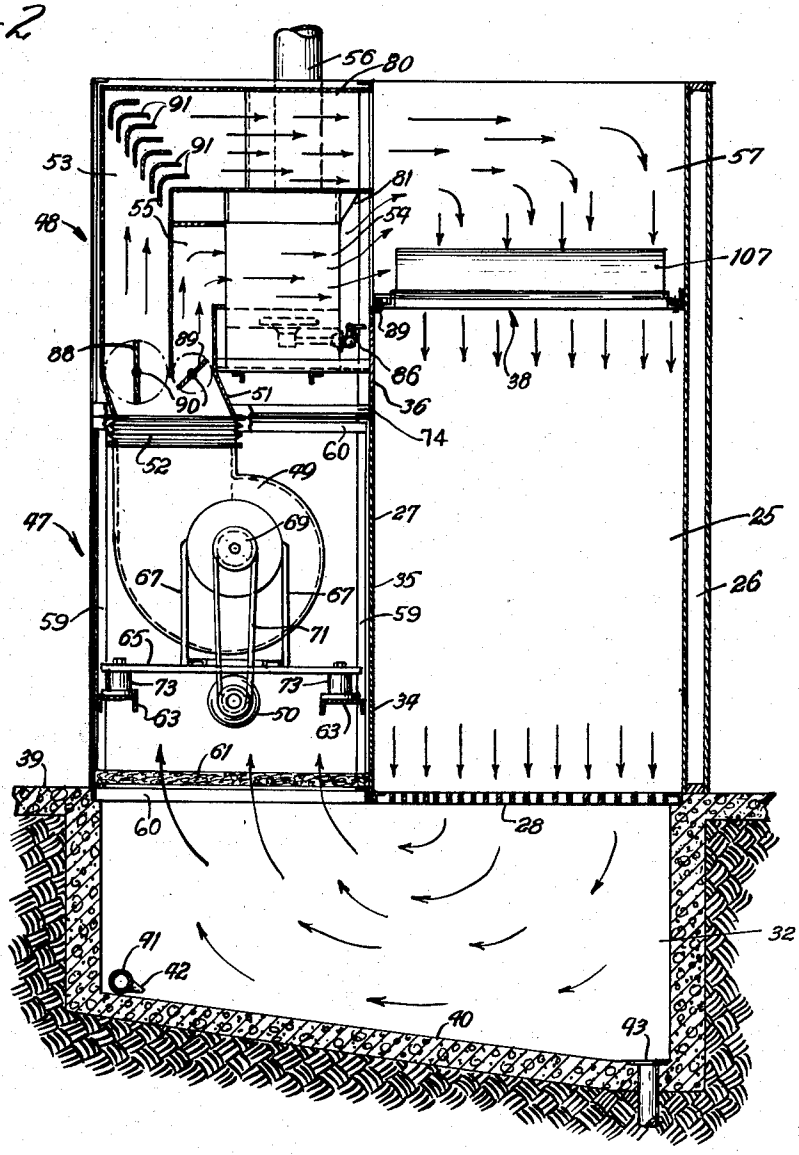
Attys.

Oct. 11, 1960 E. J. KUREK 2,955,521

AIR SCREEN DOOR

Filed July 26, 1957 7 Sheets-Sheet 2

Fig-2



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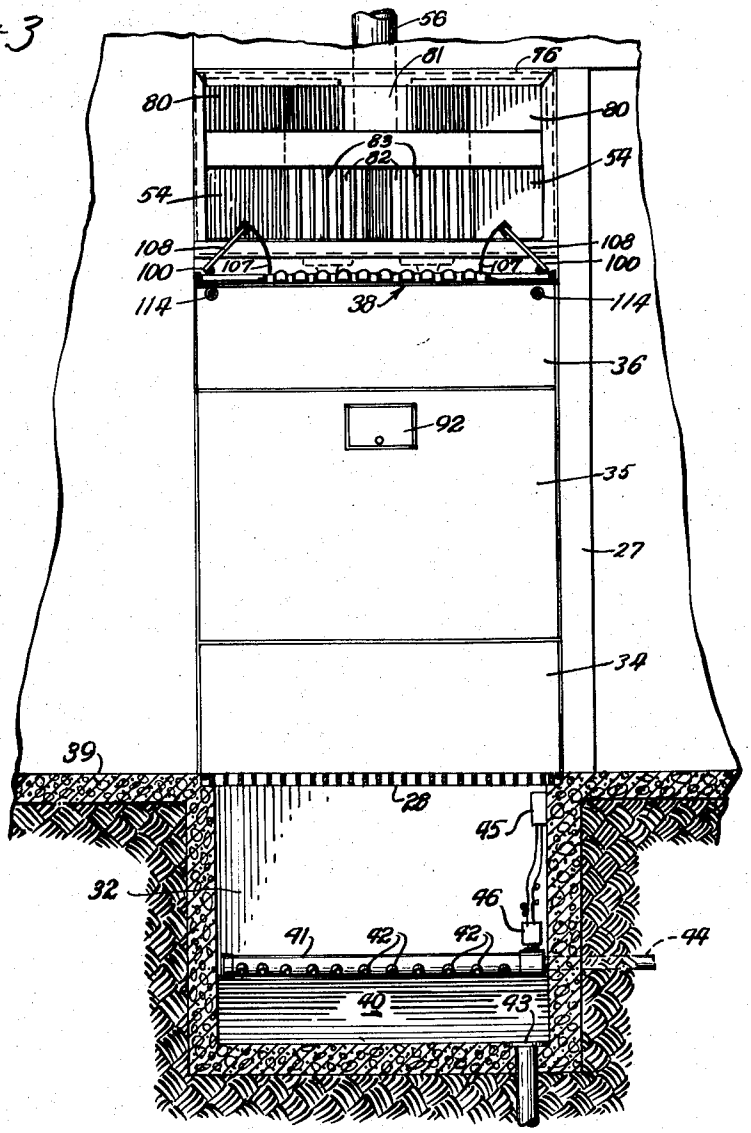
Attys.

Oct. 11, 1960 E. J. KUREK 2,955,521

AIR SCREEN DOOR

Filed July 26, 1957 7 Sheets-Sheet 3

Fig 3



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AIR SCREEN DOOR

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Fig-4

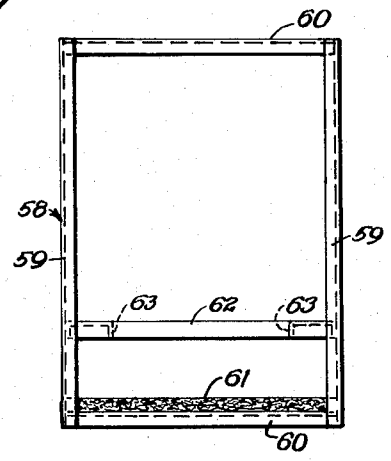


Fig-5

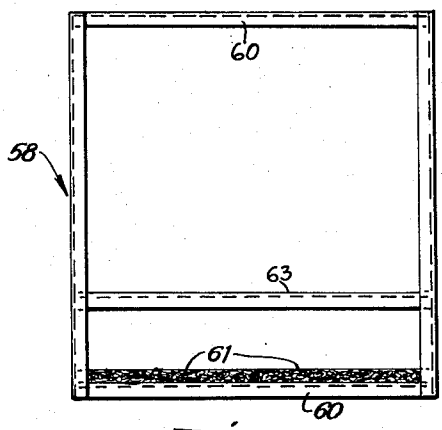


Fig-7

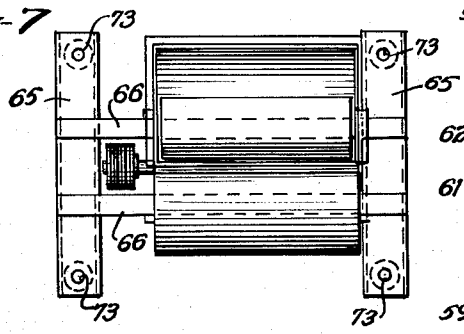


Fig-6

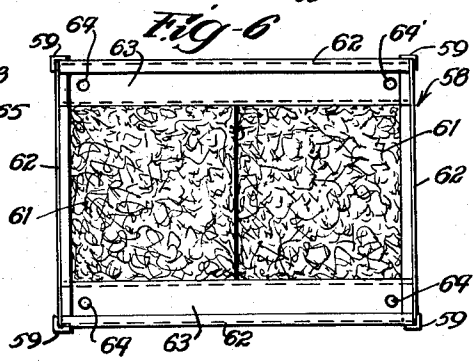


Fig-8

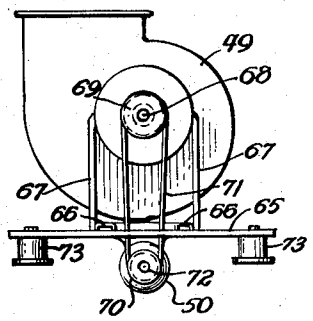
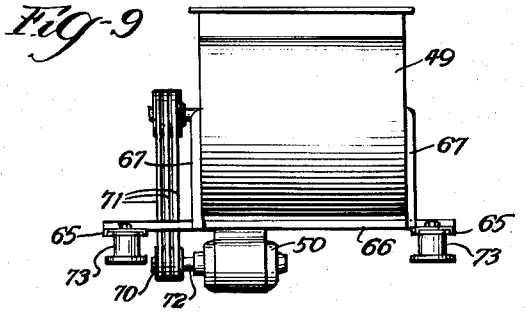


Fig-9



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AIR SCREEN DOOR

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Fig-10

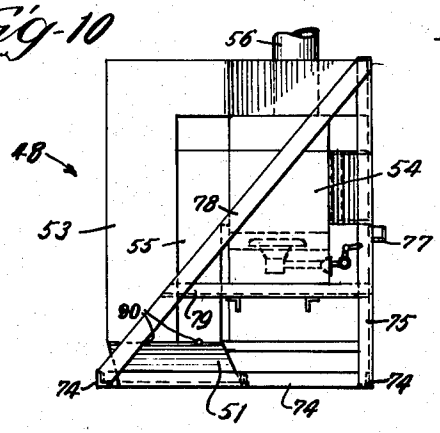


Fig-11

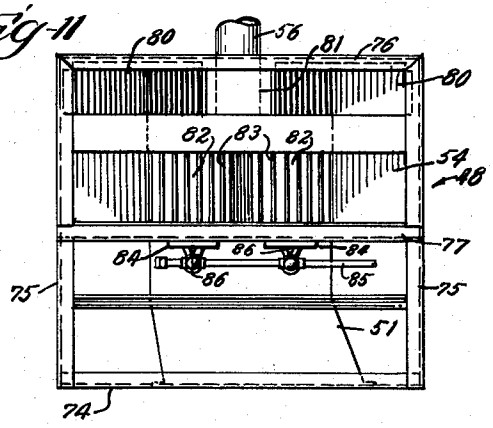


Fig-12

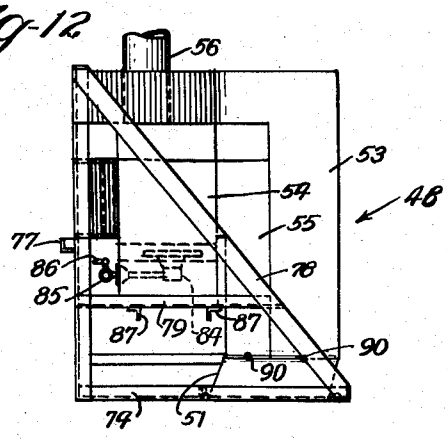


Fig-13

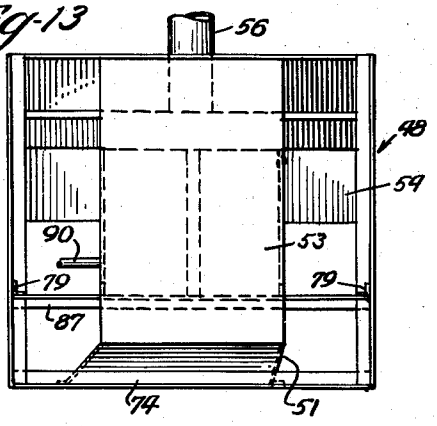
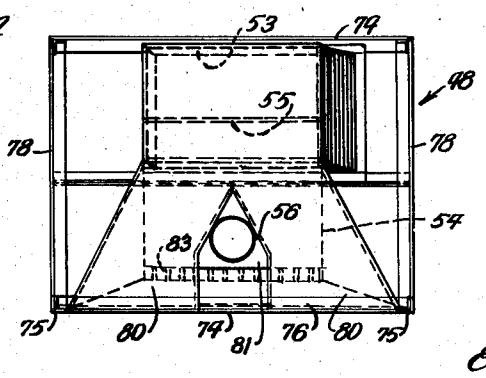


Fig-14



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AIR SCREEN DOOR

Filed July 26, 1957 7 Sheets-Sheet 6

Fig-15

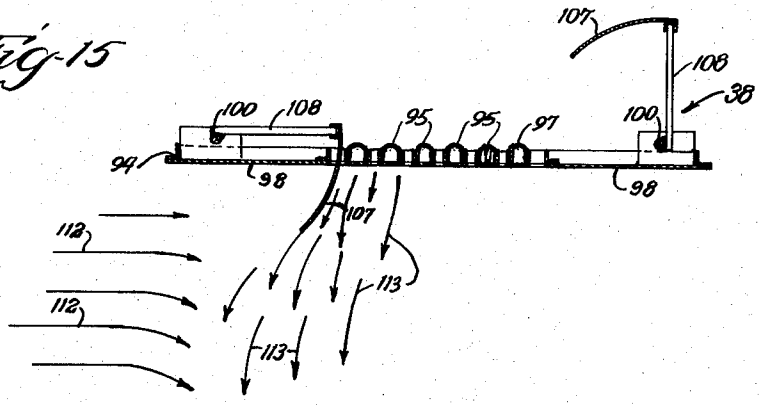


Fig-16

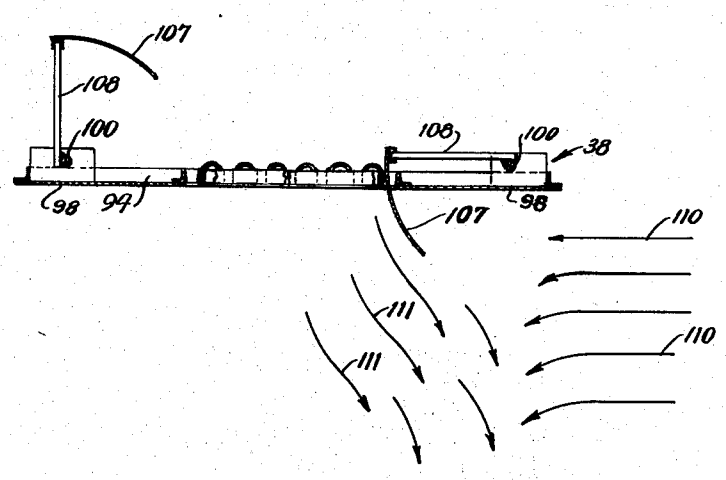
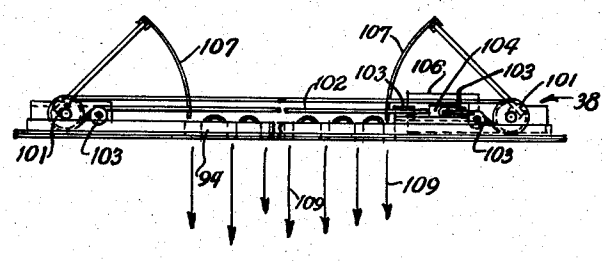


Fig-17



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AIR SCREEN DOOR

Filed July 26, 1957 7 Sheets-Sheet 7

Fig-18

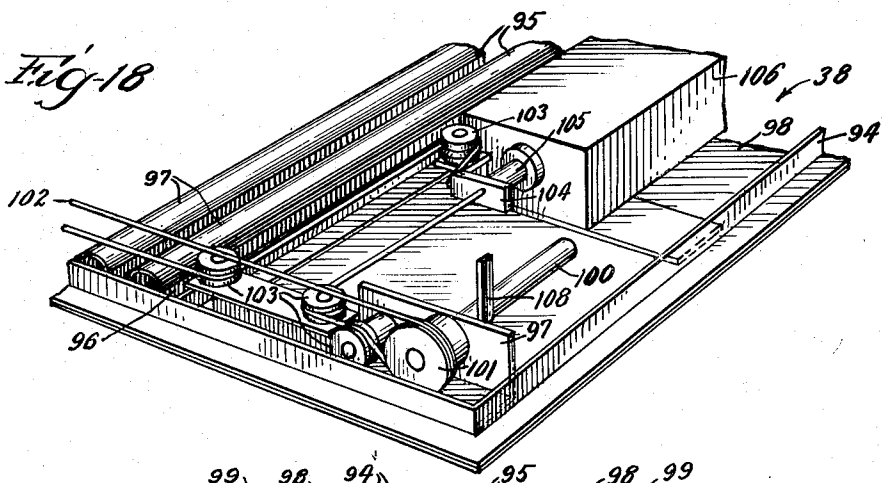
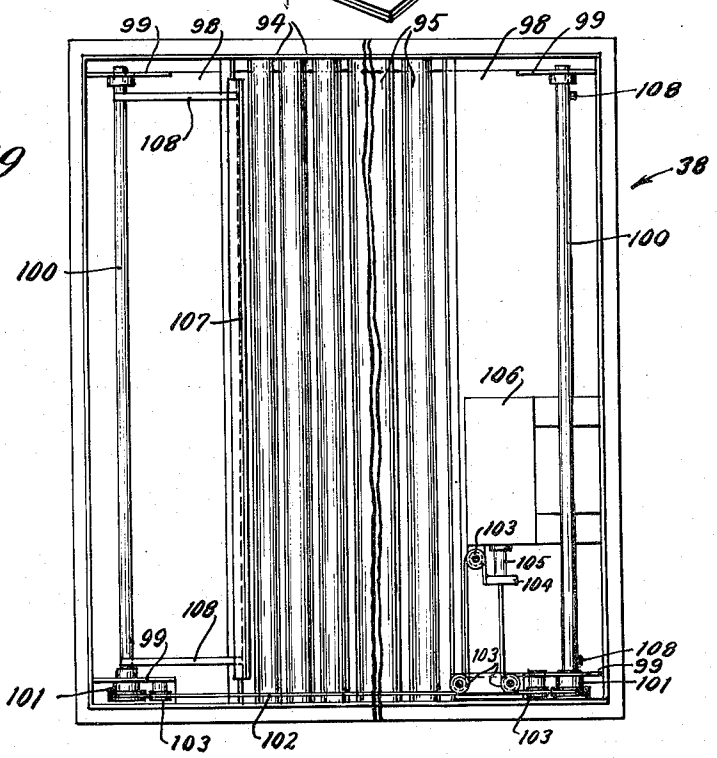


Fig-19



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United States Patent Office 2,955,521 Patented Oct. 11, 1960

2,955,521

AIR SCREEN DOOR

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Filed July 26, 1957, Ser. No. 674,378

14 Claims. (Cl. 98—36)

The present invention is directed to a new and improved air door structure which makes use of air screen forming and controlling assemblies of novel arrangement and design providing for compact, low cost and efficient installation and operation, the over-all assembly being of unitized fabrication and including an air distributing and discharge control portion of new and improved structural arrangement and operational efficiency.

Commercial use of air doors of the type providing for a continuously moving screen or barrier of air capable of efficiently closing off a passage-type entrance has recently become feasible in light of improved forms of air flow control equipment. Air doors of the type now found in use provide means whereby air is continuously recirculated at a sufficient velocity and in a regulated manner to provide for a substantially impregnable air screen capable of closing off a building opening in the form of a door structure to an extent that movement of inside or outside air or foreign material through the screen is prevented while allowing full and uninterrupted use of the door structure for ingress and egress of customers or inhabitants. A continuously moving screen of air creates, in effect, an invisible wall which is capable of preventing penetration of outside air, foreign material such as dust, dirt or debris, insects and even snow, rain or mud. The screen is of such a nature that, upon passing therethrough, the individual is not personally disturbed by air contact.

Many advantages arise from the use of an air screen door of the type described, some of these advantages being for example: the elimination of swinging or revolving door structures requiring manipulation by the user and further resulting in a bottleneck insofar as full capacity use of the door area is concerned; elimination of wind gusts often resulting from the use of a single swinging door structure; elimination of double door structures with intermediate wasted vestibule space for windproofing purposes; reduction in door structure space; and advantageous use of added display space arising from the transparent nature of the air screen.

It is an object of the present invention to provide a new and improved form of air screen door structure including therein air moving and control equipment of unitized construction providing for efficient, uncomplicated, low cost door installation while providing automatic variable operation with little accompanying upkeep.

A further object is to provide a unitized assembly of air moving and controlling equipment capable of prefabrication in the form of separate, readily combinable units which are readily assembled in their operative position on the job site with a minimum of expense and effort; the unitized assemblies constituting the air moving and controlling equipment of the door structure including a particularly efficient form of air moving and conditioning arrangement which in and of itself constitutes a part of the present invention; the over-all unitized assembly further including an air distributing and discharge control assembly of new and improved design capable of efficient

operation in defining and controlling the effective air screen in an automatic manner to compensate for variations in internal and external conditions of the type affecting efficiency of use of the air screen.

Other objects not specifically set forth will become apparent from the following detailed description made in conjunction with the drawings wherein:

Fig. 1 is a fragmentary perspective of an improved form of air screen door structure making use of the new and improved unitized air moving and control assembly of the present invention;

Fig. 2 is a partially diagrammatic illustration in end elevation of the improved air moving and control assembly in its operative position in the door structure;

Fig. 3 is a front elevation of the assembly of Fig. 2, the assembly being diagrammatically illustrated as viewed from the right in Fig. 2;

Fig. 4 is an end elevation of the frame structure of a prefabricated unit forming a part of the improved air moving and control assembly of the present invention;

Fig. 5 is a front elevation of the frame of Fig. 4;

Fig. 6 is a top plan of the frame of Fig. 4;

Fig. 7 is a top plan of a unitized blower and motor assembly designed for mounting in the frame of Figs. 4–6;

Fig. 8 is an end elevation of the assembly of Fig. 7;

Fig. 9 is a front elevation of the assembly of Fig. 7;

Fig. 10 is an end elevation of an air flow control and conditioning prefabricated unit constituting a part of the present invention;

Fig. 11 is a front elevation of the unit of Fig. 10;

Fig. 12 is an opposite end elevation of the unit of Fig. 11;

Fig. 13 is a rear elevation of the unit of Fig. 11;

Fig. 14 is a top plan of the unit of Fig. 11;

Fig. 15 is a partially schematic vertical section of an air distributing and discharge control unit forming a part of the assembly of the door structure of the present invention;

Fig. 16 is a view similar to Fig. 15 illustrating operation of the assembly thereof;

Fig. 17 is another view similar to Fig. 15 illustrating still further an operational aspect of the unit thereof;

Fig. 18 is an enlarged fragmentary perspective of a portion of the air distributing and discharge control unit of Fig. 15; and

Fig. 19 is an enlarged top plan view of the unit of Fig. 15.

In Fig. 1 an air screen door structure including the improved unitized air moving and controlling assembly of the present invention is illustrated as being defined by an elongated rectangular opening 25 formed from parallel side walls 26 and 27, a grate defining floor 28 and a ceiling 29. The side wall 26 is coextensive with the opposite side wall 27 and is constructed as an inwardly extending wall portion formed with the outer wall 30 of a store front which may include window sections 31. The grate 28 defines a portion of the top of a rectangular pit 32 which is of a width equal to the grating 28 while being in length equal to the width of the entire door structure. The pit 32 defines an air return chamber from which air is drawn by a prefabricated, unitized air moving and conditioning assembly mounted behind the side wall 27 and enclosed at the inner end as viewed in Fig. 1 by a wall partition 33.

The air moving and conditioning assembly is vertically arranged behind the side wall 27 and wall partition 33 and access panels 34, 35 and 36 are removably mounted in the central portion of the side wall 27 for dismounting for access to the air moving and conditioning assembly for maintenance thereof. The ceiling 29 defines the bottom wall of an enclosed plenum area, the location of which is defined by the uppermost wall section 37. Air

is introduced by the air moving and conditioning assembly housed behind the wall partition 33 into the plenum area behind the wall section 37 and downwardly through the ceiling 29 in a controlled manner by means of an air distributing and discharge control assembly 38 housed in the ceiling 29. Air is moved at a relatively high velocity downwardly between the side walls 26 and 27 in a controlled manner to define a transversely extending air screen, the air moving through the grating 28 and into the pit 32 for recirculation within the door structure.

As particularly shown in Figs. 2 and 3, the pit 32 is located below the floor line 39 with which the grating 28 is level and may be in the form of a poured concrete basin or chamber being provided with an inclined bottom wall 40. Near the upper end of the bottom wall 40 is positioned a spray pipe 41 provided with a plurality of water directing nozzles 42 arranged to sweep or clean the bottom wall 40 in a direction toward a drain 43 extending through the bottom wall 40 as the lowest end thereof. A suitable water supply pipe 44, partially shown in Fig. 3, is connected with the spray pipe 41 to provide water thereto for flushing the pit 32 and removing therefrom debris, dirt and other foreign matter which falls through the grating 28 and is collected on the bottom wall 40. As shown in Fig. 3, an automatic timer 45 is electrically connected to an automatic valve structure 46 to provide for periodic operation of the spray assembly at predetermined time intervals. With this arrangement the interior of the pit 32 is periodically cleaned in an automatic manner as determined by the extent to which the air screen structure is used.

As particularly shown in Fig. 2, the air moving and conditioning assembly housed by the side wall 27 and positioned to one side of the door structure opening 25 includes a pair of prefabricated or preassembled, separate units 47 and 48 which function to provide for continuous air movement in a substantially circular manner through the door structure as indicated by the arrows. Generally speaking, the lowermost unit 47 functions as an air moving unit by reason of including an air blower 49 of known design being belt-driven by an underslung motor 50. The outlet opening of the blower 49 is connected with a duct 51 by a flexible and expandable flexible duct 52, the duct 51 forming a part of the air delivery and conditioning unit 48. This latter unit includes an outer duct 53 which is, in essence, wrapped around an air heating unit 54 having in communication therewith a separate inlet duct means 55 for delivering air thereinto. The air heater 54 is provided with a venting stack 56 in a manner to be described and air is delivered through the duct 53 and heater 54 into the plenum area 57. The bottom surface of the plenum 57, as previously described, is defined by the ceiling 29 which carries the air distributing and discharge control assembly 38 through which the air is controllably discharged in a downwardly direction across the door structure opening 25 and subsequently through the grating 28 into the pit 32 for recirculation.

The units 47 and 48 of Fig. 2, as previously described, are prefabricated units each of which is separately assembled at the factory and shipped to the job site. At the job site the shipping packing of each unit is removed and the unit 47 is installed in the preconstructed side wall cavity of the door structure with the unit 48 being subsequently installed on top of the unit 47 in stacked relation and the blower 49 being interconnected with the duct 51 by means of the flexible duct 52. With this arrangement, installation costs are maintained at a minimum and each of the units 47 and 48 is of compact design so as to require only a relatively small area for mounting in their operative positions. No special structural framework or supporting beams need be installed at the job site, it being necessary merely to preconstruct the wall cavity into which the air moving and conditioning assembly is to be installed in accordance with the dimensions of the same which are readily obtainable from the manufacturer.

Figs. 4–9 illustrate in detail the structural features of the blower unit 47. This unit includes a frame 58 which as shown in Figs. 4–6 is of rectangular, box-like shape. The frame 58 includes four vertical corner posts or vertical supports 59 interconnected at their top and bottom ends by horizontally extending side beams 60. The lowermost side beams 60 are arranged to support within the frame 58 filter pads 61 which, as shown in Fig. 2, cover the opening of the pit 32 through which air is drawn into the air moving and conditioning assembly behind the side wall 27. In this manner air drawn upwardly for recirculation through the door opening 25 is filtered prior to conditioned delivery into the plenum area 57.

Slightly above the lowermost side beams 60 are a series of rectangularly arranged reinforcing side beams 62 which are interconnected with the corner posts 59 as particularly shown in Fig. 6. The reinforcing side beams 62 support therebetween a pair of spaced channel bar supports 63 which at the ends thereof are provided with drilled holes 64. As shown in Figs. 7–9, plates 65 support therebetween intermediate the ends thereof the blower 49 on platform beams 66 which are suitably attached, as by welding, at their ends to the plates 65. Spaced, vertical blower supporting flanges 67 extend upwardly from the beams 66 and are suitably attached to the blower 49. The blower 49 is provided with an operating shaft 68 carrying a multi-groove pulley 69 thereon which is drivingly connected to a multi-groove pulley 70 by a plurality of belts 71. The pulley 70 is journalled on the drive shaft 72 of the electric motor 50 which is suitably attached to the bottom surfaces of the transverse supporting beams 66 in an underslung position.

The blower motor assembly, as shown in Figs. 7–9, is mounted in the frame 58 by shock absorbing elements 73 which are carried at the ends of the plates 65. The plates 65 are received within the frame 58 transversely of the plates 63 with the bottom surfaces of the shock absorbers 73 being suitably bolted through the holes 64 therein. This mounting arrangement of the blower assembly within the frame 58 is best illustrated in Fig. 2. The compact structure provided by this arrangement is particularly adapted for prefabrication and subsequent speedy installation upon delivery to the job site. The blower 49 is of conventional design being provided with a suitable air moving element in the form of a fan which may be of the "squirrel cage" variety rotatably operated by the shaft 68 which is driven by the motor 50. The motor 50 will preferably be a single speed motor in the interest of economy of construction and maintenance with adequate air flow control being afforded by the assembly 38, the structural features of which will be subsequently described.

The structural details of the prefabricated unit 48 are particularly shown in Figs. 10–14. A structural frame is defined by four bottom beams 74 which are rectangularly arranged for resting engagement with the four uppermost side beams 60 of the structural frame 58 of the unit 47. The discharge side of the unit 48 is defined by a pair of spaced, vertically extending posts 75 which at the tops thereof are interconnected by a transverse angle iron beam 76 and which intermediate the ends thereof toward the center thereof are interconnected by a transverse beam 77 which defines the location of the ceiling 29 of the door structure. The uppermost ends of the posts 75 are interconnected with the rearmost ends of the bottom beams 74 by a pair of diagonally directed supports 78. The vertical posts 75 are further interconnected to the diagonal supports 78 by horizontally extending braces 79.

The air intake duct portion 51 is in communication with a duct 53 as previously described, this duct being formed from interconnected, vertically extending inlet duct and right angled horizontally extending outlet duct portions the latter of which opens outwardly of the front face of the unit as defined by the vertical beams 75. As

particularly shown in Figs. 11 and 14, the outlet end of the duct 53 is subdivided into separate segments 80 from which air flows into the plenum area 57 as previously described. Intermediate the duct segments 80 a flue chamber 81 is located through which the stack 56 extends for exhausting flue gases from the unit 48, the stack 56 being of sufficient vertical height to extend outwardly from the building in which the air screen door is installed.

Immediately below the duct segments 80 is positioned an air heating unit 54 which includes a pair of air heating chambers 82 of any suitable type being provided with a plurality of vertically directed fins 83 between which air flows outwardly into the plenum area along an area below the outlet openings of the duct segments 80. The air chambers 82 are at least partially divided by the flue chamber 81. The air heating chambers 82 have positioned therebelow a plurality of gas burners 84 of a well known type which are operated through a gas line 85 connected to a suitable source in the building. The gas burners 84 are suitably controlled in operation by a known type of automatic equipment which does not form a part of the present invention. Gas burner main controls 86 are accessible immediately inwardly of the access panel 36 as particularly shown in Fig. 2 for maintenance and seasonal adjustment purposes. The air heating unit 54 is supported between the horizontal beams 79 by a pair of transverse beams 87 as particularly shown in Figs. 12 and 13. Air is delivered into the heating chambers 82 by the duct portion 55 previously described which is in communication with the duct inlet portion 51 as particularly shown in Fig. 2.

The operation of the air moving and conditioning unit 48 is better shown in Fig. 2 wherein the ducts 53 and 55 are illustrated as including pivotal dampers 88 and 89, respectively, which are movable to control the amount of air passed through the duct 55 toward the heating unit 54. The dampers 88 and 89 are each carried by pivotal rods 90 which can be suitably operated by known thermostatic control equipment to provide the requisite degree of air temperature for the screen directed downwardly through the door opening 25. In colder weather operation, a substantial amount of the circulating air will be passed through the heating unit 54 to maintain the air screen at a comfortable temperature for contact with individuals passing therethrough into or out of the building. The dampers 88 and 89 are set to prevent the exceeding of the maximum volume of air flow through the heaters in line with the rated capacity of the same. While operation of the dampers by thermostatic control equipment may be used, it may be found preferable to fixedly set the dampers for rated maximum air flow control and maintained air temperature at the desired level by automatic cycle firing of the burners through a separate thermostat controlling an electric solenoid feeding gas directly to the burners. The duct 53 functions, in effect, as a by-pass duct which passes that air which is not being heated around the heating unit 54. The right angled change in direction of travel of the air through the duct 53 is controlled by a plurality of turning vanes 91 carried therein as particularly shown in Fig. 2.

The particular arrangement described whereby the duct 53 is, in effect, wrapped around the heating unit 54 provides for a compact design capable of highly efficient use and further, particularly adapted for prefabrication into a single unit for shipping and subsequent installation. All available space is efficiently used within the framework of the unit 48. Furthermore, heating efficiency is maintained at a maximum particularly where substantially all of the recirculated air is heated during cold weather operation of the air curtain door. The duct 53 extending above the heating unit 54 is, in effect, in indirect heat exchange relation therewith thus resulting in at least a slight heating of the air by-passed therethrough prior to introduction into the plenum area 57. Furthermore, the flue gas chamber 81 extends upwardly between the duct segments 80 and the flue gas is, in effect, in indirect heat exchange relation with the interior of the duct segments 80. Thus the compact design of the air moving and conditioning unit 48 provides for efficient utilization of heat in not only directly heating air passed through the heating unit 54 but further establishing indirect heat exchange relation with air by-passed through the duct 53.

Fig. 1 illustrates the access panel 35 as carrying a removable cover 92 which, when detached, exposes suitable controls for regulating such operations as the periodic flushing of the pit 32 in the manner previously described, all of the various automatic controls used in the door assembly being of a known type capable of providing automatic door operation.

Figs. 15–19 illustrate in detail the air distributing and discharge control assembly 38 which is mounted in the ceiling 29 of the door structure. This assembly constitutes an important part of the present invention in that it is relatively simply constructed with lightweight design and capable of highly efficient operation in compensating for changing weather conditions which affect efficient use of the air screen in separating the interior and exterior of the building. Referring first to Fig. 19, the assembly 38 is formed from a rectangular frame 94 which is suitably received within the ceiling 29 of the door structure and which may be hingedly attached thereto along one side for downward swinging movement to allow access thereto for maintenance or access into the plenum area 57 when desired. The frame 94 supports a plurality of spaced, bar-like members 95 which form a grate through which air passes in a downward direction. Each of the bar-like members 95 is provided with a horizontally flat bottom surface and a convex top surface. These members may be formed in any suitable manner and, as illustrated, may be fabricated from channel strips 96 into the top openings of which are received arcuate metal strips 97, these strips being suitably attached to one another such as by welding.

To each side of the series of bar-like members 95 is a plate 98 enclosing the end portions of the frame 94 adjacent the exit and entrance areas of the door opening 25. Opposite ends of the frame 94 carry vertical mounting plates 99 which journal therethrough the ends of a pair of pivotally mounted rods 100. Each of the rods 100 has attached at an end thereof a pulley 101 about which is received a cable 102 which is guided into engagement with the pulleys 101 by a series of grooved guide rollers 103. The single cable 102 is attached at one of its ends to a flat bar 104 attached to the end of a reciprocating piston rod 105 forming a part of a known type of pressure differential responsive mechanism 106. This mechanism includes a servo-motor which operates the rod 105. The remaining end of the cable 102 is attached to an end of bar 104 in such a manner that, upon movement of the piston rod 105, the cable 102 will remain taut about the pulleys 101 and guides 103 to pivot each of the rods 100 in opposite directions.

Attached to each of the rods 100 is an arcuate vane 107, the pair of vanes being better shown in Figs. 15–17. Spaced bars 108 are suitably attached at their ends to a vane 107 and at their remaining ends to an adjacent pivotal rod 100 to pivot the vanes in a vertical direction above and through the frame 94. The length of the bars 108 is equal to the radius of the arc of movement of the vanes 107 relative to the centers of the pivotal rods 100, this radius being equal to the distance from the rods 100 to the inner edges of the plates 98. With this arrangement, the vanes 107 are positioned to move through the frame 94 intermediate the endmost bar-like member 95 and the innermost edge of the adjacent plate 98. The curvature of each vane 107 coincides with the arc described during movement of the same to permit free movement of each vane 107 through the frame 94. The outer surface of each vane 107 when in its operative posi-

tion (extending through the frame **94**) is concave for a purpose to be described.

In the operation of air doors, it is essential to provide means whereby the direction of downwardly moving air current defining the curtain can be redirected to compensate for changing external or internal pressure conditions which might cause breaching or partial destruction of air screen. Figs. 15–17 diagrammatically illustrate the manner in which the vanes **107** regulate the direction of flow of air stream through the assembly **38** to compensate for variations in weather conditions. Referring first to Fig. 17 where air pressure externally of the door structure is at least substantially equal to internal building air pressure, no control of the downwardly directed air current defining the air screen is necessary and air flow is vertically downwardly through the assembly **38** in the direction of the arrows **109**. With no directional control being required, the vanes **107** are held in their inoperative positions which constitute location of the vanes above the frame **94**.

In the event of greater air pressure externally of the building, an air current illustrated by the arrows **110** in Fig. 16 will tend to pass through the door structure and through the air screen exemplified by the arrows **111** in Fig. 16. Under these circumstances, the air current **110** has a tendency to penetrate the air curtain **111** if suitable directional control of the latter is not utilized. In order to prevent external air current penetration, the right hand vane **107**, which is the outermost vane as described in connection with Fig. 15, is moved into a downwardly projecting position relative to the frame **94**. The outer concave surface of the vane **107** causes the formation of an area of vacuum which results in the drawing of the air currents **111** defining the air screen to the right, as viewed, toward the incoming air currents **110**. With this arrangement, the force of the downwardly flowing air screen is directed sufficiently toward the inwardly flowing air currents to counteract the same and prevent penetration of the air screen. With the downward positioning of the outermost vane **107** as viewed in Fig. 16, the innermost or opposite vane **107** is automatically moved upwardly above the frame **94** into a completely inoperative position. Single cable operation of both of the vanes **107**, as previously described in connection with Fig. 18, causes both to move at the same time to provide relative positioning described. While single cable operation is disclosed, it will be understood that dual cable or separate vane operation is intended to fall within the scope of the present invention.

Fig. 15 illustrates operation of the assembly **38** in the event of a greater internal pressure in the building, such as would be caused by fan operation or air conditioning, which results in air currents **112** attempting to penetrate the air screen **113** by moving through the same toward the exterior of the building. In order to counteract the internal air currents **112**, the innermost vane **107** on the left as viewed in Fig. 15 is lowered into its operative position below the frame **94** to form a vacuum pocket and cause the air curtain **113** to flow substantially toward the left as viewed. The oppositely positioned or external vane **107** is, under these circumstances, raised into a completely inoperative position above the frame **94**.

To provide automatic control operation of the air distributing and discharge assembly **38** in response to variations in internal or external pressures relative to the door structure, a static pressure differential control system including the mechanism **106** is used to determine the differential pressure existing between the pressures on each side of the air screen. Such control systems are well known and their structural features per se do not constitute a part of the present invention. Any suitable static pressure control system can be mounted relative to the air moving and conditioning assembly behind the side wall **27** of the door structure in operative connection with the mechanism **106** of the assembly **38**. By way of example, flexible tubing may extend from pressure communication taps to the mechanism **106**. As illustrated in Figs 1 and 3, static pressure taps or measuring openings **114** are preferably carried in the top access panel **36** to either side of the air screen maintained within the door opening **25**. Pressure differential between the two points **114** is automatically and continuously measured and the servo-motor forming a part of the mechanism **106** operates in response to predetermined differential to move the vanes **107** into or out of their operative positions and thus compensate for pressure differential by controlling the direction of flow of the air curtain. The static pressure differential taps **114** are preferably positioned immediately below the ceiling **29** where the air currents defining the air curtain are most effective by reason of their velocities being the greatest in this area. Due to the highest velocities existing at the defining area of the air curtain, the differential pressure built up on either side of the same will be the greatest and such differential pressure should preferably be measured within this area. Variations in location of the pressure measuring taps **114** can be made and, for example, an alternate tap location **115** is illustrated in Fig. 1 as being in the ceiling **29** on either side of the assembly **38**. The location of the taps within the door structure as, for example, along the side wall **27** or ceiling **29**, is preferred in order to protect the same from the deleterious effect of outside weather conditions.

As illustrated in Figs. 18 and 19, movement of the piston rod **105** outwardly of the housing of the servo-motor of the mechanism **106** would cause the vane **107** on the left, as viewed in Fig. 19, to move downwardly through the frame **94** into its operative position. By use of the single cable **102**, the opposite vane **107** (not illustrated in Fig. 19) would be raised to its inoperative position above the frame **94**. Withdrawal of the piston rod **105** into the housing of the mechanism **106** would result in reverse operation of the vanes **107**. With equalized internal and external pressure conditions relative to the door structure, the position of the piston rod **105** will be such that each of the vanes **107** are inoperatively positioned as illustrated in Fig. 17.

From the foregoing description it will be apparent that a double door structure can be readily obtained by utilizing oppositely positioned air screen forming units. In other words, a complete assembly similar to that described can be mounted on the opposite side of the door structure which, as illustrated is defined by the wall **26**, and the door structure will, in effect, be doubled in width. The provision of the side wall **26** in connection with the use of a single air screen producing assembly as illustrated is essential to maintain efficient establishment of the air screen. That portion of the side wall **26** which the air screen contacts in its downward movement provides a surface which the air current follows and by which it is controlled to establish an uninterrupted or unbroken flow of air capable of preventing the passage of foreign matter, such as dirt, rain or snow, therethrough. The side wall **26** can be of any solid construction adjacent the air screen area.

The velocity of the air delivered downwardly through the door structure will be in the neighborhood of 2,000 feet per minute and in providing this air velocity in the type of assembly described, the motor used may be a relatively inexpensive, one speed 5 H.P. unit. While the motor has been previously described as a single speed unit, it will be understood that a multi-speed unit can be used to provide a further means for controlling the effectiveness of the air screen with changing external and interal pressure conditions.

With automatic operation of the assembly as described, practically no upkeep or maintenance is necessary with the exception that the filters **61** must be periodically removed, cleaned or replaced. The access panels **34**, **35** and **36**

can be readily removed for this purpose or for any other maintenance purpose. Other types of air heating units can be utilized if desired, it being understood that a gas heated unit has been described merely for purposes of illustration. The floor grating **28** may be of any known structural arrangement, such gratings being frequently used in building structures. During cold weather, the use of heated air in forming the air screen will not only retain building heat but will further prevent snow or ice accumulation on the grate **28**.

Obviously many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. An air screen door structure having an inner air screen divided passageway defined by top, bottom and side walls, said bottom wall including a floor grating which defines the top of an air return chamber forming a part of said structure, said top wall having mounted therein an air control delivery assembly which defines the bottom of an air delivery chamber forming a part of said structure, at least one of said side walls enclosing an air moving and conditioning assembly in communication with said air return and air delivery chambers and which is formed from a pair of sectionalized prefabricated units one resting on the other in stacked relation, the lowermost of said units being formed from a frame structure which supports air moving means for drawing air from said air return chamber and delivering the same upwardly into the uppermost of said units, said uppermost unit being formed from a frame structure which supports an air conditioning and air flow control means for delivering air into said air delivery chamber for forced air flow downwardly therefrom through said passageway.

2. An air screen door structure having an inner air screen divided passageway defined by top, bottom and side walls, said bottom wall including a floor grating which defines the top of an air return chamber forming a part of said structure, said top wall having mounted therein an air control delivery assembly which defines the bottom of an air delivery chamber forming a part of said structure, said air control delivery assembly comprising a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members past which air is moved downwardly and by which air is distributed, vanes movably mounted on said frame-like structure along opposite sides thereof for vertical pivotal movement thereof relative to said bar-like member through said air control delivery assembly into a downwardly position projecting into the interior of said passageway, each of said vanes being in the form of a solid panel of arcuate shape the outermost surface of which is concave, means for pivoting said vanes, at least one of said side walls enclosing an air moving and conditioning assembly in communication with said air return and air delivery chambers and which is formed from a pair of sectionalized prefabricated units one resting on the other in stacked relation, the lowermost of said units being formed from a frame structure which supports an air moving means for drawing air from said air return chamber and delivering the same upwardly into the uppermost of said units, said uppermost unit being formed from a frame structure which supports an air conditioning and air flow control means for delivering air into said air delivery chamber for forced air flow downwardly therefrom through said passageway.

3. An air screen door structure having an inner air screen divided passageway defined by top, bottom and side walls, said bottom wall including a floor grating which defines the top of an air return chamber forming a part of said structure, said top wall having mounted therein an air control delivery assembly which defines the bottom of an air delivery chamber forming a part of said structure, said air control delivery assembly comprising a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members past which air is moved downwardly and by which air is distributed, vanes movably mounted on said frame-like structure along opposite sides thereof and positioned transversely of said side walls for vertical pivotal movement through said frame-like structure relative to said bar-like members into a downwardly position projecting into said passageway, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, and operating means for said vanes including spaced pressure sensitive means positioned on each side of the area of downwardly moving air along a side wall of said passageway near the top wall thereof, said pressure sensitive means measuring pressure differential within said passageway for operational control of said operating means, at least one of said side walls enclosing an air moving and conditioning assembly in communication with said air return and air delivery chambers and which is formed from a pair of sectionalized prefabricated units one resting on the other in stacked relation, the lowermost of said units being formed from a frame structure which supports air moving means for drawing air from said air return chamber and delivering the same upwardly into the uppermost of said units, said uppermost unit being formed from a frame structure which supports an air conditioning and air flow control means for delivering air into said air delivery chamber for forced air flow downwardly therefrom through said passageway.

4. An air screen door structure having an inner air screen divided passageway defined by top, bottom and side walls, said bottom wall including a floor grating which defines the top of an air return chamber forming a part of said structure, said top wall having mounted therein air control delivery assembly which defines the bottom of an air delivery chamber forming a part of said structure, at least one of said side walls enclosing an air moving and conditioning assembly in communication with said air return and air delivery chambers and which is formed from a pair of sectionalized prefabricated units one resting on the other in stacked relation, the lowermost of said units being formed from a frame structure which supports air moving means for drawing air from said air return chamber and delivering the same upwardly into the uppermost of said units, said uppermost unit being formed from a frame structure which supports therein separate sets of inlet duct means and outlet duct means which duct means of each set are interconnected at substantially right angles to one another, one of said sets being nested in the other, air heating means interposed in one of said sets to heat a predetermined quantity of air passed therethrough, air being discharged from said outlet duct means into said air delivery chamber for forced air flow downwardly therefrom through said passageway, and flue means forming a part of said air heating means and extending therefrom and through said outlet duct means in indirect heat exchange relation with air moving therethrough.

5. An air screen door structure having an inner air screen divided passageway defined by top, bottom and side walls, said bottom wall including a floor grating which defines the top of an air return chamber forming a part of said structure and including therein means for periodically flushing foreign matter therefrom, said top wall having mounted therein an air control delivery assembly which defines the bottom of an air delivery chamber forming a part of said structure, said air control delivery assembly comprising a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members past which air is moved downwardly and by which air is distributed, vanes movably mounted on said frame-like structure along opposite sides thereof

transversely of the side walls of said passageway for vertical pivotal movement through said frame-like structure relative to said bar-like members into a downwardly position projecting into said passageway, each of said vanes being in the form of a solid panel of arcuate shape the outermost surface of which is concave, means for pivoting said vanes, at least one of said side walls enclosing an air moving and conditioning assembly in communication with said air return and air delivery chambers and which is formed from a pair of sectionalized prefabricated units one resting on the other in stacked relation, the lowermost of said units being formed from a frame structure which supports air moving means for drawing air from said air return chamber and delivering the same upwardly into the uppermost of said units, said uppermost unit being formed from a frame structure which supports therein separate sets of inlet duct means and outlet duct means which duct means of each set are interconnected at substantially right angles to one another, one of said sets being nested in the other, air heating means interposed in one of said sets to heat a predetermined quantity of air passed therethrough, air being discharged from said outlet duct means into said air delivery chamber for forced air flow downwardly therefrom through said passageway, and flue means forming a part of said air heating means and extending therefrom and through said outlet duct means in indirect heat exchange relation with air moving therethrough.

6. An air moving and heating assembly of prefabricated design for use in an air screen door structure, said assembly including a structural frame of box-like shape supporting therein along two adjacent sides thereof a right angled duct structure which at one end is open for air intake and at the other end is longitudinally subdivided into two separate segments which define a space therebetween and each of which at their outermost ends defines an air discharge opening, a pair of transversely spaced air heating chambers supported by said frame substantially centrally thereof and in communication with said duct structure near the intake end thereof through separate duct means forming a part thereof, said chambers each having an air discharge opening in closely spaced relation to the air discharge openings of said duct structure, heat supply means carried by said frame in association with said heating chambers, and flue means in communication with said heat supply means and extending intermediate said heating chambers and said duct structure segments through said space in indirect heat exchange relation therewith.

7. An air moving and heating assembly of prefabricated design for use in an air screen door structure, said assembly including a structural frame of box-like shape supporting therein along two adjacent sides thereof a right angled duct structure which at one end is open for air intake and at the other end is longitudinally subdivided into two separate segments which define a space therebetween and each of which at their outermost ends defines an air discharge opening, a pair of transversely spaced air heating chambers supported by said frame substantially centrally thereof and in communication with said duct structure near the intake end thereof through separate duct means forming a part thereof, said chambers each having an air discharge opening in closely spaced relation to the air discharge openings of said duct structure, air flow control means forming a part of the intake end of said duct structure and said separate duct means to control the flow of air therethrough, heat supply means carried by said frame in association with said heating chambers, and flue means in communication with said heat supply means and extending intermediate said heating chambers and said duct segments through said space in indirect heat exchange relation therewith.

8. Air distributing and discharge control means for use in an air screen door structure, comprising a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members mounted therein past which air is moved and by which air is distributed, vanes movably mounted on said frame-like structure along opposite ends thereof for movement therethrough relative to said bar-like members in substantially parallel relation therewith, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, and means for moving said vanes.

9. Air distributing and discharge control means for use in an air screen door structure, comprising a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members mounted therein past which air is moved and by which air is distributed, said bar-like members each having a flat bottom surface and a convex top surface, vanes movably mounted on said frame-like structure along opposite sides thereof for movement therethrough relative to said bar-like members in substantially parallel relation therewith, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, and means for moving said vanes.

10. Air distributing and discharge control means for use in an air screen door structure, comprising a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members mounted therein past which air is moved and by which air is distributed, vanes movably mounted on said frame-like structure along opposite sides thereof for movement therethrough relative to said bar-like members in substantially parallel relation therewith, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, said vanes each being held at the top thereof by inwardly directed arms which at their outermost ends are attached to rods mounted on said frame-like structure for reciprocal pivoting, and means for moving said vanes.

11. Air distributing and discharge control means for use in an air screen door structure, comprising a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members mounted therein past which air is moved and by which air is distributed, vanes movably mounted on said frame-like structure along opposite sides thereof for movement therethrough relative to said bar-like members in substantially parallel relation therewith, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, said vanes each being held at the top thereof by inwardly directed arms which at their outermost ends are attached to rods mounted on said frame-like structure for reciprocal pivoting, and operating means for said vanes including a single cable and plural pulley arrangement interconnected with said rods for simultaneous raising of a vane on one side of said frame-like structure while lowering an oppositely positioned vane.

12. In an air screen door structure having a through tunnel-like passageway with said structure being provided with air moving means arranged to continuously close said passageway by providing a screen of downwardly directed air, the provision in association with the ceiling of said passageway of an air distributing and discharge control means which comprises, a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members mounted therein past which air is moved downwardly and by which air is distributed, vanes movably mounted on said frame-like structure along opposite sides thereof for vertical pivotal movement therethrough relative to said bar-like members in substantially parallel relation through into a downwardly position projecting into said passageway, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, and means for moving said vanes.

13. In an air screen door structure having a through

tunnel-like passageway with said structure being provided with air moving means arranged to continuously close said passageway by providing a screen of downwardly directed air, the provision in association with the ceiling of said passageway of an air distributing and discharge control means which comprises, a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members mounted therein past which air is moved downwardly and by which air is distributed, said bar-like members each having a flat bottom surface and a convex top surface, vanes movably mounted on said frame-like structure along opposite sides thereof for vertical pivotal movement therethrough relative to said bar-like members in substantially parallel relation therewith into a downwardly position projecting into said passageway, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, said vanes each being held at the top thereof by inwardly directed arms which at their outermost ends are attached to rods mounted on said frame-like structure for reciprocal pivoting, and operating means for said vanes including a single cable and plural pulley arrangement interconnected with said rods for simultaneous raising of a vane on one side of said frame-like structure while lowering an oppositely positioned vane.

14. In an air screen door structure having a through tunnel-like passageway with said structure being provided with air moving means arranged to continuously close said passageway by providing a screen of downwardly directed air, the provision in association with the ceiling of said passageway of an air distributing and discharge control means which comprises, a frame-like structure in the form of a grate provided with a plurality of spaced bar-like members mounted therein past which air is moved downwardly and by which air is distributed,

vanes movably mounted on said frame-like structure along opposite sides thereof for vertical pivotal movement therethrough relative to said bar-like members into a downwardly position projecting into said passageway, each of said vanes being in the form of a solid panel of arcuate shape the outer surface of which is concave, said vanes each being held at the top thereof by inwardly directed arms which at their outermost ends are attached to rods mounted on said frame-like structure for reciprocal pivoting, and operating means for said vanes including a single cable and plural pulley arrangement interconnected with said rods for simultaneous raising of a vane on one side of said frame-like structure while lowering an oppositely positioned vane, said operating means further including spaced pressure sensitive means positioned on each side of said screen in said passageway to measure pressure differential for operational control of said operating means.

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