Aug. 17, 1937. O. J. KUENHOLD 2,089,969

WARM AIR FURNACE STRUCTURE

Filed Oct. 7, 1933 6 Sheets-Sheet 1

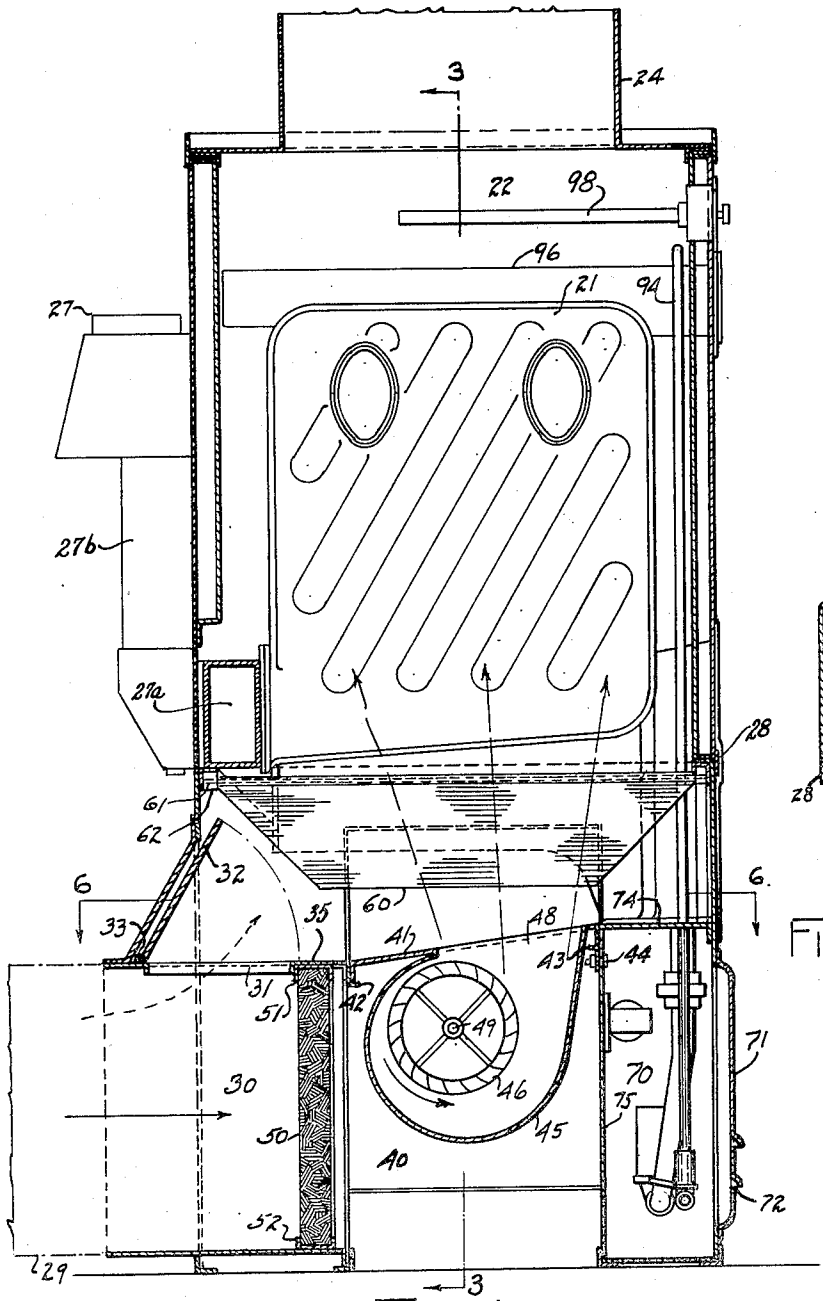

FIG - 1

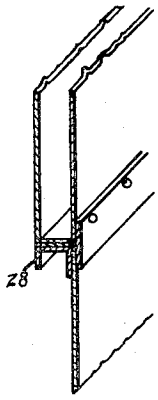

FIG - 2

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WARM AIR FURNACE STRUCTURE

Filed Oct. 7, 1933 6 Sheets-Sheet 2

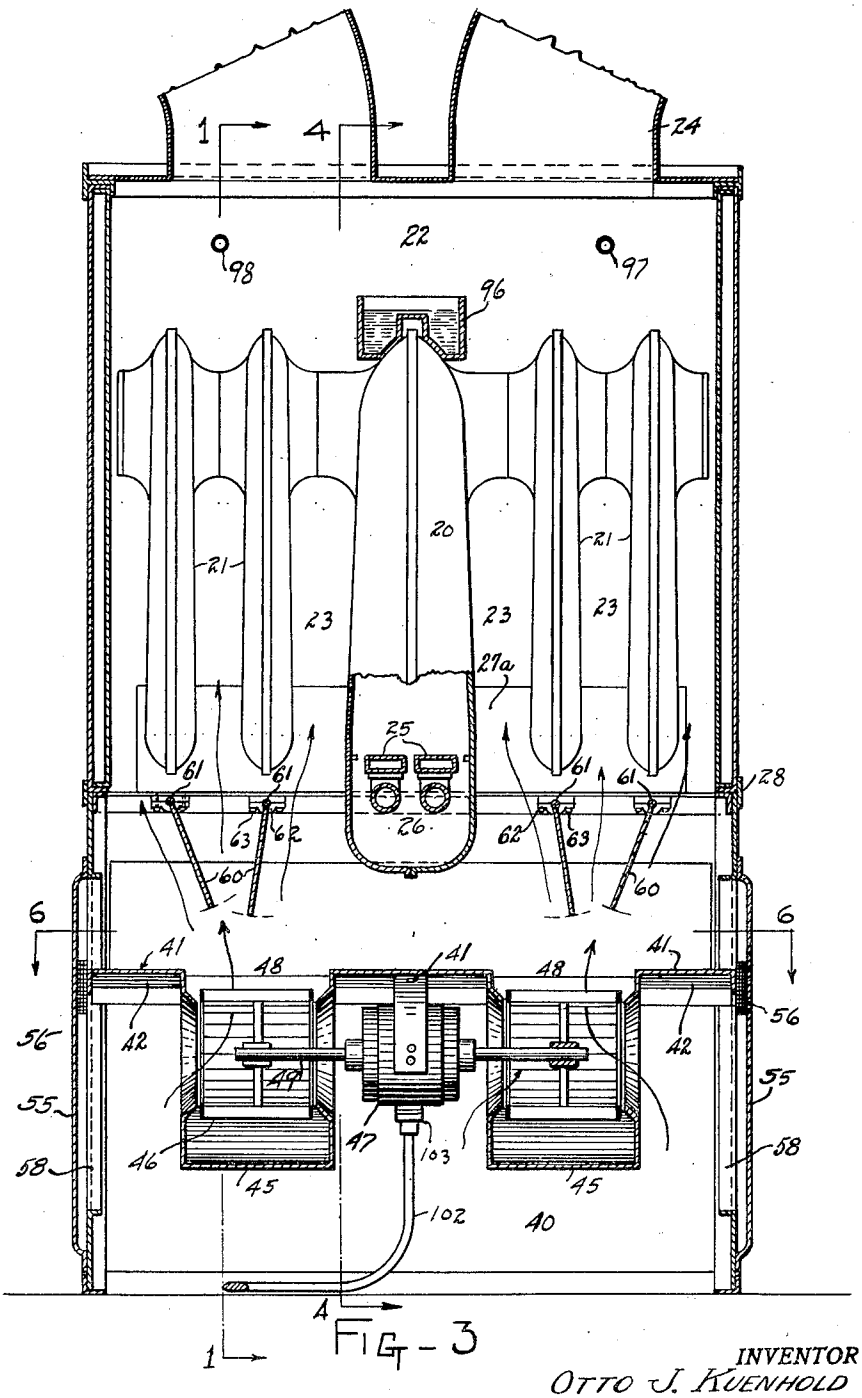

FIG - 3

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WARM AIR FURNACE STRUCTURE

Filed Oct. 7, 1933 6 Sheets-Sheet 3

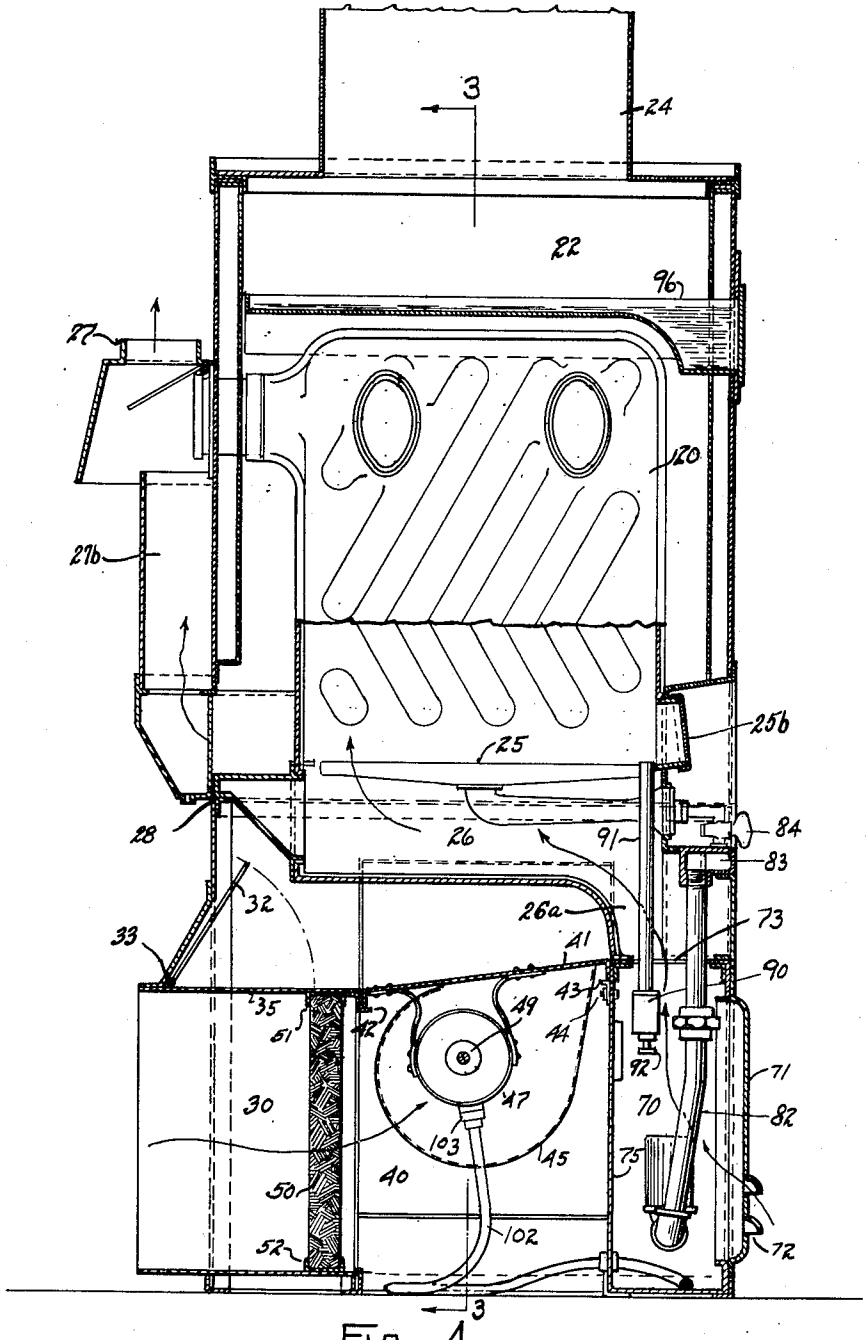

FIG-4

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WARM AIR FURNACE STRUCTURE

Filed Oct. 7, 1933 6 Sheets-Sheet 4

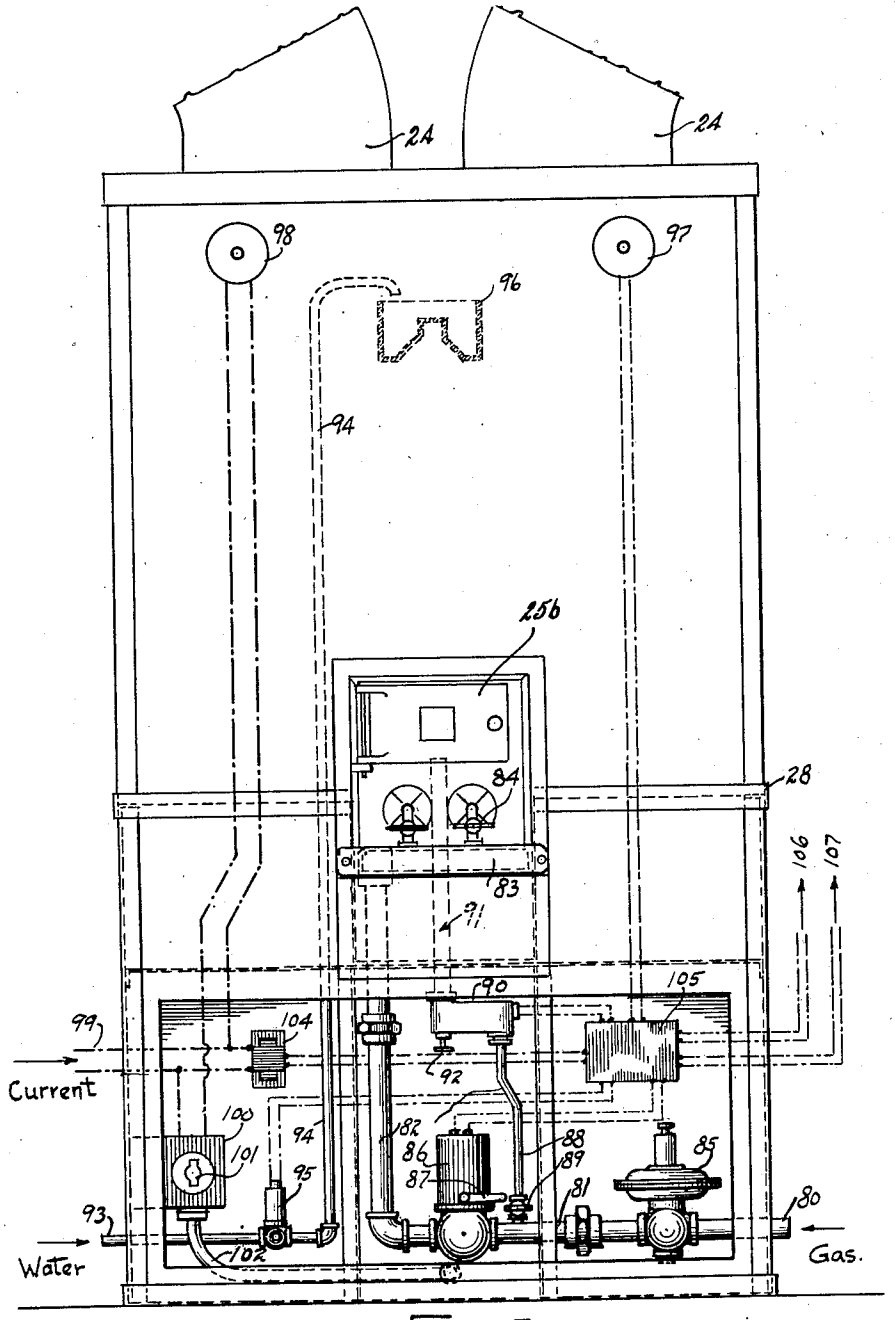

FIG-5

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WARM AIR FURNACE STRUCTURE

Filed Oct. 7, 1933 6 Sheets-Sheet 5

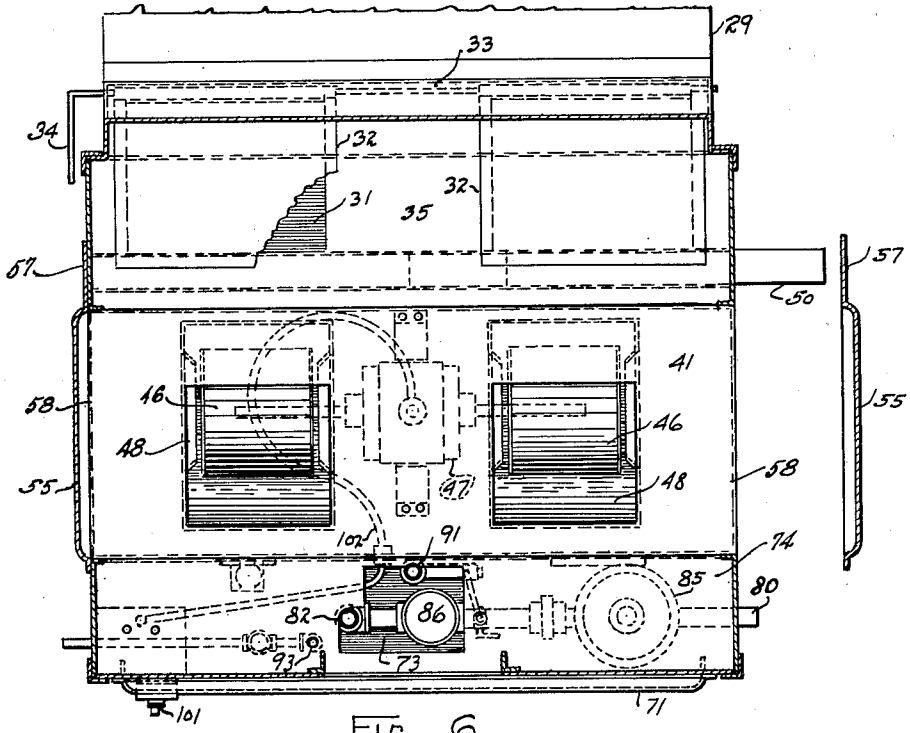

FIG-6

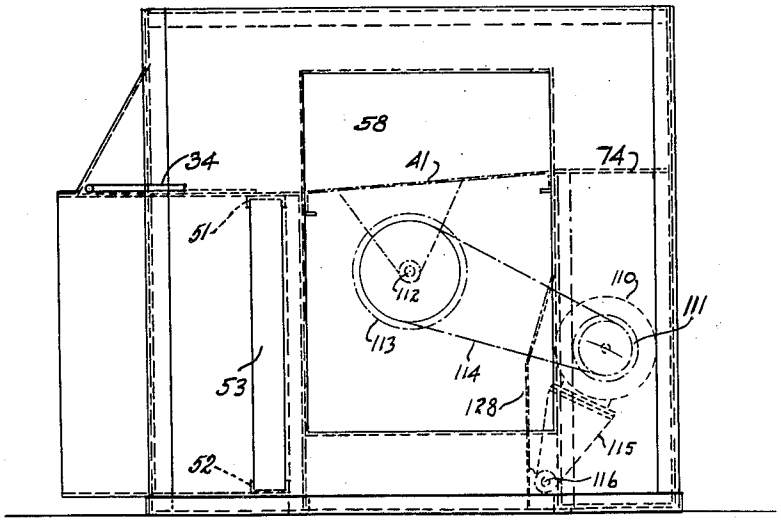

FIG-7

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WARM AIR FURNACE STRUCTURE

Filed Oct. 7, 1933 6 Sheets-Sheet 6

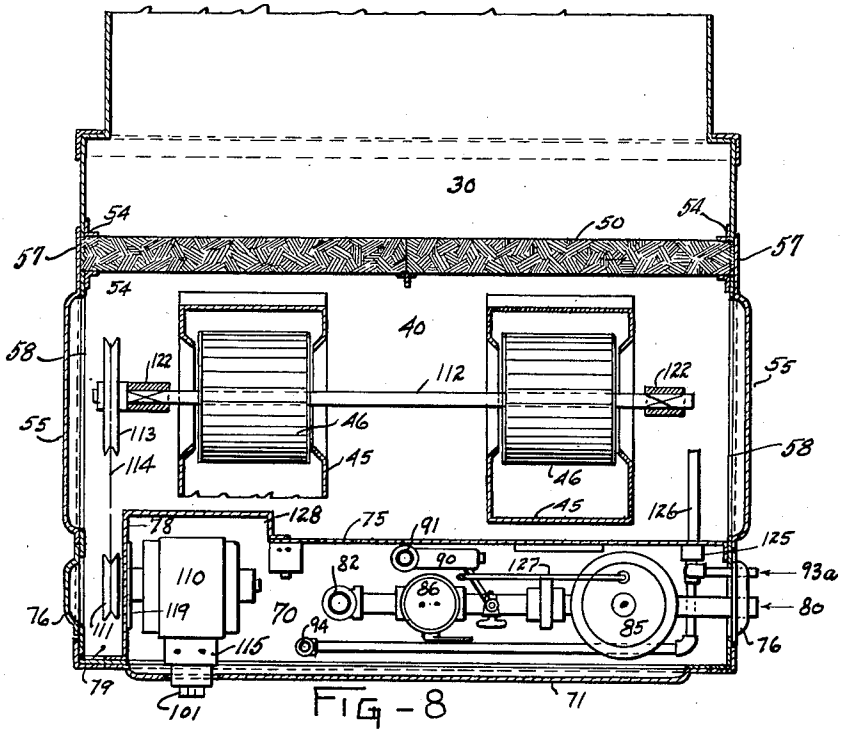

FIG - 8

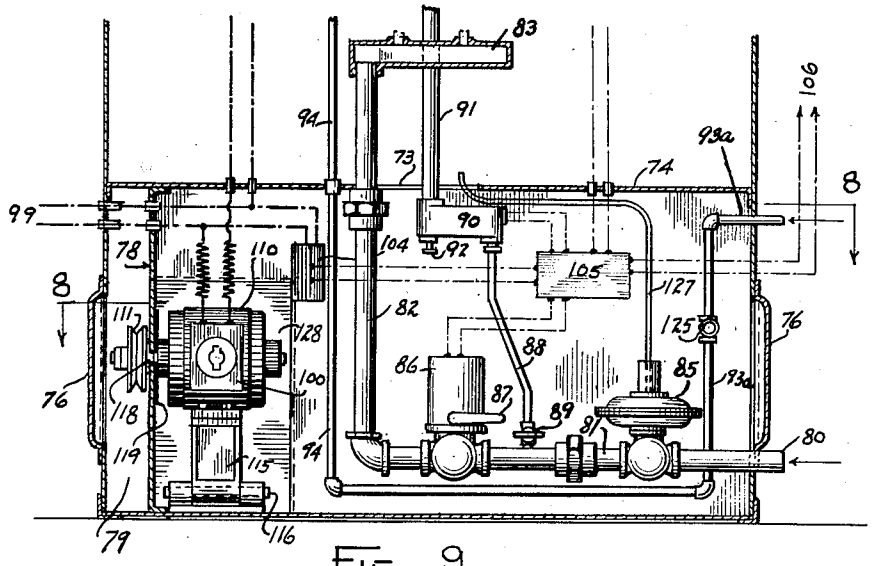

FIG - 9

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UNITED STATES PATENT OFFICE

2,089,969

WARM AIR FURNACE STRUCTURE

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Application October 7, 1933, Serial No. 692,691

5 Claims. (Cl. 126—116)

This invention relates to improvements in warm air furnaces and more particularly, in furnaces for modern, conditioned air heating systems employing forced air circulation.

One of the objects of the present invention is the provision of an improved warm air furnace in which the enclosing casing thereof is horizontally separable into an upper portion containing an air heating chamber and a lower portion containing an air inlet chamber, a blower chamber and a control chamber.

A further object of the present invention is the provision of an improved warm air furnace in which the air inlet chamber thereof has air-delivering communication at all times, through suitable air filtering means, with the blower chamber of the furnace, and also has direct air-delivering communication, when desired, such as when the air-blowing means of the blower chamber is not in operation, with the air heating chamber of the furnace.

A further object of the present invention is the provision of an improved warm air furnace in which the air-blowing means of the blower chamber is mounted for ready removability from the furnace casing for inspection, replacement or repair and is readily adjustable to enable it to properly deliver air into the air heating chamber of the furnace.

A further object of the present invention is the provision of an improved warm air furnace in which the air heating chamber thereof is provided with adjustable air deflecting means to insure proper flow of air therethrough.

A further object of the present invention is the provision of an improved warm air furnace in which substantially all of the control devices thereof are conveniently and neatly arranged in a separable control chamber for ready access thereto for inspection, adjustment, replacement or repair.

A further object of the present invention is the provision of an improved warm air furnace in which proper ventilation of the control chamber is readily and simply afforded.

A further object of the present invention is the provision of an improved warm air furnace which is of simple and inexpensive construction, of exceedingly compact form, of neat and pleasing appearance, of readily accessible and easily assembled parts, and of an exceptionally high degree of efficiency in use thereof.

With the foregoing and other objects in view which will appear as the description of the invention proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the invention as here disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

The present invention will be readily understood from the following description thereof, reference being had to the accompanying drawings in which:

Fig. 1 is a vertical, longitudinal sectional view of a warm air furnace constructed in accordance with one embodiment of the present invention, the view being on the line 1—1, Fig. 3; Fig. 2 is a detail sectional view, on an enlarged scale, of the horizontal joint between the upper and lower portions of the furnace casing; Fig. 3 is a vertical, transverse, sectional view of said furnace, taken on the lines 3—3, Figs. 1 and 4; Fig. 4 is a vertical, longitudinal sectional view of the furnace, taken on the line 4—4, Fig. 3; Fig. 5 is a front elevation of the furnace with the control chamber door removed; Fig. 6 is a cross sectional view of said furnace, taken on the lines 6—6, Figs. 1 and 3, one of the casing side doors being shown in spaced relation and one of the air filter panels being in partially assembled position; Fig. 7 is a side view of the lower portion of the furnace and showing a modified form of control chamber and a modified arrangement of parts therein, one of the casing side doors being removed; Fig. 8 is a cross-sectional view of the modified form of control chamber of Fig. 7, the view being on the line 8—8, Fig. 9; and Fig. 9 is a vertical sectional view of the modified form of control chamber of Fig. 7.

In the furnace here illustrated, 20 and 21 represent a plurality of generally parallel, transversely disposed and longitudinally spaced hollow heat convectors, which convectors constitute a means for transmitting heat into the air to be heated which circulates through vertically disposed spaces 23 between and around said convectors. In this embodiment, the central and main heat convector 20 contains one or more burners, two gas burners 25 being here shown, the combustion products of which travel upwardly in this central convector 20, are then communicated laterally to the upper ends of the side, auxiliary convectors 21, in which convectors they then circulate downwardly and are vented to a suitable chimney or the like through a cross-connected, horizontally disposed vent duct 27a and a vertically disposed vent duct 27b, the latter duct communicating at its upper end with a suitable draft hood connectible at 27 to a chimney or the like.

The enclosing casing of the furnace, (see Fig. 2) is horizontally separable at 28 into a lower portion and an upper portion, both of which portions may be shipped in either assembled or in knock-down form.

Although the furnace is structurally separable into a lower portion or base and an upper portion, from the standpoint of its functions the furnace is divided by horizontally disposed walls 35, 41 and 74 into an air heating chamber 22 lying above these walls in the casing upper portion and into three chambers 30, 40 and 70 lying below these walls in the casing lower portion.

The chamber 30 is an air inlet chamber into which a cold air return duct 29, Fig. 1, communicates and from which chamber the air passes either into the air heating chamber 22 through suitable by-pass openings 31 in wall 35 or into the chamber 40, which is here termed a blower chamber, through suitable air filtering means 50. This blower chamber 40 can receive air only through said air filters 50 and can discharge air only through its outlets 48 into the air heating chamber 22. The chamber 70 is a control chamber having a horizontally disposed top wall 74, heretofore mentioned, a rear wall 75 and side walls which are parts of the furnace casing.

In the blower chamber 40 are suitable air blowers which, as here shown, may consist of the usual centrifugal blower wheels 46, the housings 45 therefor having their outlet ends connected to the blower chamber top wall 41 so that said wheels discharge air through the outlet openings 48 in said wall into the air heating chamber 22 thereabove, said wall 41 forming a complete closure, except for the outlets 48, between the blower chamber and the air heating chamber, as shown. The blower wheels draw air thereinto by centrifugal action upon rotation thereof, as is usual, and for rotating said wheels, a suitable electric motor 47 is employed, said motor being here shown as suspended from and mounted upon the blower chamber top wall 41 and provided with extended shaft portions 49 upon which the blower wheels 46 are suitably mounted.

Rotation of the blower wheels places the blower chamber 40 under partial vacuum which results in drawing air from the air inlet chamber 30 through the air filters 50, said filters, which constitute the only means by which air can pass into the blower chamber, (barring slight leakage at other points), extending from one side of the furnace to the other, as best shown in Fig. 8.

As before mentioned, the air inlet chamber 30 has suitable by-pass openings 31, two in the present instance, (see Figs. 1 and 6) leading directly to the air heating chamber 22 thereabove, and with said openings cooperate suitable closures 32 each pivoted at one end on a cross shaft 33 suitably mounted in the casing side walls. As shown in Fig. 6, this shaft 33 projects outwardly through one of said side walls and is provided with an operating handle 34 which may be manually manipulated to effect opening or closing of the by-pass openings 31. Preferably, however, means is provided for automatically operating the closures 32 to close the by-pass openings 31 when the blower wheels 46 are in operation and to open said by-pass openings when operation of said wheels is discontinued. The purpose of these by-pass openings is, of course, to provide a direct flow of air from the air inlet chamber 30 into the air heating chamber 22 during periods when the air blowers are not operating, and by so doing, a natural or "gravity" air circulation will take place in the furnace without being retarded by the necessity of passing the air through the air filters 50 and the blower chamber 40 when the blower wheels 46 are stationary. Otherwise, the resistance encountered would be too high for gravity circulation to overcome. Preferably, just as soon as the blowers are put in operation, the by-pass openings 31 are automatically closed by closures 32 and all air circulation thereafter will be drawn through the air filters 50 and hence will be filtered thereby.

The particular means for automatically operating the closures 32 to thereby effect automatic opening and closing of the by-pass openings 31 is not shown, inasmuch as it constitutes a separate invention from that of the present application.

In the design of forced air circulating furnaces, it is almost the universal practice to locate the air blowing or air propelling means outside of the furnace casing. When that is done, the distance of the path of the air from the air blower means to the air heating surfaces of the furnace is ample to permit the air to properly spread out. In placing the air blower means within the casing of the furnace, directly below and so close to the heating surfaces of the furnace, as shown in the present drawings, a difficulty was encountered which at first seemed insurmountable. Normally, each air blower would discharge a concentrated stream of air at excessive velocity into only part of the air spaces or passages 23 between and around heat convectors, with consequent downward back-streams of air at all other points, which in turn would result in wastage of the energy of the air blower in causing such air rotation, in a complete upsetting of the intended efficient direction and proportional distribution of the air streams upwardly into all air spaces or passages 23, in overheating of the furnace casing, and in lack of pressure in the upper portion of the air heating chamber 22 and in uneven distribution of air to the air outlet ducts 24 leading from said chamber upper portion.

In the present furnace, I have completely overcome the above objections by providing an expanded air outlet for the air blowers and by so arranging the blowers that they may be tilted, longitudinally with relation to the furnace to discharge their air streams in such direction, as shown in Fig. 1, that the intended relative volume of air is distributed from front to back of the air heating chamber 22,—with somewhat more air discharged into the air spaces 23 between the heat convectors and with somewhat less air discharged into the spaces between the heat convectors and the casing front and back walls—but with a definite upward air flow everywhere into that part of the air heating chamber 22 above the heat convectors.

To achieve this tilting adjustment of the air blowers 46, the top wall 41 of the blower chamber 40 is a separate panel carrying the blowers and resting on vertically adjustable side shelves 42 and 43, Fig. 4. Either one or both of these side shelves may be vertically adjustable, the means here shown for adjusting shelf 43 including bolts 44 which extend through vertically disposed slots in the vertically disposed wall 75 which separates the control chamber 70 and the blower chamber 40. By vertically adjusting such bolts, the height of the shelf 43 may be readily adjusted and thereafter clamped in place to give any desired angle, within reasonable limits, of air discharge into the air heating chamber 22 through the air outlets 48

in this wall panel 41. As will be readily understood, the shelves 42 and 43 extend from one side of the blower chamber to the other and the blower supporting wall panel 41 is in contact therewith for their full length, thereby sealing the joints against back leakage of air, and said shelves being obviously adjustable to also take up any slight warping of said panel which may occur. Packing means at such joints to absorb vibrations and afford a tight closure at such joints may obviously be used and are therefore not here shown.

It might be pointed out at this time that different sized air blowers, operating at varying speeds, may be employed in various furnace sizes, according to the varying requirements of different installations. Where a standard air blower is employed, the location of the blower supporting shelves 42, 43 may be fixed, but for other cases, a certain amount of adjustment of the angle of blower discharge is preferable.

Proper distribution of the air into the air spaces or passages 23 of the air heating chamber 22, from one side of the furnace to the other, is attained by suitable air deflector means best shown in Figs. 1 and 3. A series of transversely disposed, longitudinally spaced air deflector plates 60 are arranged in the air heating chamber 22, below the heat convectors and transversely of the axis of blower rotation. These deflector plates, as best shown in Fig. 3, are arranged in pairs, with the plates of each pair arranged in downwardly converging relation and adapted to intersect the air streams discharged from the blowers and divide said streams in such proportions that the desired relative volume of air is delivered into the various air passages 23 of the heating chamber 22.

In the embodiment of the invention here illustrated, and as I prefer, the pivotal axis of each air deflector 60 is located below one of the side or auxiliary heat convectors 21 and the angle of each such deflector is adjustable to enable each air passage 23 of the air heating chamber to receive a volume of air proportional to the heat transmitted thereto by the adjacent heat convector surfaces. In this way, I secure maximum furnace efficiency by delivering air from all air passages 23 into that portion of the heating chamber 22 above the heat convectors at the most uniform temperature possible to achieve.

In connection with this air deflector method of apportioning the upward air discharge into the heating chamber 22, I decrease the number of air blower wheels, the width of the blower chamber outlets 48 and the distance between said outlets. Because of the above alterations in proportions, I am able to achieve equal and proper upward air distribution into furnaces of any width and of any number of heat convectors or their equivalent.

In the embodiment of the invention shown in Figs. 1 to 6 inclusive, I utilize the space directly below the central and main heat convector 20, which convector contains the burners 25 and is wider than the side convector 21, for location or placement of the motor 47 for driving the blower wheels 46. An alternate location or placement for such motor will be later described.

I prefer to place the pivots 61 of the air deflector plates 60 in suitable clamp bearings 62, in which bearings they can be tightly clamped by screws 63 after said plates have been adjusted to that particular angle which gives best air distribution.

These air deflectors or guide vanes 60, being at a slight angle to the impinging air streams from the blower chamber 40, effectively serve as spreaders of the air to give desired equality of distribution of the air from side to side of the air heating chamber 22 of the furnace. In those furnaces which always utilize the same blower supporting wall panel 41 and a standard spacing and arrangement of air blowers, etc., the relative angles of the air deflectors 60 may be fixed and such deflectors suitably anchored after the correct angles have once been determined at the factory.

By these air deflectors or guides 60, needless eddy currents and reversed air flow in the air passages 23 are effectively eliminated; the kinetic energy of the air streams issuing from the blower chamber is utilized to the maximum to produce pressure in that portion of the air heating chamber 22 lying above the heat convectors and all heating surfaces of the furnace are utilized to the maximum by the proper distribution of the air flowing by said heating surfaces.

It may be noted at this time that the described uniformity of air distribution from the air passages 23 into that portion of the air heating chamber 22 lying above the heat convectors is achieved, notwithstanding the fact that the center of average air volume discharge, from the blower outlets 48, located about where the numeral 48 appears in Fig. 1, is not on the transverse central plane of the heating surfaces of the furnace.

As clearly shown in the accompanying drawings, the side walls of the furnace casing are provided with suitable openings 58, Fig. 7, for the insertion into the furnace and the removal therefrom of the slidable wall panel 41 on which are mounted the air blowers 46 and, in Figs. 1 to 6 inclusive, the driving motor 47 therefore. For normally closing said openings, suitable doors 55 are provided, and to insure against possible leakage of air from the air heating chamber 22 down into the blower chamber 40, suitable cross bands 56 of packing material, Fig. 3, are provided between the ends of said panel and said casing doors, said bands being preferably secured to and carried by said doors.

In those embodiments of my invention in which the motor 47 for the air blowers 46 is mounted upon a removable wall panel, as shown in Figs. 1 to 6 inclusive, a cable 102 is provided to conduct current to said motor from a suitable motor speed control box or switch, said cable including a suitable coupling plug 103 so that after said panel is partially withdrawn from the furnace, it may be disconnected from said cable at the plug 103 and thereafter be readily, conveniently and completely removed from the furnace.

The air filtering means 50 between the air inlet chamber 30 and the blower chamber 40 includes some suitable flocculent material to enmesh and retain the dust particles of the air which is drawn therethrough. Preferably, the air filtering means consists of two or more filter panels, which may be inserted and withdrawn through suitable openings 53, Fig. 7, in each side of the lower portion of the furnace casing. Channels 51 and 52, Figs. 1 and 4, serve as retainers and guides for said filter panels, and with the aid of vertical end angles 54, Fig. 8, securely embrace the edges of the filter panels and effectively prevent leakage of air around such edges. As clearly shown, especially in Fig. 6, the casing doors 55 for the blower wall panel 41 have suitable extension flanges 57 which

normally close and seal the casing openings 53 for the two filter panels.

The present day trend of public demand is toward the automatic control of furnaces, with a tendency to add more safety and automatic control devices, especially in furnaces employed in modern, conditioned air heating systems. The common practice is to attach these control devices externally of the furnace, with the result that they are exposed to dust and damage and make the entire installation look unworkman-like and messy in appearance. To improve upon the above and to secure other important advantages, I provide in the lower portion of the furnace, at the front thereof, the control chamber 70 heretofore mentioned and in said chamber I place as many of the automatic control devices as possible.

The control chamber 70, which is shown in transverse section in Figs. 1 and 4, is normally closed at the front by a suitable door 71 extending from one side of the furnace casing to the other and affording complete access to the control devices placed within this chamber. A front elevation of said control chamber, with the door 71 thereof removed, is shown in Fig. 5, giving an idea of what devices, etc., this control chamber may contain, the neatness of the arrangement of said devices and their ready accessibility.

Gas for the burners 25 enters the furnace control chamber at 80, continues horizontally, as at 81, then passes vertically, as at 82, to the burner valve manifold 83, into which burner cocks 84 are suitably connected. 85 is a gas pressure governor, 86 an automatically controlled electric main gas valve, 87 a manually operable emergency control lever for said valve, 90 a safety pilot valve, 91 the thermostatic stem of said pilot valve extending up into the burner compartment 26, 92 a starting button for said pilot valve, and 88 a gas supply tube for said pilot valve. Water supply from city mains is at 93, said water supply conduit continuing upwardly at 94 to an evaporating pan 96, and 95 is an electrically controlled valve for regulating the amount of water supplied to said evaporating pan and hence regulating the amount of water supplied to the circulating air. House current comes into the control chamber at 99 and passes through a thermostatic blower motor control unit 98 at the top of the furnace, then through a motor speed control box 100 and a manual switch 101 therefor and then through the cable 102 to the blower motor 47. House current also passes to a transformer 104 which supplies low voltage current to a terminal panel 105 which connects by lower voltage wiring, as shown in light dot and dash lines, Fig. 5, to the various lower voltage units, including the water regulating valve 95, the main gas valve 86 and a thermostatic outgoing heat limit control 97 at the top of the furnace. 106 represents wires leading from the terminal panel 105 to a room thermostat (not shown) and 107 wires leading from said terminal panel to a room humidostat (not shown).

It is highly desirable that control devices, especially those containing oiled leather diaphragms and the like, be maintained in comparatively cooled condition. This is provided for in the present furnace by having the rear wall 75 of the control chamber exposed on its rearward side to the cold air circulation in the adjacent blower chamber 40. It is also necessary that the control chamber, with its control units, stuffing boxes, pipe joints, etc., be ventilated. This could obviously be accomplished by providing louvers or openings, such as the louvers 72, Fig. 2, at the top and the bottom of the control chamber door 71. This, however, would pass any leakage of gas into the furnace room. To avoid this and to supply a definite current of ventilating air through the control chamber, I provide said chamber with air inlet louvers 72 at the bottom of the control chamber door 71 and with an outlet passage 73 communicating directly with the burner compartment 26 through a downwardly disposed extension 26a thereof, as shown in Fig. 4. The control chamber is substantially air tight except for the air inlets 72 from outside the casing and for the outlet 73 into the burner compartment 26, which compartment is provided at the front thereof with a suitable door 25b for affording access to the burners 25 thereof, etc. Preferably, the entire secondary air supply for the burner compartment is secured from the control chamber, and as the burner compartment is vented to the chimney, any gas leakage occurring in the control chamber will be safely vented.

In Figs. 7, 8 and 9, a modification as to the arrangement of the control chamber is shown, which modification further indicates the value of having a separate control chamber located as herein described. In this modification, the motor 110 for the air blowers 46, instead of being mounted on the slidable wall panel 41, as in Figs. 1 to 6 inclusive, is located within one end of the control chamber. The blower wheels, however, are carried by said wall panel, being secured to a shaft 112, Figs. 7 and 8, rotatable in bearings 122 suspended from said panel, said shaft 112 being driven by the motor 110 through a motor shaft pulley 111, a belt 114 and a blower wheel shaft pulley 113.

This modified arrangement results in a number of advantages, namely, the pulley ratio can easily be altered, the driving motor 110 may be of higher speed and of more compact type and the motor location is more accessible, etc. In case of a breakdown of the motor, the motor can be easily replaced by a standard motor, obtainable from warehouse stocks, a special motor, such as the motor 47 of Figs. 1 to 6 inclusive, being unnecessary. Furthermore, the mounting of motor 110 is preferred, said motor being bolted to a swinging arm 115 pivoted at 116, whereby the weight of the motor, assisted, if necessary, by spring means, will maintain the required belt tension for properly driving the blower wheel shaft 112. The motor pulley 111 preferably is of a type in which the pitch diameter thereof can be readily altered.

To provide the necessary arcuate movement of the motor 110 on its pivot 116, an arcuate slot 118 is provided in the control chamber end wall 78, adjacent the motor, and through this slot the motor shaft projects, the motor shaft pulley 111 being located in an end space 79 forming an alcove of the blower chamber 40. As it is necessary to provide against leakage of air from the control chamber into the blower chamber, which blower chamber is under partial vacuum while the blowers are in operation, means to prevent air leakage at the arcuate slot 118 must be provided. This means consists simply of a plate 119 of ample size to completely cover the slot 118 at all times and having a round hole to fit the motor shaft, said plate riding on said shaft but not rotating with it. Although light spring pressure or the like may be provided for holding

said plate 119 in engagement with the control chamber end wall 78, suction from the blower chamber 40 will hold said plate in adequately tight engagement with said wall 78 to prevent any appreciable leakage of air from the control chamber into the blower chamber, and without interfering with swinging movement of the motor back and forth on its pivot 116 to adjust the belt tension, the axis of which pivot is parallel to the blower wheel shaft 112. This sealing plate 119 is preferably of fibre or similar material, and as the hole therethrough is adjacent the motor end bearing, said hole will be properly lubricated.

If desired and as shown, the rear wall 75 of the control chamber may be extended rearwardly, as at 128, below and to clear the blower housing and to provide ample space for the motor 110. It is obvious that the end wall 78 of the control chamber could be located to the right of the motor, Figs. 8 and 9, in which case the motor would be located within the space 79 which forms an alcove of the blower chamber 40 and which is sealed at its top from the air heating chamber 22 by the top plate or wall 74 of the control chamber. However, I prefer to locate the motor in the control chamber 70 because oiling of the motor is invited each time the control chamber door 71 is opened and because the hum of the motor is not carried into the warm air ducts. If desired, the control chamber may be insulated or the like to absorb any motor sounds, although this is usually not necessary.

The control chamber arrangement of Figs. 7, 8 and 9 is also of interest because it shows how easily a tube 127 from the upper diaphragm chamber (not shown) of the gas pressure governor 85 can be carried over to discharge any seepage or leakage of gas into the burner compartment inlet 26a. The water supply pipe 93a, Figs. 8 and 9, leads the water through a type of water valve 125 actuated by a moisture sensitive element 126 which projects through the rear wall 75 of the control chamber into the blower chamber 40 where it is subjected to the moisture in the incoming air which circulates through the blower chamber. The use of such valve with its moisture responsive element results in automatically regulating the humidity of the air in the rooms heated by the present furnace, such regulation being effected by regulating the opening of the water valve 125 and hence regulating the amount of water delivered through pipe 94 to the evaporating pan 96.

Further features and advantages of the present invention will be apparent to those skilled in the art to which it relates.

What I claim is:

1. In an air heating furnace, a casing having an air heating chamber and a control chamber, said chambers being non-communicating and said control chamber being located at a lower level than said heating chamber, means in said air heating chamber having a burner compartment, said burner compartment and said air heating chamber being non-communicating, gas burner means in said compartment, vent means for said burner compartment, valve means in said control chamber for said burner means, and means for venting said control chamber at its upper end portion to said burner compartment, whereby any gas escaping from said valve means in said control chamber will be vented to and then from said burner compartment.

2. In an air heating furnace, a casing having an air heating chamber and a control chamber, said chambers being non-communicating, means in said air heating chamber having a burner compartment, said heating chamber and said burner compartment being non-communicating, vent means for said burner compartment, gas burner means in said burner compartment, valve means in said control chamber for said burner means, said casing having a door for providing access to said control chamber, ventilating louvres in the lower portion only of said door providing an air inlet for said control chamber, and means at the upper portion of the control chamber for venting said control chamber to said burner compartment, whereby said control chamber is kept in a relatively cool condition and any gas escaping from said valve means in said control chamber will be vented to said burner compartment.

3. In an air heating furnace, a casing having an air heating chamber and a control chamber, said chambers being non-communicating, means in said air heating chamber having a burner compartment, said burner compartment and said air heating chamber being non-communicating, gas burner means in said burner compartment, air inlet means in the lower portion of said control chamber, and means for establishing communication between the upper portion of said control chamber and said burner compartment, the air delivered to said burner compartment from said control chamber constituting the sole secondary air supply for the burner means in said burner compartment.

4. In an air heating furnace, a casing having an air heating chamber and a control chamber, said chambers being non-communicating, means in said air heating chamber having a burner compartment, said burner compartment and said air heating chamber being non-communicating, gas burner means in said burner compartment, regulating means for said burner means having portions thereof located outside of the furnace for convenient manipulation, said control chamber being located at a lower level than said regulating means, valve means in said control chamber for said burner means, air inlet means for said control chamber, and air outlet means for said control chamber at the upper end portion thereof and communicating with said burner compartment, whereby said control chamber is kept in a relatively cool condition and any gas escaping from said valve means in said control chamber is vented to said burner compartment.

5. In an air heating furnace, a casing having an air heating chamber and a control chamber, said chambers being non-communicating, means in said air heating chamber having a burner compartment, said heating chamber and said burner compartment being non-communicating, gas burner means in said burner compartment, means for venting said burner compartment, valve means in said control chamber for said burner means, said casing being also provided with a chamber into which cold air is delivered for said air heating chamber, said control chamber and said cold air chamber having a common wall so that said control chamber receives a cooling effect from the cold air chamber on the other side of said wall, and means for venting said control chamber at its upper end portion to said burner compartment.

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