June 17, 1958 L. C. COTTS ET AL 2,839,659

HEATING SYSTEM AND HEAT DIFFUSER THEREFOR

Filed Oct. 28, 1957 2 Sheets-Sheet 1

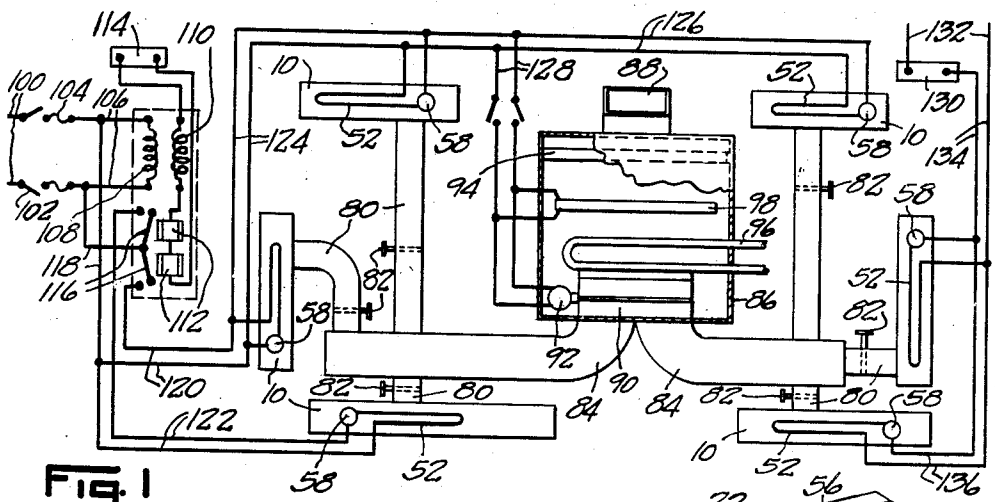


FIG. 1

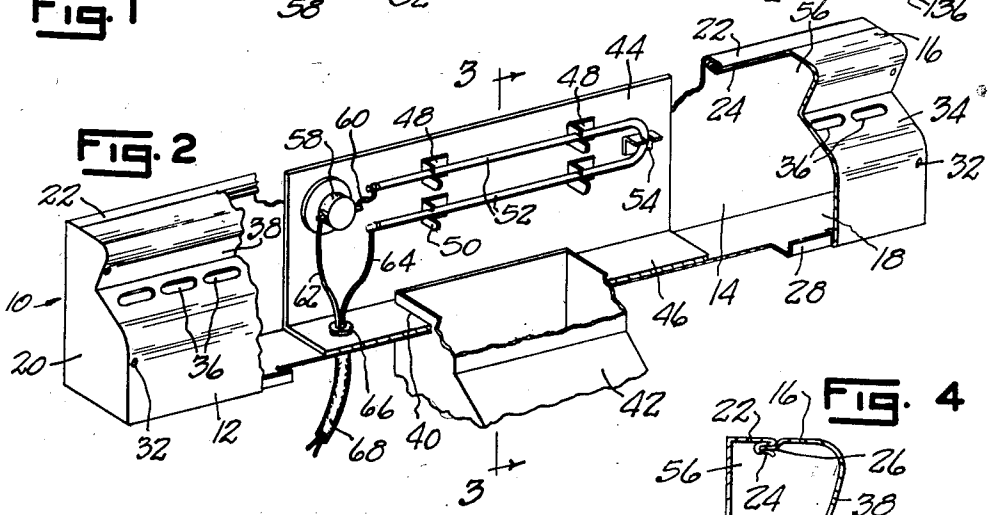


FIG. 2

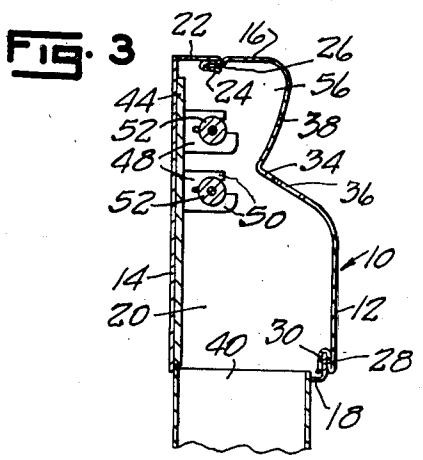


FIG. 3

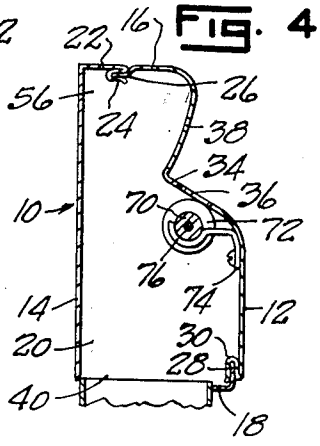


FIG. 4

INVENTOR.
LOUIS C. COTTS AND
HENRY G. BRENNER.
BY Eugene C. Knoblock
ATTORNEY

June 17, 1958 L. C. COTTS ET AL 2,839,659

HEATING SYSTEM AND HEAT DIFFUSER THEREFOR

Filed Oct. 28, 1957 2 Sheets-Sheet 2

FIG. 5

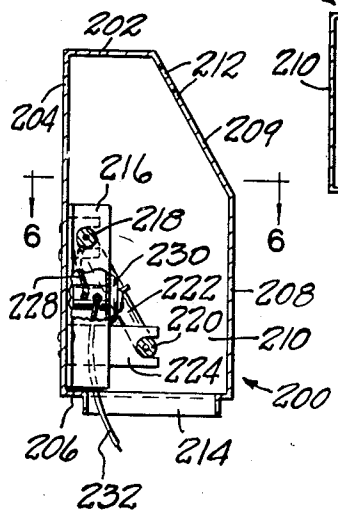


FIG. 6

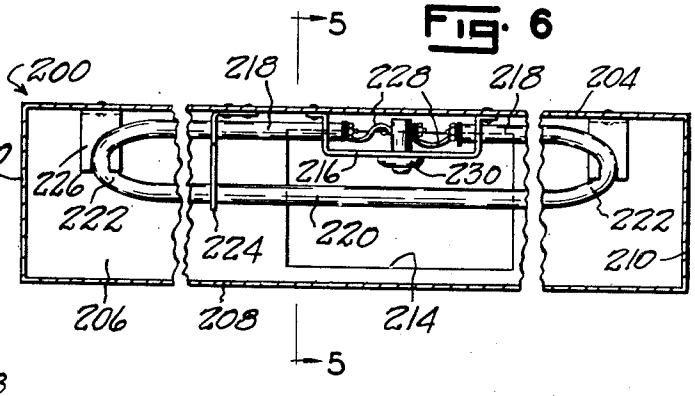
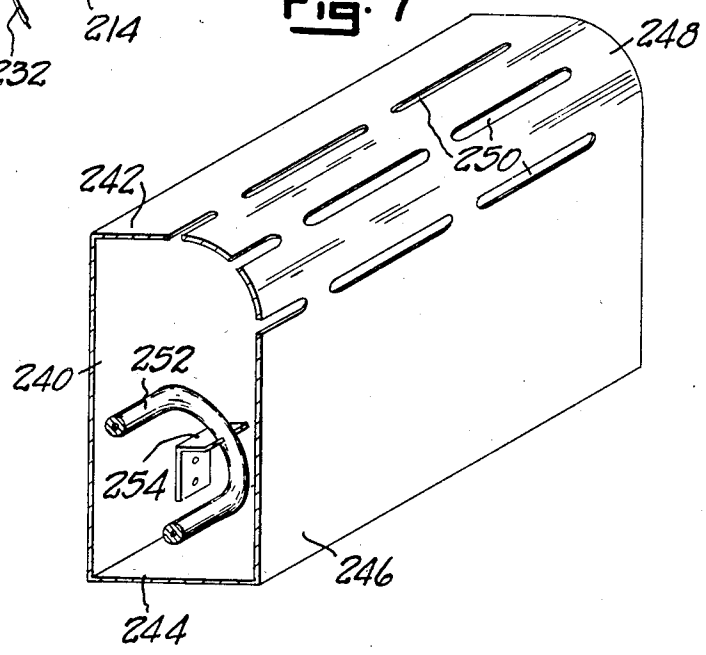


FIG. 7



LOUIS C. COTTS AND
HENRY G. BRENNER.
INVENTORS.

BY Eugene C. Knoblock
ATTORNEY

United States Patent Office

2,839,659

Patented June 17, 1958

2,839,659

HEATING SYSTEM AND HEAT DIFFUSER THEREFOR

Louis C. Cotts and Henry G. Brenner, Michigan City, Ind.

Application October 28, 1957, Serial No. 692,872

23 Claims. (Cl. 219—39)

This invention relates to improvements in heating systems and heat diffusers therefor. This application is a continuation in part of our copending application, Ser. No. 558,305, filed January 10, 1956, now abandoned.

The primary object of the invention is to provide a novel heat diffuser having a heat-generating element therein and adapted for connection with a forced air circulating system.

A further object is to provide a heat diffuser comprising an elongated member defining a chamber closed throughout except for air inlet and heat discharge openings, wherein the heat discharge openings are so located intermediate the height of the member as to provide thereabove a chamber for converting velocity pressure into static pressure, and wherein a heating element is located in the conversion chamber adjacent to the air inlet and of a length shorter than said diffuser, said outlet openings extending substantially full length of said diffuser casing and discharging heat substantially uniformly throughout the length of said diffuser.

A further object is to provide a heat diffuser adapted to be connected with a forced air circulating system, having means for altering the temperature of air circulated thereby, wherein said diffuser is provided with an electrical heating element adapted to temper or alter the heat content of the air in response to a thermostatic control.

A further object is to provide a heating system having a central air-circulating means equipped with air temperature-controlling means and connected to a plurality of elongated diffusers, each constructed with an elongated outlet and means for substantially uniformly discharging air throughout the full length of said outlet, wherein said diffusers include supplemental local heat-generating means, each responsive to a thermostatic control.

A further object is to provide a heat diffuser of this type having an elongated housing and elongated air-discharge means for substantially uniformly discharging air throughout the full length thereof, with novel means for mounting therein an electrical heat-generating unit.

Other objects will be apparent from the following specification.

In the drawing:

Fig. 1 is a schematic view illustrating a typical heating and air-conditioning system employing a plurality of air diffusers connected to a central air-circulating means by ducts, and also illustrating a typical wiring system for control and actuation of said first system;

Fig. 2 is a perspective view of a heat diffuser with parts broken away;

Fig. 3 is a transverse sectional view of the construction illustrated in Fig. 2, taken on line 3—3 of Fig. 2;

Fig. 4 is a transverse sectional view similar to Fig. 3 but illustrating a modified construction and arrangement of the heating element in the diffuser;

Fig. 5 is a transverse sectional view of another modified embodiment of the construction of the diffuser taken on line 5—5 of Fig. 6;

Fig. 6 is a fragmentary longitudinal horizontal sectional view taken on line 6—6 of Fig. 5; and

Fig. 7 is a fragmentary perspective view illustrating still another modified construction of the diffuser.

Referring to the drawing, and particularly to Figs. 2 and 3 which illustrate one embodiment of the heat diffuser, the numeral **10** designates the casing or housing which defines the diffuser and which includes front wall **12**, rear wall **14**, top wall **16**, bottom wall **18**, and end walls **20**. In the preferred construction the rear wall **14** and the bottom wall **18** are formed in one part, the front wall **12** and the top wall **16** are formed in a second part, and the end walls **20** are formed separately. A flange **22** preferably extends forwardly along the upper margin of the rear wall **14** and terminates in a reversely bent flange portion **24** defining a channel snugly receiving a tongue portion **26** located at the rear of the top wall **16** of the front-defining unit. The bottom wall **18** preferably has an upturned flange **28** extending along its length, and the lower end of the front wall **12** has a reversely bent channel-defining flange portion **30** adapted to engage and anchor over the flange **28**. Screws or other securing means **32** anchored to the respective sections and to inturned flanges at the margins of the end walls **20** serve to detachably connect together all of the parts and complete a closed chamber.

The front wall **12** of the housing is preferably configured to provide an inwardly directed shoulder portion **34** intermediate its height. The shoulder portion **34** has one or more openings formed therein to provide a substantially uniform air discharge extending substantially full length of the shoulder. As here shown, the outlet is provided by a plurality of apertures **36**. The upper portion of the front wall at **38** preferably extends forwardly and upwardly from the rear portion of the shoulder **34**, as shown. The bottom wall **18** has an opening **40** formed therein at any selected point along its length, and this opening is adapted to have connection with a conventional boot **42** for connection with a conduit system so as to lead air into the housing at the bottom thereof. The opening **40** will be short compared to the length of the diffuser, as shown.

Within the diffuser is mounted a holder or carrier for a heating element and, as here shown, said holder or carrier comprises a rear or upright wall portion **44** and a base portion **46** of such construction and such size as to fit snugly within the housing of the diffuser. The base plate **46** has a portion thereof cut out, preferably at or near its center, for register with the opening **40** at the bottom **18** of the diffuser. A plurality of brackets **48** are mounted upon the support wall **44** at spaced points along the length thereof and preferably at uniform height or elevation. Each of these brackets preferably includes one or more sets of finger or gripping portions **50** projecting forwardly from the wall **48** and adapted to receive and support therebetween the electrical heating element **52**, here shown as U-shaped. The heating element **52** is preferably insulated or sealed and may be of the type having a central electric resistance wire or rod suitably insulated and completely sheathed and encased, with the casing of which the metal

fingers 50 of the brackets 48 may directly engage. It will be understood, however, that the electrical heating element 52 may be formed of wire or other bare resistor, in which event the brackets 48 will be provided with electrical insulators in the manner well understood in the art to support the heating element. The heating element 52 here shown is rigid, and a secondary bracket 54 may be employed to support the same at the bend or bight thereof. While two runs of the electrical element are shown, it will be understood that only a single run, or more than two runs, may be provided.

The brackets will preferably locate at least the upper portions or runs of the electrical heating element within the chamber 56 of the diffuser located above the discharge outlets 36. The upper chamber portion 56 is substantially imperforate and serves to convert air discharged therein under velocity pressure into air at static pressure. Air under pressure enters the diffuser at inlet opening 40 and thence passes upwardly, with the majority thereof entering the conversion chamber because of the restricted area of the portion of the outlet 36 located directly above the air inlet opening 40. The heating element 52 is located directly above the inlet 40 so that all of the air which enters the conversion chamber 56 is subject to the influence of the heating element, as best seen in Fig. 3. The air so heated and converted from velocity pressure to static pressure within the chamber 56 is distributed throughout the full length of the diffuser and is discharged substantially uniformly along the full length of the diffuser at the outlets 36. The heating of the air entering the conversion chamber insures substantially equal heat distribution throughout the full length of the diffuser even though the heating element is short in length compared to the overall length of the diffuser. Thus the diffusers are commonly made in lengths of three feet, five feet or eight feet, and the heating elements will be shorter in each instance, for example, of lengths in the order of from fourteen inches to thirty inches, or more.

A limit switch 58 responsive to temperature is mounted on the bracket portion 44 adjacent to one terminal of the heating element 52. This limit switch will preferably be set to be normally closed but to open at a selected temperature, for example, a temperature in the order of 170° Fahrenheit. A conductor 60 connects one terminal of the limit switch 58 to one terminal of heating element 52. The other terminal of the limit switch is connected by conduit or lead 62 of a two-wire cable, and the other terminal of the heating element 52 is connected by conductor 64 of the two-wire cable. The two conductors are preferably suitably insulated, as by the use of asbestos, and pass through a fitting 66 mounted in registering openings formed in the base 18 and the bracket base 46. A tubular sheath 68 confines the two conductors 62, 64 and extends to an outlet or to a line. The electric heating element may be preassembled or mounted on the brackets 44, 46, and the limit switch 58 may be mounted upon the bracket and connected through the lead 60 with the heating element 52, prior to mounting of the assembly in the diffuser. All that is then required to complete the assembly is to connect the fitting 66 and to connect the terminals with the conductors 62, 64 from the cable 68 to the limit switch and the heating element, respectively, as shown. This can be accomplished while the diffuser is in disassembled form with only the portion thereof constituting the back and the base mounted in place. After the electrical elements have been completely assembled, the top-front unit and the separate end caps may be assembled in operative relation and secured by the screws 32 to complete the assembly operation.

Another form of diffuser is shown in Fig. 4 wherein the diffuser housing 10 is of substantially the same construction shown. In this instance the heating element constitutes a single longitudinal element 70 which may be either of the smooth insulated type having a continuous tubular sheath or may be of the type having spaced transverse heat radiating fins 72, as shown. Brackets 74 are secured to the diffuser housing at spaced intervals, preferably adjacent to the discharge outlets 36, and each such bracket includes a hanger portion or support 76 for mounting the heating element 70 in a position located adjacent to and below the discharge openings 36 so that substantially all of the air which passes through said discharge openings 36 will have been subjected to the influence of the heating element 70. For this purpose the heating element 70 will extend full length of the diffuser or substantially so. While only one run 70 is here shown, it will be understood that the heating element 70 may consist of a plurality of elongated runs or units of electrical heating material. It will also be understood that the air inlet for the Fig. 4 construction will be located similarly to the inlet 40 shown in Fig. 2.

In both the Fig. 2 and Fig. 4 constructions, the location of the air inlet 40 along the length of the elongated diffuser is not important because of the functioning of the conversion chamber 56 to convert velocity pressure of the air entering the device into static pressure to produce pressure equalization throughout the full length of the diffuser, so that substantially uniform air discharge will occur throughout the length of the diffuser.

A typical duct layout and wiring diagram of a heating and cooling system employing diffusers of the character shown in Figs. 2 to 4, inclusive, is shown in Fig. 1, where, for purposes of convenience, the various parts are shown schematically and in which it will be assumed that the various heat diffusers 10 are located in different parts or rooms of a building, usually along the outside wall thereof, as at the perimeter of the building. The air inlet openings 40 of the various diffusers 10 are shown as connected by individual ducts 80, each preferably provided with a damper 82, and leading to one or more main ducts or trunks 84 connected to the housing 86 of a central air circulator which is provided with one or more air return ducts 88 communicating with the spaces in which the respective diffusers 10 are located. The unit 86 includes a blower 90 actuated by a motor 92 so positioned as to provide a forced circulation of air through the return air duct 88, the unit 86, the trunks 84, and the conduits 80 to the diffusers 10 for discharge in the spaces to be heated or cooled. The unit 86 may also include filter means 94 and air-treating means. The air-treating means may include either or both of cooling means, such as cooling coils 96, and heating means 98. If employed, the heating means 98 may be of any conventional type and may consist of burners for gas, oil or other fuel, or may consist of electrical heating units. Each of the heating means 98 and cooling coils 96 will be under control of suitable control elements (not shown) and of the character well understood in the art, so it is believed unnecessary to describe the same individually.

The blower motor 92 and the various heating elements of the diffusers 10 are connected in an electrical circuit or circuits. Thus two such circuits are here shown to provide a zone type of control. It will be understood that all diffusers and the blower fan may be connected in a single circuit or in two or more circuits. A line 100 has suitable switch means 102 and fuse means 104 interposed therein, and leads 106 extend therefrom to the primary 108 of a transformer having a secondary 110. The secondary 110 is connected in a circuit having one or more relays 112 and a low voltage thermostat 114. The thermostat is preferably connected in series with the relay and, where more than one relay is employed, the same may be connected either in series or in parallel. The relay coils 112 control relay switch elements 116 controlling high voltage circuits tapped to the line by leads 118 from which extend in parallel relation the leads 120, 122, 124, 126 and 128 extending to the vari-

ous individual diffusers and to the blower motor, respectively. Thus it will be seen that upon closing of the switch **102**, the entire system is under the control of the thermostat **114** so that upon a change in temperature energizing the circuit to the relay coils **112**, the relay switches **116** will be operated in a proper sense. Thus the blower motor **92** and the electrical elements of each of the diffusers **10** will be controlled simultaneously in each of the circuits or zones common to or controlled by the single thermostat **114**.

A high voltage thermostat **130** may be employed for controlling the heating elements in a selected zone, said high voltage thermostat being connected directly to a line by a lead **132** and being connected by leads **134** and **136** in parallel relation to two or more diffusers **10**. Of course, a single thermostat **130** may also control only a single diffuser **10**, if desired.

The thermostats **114** and **130** may be separated from the thermostats which control the cooling element **96** and the heating element **98** of the unit **86**. However, either of these thermostats may control the heating element **98**, whether or not the same is an electrical heating element. Also, the thermostat **114** may control either or both of the heating element **98** and the cooling element **96**, if desired.

The advantages of the system reside in the high degree of comfort and the close control of temperature which can be obtained. Thus, if desired, each room or each zone or group of rooms can have a thermostat controlling the same independently of the condition in the other rooms or zones. Another characteristic of the system is that the blower motor **92** can be so connected in parallel with the heating elements of the individual diffusers **10** as to operate whenever any room or zone requires heat as sensed by the thermostat in control thereof. Alternately, the blower motor may be connected to an electrical source for continuous operation. Still another control for the blower motor may be one in which a separate thermostat is employed which is responsive either to inside air or outside air or to the difference in temperature between inside air and outside air.

The safety factor of the device or system is high. Thus, if any of the diffusers **10** should operate in response to the control thermostat associated therewith, and the blower **90** should fail to operate for any reason, so that a forced circulation of air is not provided, the operation of the heating element is prevented from reaching excessive temperatures by the temperature responsive limit switch in that diffuser **10**, such as the limit switch **58** shown in Fig. 2.

One of the outstanding advantages of this system is that it possesses all of the advantages of a central heating system. Thus, although the heating elements in the ducts **10** are localized, the air heated thereby can be filtered at **94** and circulated by the blower **90**. Additionally, it will be understood that humidification means (not shown) may be incorporated in the unit **86** so that the air discharged by the diffuser will be controlled as to humidity. In cases where summer temperatures are encountered requiring cooling, the diffusers still operate to effectively distribute the air discharge thereto by the blower **90**, and a central cooling unit **96** can lower the temperature of the air before it is discharged to the distributors **10**. By virtue of the thermostat control, if excessive cooling occurs, the heating elements of the diffusers can be brought into play to temper the air so cooled, and a different degree of tempering can occur at each individual zone under thermostatic control in the system.

In cases where the diffusers are used only with the blower and without cooling means **96** or heating means **98**, the air supplied to the diffusers of both Figs. 2 and 4 is not heated, so that heat losses in the ducts **80** and **84** do not occur and no heat is wasted or lost in said ducts. In instances where a diffuser of the Fig. 4 construction is used, this economy of heat reaches its maximum, since in that instance the air in the chamber is not heated but only that air which is discharging at the opening **36** is heated. Thus no heat loss occurs as by radiation from the outer wall **14**, as in the construction here shown in Fig. 2.

A modified construction of an air distributor usable in our improved system is illustrated in Figs. 5 and 6, and is adapted to be used in place of the distributors **10** in the system illustrated in Fig. 1. These distributors are identified by the reference numeral **200** and constitute elongated distributors adapted to be mounted in a room along the wall thereof and preferably above the floor of the room or at least to bear upon the upper surface of the floor. The distributor **200** comprises a top wall **202**, rear wall **204**, bottom wall **206**, front wall **208**, and end walls **210**. The front wall **208** preferably includes an inclined longitudinal upper portion **209** within which discharge outlets **212** are formed. The outlets **212** preferably constitute one or more elongated comparatively narrow openings or sets of openings extending substantially full length of the unit and at a level at or below the level of the top wall **202** of the unit. The distributor is provided with an inlet **214** in its lower portion, as in its bottom **206**, which inlet **214** is adapted for connection with a boot of a forced air system, such as boots connecting to the conduits **80** of the system shown in Fig. 1. The inlet **214** will be short compared to the overall length of the distributor and will be of substantial width so that there is only a minimum resistance to flow of air therethrough and into the distributor per unit of length of the inlet. This resistance contrasts with a comparatively high resistance per unit or inch of length of the comparatively narrow elongated discharge outlets **212**. The distributor may be formed of multiple parts in any manner found suitable that will provide throughout the same a substantially unobstructed chamber or passageway between the inlet and the outlet or outlets for the full length of the latter. However, in the normal operation of the system illustrated in Fig. 5 the resistance of the outlets **212** to the flow of air therethrough induced by the blower **90** will be such that air will be discharged substantially uniformly and substantially full length of the unit even in cases where the inlet is substantially spaced from one end of an outlet lengthwise of the distributor. The distributors may be made in different lengths as desired as suggested above and the inlet may be located at any convenient point along the length of the distributor.

A bracket **216** is suitably carried by the distributor, as by securing the same to the rear wall **204**, preferably at a point adjacent to and above the inlet **214**. The bracket **216** mounts the end portions **218** of an electrical heating element which preferably is substantially of elongated looped or oval form having a run **220** spaced from the anchor portions **218** and having bent end portions **222**. Supplemental brackets may be provided, such as brackets **224**, supporting the run **220**, and brackets **226** supporting the ends **222**. The heating element will preferably be of the type described above, having an insulating sheath. Leads **228** from the opposite ends **218** extend to a limit switch **230** carried by the bracket **216**. Leads **232** extend to the power source, as in the circuit illustrated in Fig. 1. The brackets are so positioned as to locate the heating element above the inlet and adjacent to or in the path of flow of air from the inlet to the outlet. The heating element may be of any length desired and preferably will terminate short of the ends of the distributor. We have found that a heating element of a length of approximately 30 inches will work satisfactory in distributors of a length of three feet and more and up to at least eight feet in length. The heating element in each instance will be located adjacent to the inlet so as to intercept air therefrom and to heat the air discharged from the outlet along the full lentgh thereof.

Another alternate construction of a diffuser usable in this system is illustrated in Fig. 7 and constitutes an elongated hollow housing or casing having a back wall 240, a top wall 242, a bottom wall 244, front wall 246, and end walls (not shown). The top and front walls merge in a curved portion 248. The distributor is provided with the usual inlet for attachment with a boot and characterized by a low air resistance and by one or more longitudinal air discharge outlets 250. As shown, a plurality of longitudinally aligned sets of narrow elongated openings are provided at the curved portion 248 at or adjacent the top 242 and in free open communication with the inlet at all parts thereof. Electrical heating element 252, preferably of substantially looped form comparable to that illustrated in Figs. 5 and 6, is used in the construction and is insulated for support thereof by suitable brackets 254.

In each embodiment of the invention illustrated it will be apparent that the diffuser will be mounted within a room at the lower part of a building wall and will rest upon or be located above a floor of the room. All parts of each form of the diffusers shown are in free and open and unrestricted communication throughout so as to have therein a single chamber substantially coextensive therewith and either having a longitudinal restriction intermediate its height as illustrated in Figs. 2, 3 and 4, or lacking such restriction as illustrated in Figs. 5 and 7. The air outlet openings in each instance extend substantially full length of the housing, whereas the air inlet opening in each instance has a longitudinal dimension comparatively short and adapted for connection with a forced air supply duct. The electrical heating element in the housing is adapted to intercept air flowing from the inlet to the outlet, and air flows to the outlet in a longitudinally flaring pattern with substantially uniform discharge of air throughout the length of the unit by reason of the comparatively narrow width of the discharge openings which produce a resistance at the outlet per inch of length substantially greater than the resistance of the inlet per inch of length. It will be understood that in each form a thermally responsive switch is provided within the diffuser to deenergize the heating element upon attainment of a predetermined temperature in the housing or diffuser so that overheating of the diffusers is prevented. The device makes possible an accurate control of heat at each diffuser in a system and regulation of the temperature in different rooms very easily and automatically without sacrificing the beneficial advantages of a forced air circulating system for insuring that air will flow freely as distinguished from flow thereof simply by convection. Also the system makes possible the provision of a central filter, a central humidifier and any other element required. A still further advantage is that the system may be used in a combination for both heating and air-conditioning or cooling with the temperature regulated at a central point in the system, as will be apparent from a consideration of Fig. 1.

While the preferred embodiment of the invention has been illustrated and described, it will be understood that changes in the construction may be made within the scope of the appended claims without departing from the spirit of the invention.

We claim:

1. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, whereby the part of said housing above said outlet constitutes a conversion chamber for converting velocity pressure to static pressure, and an electrical heating element in said chamber.

2. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, whereby the part of said housing above said outlet constitutes a conversion chamber for converting velocity pressure to static pressure, an electrical heating element in said chamber, and a temperature sensitive limit switch in said housing electrically connected to said heating element for controlling said element.

3. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, whereby the part of said housing above said outlet constitutes a conversion chamber for converting velocity pressure to static pressure, an electrical heating element in said chamber, a temperature sensitive limit switch in said housing electrically connected to said heating element for controlling said element, and a support removably mounted in said housing and mounting said heating element and limit switch.

4. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, whereby the part of said housing above said outlet constitutes a conversion chamber for converting velocity pressure to static pressure, an electrical heating element in said chamber, a temperature sensitive limit switch in said housing electrically connected to said heating element for controlling said element, said housing being formed from a plurality of separable parts, and a support removably mounted by one of said parts and mounting said heating element.

5. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, whereby the part of said housing above said outlet constitutes a conversion chamber for converting velocity pressure to static pressure, and an electrical heating element in said housing, having at least a portion thereof located in said conversion chamber.

6. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, whereby the part of said housing above said outlet constitutes a conversion chamber for converting velocity pressure to static pressure, and an electrical heating element in said housing, said housing being horizontally elongated with said air outlet extending substantially full length thereof and said heating element being of shorter length and at least partially located in said conversion chamber and adjacent to said inlet to intercept air flowing from said inlet.

7. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, whereby the part of said housing above said outlet constitutes a substantially imperforate conversion chamber for converting velocity pressure to static pressure, and an electrical heating element in said housing, said heating element being horizontally elongated and having at least a part thereof located above the level of said outlet.

8. An air diffuser comprising a housing including top, bottom, front, back and end walls and having an air inlet opening and an air outlet opening, said air outlet extending substantially full length of said housing intermediate the height thereof at said front wall, the part of said housing above said outlet being substantially imperforate and constituting a conversion chamber for con-

verting velocity pressure to static pressure, an electrical heating element in said chamber, and means mounting said heating element in the path of flow of air to said outlet, said heating element extending substantially full length of said outlet.

9. In combination, an air circulating device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing defining a chamber for unrestricted flow of air therein and having an elongated substantially horizontal outlet spaced from and above said inlet and intermediate the height of said housing, and an electrical heating element mounted in said housing.

10. In combination, an air circulating device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing having an elongated substantially horizontal outlet spaced from said inlet, and an electrical heating element mounted in said housing, said outlet being located intermediate the height of said housing whereby the portion of said housing above the level of said outlet is substantially imperforate, said heating element being at least partially located above the level of said outlet.

11. In combination, an air circulating device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing having an elongated substantially horizontal outlet spaced from said inlet, and an electrical heating element mounted in said housing above the level of said inlet, said housing and heating element both being elongated horizontally, at least a part of said heating element being located above the level of said outlet and said inlet and being shorter than said outlet.

12. In combination, an air circulating device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing defining a chamber for unrestricted flow of air therein and having an elongated substantially horizontal outlet spaced from and above the level of said inlet and below the top of said housing, and an electrical heating element mounted in said housing, said heating element extending substantially full length of said outlet and adjacent thereto and in a position to intercept air flowing to said outlet.

13. In combination, an air circulating device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet in its lower portion communicating with said duct, said distributor constituting a housing defining a chamber for unrestricted flow of air therein and having an elongated substantially horizontal outlet spaced from said inlet and below the top of the housing, an electrical heating element mounted in said housing, and a thermally sensitive limit switch in said housing connected to and controlling said heating element.

14. In combination, an air conditioning device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing defining a chamber for unrestricted flow of air therein and having an elongated substantially horizontal outlet spaced from said inlet and below the top of the housing, an electrical heating element mounted in said housing, and thermostatically controlled means for energizing and deenergizing said blower and heating element.

15. In combination, an air conditioning device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing defining an unrestricted chamber and having an elongated horizontal outlet spaced from said inlet and below the top of the housing, an electrical heating element mounted in said housing, thermostatically controlled means for actuating and deenergizing said blower and heating element, and a normally closed limit switch in said housing in controlling relation to said heating element and operative to deenergize said heating element when a predetermined temperature is attained in said housing.

16. In combination, an air conditioning device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing having an unrestricted interior chamber and an elongated horizontal outlet spaced from said inlet and below the top of said housing, an electrical heating element mounted in said housing, and air treating means associated with said air conditioning device.

17. In combination, an air conditioning device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing having an elongated horizontal outlet spaced from said inlet, an electrical heating element mounted in said housing, and an air cooling means associated with said air conditioning device.

18. In combination, an air conditioning device having an outlet and including a blower, a duct connected to said blower, an air distributor positioned remote from said device and having an inlet communicating with said duct, said distributor constituting a housing having an unrestricted interior chamber and an elongated horizontal outlet spaced from and above said inlet and spaced below the top of said housing, an electrical heating element mounted in said housing, and heating means associated with said air conditioning device, for heating air propelled by said blower.

19. An air diffuser adapted to be mounted at the lower part of a building wall and above a building floor comprising a horizontally elongated housing including top, bottom, front, back and end walls defining a single chamber therein coextensive therewith and having an air outlet opening extending substantially full length of said housing and an air inlet opening having a longitudinal dimension shorter than said housing and adapted for connection with a forced air supply duct, and an electrical heating element mounted in said housing above the said inlet and spaced from the walls of said housing and adapted to intercept air flowing from said inlet to said outlet.

20. An air diffuser as defined in claim 19, wherein the cross-sectional area of said outlet is at least equal to the cross-sectional area of said inlet and the resistance of the outlet per inch of length is greater than the resistance of the inlet per inch of length.

21. An air diffuser as defined in claim 19, and a thermally responsive switch within said housing and electrically connected to said heating element to deenergize said element upon attainment of a predetermined temperature in said housing.

22. In combination, an air circulating device having an outlet and including a blower, a horizontally elongated air distributor having an inlet, a duct connected to and providing communication between the outlet of said circulating device and the inlet of said distributor, said distributor constituting a housing having top, bottom, front, back and end walls and being open throughout to define a single chamber therein coextensive there-

with for unrestricted flow of air therein and having an air outlet opening extending substantially full length thereof, and an electrical heating element mounted in said housing above said inlet and spaced from the walls of said housing for intercepting air flowing from said inlet to said outlet.

23. The combination defined in claim 22, wherein said air circulating device includes thermostatically controlled air temperature control means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,007,102	Wallace	July 2, 1935
2,414,339	Skaggs et al.	Jan. 14, 1947
2,438,670	MacDonald et al.	Mar. 30, 1948
2,451,926	Dallin	Oct. 19, 1948
2,458,268	Hinds	Jan. 4, 1949
2,528,650	Graham	Nov. 7, 1950