

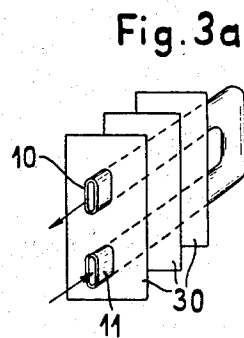
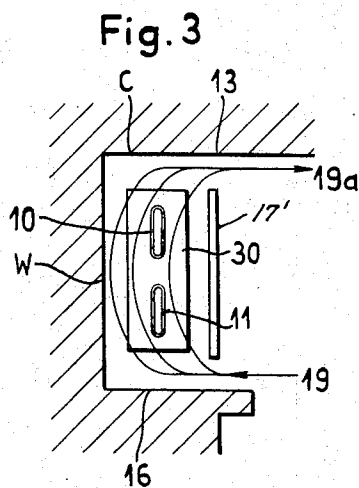
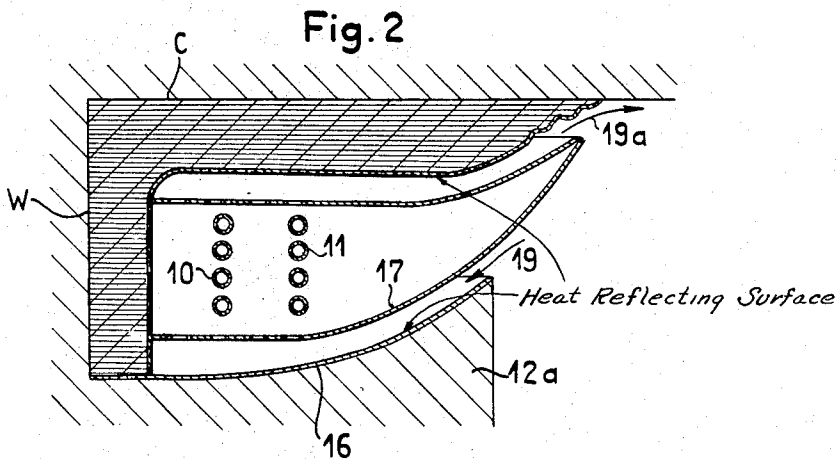
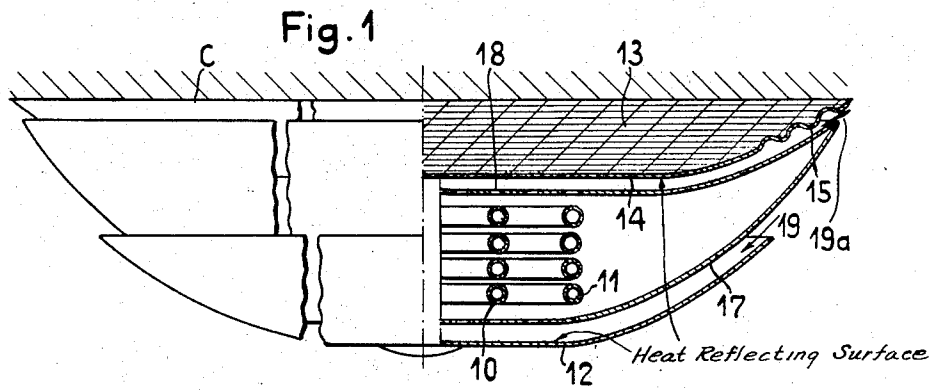
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HEATING OF BUILDINGS

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HEATING OF BUILDINGS

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2 Claims. (Cl. 257—124)

The present invention relates to means for and methods of heating buildings, and has for its main object to provide a novel and improved radiant heating apparatus, as distinguished from the convection heaters used in conventional central heating systems.

Apparatus which heats mainly by convection, chief of which is the so-called "radiator" of a conventional central heating system, has not the same physiological value as a pure radiant heater and, since a convection heater operates by inducing the circulation of heated air, the heating effect is liable to be upset by the introduction of disturbing air currents from the doors and windows. Furthermore, a considerable amount of dust is constantly carried around by the local air currents, adding to the discomfort and being deposited upon the walls and furniture. Convection heaters also do not give any appreciable directional heat, the warm air rising vertically. As a result, the whole atmosphere in a room must be warmed before a feeling of comfort is obtained.

With radiant heating, on the other hand, a person within range of the radiating source may be comfortably warmed although breathing comparatively cool air, thus avoiding the feeling of closeness associated with many forms of conventional central heating. Furthermore, radiated heat rays travel directly without being disturbed or deflected by air currents, until they strike some solid substance or person which absorbs the heat and itself acts as a subsidiary heater by conduction and convection.

Whereas until recently rooms have been heated almost exclusively by convection heaters, such as the well-known "radiators" of conventional central heating installations, effecting circulation of warm air at the person level, the trend in modern heating engineering is towards lower temperature panel heating or radiation by extending heated surfaces, such as the floor, walls or ceiling of the room to be heated. The heat distribution from the surfaces or panels at relatively low temperature is considerably more pleasant as well as hygienic and economical, compared with convection heating involving intensive air circulation. In effecting such surface radiation or heating, it has been found especially advantageous to utilize the ceiling as a radiating surface, in that bulky heating devices are avoided and since no other surface is able to encompass the entire room as uniformly as heat radiated from a ceiling surface maintained at a temperature of about 93 to 97° F.

Another advantage of ceiling radiation heating is the almost complete elimination of convection or circulating currents at the person level, the room atmosphere being uniformly heated to a relatively low temperature by re-radiation from the walls, the floors and the fixed objects and persons in the room. As a result, the air in ceiling-heated rooms is always fresh and free from dust, even in the case of relatively high room temperatures, while the atmosphere in the room remains below the floor temperature, a condition which greatly contributes to the feeling of comfort and cheerfulness.

On the other hand, in the case of convection heating by

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air circulation at the person level, the colder, heavier and dust laden air is sucked from the floor upwardly in a continuous circulating current, thus involving all the disadvantages mentioned both from an economical and hygienic point of view, aside from the discomfort and feeling of unpleasantness associated with conventional convection heater. Furthermore, the more intense the air current, the greater the amount of heat withdrawn from the persons in the room which, in turn, contributes to the low efficiency of convection heating systems. The fact that the heated air current carries along a considerable amount of dust also gives the impression of "dry air," a common objection made to conventional central heating devices.

Although it has been well established by theoretical considerations that ceiling radiation heating is superior to any other type of radiant heat distribution, it has not been possible in the past to produce a wholly satisfactory and economical heating apparatus of this character. The known ceiling heating devices are practically limited to installations in new buildings, aside from many other disadvantages and defects. The common practice is to supply the heat from the inside of the ceiling such as by means of hot water or steam pipes incorporated in the ceiling structure. This not only involves a considerable heat loss by conduction of the heat from heating pipes through the ceiling material, but renders the installations of this type both complicated and expensive to an extent as to limit their practical use to new building constructions.

The same applies to all other surface and panel heating system for warming rooms or buildings by means of heating pipes, electric heaters in the form of heating wires or ribbons fitted inside the walls or panels, or the like, to heat an extended surface to a substantially uniform surface temperature.

Accordingly, an important object of the invention is the provision of simple and efficient apparatus for uniformly heating or cooling a panel or extended surface, in particular the ceiling of a room to be cooled or heated, utilizing a convection current or circulation limited to a relatively thin layer or sheath contiguous to and spread over the surface to be heated.

Another important object is the provision of a novel and improved apparatus for heating or cooling a room by radiation from the ceiling by maintaining the ceiling at a substantially uniform surface temperature by means of a heat convection stream or current.

Among the more specific and ancillary objects of the invention is the provision of a ceiling convection heater which is both simple in construction and easy to install in existing rooms; by which the heating or cooling air circulation is substantially restricted to a relatively thin layer or sheath underneath the ceiling surface, leaving the region at the person level substantially by radiation of heat energy towards or away from the ceiling surface; which can advantageously be structurally combined with an illuminating device for either direct or indirect illumination, which can be constructed to act both as a radiator and convector for direct and indirect room heating; and which may be adapted for use with an artificial ceiling or radiating panel to suit special existing conditions and requirements.

The invention, both as to its further objects and novel aspects, will be better understood from the following detailed description taken in reference to the accompanying drawings, forming part of this specification and wherein:

Fig. 1 shows diagrammatically, partly in elevation and partly in section, a ceiling convection heater constructed in accordance with the principles of the invention and suitable for mounting in the center of a ceiling;

Fig. 2 shows a heater similar to Fig. 1 designed for mounting in the corner or along an edge of the ceiling;

Fig. 3 shows a modification of the heater of Fig. 2; and

Fig. 3a shows the heater source (hot water convector) of Fig. 3.

Like reference characters identify like parts throughout the different views of the drawings.

With the foregoing objects in view, the invention involves generally the provision of heater means to cause a sheath or thin stream of air to flow continuously in contact with and to the colder regions of the ceiling, until heating the entire ceiling surface to approximately uniform temperature, i. e., above room temperatures in the case of a cooling system, respectively. The apparatus for carrying out the invention comprises essentially a hot water convector, electrical heater or equivalent heating source disposed below and closely adjacent to the ceiling and a screen or system of screens enclosing or shielding said source from the space below the heater and constructed to provide suitable upper and lower inlet and outlet air passageways, to cause a circulating air current to pass in contact with said source and to uniformly spread over the ceiling surface in the form of a sheet-like convection stream. Such a ceiling convection heater may be either mounted in the center of a ceiling or a plurality of heaters may be suitably distributed to uniformly heat a greater ceiling area, the heater or heaters being designed to produce a radial convection current towards or away from the heating source or sources. Alternatively, the heater or heaters may be of an oblong or linear shape and mounted parallel to and preferably along an edge of the ceiling, the screening device in this case being constructed to produce a convection current in a single direction at right angle to the heater, in a manner described in greater detail hereafter.

As is understood, such a heat distributing or radiant heating system may operate equally well as a heating or cooling device, depending upon the relative temperature of the heat source compared with the room temperature. In this case of a heater, the warm air rises and moves along the ceiling in a direction away from the heater, while the cool air entering the heater from below flows in the opposite direction. In the case of a cooling system, with the heat source having a temperature below room temperature, the flow of the air is reversed, resulting in a cooling of the objects in the room by heat radiation therefrom toward the relatively cooler ceiling surface.

For the purpose of this specification, the term heater or heating is, therefore, to be understood to include a cooling system of the same type, the difference being a mere matter of degree in respect to the temperature of the source or heat energy supply relative to a desired ceiling temperature.

Referring more particularly to Fig. 1 of the drawings, there is shown a ceiling convection heater designed for mounting in the center of a ceiling C and comprising a pair of concentric heating devices 10 and 11 in the form of spiral heating coils or the like, suitable means (not shown) being provided for mounting the heater below and close to the ceiling surface. There is further shown a first concave screen 12 mounted below and having its concave surface facing the heater 10, 11 to reflect heat rays towards the heater, if necessary, by providing the inside of the screen 12 with a suitable heat reflecting surface. There is shown a further screen 13 mounted above the heater 10, 11 adjacent to the ceiling C and preferably consisting of heat insulating material or being provided with a heat reflecting surface 14, to substantially concentrate the heat supplied in the immediate neighborhood of the heater 10, 11. The screens 12 and 13 may be provided with grooves or recesses 15 serving as a means for collecting dust carried along by the air currents passing through the device.

Item 17 represents a hollow perforate member or enclosure surrounding the heater 10, 11 in spaced relation to and conforming to the screens 12 and 13, in such a

manner as to serve as a guide for the air convection current and to provide a pair of lower and upper inlet and outlet passageways or openings, as indicated by the arrows 19 and 19a, respectively, in the drawing. More specifically, the edges of the screen 12 are so shaped as to cause the cool air to enter the heating device in a substantially lateral or horizontal direction, to prevent any substantial circulation in the space below the heater. In this manner the setting up of air currents in the lower regions, especially at the person level, is substantially avoided.

The enclosure 17 is furthermore so constructed as to prevent any closed air circulation inside the heater itself. In order to enable the air to circulate freely and to readily leave the heater through the outlet opening 19a between the enclosure 17 and the ceiling or screen 13, the upper and lower walls of the enclosure are provided with perforations 18 or otherwise constructed to readily pass the air convection current. The circulation through the heater may be caused solely by the natural suction effect resulting from the heated air rising from the lower to the upper parts of the heater and/or by means of artificial circulation by the provision of a fan (not shown) mounted within the device.

The function and operation of a ceiling convection heater of the type described above is as follows. The air passing in contact with the heater or elements 10 and 11 is heated to a higher temperature and caused to rise and pass along the screen 13 to the ceiling C, thus spreading or being distributed uniformly over the ceiling surface due to the reduced specific weight of the warmer air. At the same time, cool air will be drawn into the heater from the region immediately underneath the ceiling or adjacent to the inlet opening 19, as a result of the construction of the screen 16 and enclosure or guide member 17. Accordingly, a continuous circulation or convection current passes in contact with the heater 10, 11 and is spread uniformly over the ceiling in the form of a sheet-like stream or sheath, thus effecting a heating of the ceiling surface to a substantially constant and uniform temperature. The same applies in the case of a cooling system, in which case the heater elements 10 and 11 are replaced by a cooling device such as a system of cooling water pipes, the direction of the convection current in this case being reversed, as is readily understood.

In a device as described, which may be of round, oval or of any other suitable shape, the convection current or circulation passes or spreads from the heater radially in all directions until uniformly covering the entire ceiling surface. In the case of relatively large ceilings, a plurality of convection heaters suitably spaced and distributed may be provided, to uniformly heat the entire ceiling surface.

Fig. 2 shows a modified ceiling convection heater according to the invention, suitable for mounting in a corner or along the edge of the ceiling C. In the latter case, the device preferably has an oblong or linear shape comprising one or more sets of heating pipes 10 and 11 arranged parallel to one another and to the edge between the ceiling C and wall W. According to a preferred embodiment, the heater may be mounted within a lateral recess in the wall W, providing a lower screen 16 in the form of a projection 12a integral with a forming part of the wall, as shown in the drawing. Otherwise, the function and operation of this heater is substantially similar to the heater according to Fig. 1, the cool air again entering substantially laterally, as indicated at 19, passing in contact with the heater and leaving the device near the ceiling, as indicated at 19a. In this case, the convection current moves across the ceiling in a substantially straight direction and a pair of heaters may be suitably provided at the opposite edges, to insure a uniform heat distribution over the entire ceiling surface. As pointed out, the heater itself may consist of a system of steam or hot water pipes or the like, which are advan-

tageously provided with longitudinal or ring-shaped radiating ribs or fins, to promote the heat exchange with the circulating air or convection current.

Figs. 3 and 3a show a modification of Fig. 2, suitable for mounting in a corner or along the edge of the ceiling C. This arrangement of the ceiling convection heater has been particularly successful in practice. The device is mounted near the corner or along the edge of the ceiling C within a recess in the wall W, the latter being provided with a suitable projection 16 acting as lower screen or guide for the entering air current 19. The heating device has one or more sets of heating pipes 10 and 11 consisting of edgewise mounted flat pipes arranged parallel to one another and to the edge between the ceiling C and the wall W. The heating pipes 10 and 11 are provided with radiator fins 30. In front of the heating device towards the room to be heated a screen 17' is provided. In the example under consideration the heating device is surrounded by four screens, namely, the ceiling screen 13 C, the lower screen 16 and the two lateral screens W and 17' in front of the pipes. Otherwise, the function and operation of this heater is substantially similar to the heater according to Figs. 1 and 2.

According to an improved feature of the invention, a ceiling convection heater of the type described may be structurally combined with an illuminating device by providing a common screen or reflector shielding both devices from the room, said screen being adapted to reflect heat or light rays or both. Thus, the lower screen 12 of Fig. 1 may serve as a reflector for heat rays towards the heater 10, 11 and at the same time as means for reflecting light rays from a lamp mounted within the device towards the ceiling for indirect illumination, in a manner readily understood. Alternatively, the upper screen 13 near the ceiling may be designed to reflect and distribute both heat and light rays, to concentrate the heat energy and to serve as a means for distributing indirect illumination.

As will be understood, the separate and independent construction and installation of ceiling heaters according to the invention makes it possible to design the heaters so as to fit or harmonize with the architectural design of the surroundings and/or to mount the heaters in suitable recesses in the ceiling or walls, in a manner analogous to indirect lighting systems at present being widely used.

In the foregoing, the invention has been described with reference to a few specific illustrative devices. It will be evident, however, that numerous variations and modifications, as well as the substitution of known elements for those shown and described herein, may be made without departing from the broader scope and spirit of the invention as set forth in the appended claims. The specification and drawings are accordingly to be regarded in an illustrative rather than a limiting sense.

What I claim is:

1. A convection heater for buildings comprising heating coils adapted to receive hot water and to be mounted adjacent to a ceiling along the edge thereof a perforated screen under said heating coils, a second perforated screen above said heating coils and adjacent the ceiling, said screens being extended into and interconnected with an upswEEP to the connecting edge, and lateral surfaces spaced from the screens to provide inlet and outlet openings above and below said screens to cause a circulating air current to pass said screens substantially laterally and horizontally in a zone somewhat beneath said ceiling and to pass vertically through the perforations in the screens and in contact with said heating coils and to leave said coils and between the upper screen and the adjacent lateral surface substantially laterally and horizontally in contact with said ceiling in order to heat the ceiling by convection so that it will act as a radiator.

2. A convection heater for buildings according to claim 1, in which the upper lateral surface is provided with a series of corrugations at the outlet acting as a dust collector.

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