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RADIANT PANEL HEATING AND AIR DISTRIBUTING STRUCTURE

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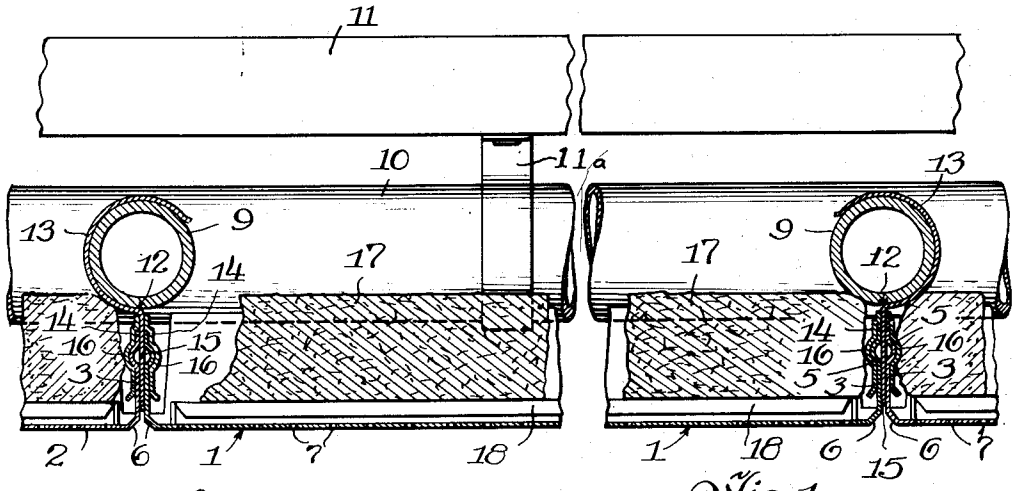


Fig. 1

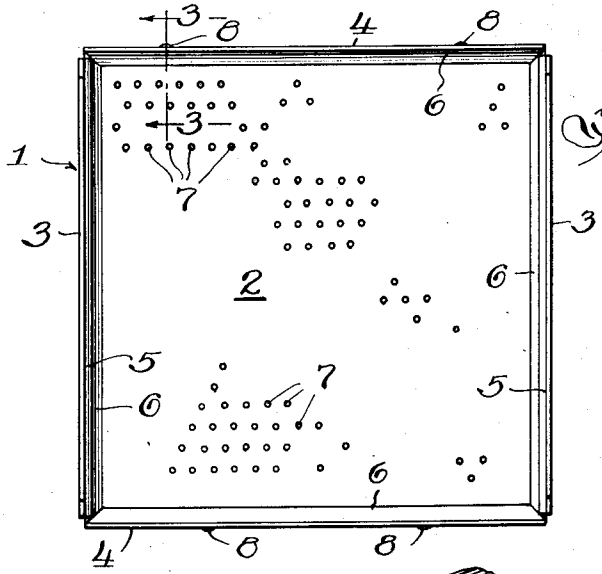


Fig. 2

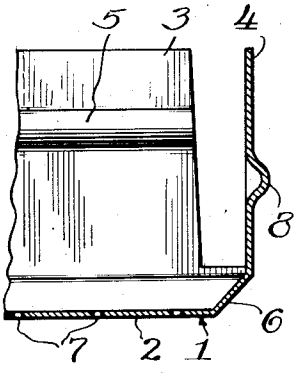


Fig. 3

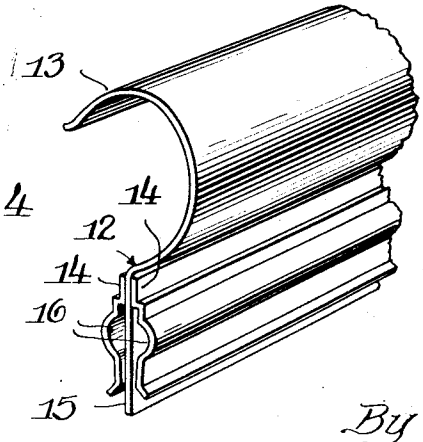


Fig. 4

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RADIANT PANEL HEATING AND AIR DISTRIBUTING STRUCTURE

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2 Claims. (Cl. 257—124)

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This invention relates to heating and ventilating systems for enclosures, including panel heating or what is more popularly known as "radiant heating." More particularly, the invention pertains to improvements in the structural elements of suspended ceilings which provide the means for the heating of rooms by radiation and may, at the same time, provide the means for distributing ventilating air introduced into the room.

Sheet metal has long been used as an exposed surface element of ceilings and walls. In some instances, as, for example, in the suspended ceiling sound absorbing constructions shown in Norris Patent No. 1,726,500, the sheet metal panel elements are applied in the form of pans having broad surface areas and flanges which serve as stiffening and supporting means for the pans. The exposed face areas of such pans are perforated when used as part of an acoustical treatment. The pans are supported by fabricated sheet metal furring strips having resilient legs which engage the flanges of the pans and are, in turn, supported by suitable means from the principal ceiling or wall structure.

It has heretofore been proposed to provide an extended heat-radiating surface in the form of a suspended ceiling by arranging sheet metal pans to cover the ceiling and supporting the same by means of tubes or pipes through which hot water is circulated and which directly engage the flanges of the pans to support and heat the same. It has also been proposed to use, in such a system, an arrangement of the structural elements of the suspended ceiling which provides restricted air passageways through the ceiling throughout substantially the entire area thereof, this structure then furnishing a means whereby ventilating air introduced into the space between the suspended ceiling and the slab or principal ceiling structure above may be continuously supplied to the room at low velocity. For this purpose, the several pans may be slightly spaced apart or provision may be made for the restricted passage of the air through the perforations of the pans where such pans are used as a combined heating, air distributing, and acoustic structure.

One object of the present invention is to provide a suspended ceiling type of panel heating system wherein a standard form of sheet metal ceiling pan readily available on the market may be employed as the radiating element. A complementary object is to provide a simple, but efficient, system of this type which is low in cost by reason of the standardization of parts of which the ceiling structure is constructed and the low

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cost of installation labor made possible by the design and arrangement of parts.

Another object of the invention is to provide a combined panel heating and air distributing ceiling structure wherein positive means are provided for spacing the ceiling pans to provide restricted passage for the flow of air into the space below the ceiling. A further object is to provide a clip which securely supports the pans form the hot water pipes and, at the same time, efficiently conducts heat from the pipes to the pans. A still further object is to provide ceiling pans which incorporate positive means for spacing adajacent pans apart.

In the accompanying drawings,

Fig. 1 is a sectional view of a suspended ceiling panel heating structure embodying the invention;

Fig. 2 is a plan view of an individual pan used in the ceiling;

Fig. 3 is a detailed sectional view taken at the line 3—3 of Fig. 2; and

Fig. 4 is a perspective view of the clip employed in the construction of Fig. 1.

Referring to Fig. 1 of the drawing, the exposed ceiling surface which serves as the radiating source of heat for the enclosure or space below the ceiling is composed of sheet metal pans 1 having broad panel faces 2 and flanges 3 and 4. A bead 5 is impressed inwardly in each of the opposed flanges 3 of each pan, this bead preferably extending the full length of the flange. The bead is parallel to the edge of the flange and is located between the edge of the flange and the juncture of the flange with the face of the pan. Bevels 6 are customarily formed at the peripheries of the pan faces to give the pan a tile-like appearance. If employed in a combination acoustical treatment, the pan faces are perforated, as at 7, to permit the passage of sound.

If used in a suspended ceiling which is intended to distribute ventilating air into the space below, pans 1 may be slightly spaced apart when being installed and are preferably provided with suitable positive spacing means, such as dimples 8 (Figs. 2 and 3) formed in flanges 4. These dimples protrude outwardly beyond the sides of the pan and are intended to engage the flange of an adjacent pan to space the pans apart uniformly throughout the ceiling structure. Provision may readily be made in the tools now in use in the fabrication of standard pans for pressing out the dimples 8, or these protuberances may be provided as a separate step in the fabrication of the pans. The dimples should be located far enough from the

face of the pan to be invisible in the finished ceiling and the dimples in opposed flanges 4 should not be in line as it is intended that they make contact with the flanges of adjoining pans and not the dimples therein.

It will be understood also, that it is not necessary to provide the dimples on both flanges, one set being adequate to space the pans of the successive courses of pans which comprise the ceiling surface.

A series of spaced parallel hot water pipes 9 are connected to header 10 and suspended from the supporting ceiling structure 11. The particular arrangement of pipes and headers employed will depend upon the size and shape of the ceiling surface. If the span is not too great, a supply header may be installed along one edge of the ceiling supported, for example, by hangers 11a, and the return header may be located along the opposite side of the ceiling. The hot water pipes may be connected in series, rather than in parallel, if desired, the particular arrangement of the hot water connections being no part of the present invention. It is necessary only that the pipes 9 be horizontal, parallel, and accurately spaced apart to form a gridwork for the support of the pans.

In order to properly carry out the purposes of the invention, it is necessary not only to securely support pans 1 from pipes 9, but also to provide an efficient heat bridge between pipe and pan for the conduction of heat to the radiating surfaces. Clips 12 are employed for these purposes. As will be apparent as the description proceeds, this clip serves the third function of spacing the two panels which are supported, in part, by a particular clip. Each clip 12 has a hook-like upper portion 13 and a pair of resilient legs 14 welded or otherwise intimately fastened to a tongue 15 as close as possible to the juncture of the latter with the hook 13. Tongue 15 which is an integral part of the hook-like portion 13 of the clip, being formed from the same piece of sheet metal, extends downwardly between legs 14 and is preferably somewhat longer than the legs themselves for the more convenient insertion of the pan flanges during assembly of the suspended ceiling structure. The upper portion of the clip is cylindrical to conform with the surface of pipe 9 and legs 14 are grooved at 16 to conform their inner surfaces with the engaging surfaces of pan flanges 3. The entire clip structure is composed of a heat conducting resilient metal and is so formed that the hook-like portion must be snapped upon the pipe and the legs must be forced apart to insert the pan flanges, whereby intimate engagement of the clip with the pipe and flanges under constant spring pressure is provided.

If the suspended ceiling is to serve as an acoustical treatment for the room, as well as a means for heating the same, sound absorbing pads 17 are placed in pans 1 upon spacing members 18. These pads also serve as heat insulation to minimize the dissipation of heat from pans 1 to the ceiling structure 11 above. If the ceiling structure is not intended to function as an acoustical treatment, some form of thermal insulation should nevertheless ordinarily be used to cover the upper surface of the suspended ceiling.

To assemble the suspended ceiling, pipes 9 and headers 10 are first installed and proper connections made. The spacing of the pipes will correspond to the dimensions of the pans. After the pipes have been installed, the spacers 18 and pads 17 may be placed in the pans and the pan assemblies may then be snapped into position by means of the clips which had previously been hung or snapped upon the pipes. Any suitable length of clip may be employed, the preferred length being slightly less than the length of the flange of the pan which the clip is intended to engage. Clip length is determined largely as a matter of convenience, the minimum length being that which is adequate to conduct heat at a satisfactory rate from the pipe to the pan. Two or more clips may be used for a single length of flange, or a single long clip may be used for two or more pans. However, if the suspended ceiling is to be used for air distribution, the lengths of the clips must be given additional consideration because of the gaps that would be left for the passage of air when less than full length clips are used.

When the pans are in place, they are securely held by the clips which yieldingly clamp the pipes and pan flanges. Grooves 16 in the legs of the clips engage beads 5 of the flanges for the positive support of the pans without complete reliance upon frictional engagement of the clip with the flange surfaces. In addition, grooves 16 and beads 5 cooperate to properly position the pans in the ceiling surface so that the latter will be even. As stated above, the engaging surfaces of clips, pipes, and flanges conform as closely as possible to facilitate the transfer of heat from the pipes, through the clips, to the flanges and thence to the radiating broad faces 2 of the pans. Both surfaces of each flange are in engagement with elements of the heat-conducting clip and an efficient transfer of heat results. In addition, tongues 15, sandwiched between the flanges, space the pans apart so that the ceiling will have a uniform appearance, the height of dimples 8 being approximately the same as the thickness of tongues 15.

It will be understood that the structure described may be used as only a panel heating system, as a combined panel heating and sound absorbing apparatus, as a combined panel heating and air distributing ceiling, or as a combined panel heating, sound absorbing, and air distributing system. In those installations where the suspended ceiling is to be used for the purpose of distributing ventilating air into the space below the ceiling, the air is introduced into the space between the suspended ceiling structure and the slab or primary ceiling 11 by means of suitable blowers and ducts, not shown. Flow of air from this space through the suspended ceiling structure is restricted to the passageways between adjoining pans.

Although the structure with which the invention is concerned is herein and commonly referred to as a suspended ceiling, it will be understood that it may be erected independently of any principal or other ceiling structure. Also, it should be pointed out that the clips, as well as the pans, herein described may be somewhat altered in form without departing from the inventive concept. For example, a suitable offset may be provided in the rounded upper portion of the clip near the juncture with the tongue, and the legs may be carried up beyond this juncture and welded to the upper portion of the clip. In this way, the overall length of the lower part of the clip may be somewhat reduced.

Invention is claimed as follows:

1. An elongated ceiling suspension clip composed of resilient heat-conductive material and having a median portion extending throughout the length of said clip and dividing said clip into

upper and lower portions, the upper portion comprising resilient clamping means of sheet material having a continuous surface elongated in the direction of the length of the clip and adapted to engage a pipe under constant spring tension, the lower portion comprising a pair of spaced, generally-parallel resilient legs of sheet material elongated in the direction of the length of the clip depending from said median portion of said clip, and a tongue also depending from said median portion and disposed between said legs in spaced, substantially-parallel relation thereto, said tongue being an integral extension of the upper portion of the clip, said lower portion having continuous contact surfaces extending in a straight line throughout the length of said clip.

2. In a combined panel-type heating and air-distributing ceiling structure, a plurality of flanged rectangular pans arranged in a plane to form a ceiling, at least one flange of each pan being outwardly dimpled and the pans being so oriented that the dimples of each pan engage a flange of an adjoining pan to thereby positively space said adjoining pans apart, a plurality of spaced parallel pipes arranged in a plane above said pans, and clips of sheet material engaging flanges adjacent said dimpled flanges and said pipes to support said pans and thermally connect the same with said pipes, each said clip comprising an upper portion hooked over and

resiliently clamping a pipe and a lower portion comprising a pair of spring legs clamping adjacent flanges under constant spring pressure and a tongue extending between said spring legs and said adjacent flanges to positively space said adjacent flanges apart.

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