

Dec. 15, 1953

G. FRENGER

2,662,743

SUSPENDED PANEL TYPE AIR CONDITIONER

Filed Feb. 10, 1948

2 Sheets-Sheet 1

FIG. 1

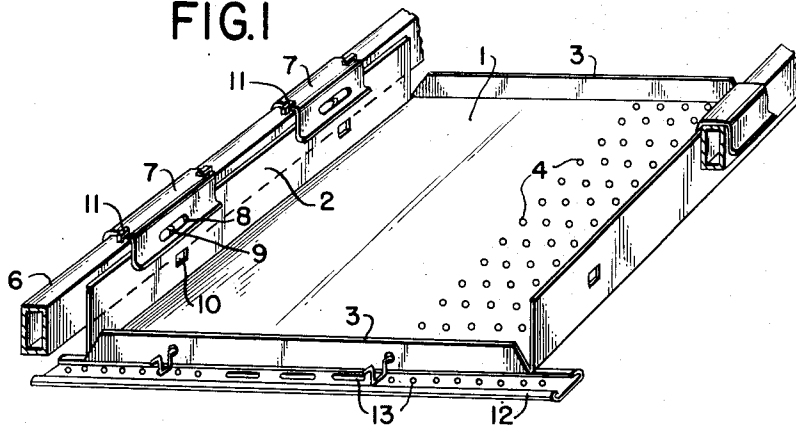


FIG. 2

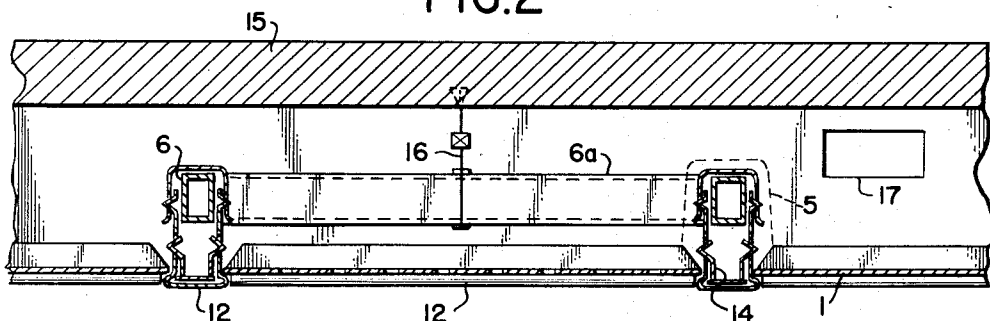
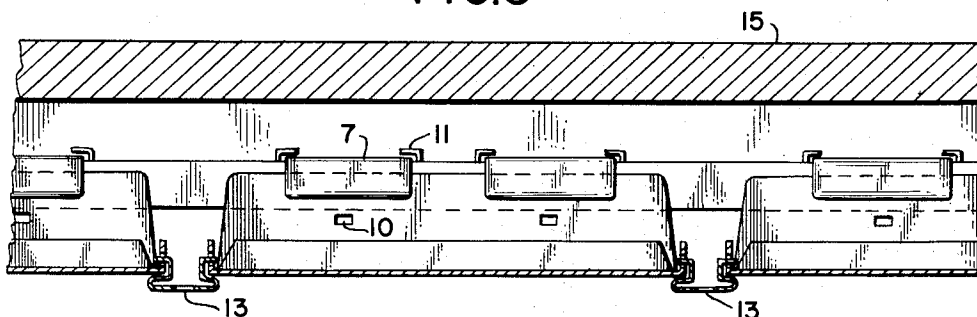


FIG. 3



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FIG. 4

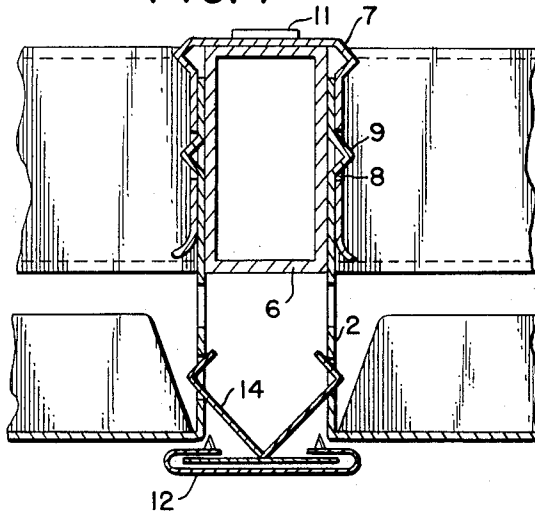


FIG. 5

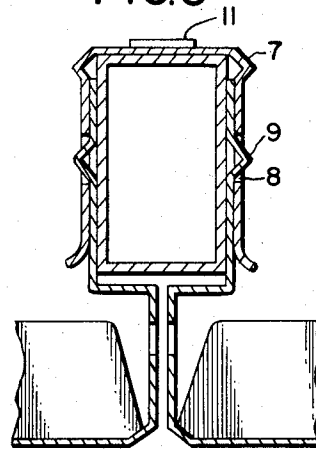


FIG. 6

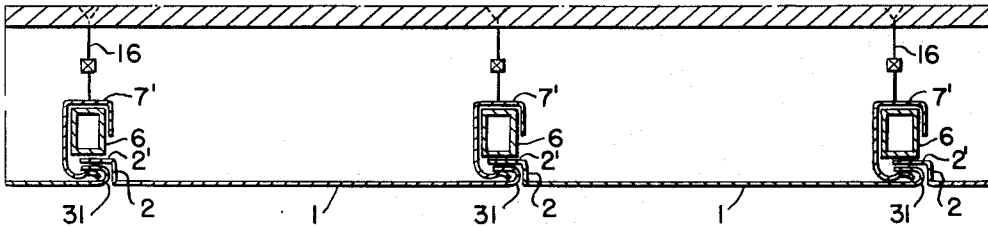
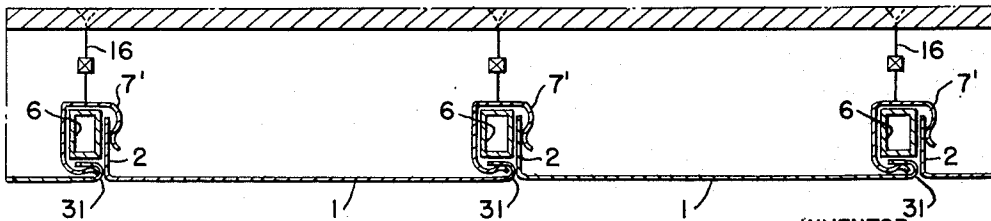


FIG. 7



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SUSPENDED PANEL TYPE AIR CONDITIONER

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October 21, 1947

2 Claims. (Cl. 257—124)

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The present invention relates to ceiling and/or wall constructions of a type where the surface areas are formed by a number of preferably rectangular plates. The invention is particularly adapted for use in conjunction with radiation heating and cooling plants respectively, where the ceiling and the wall surfaces respectively, entirely or in part of their area, are used as heating or cooling surfaces.

In constructions of this type, which the applicant has previously carried out and for which patent applications have been filed, systems of rectangular aluminium plates are used in heat conducting connection preferably with special pipe or bar systems, and also combined radiation heating and acoustic ceilings and further combined air conditioning and radiation heating and cooling plant respectively.

The present invention concerns a special method of construction of this type of plant, which provided for simple and rapid mounting of the equipment and simplifies the problem of transportation. Below the invention is described only with reference to ceiling constructions, contingent wall constructions being executed in a similar manner according to the prevailing conditions.

The invention is of a type where the preferably rectangular, cooling or heating elements used are made of metal plate and are of such construction that they can be attached to the tube or pipe system by means of preferably protruding portions of the elements. A feature of the invention is that the tube members are made with comparatively plane side surfaces and that a spring system (clamping device) is utilized in conjunction with the tubes in such manner that the elements, by being pressed against the tubes, become heat-conductively interlocked with the tube system through their protruding portions.

Other features of the invention are described below.

The accompanying drawings illustrate the invention applied to some methods of construction.

Figure 1 shows a perspective view of a box shaped metal plate ceiling element according to the invention.

Figure 2 shows a vertical cross section of the ceiling element according to Figure 1, at right angles to the heating pipes, and

Figure 3 a vertical cross section of the ceiling element, the section being parallel to the heating pipes.

Figures 4 and 5 illustrate, at a larger scale, cross

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sections of a heating pipe and its adjacent parts in two different methods of construction.

Figures 6 and 7 show two more variations of the method of establishing connection between the heating pipes and the radiating plates.

Each ceiling element 1 consists of a metal plate, preferably rolled aluminium or copper plate, two opposite edges of which are bent upwards at right angle to the plate surface 2, these bent-up edge portions hereinafter being called bent-ups, which constitute the inter-locking members by means of which the plate is fixed to the heat conducting, contingently pipe shaped, bars described below. The remaining two opposite edges of the plate may be provided with bends 3 for stiffening purposes. In addition the plate may be provided with a large number of perforations or slits 4 for the purpose of sound absorption.

The numeral 6 indicates heat conducting tube members or ducts with plane side surfaces which convey some kind of circulating heating medium therein, for instance water, and which are connected to the customary intake and return conduits (not shown), or which is formed by a directly heated electric bar or cable. The numeral 7 indicates springs made of steel or some similar material being fixed to the bar 6 by means of lugs 11, which are bent downwards and fastened by welding. The springs are provided with slots or notches 8, co-operating with protuberances or pins 9 impressed in the bent-ups 2 thus locking the plate to the springs. Below the slots or notches 8 are holes 10 in the bent-ups 2 for insertion of a suitable tool, releasing the pressure of the springs 7 to enable the plate to be loosened if the protuberances or pins have become stuck in the slots or notches 8. If desired, the locking pins 9 and the slots 8 may be dispensed with, the locking of the plate to the springs in this case being obtained only by friction.

The tube system may be constructed as a frame work 6 with transversely mounted tubes 6a, said frame work surrounding the plates 1, and being beforehand suspended from the ceiling proper 15 by means of suspension devices 16, which may consist of clips gripping around the bars and connected to turn-buckles or some other suitable devices for adjustment. After suspension of the tube system the plates are mounted by pressing them right upwards, the bent-ups thereby being pushed in between the springs 7 and the tubes 6 and secured in position by means of the protuberances or pins 9. The springs 7 are given a suitable biasing tension ensuring the bent-ups 2 to be pressed against the plane side surfaces

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of the tubes or the pipe system 6 at a suitable pressure for obtaining an adequate heat conducting connection between the tubes and the bent-ups.

After the mounting of the plates 1, channel-formed spaces will appear between the bent-ups. These spaces are closed at the lower side with lists 12, which may suitably be made of aluminium. Those of the lists, which are placed between the side bent-ups 3, may be provided with perforations or slits 13 allowing passage of air. The space formed between the ceiling proper 15 and the sub-ceiling may be fed with ventilation air through a vent 17, for instance from a suitable air conditioning plant. The perforations or slits 13 in the transverse lists 12, through which ventilation air is admitted into the room, are adjusted according to the volume of air. The lists can easily be mounted and removed, being automatically fixed when pressed into position, by means of the springs 14 engaging holes in the bent-ups. If an element is to be removed it may simply be withdrawn, releasing, if necessary, the pressure of the spring 7 by inserting a tool through the holes 10 in the bent-ups 2.

The top side of the elements and/or the pipe system and the tube system respectively may be covered with a heat insulating layer 5 of glass wool, rock wool or the like, which, together with the holes 4, may also have a sound absorbing effect. The mounting of elements and list is illustrated more clearly in Figures 4 and 5, in which two different methods of construction are shown.

Referring now to Figure 4, steel spring 7 fits over three sides of heat conducting tube 6 and by means of protuberances 9 fitting into the notches or slots 8 of the spring 7 the bent-ups 2 and thus plate 1 are retained in place. When using the bent-ups of the type shown in Figure 4 channel-formed spaces appear between the bent-ups. These are closed at the lower side with lists 12. The lists are easily mounted and removed by being automatically fixed when pressed into position, by means of spring 14 engaging holes in the bent-ups.

Figure 5 illustrates a modification in the construction of the bent-ups. The bent-ups of Figure 5 are shaped in such a manner that when assembled each bent-up of adjacent plates substantially covers one half of the bottom of tube 6, to thereby reduce the amount of space between plates and thus eliminate the necessity for lists.

The radiating plates 1 shown in Figures 1-5 also may be connected to the piping in the manner illustrated in Figures 6 and 7.

According to Figure 6 the clips 7' embrace all sides of the heating pipes. The right hand edge portion 31 of each plate 1 is, as shown, bent right back through 180 degrees, whilst the left hand edge portion is initially bent upwards as indicated at 2 and then again to the left as indicated at 2'. Mounting of a plate is effected by initially lifting it to the right level, then sliding it to the left until the bent portions 31 and 2' are gripped between the lower portions of the springs and thus being held by these in heat conducting con-

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tact with the pipes. This method of construction does not require any great accuracy in the mounting of the pipes.

The method of construction shown in Figure 7 corresponds to the method of construction according to Figure 6, the only difference being that the left hand edge portions of the plates are bent only right upwards and adapted to be inserted between the right hand sides of the pipes and the portions of the springs 7' engaging these sides. In this case the mounting of a plate is effected by initially bringing the edge portion 31 into engagement with the spring by sliding the plate sideways, and then bringing the other edge portion 2 into engagement with the spring by pushing the plate right upwards.

I claim:

1. In a system for supporting plates to define a radiant wall, ceiling or a like surface, a conduit member having a flat surface parallel to the wall or the like surface to be defined, means cooperating with said member to deliver a temperature modifying fluid to said member, a resilient element surrounding said member and defining with said flat surface of said member a slot, and a plate having a flat flange parallel to the plate and seated in the slot defined by the flat surface of the member and element.

2. In a system for supporting plates to define a radiant wall, ceiling or a like surface, a conduit member having a first flat surface parallel to the wall or the like surface to be defined and a second flat surface at right angles thereto and intersecting said first flat surface, a resilient clip surrounding said member and defining with the flat surfaces thereof a pair of slots having their mouths faced toward the intersection of the first and second flat surfaces, means cooperating with said member to deliver a temperature modifying fluid to said member, and a pair of adjacent plates, one of said plates having an upstanding flat flange seated in the slot defined by the clip and the second of said flat surfaces, and the other of said plates having a flat flange parallel to the plate and seated in the slot defined by the clip and the first of said flat surfaces.

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