United States Patent

Ammerman et al.

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[54] OPEN COIL HEATING ELEMENT ASSEMBLY

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[52] **U.S. Cl.** **219/532,** 219/536, 219/546, 338/299, 338/317

[51] **Int. Cl.** **H05b 3/06**

[58] **Field of Search** 219/532, 536–537, 219/539, 550, 546; 338/299, 317–321; 174/1

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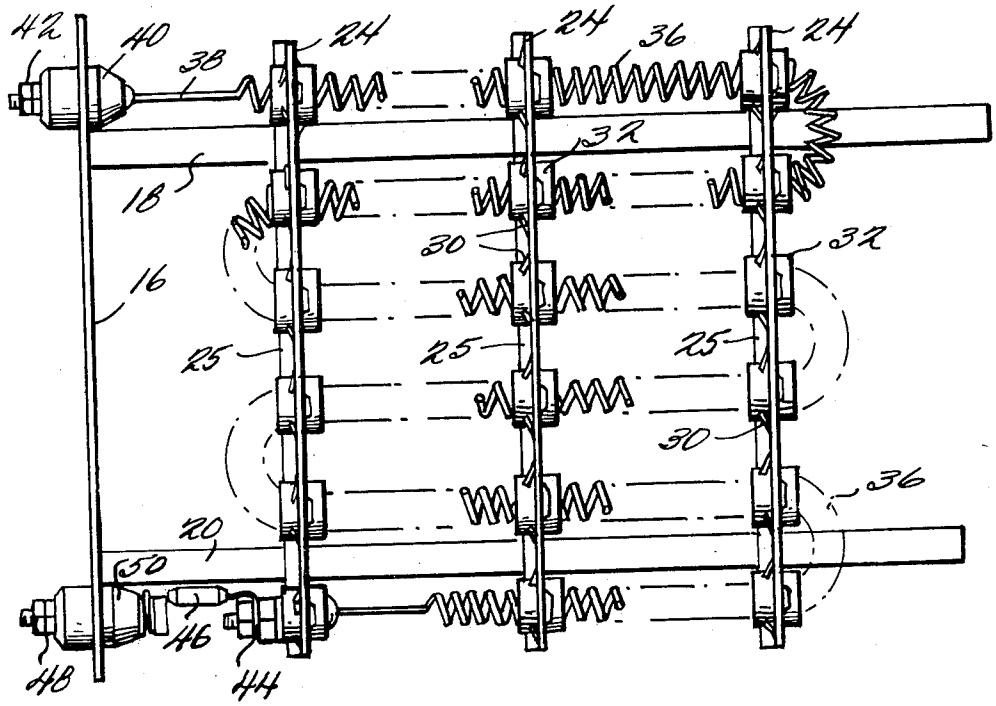
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[57] **ABSTRACT**

An arrangement for supporting open coil heater elements including a baseplate and a pair of spaced arms projecting from the plate. Each arm is rigidly affixed to the baseplate at one of its ends. A plurality of spaced cross supports are attached to the arms. The cross supports comprise plates having apertures therein to receive insulators through which the heater elements pass. The ends of the heater elements are appropriately connected to circuit terminals mounted to the baseplate.

2 Claims, 5 Drawing Figures



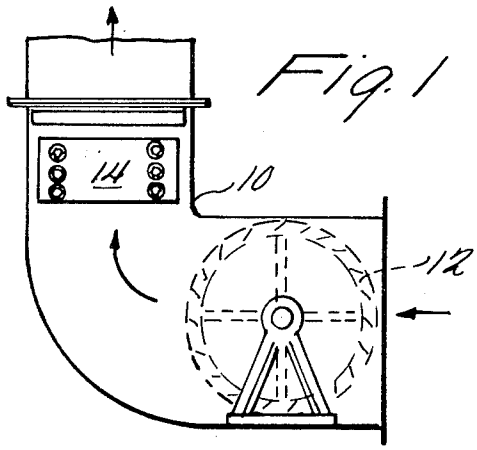


Fig. 1

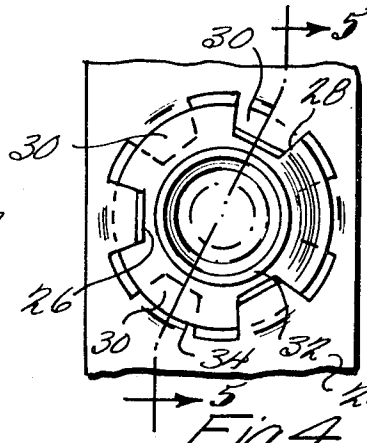


Fig. 4

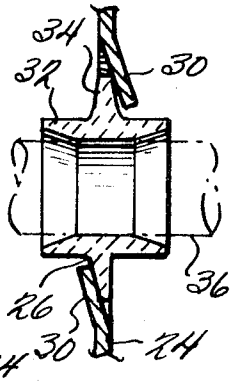


Fig. 5

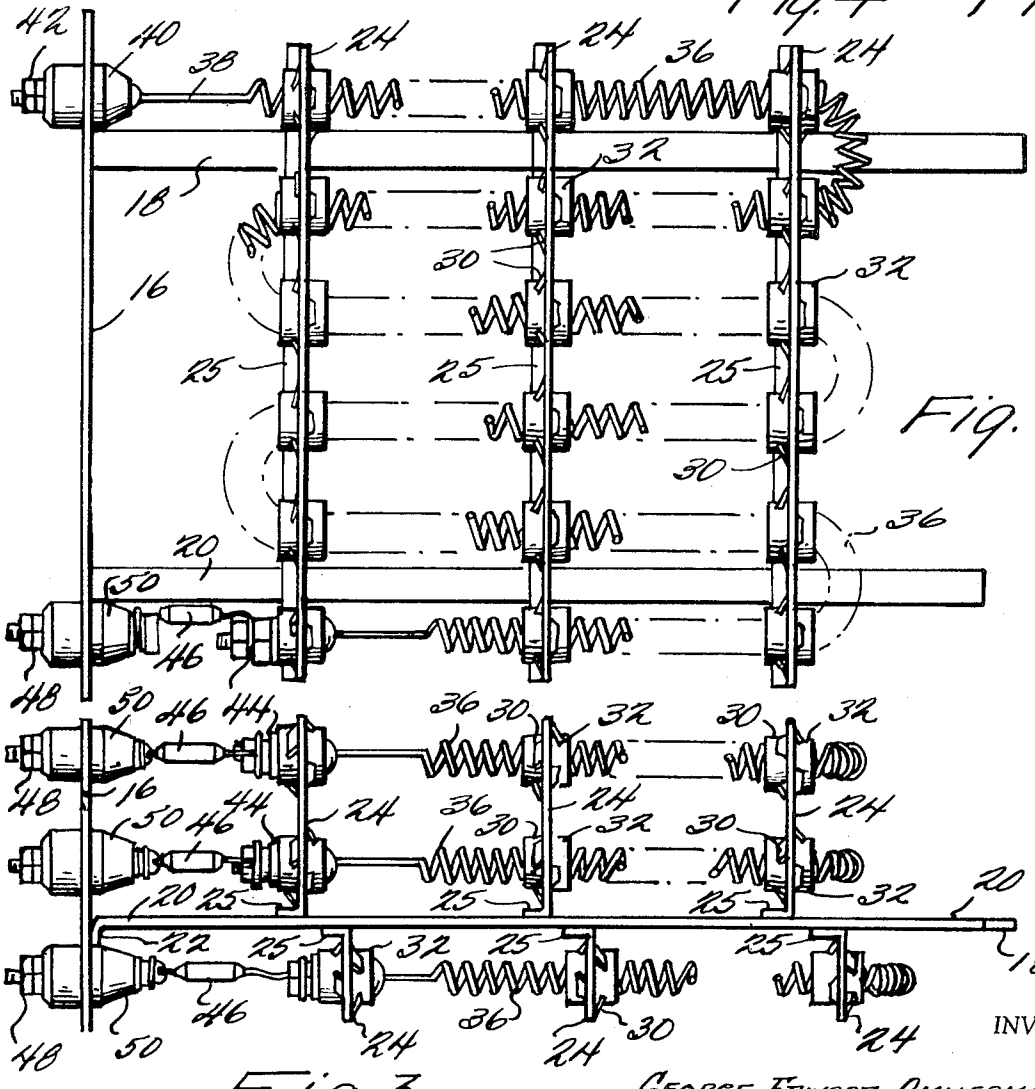


Fig. 2

Fig. 3

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OPEN COIL HEATING ELEMENT ASSEMBLY

This invention generally relates to an improved construction for supporting a plurality of conventional open coil heating elements and, more particularly, to structure wherein the heating elements are stacked in spaced parallel planes. Such arrangement of heating elements finds application in the heating and air-conditioning field. For example the invention is useful as a heater within ductwork, in combined heating and cooling air conditioners, in association with fan coil units, in heat pumps, etc.

In the past heating elements in plural planes have been supported by separate frames or single ones having such complexity as to make them quite expensive. The present support arrangement incorporates a reduced number of components which produces economical advantages for the assembly, and which causes only low impedance to airflow past the heating elements. The assembly further provides a baffling capability to improve the operating characteristics of temperature sensors which are utilized in conjunction with the heating elements.

Briefly, the invention comprises a baseplate and a pair of spaced arms projecting from the plate. Each arm is attached at one of its ends to the baseplate. A plurality of spaced cross supports extend between the arms and are rigidly affixed thereto. The cross supports comprise plates having apertures therein arranged with their centers aligned in spaced parallel planes. The apertures receive insulators through which heating elements pass. By the arrangement just described, a plurality of open coil heating elements are supported in parallel planes by a single frame. The cross support plates can be attached to the arms at different angles to thereby deflect air flowing past the heaters causing a baffling effect.

The invention will be described in further detail by reference to the accompanying drawings, wherein:

FIG. 1 is an illustration of an open coil heating element assembly in a typical operative position with respect to an air duct and blower arrangement;

FIG. 2 is an elevational view of an open coil heating element assembly made in accordance with the invention;

FIG. 3 is an elevational view of the assembly taken at 90° to that view shown in FIG. 2;

FIG. 4 is an enlarged detail view of the mounting arrangement for an insulator through which a heating element passes; and

FIG. 5 is a view in section taken along line 5—5 of FIG. 4.

Referring now to the drawings, a preferred embodiment of the invention will be described in detail. The description will be of an open coil heating element assembly used to warm air passing through a duct. However, it will be understood, as hereinbefore stated, that the heating element assembly may be employed in a number of other environments. In FIG. 1, the duct is indicated by the numeral **10**, and a conventional blower **12** is employed to force air through the duct. The open coil heating element assembly **14** is arranged to project into the air flow path such that the major plane of each open coil is substantially normal to the air flow. The heater coils are connected to an external voltage source (not shown) for energizing the coil.

The details of the heating element assembly can be appreciated by reference to FIGS. 2 and 3. More particularly, the assembly comprises a base member comprising plate **16** from which a pair of spaced arms **18** and **20** project normally to the plane of the baseplate. Arms **18** and **20** are rigidly fastened to the plate **16**, typically by welding a foot **22** at the end of each arm to the baseplate.

A plurality of spaced cross support elements **24** extend between arms **18** and **20**. As can be seen in FIG. 3, elements **24** are positioned on opposite sides of the arms **18** and **20**. The elements **24** are plates having foot portions **25** which are secured to the arms **18** and **20** by a suitable means such as by spot welding or riveting. Accordingly, the baseplate **16**, arms **18** and **20**, and cross support elements **24** are rigidly joined together.

Each of the cross support elements **24** is provided with a plurality of spaced apertures **26** (FIGS. 4 and 5). The apertures are arranged with their centers aligned in spaced parallel planes (FIG. 3). Within a single plane the apertures of adjacent elements **24** are aligned in a manner to receive a single open coil heating element as will now be described.

The walls of each aperture **26** are pierced radially as at **28** (FIG. 4) to form tongues **30**. Adjacent tongues **30** are inclined outwardly in opposite directions from the plane of the plate **24**. By such an arrangement, these tongues serve to support cylindrical ceramic heating coil insulators **32** each having a projecting rib **34** about its periphery. The insulator construction and the manner by which it is held within an aperture **26** can be appreciated by reference to FIG. 5. Heating coils **36** project through the insulators in aligned apertures in a serpentine manner as is well known in the art. Such an arrangement is shown in FIG. 2. The ends of each coil are connected to a power source (not shown). Typically, one end **38** of the coil passes through an insulator **40** attached to baseplate **16** and is provided with a terminal **42** on the opposite side of the baseplate from the coil (FIG. 2). The other end of the coil is joined to a screw-type terminal **44** joined to an insulator **32** within an aperture **26** in a cross support plate **24** adjacent the baseplate. A fuse **46** is positioned between terminal **44** and an external terminal **48** supported by a further insulator **50** projecting through the baseplate **16**. When power is applied at terminals **42** and **48**, the respective open coil heating element is energized so as to warm air passing normal to the plane of the coil.

In the embodiment shown in FIGS. 2 and 3, a single open coil heating element is associated with one set of cross supports **24**, and a pair of open coil heating elements is illustrated as being supported by the second set of cross supports **24**. However, by enlarging the plates comprising cross supports **24** and by providing suitable rows of apertures **26** therein, further open coil heating elements can be stacked in parallel-spaced relationship with the coils shown without the requirement of additional frame members. Thus, it can be appreciated that in accordance with the present invention a number of parallel-spaced circuits may be supported by each cross support **24**. This construction permits substantial economy in construction.

When assembly **14** is in its operative position within a duct, it is desirable that the side of the frame opposite that attached to the baseplate **16** be secured to the opposite side of the duct. This can be accomplished by one of the arms **18** being made longer than the other so as to project through an aperture in the wall of the duct to thereby support the end of the heating element assembly remote from baseplate **16**.

When installed within a duct, the heating element assembly is inserted through an aperture in the wall of the duct and the baseplate **16** is secured to the wall adjacent this opening. The end of the assembly remote from plate **16** is secured to the opposite duct wall as has just been described. By connecting the plurality of open coil heaters to respective power sources, the heaters are energized.

Typically, an aperture is provided in the baseplate **16** to permit sensors to project into the area of each of the open coil heaters. These sensors (not shown) operate to control the application of power to the respective heater. Ideally, the sensors are responsive to the temperature of the air passing through the duct, but in practice, they also respond to radiant heat generated by the heaters. It has also been found that there is a tendency for air along the walls of the duct to stagnate, and this also introduces problems of controlling the operation of the sensors to achieve the desired air temperature within the duct. The present structure assists in reducing the problems of sensor control. More particularly, the cross support elements **24** may be varied so that the feet **25** meet the main plate portions of the respective elements **24** at angles other than 90°. When this is the case, the plate portions of the support elements serve as a baffle to divert the air flow from its normal path past the heater coils. By proper selection of the angle

between feet **25** and the main plate portions of support elements **24**, air may be directed to downstream sensors so as to "cool" them to reduce the radiant heat effect and also to assist in maintaining the flow of air at the walls of the duct commensurate with the main air flow. This permits the sensors to more accurately monitor the true air temperature within the duct.

The structure disclosed herein is an example of an arrangement in which the inventive features of this disclosure may be utilized, and it will become apparent to one skilled in the art that certain modifications may be made within the spirit of the invention as defined by the appended claims.

What is claimed is:

1. An assembly for supporting a plurality of open coil heating elements in spaced parallel relationship, including:

a base member;

a pair of spaced parallel arms each rigidly attached at one of its ends to said base member and projecting normally therefrom;

a plurality of spaced cross support elements, said cross support elements comprising flat, one-plane plates extending between said arms and rigidly joined thereto and arranged in planes substantially parallel to the plane of said base member, each plate having at least two rows of a plurality of apertures therein, the centers of the apertures being aligned in spaced parallel planes and each aperture having a plurality of tongues radially arranged about its periphery; and

insulators supported by said tongues within said apertures, said heating elements passing through said insulators.

2. An assembly as set forth in claim 1 wherein the planes of said cross support element plates are variable.

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