United States Patent

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[45] **Sept. 12, 1972**

[54] HEATING ELEMENT ASSEMBLY

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[73] Assignee: **General Electric Company**

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[52] **U.S. Cl.** **219/532**, 219/536, 338/299, 338/304, 338/318

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

[58] **Field of Search**.....219/532, 536, 537, 539, 546, 219/550; 338/299, 304, 318, 319, 320, 321

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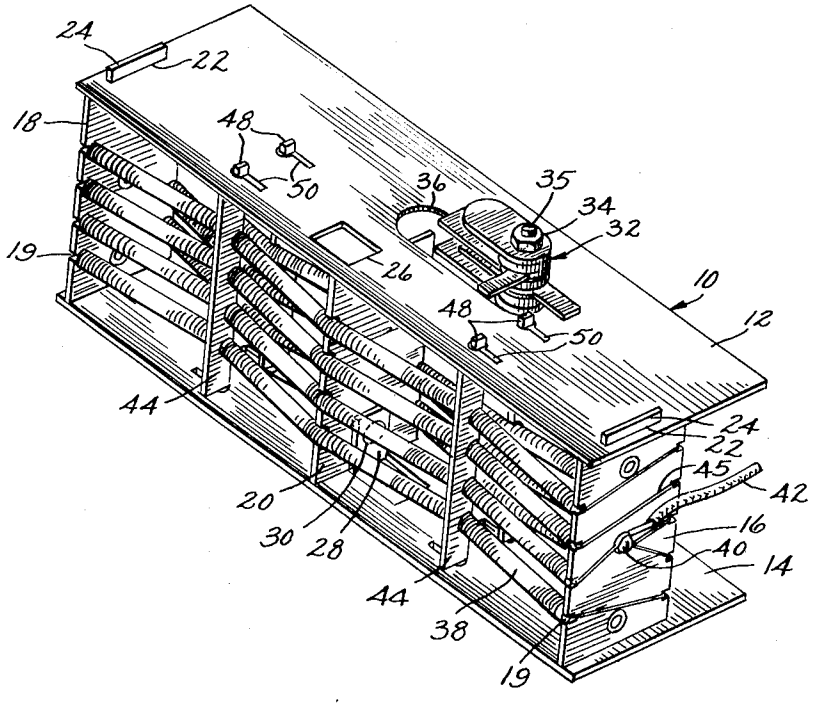
[57] **ABSTRACT**

An electrical resistance heating element assembly for use in electric portable space heaters having a support structure comprising a top panel and a bottom panel in spaced relationship and end panels extending therebetween with outwardly directed open-ended vertically spaced peripheral notches. An electrical resistance heating element is wrapped around the end panels and seated in the end panel notches with the heating element retained in its proper position by retainer members having inwardly directed open-ended vertically spaced notches that engage the heating element between the end panels and depress the heating element inwardly.

10 Claims, 4 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

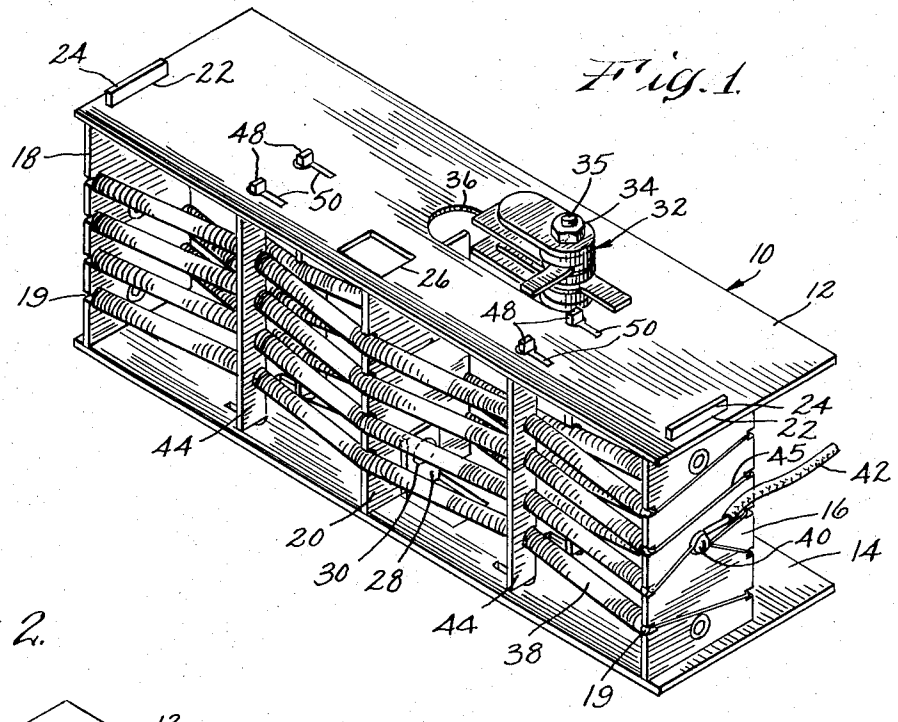

Fig. 2.

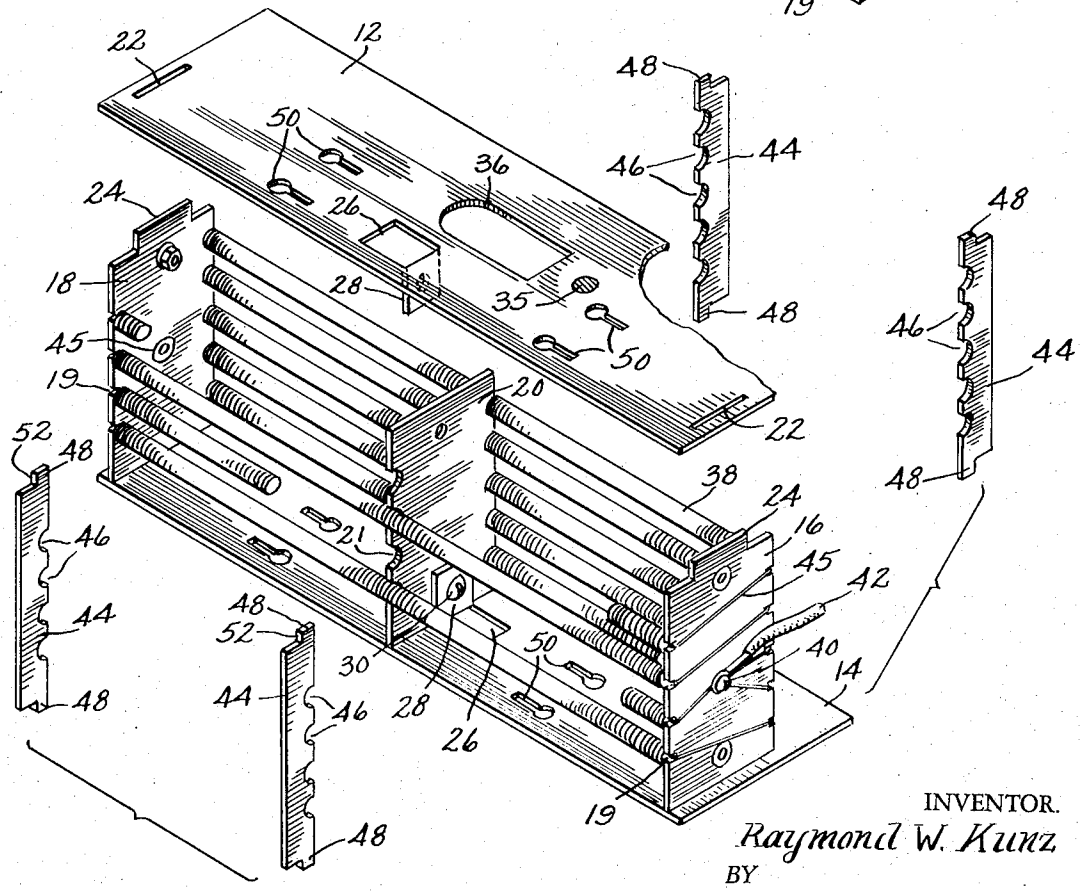

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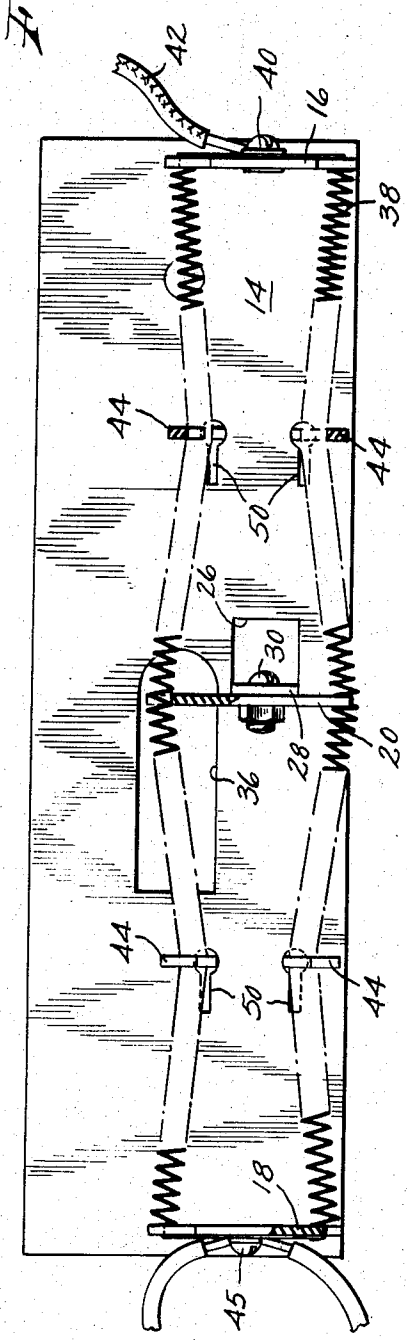
Fig. 3



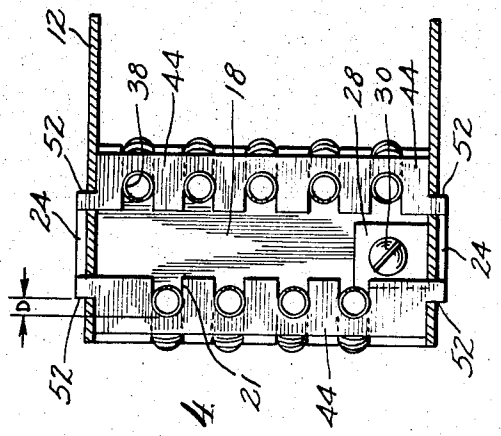


Fig. 4

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HEATING ELEMENT ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention relates to a heating element assembly, and more particularly to an electrical resistance heating element assembly utilized in portable electric space heaters.

2. Description of the Prior Art:

It is desirable that portable electric space heaters have a minimum number of parts and that these parts be inexpensive to manufacture. In line with this, it is also desirable that the parts can be quickly and easily assembled. Further, since electric space heaters are frequently moved, it is essential that the heater components, in general, and the electrical resistance heating element assembly in particular is sufficiently rugged to withstand minor shocks caused by dropping and so forth. This requirement is also important with respect to handling and shipping of electric space heaters.

The electrical resistance heating element assembly should be constructed such that the electrical resistance heating element has minimum tension while providing positive location and retention of the heating element in its proper position within the assembly. Minimum tension is desired to reduce the tendency of the heating element to move or creep resulting from expansion and contraction caused by heating and cooling of the heating element during operation of the heater. Movement of the heating element is undesirable as it becomes distorted, interferes with positive securement of the heating element to insulating members, and, if sufficient, could come into contact with adjacent coils or other metal parts and cause electrical failure within the heater. It is also important that the heating element assembly be constructed as a unit with a minimum amount of labor and component parts and that the unit is easily incorporated into the heater during its manufacture.

By my invention, there is provided an improved electrical resistance heating element assembly for use in portable electric space heaters that accomplishes the above-mentioned desirable characteristics.

SUMMARY OF THE INVENTION

In accordance with this invention, there is provided an electrical resistance heating element assembly having a support structure comprising a top panel and a bottom panel in a spaced relationship with end panels extending between the top and bottom panels. The end panels have outwardly directed open-ended notches spaced vertically along the periphery of each panel. An electrical resistance heating element is wrapped around the end panels and retained in the peripheral notches to provide horizontal runs of spaced heating element across the open front and open rear of the support structure. Retainer members located at the front and rear of the assembly are secured to the top and bottom panels with the retainer members having inwardly directed open-ended vertically spaced notches that engage the runs of heating element between the end panels such that the heating element is slightly depressed inwardly by the retainer members to thereby retain the runs of the heating element in their proper spaced position.

It is an object of this invention to provide an improved electrical resistance heating element assembly.

It is another object of this invention to provide an improved electrical resistance heating element that can be preassembled as a unit and incorporated into a portable electric space heater.

It is also an object of this invention to provide an electrical resistance heating element assembly that may be constructed with a minimum amount of labor and parts.

It is another object of this invention to provide an electrical resistance heating element assembly which is sufficiently rugged so that the assembly can withstand minor drops or shocks without displacement of the electrical resistance heating element from its proper position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the electrical resistance heating element assembly.

FIG. **2** is an exploded perspective view of the electrical resistance heating element assembly.

FIG. **3** is a top plan view of the electrical resistance heating element assembly with the top panel removed to show the internal construction of the heating element assembly.

FIG. **4** is an end elevational view of the electrical resistance heating element assembly with the right end panel removed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is illustrated an electrical resistance heating element assembly generally shown at **10** that includes a support structure comprising a top panel **12** and a bottom panel **14** in spaced relationship with a right end panel **16** and left end panel **18**. These end panels have outwardly directed open-ended notches **19** spaced vertically along the periphery on both sides. In the preferred embodiment there is also included an intermediate or center panel **20** which has outwardly directed semi-circular open-ended notches **21** spaced vertically along the periphery on both sides. The end panels **16** and **18** and center panel **20** are made from a sheet of electric insulating material, such as mica board. Both the top panel **12** and the bottom panel **14** are made from suitable sheet metal and they are identical so that they may be interchanged during manufacture of the heating element assembly. Both the top and bottom panel have slots **22** located at each end thereof. The end panels **16** and **18** are also identical and have tongue extension portions **24** located at the top and bottom with the tongue extension portions **24** dimensioned to be received within the slots **22** in both the top and bottom panels. Both the top and bottom panels **12** and **14** have a centrally located opening **26** that results from each panel being lanced so that the metal may be bent at a right angle to the panel to provide a depending tab **28**. This tab **28** is used for securing the center panel **20** to both the top panel **12** and bottom panel **14** as by rivets screws **30** through the tab **28** and center panel **20**. These screws **30** are the only fastening means used to construct the support structure. When the center panel **20** is secured to the top and bottom panels the support

structure includes the top panel **12**, bottom panel **14**, end panels **16** and **18**, and center panel **20**. The front and rear of the support structure is open to allow the passage of air therethrough.

The electrical resistance heating element assembly may have secured to the top panel **12** a thermostat or temperature responsive switch assembly **32** which is utilized to control energization of the heating element depending upon the temperatures desired. The switch assembly **32** is secured to top panel **12** by a rivet or nut **34** and bolt **35** through the switch assembly and hole **35** in top panel **12**. Top panel **12** has a cut-out opening **36** underlying the switch assembly **32** to allow heat from within the heating element assembly to be readily transferred to the switch assembly **32**. While the temperature responsive switch assembly is not part of this invention it is nevertheless shown because if such a switch assembly is to be used it would be secured to the heating element assembly prior to incorporation of the heating element assembly into an electric space heater.

Wrapped around the support structure constructed as thus far described, is an electrical resistance heating element **38** which may be in the form of a resistance wire helically wound to form an elongated length of coiled resistance wire. Prior to winding the heating element on the support structure the heating element is pre-stretched and annealed to minimize tension of the heating element. The heating element **38** is secured at one end to terminal **40** on end panel **16**, which terminal also is connected to an outside electrical power source through lead wire **42**. From terminal **40** the heating element **38** is inserted into the outwardly directed notches **19** on the periphery of end panel **16** and then extends from end panel **16** to corresponding outwardly directed notches **19** in the opposite end panel **18**. It should be noted that the notches **19** are only slightly larger than the diameter of the wire used to form the coiled heating element to aid in retaining the heating element in its proper location by minimizing the possibility of movement of the wire in the notches **19**. The heating element is in close proximity to the outwardly directed semi-circular open-ended notches **21** in the periphery of center panel **20**. The diameter of notches **21** is slightly larger than the outside diameter of the coiled wire heating element **38**. The heating element is continued to be wound around the support structure in this fashion to provide a plurality of horizontal runs of heating element extending from one end panel to the other across the open front and open rear of the support structure. Preferably, as can be most readily observed in FIG. **4**, the runs of heating element at the front and rear are not on the same horizontal plane but rather the runs at the front of the heating element lie in a plane between the rear heating element runs. This arrangement affords more even distribution of the heating element surface exposed to the air passing through the heating element assembly from the rear to the front.

After the desired number of heating element runs have been wound on the support structure the end of the heating element is terminated at terminal **45** on end panel **18** in the same fashion as previously described for end panel **16**. It should be understood that any number of separate heating element lengths may be utilized and connected to end panels **16** and **18** at appropriate terminals to provide variation in heat output by energizing the various heating element lengths. In the particular embodiment shown in the drawings three separate lengths of resistance wire are used all joined in parallel electrical connection to provide through switch means two different outputs of heat. Also, when the coiled wire heating element is prestretched and annealed to provide minimum tension prior to winding on the support structure, sections **45** of the heating element **38** are stretched to an extent that they will lie relatively flat against the end panels after winding on the support structure.

When the winding of the heating element **38** is complete, the runs between end panels **16** and **18** will be in the form shown in FIG. **2**; that is, the runs are relatively straight and under only slight tension. To complete assembly of the electrical resistance heating element assembly **10**, retainer members **44** are installed. For this purpose keyhole-shaped slots **50** are formed in the top and bottom panels **12** and **14**. These slots **50** are located intermediate the end panels and center panel and inboard of the runs of heating element. Retainer members **44** are made of flat mica board or other suitable electric insulating material and have tab projections **48** at each end and open-ended semi-circular notches **46** along one edge, which notches are slightly larger in diameter than the coiled heating element. The width of the retainer members **44** is slightly smaller than the length of the keyhole-shaped slots **50** and the thickness is also slightly less than the width of the slots **50** so that the retainer members **44** may be slipped down through the slots **50** in top panel **12**. During this manufacturing operation the runs of heating element are depressed inwardly to permit the retainer member to be positioned outboard of the runs of heating element. The bottom retainer member tab projection **48** will seat in the circular portion of keyhole-shaped slots **50** formed in the bottom panel **14**. It should be noted that the tab projections **48** are slightly smaller in width than the circular portion of keyhole-shaped slots **50** to allow rotation of the retainer members with the tab projections seated in the circular portion of the slots **50** in both the top panel **12** and bottom panel **14**. By rotating the retainer members 90° the notches **46** are urged against the runs of heating element **38** to retain the heating element depressed inwardly between the end panels **16** and **18** and the central panel **20**. By this construction the heating element has a zig-zag contour from one end of the support structure to the other as can be readily seen in FIG. **3**. By retainer members **44** exerting force against the heating element in an inwardly direction and end panels **16**, **18** and center panel **20** exerting pressure in an outwardly direction against the heating element, the runs of heating element are retained in their proper spaced position in the open-ended notches.

With reference particularly to FIG. **4** it will be noted that shoulder **52** of the tab projections **48** on retainer members **44** is located in a vertical plane inwardly of the vertical plane passing through the rear of notches **21**. The distance between these two plans is designated D in FIG. **4**. By this construction since the heating element is under slight tension it exerts force outwardly against the retainer members. This force acts to center the retainer members in the circular portion of the keyhole-shaped slots **50** and prevent the retainer mem-

bers from rotating out of their proper position and their correct orientation with respect to the heating element. If this construction is used the retainer members are secured to the top and bottom panels and do not need to be fastened to top panel **12** or bottom panel **14**.

After construction of the heating element assembly it may be incorporated into an electric portable space heater with normal electrical connections to accomplish the intended function of the heater.

The foregoing is a description of the preferred embodiment of the invention and variations may be made to the electrical resistance heating element assembly without departing from the spirit of the invention as defined in the appended claims.

I claim:

1. An electrical resistance heating element assembly comprising:

a. a support structure having a top panel and a bottom panel in spaced relationship with end panels made of electric insulating material secured to the top and bottom panels and extending therebetween, said end panels having outwardly directed open-ended notches spaced vertically along the periphery of said end panels,

b. an electrical resistance heating element wrapped around the end panels and retained in said notches to provide spaced runs of heating element across the open front and open rear of the support structure, and

c. retainer members made of electric insulating material at the front and the rear located between the end panels and secured to the top and bottom panels, said retainer members having inwardly directed open-ended vertically spaced notches and engaging said heating element to slightly depress the heating element inwardly.

2. The heating element assembly of claim **1** wherein the electrical resistance heating element is a coiled wire prestretched to provide minimum tension.

3. The electrical resistance heating element assembly of claim **1** wherein each retainer member has a tab projection at each end and the top and bottom panels have keyhole-shaped slots, said tab projections cooperate with the slots to allow insertion of the retainer members through the slots in one of the panels and the tab projections to be seated in the slots of the top and bottom panel for subsequent rotation of the retainer member.

4. The heating element assembly of claim **1** wherein the support structure includes an intermediate panel between the end panels and the retainer members are located between said intermediate panel and each of said end panels both at the front and rear of the support structure.

5. An electrical resistance heating element assembly comprising:

a. a support structure having a top panel and a bottom panel in spaced relationship and secured to end panels and a center panel extending therebetween, said end panels and center panel being made of electric insulating material and having outwardly directed open-ended notches spaced vertically along the periphery thereof,

b. an electrical resistance heating element wrapped around the end panels and center panel and seated in said outwardly directed notches to provide spaced runs of heating element across the open front and open rear of the support structure, and

c. retainer members at the front and the rear of the support structure located between the end panels and center panel secured to the top and bottom panels, said retainer members being made of electric insulating material and having inwardly directed open-ended vertically spaced notches to receive the heating element and engaging said heating element to slightly depress the heating element inwardly.

6. The heating element assembly of claim **5** wherein the electrical resistance heating element is a coiled wire prestretched to provide minimum tension.

7. The electrical resistance heating element assembly of claim **5** wherein each retainer member has a tab projection at each end and the top and bottom panels have keyhole-shaped slots, said tab projections cooperate with the slots to allow insertion of the retainer members through the slots in one panel and the tab projections to be seated in the slots of the top and bottom panel for subsequent rotation of the retainer member.

8. The electrical resistance heating element assembly of claim **5** wherein the top and bottom panels are made of sheet metal.

9. An electrical resistance heating element assembly comprising:

a. a support structure having a metal top panel and a metal bottom panel secured in spaced relationship with end panels and a center panel extending therebetween, said end and center panels being electrically insulating and having outwardly directed open-ended notches spaced vertically along the periphery thereof and said top and bottom panel having keyhole-shaped slots,

b. an electrical resistance heating element coiled wire wrapped around the end panels and center panel and seated in said outwardly directed notches to provide spaced runs of heating element across the open front and open rear of the support structure, and

c. vertical retainer members being electrically insulating and having tab projections at both ends and located at the front and the rear of support structure between the end panels and center panel removably secured to the top and bottom panels in said keyhole-shaped slots, said retainer members having inwardly directed open-ended vertically spaced notches to receive the heating element and engaging said heating element to slightly depress the heating element inwardly.

10. The electrical resistance heating element assembly of claim **9** wherein the tab projections have a vertical shoulder located in a vertical plane inwardly of a vertical plane passing through the rear of the retainer member notches.

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