United States Patent

Zenz

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[54] ELECTRIC HEATING UNIT FOR CLOTHES DRYERS

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[73] Assignee: **Whirlpool Corporation,** Benton Harbor, Mich.

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[52] **U.S. Cl.**.....**219/375,** 34/133, 338/316

[51] **Int. Cl.**.....**H01c 1/02,** F24h 3/04

[58] **Field of Search**.....34/132, 133; 219/374–377, 553; 338/315, 316, 318, 319

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[57] **ABSTRACT**

A heater box assembly for an electrically heated clothes dryer has a pair of spaced insulators with a wire heating element wound around the two insulators and with adjacent turns spaced apart. The support for the heating unit includes at least one spring acting on at least one insulator to apply a tension on the wire heating element to compensate for the change in length of the wire element due to thermal expansion. The box-like support is snugly received in a flanged opening of a wall of the dryer to form the heated air inlet for the dryer and mounting means including one or more tabs on the box for insertion into one or more corresponding slots in the flanged opening and a single fastener for securing the box at a side removed from the position of the slot or slots.

12 Claims, 12 Drawing Figures

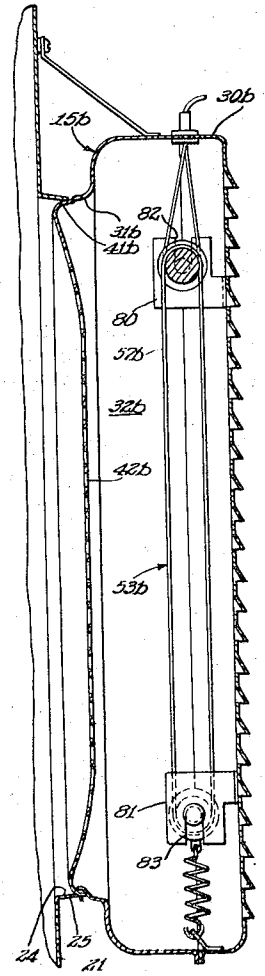


Fig. 1

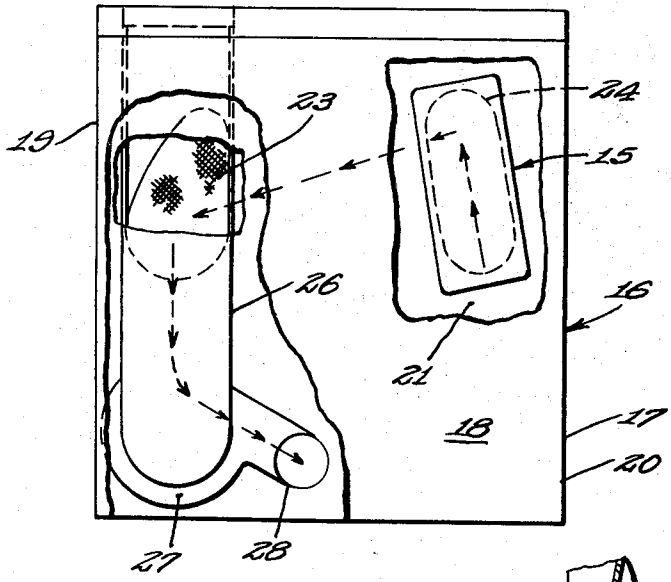


Fig. 5

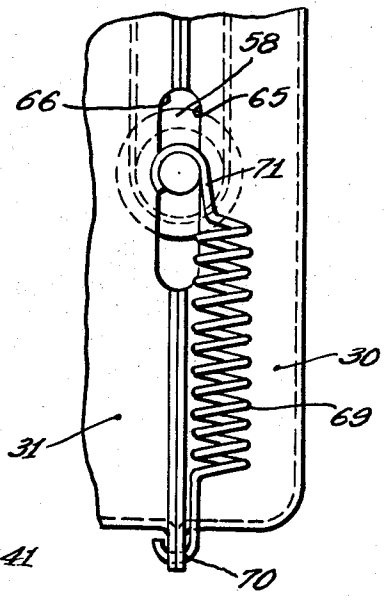
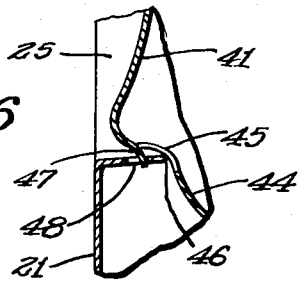


Fig. 6



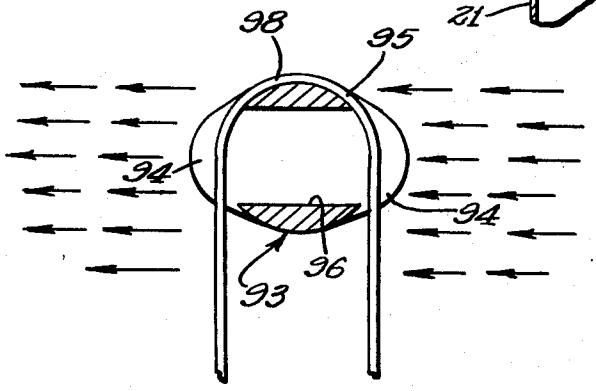


Fig. 11

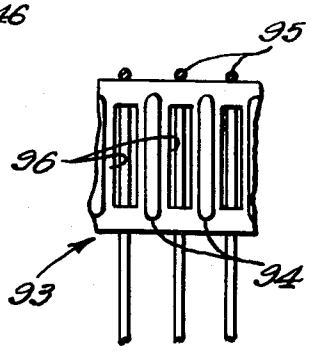


Fig. 12

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Fig. 2

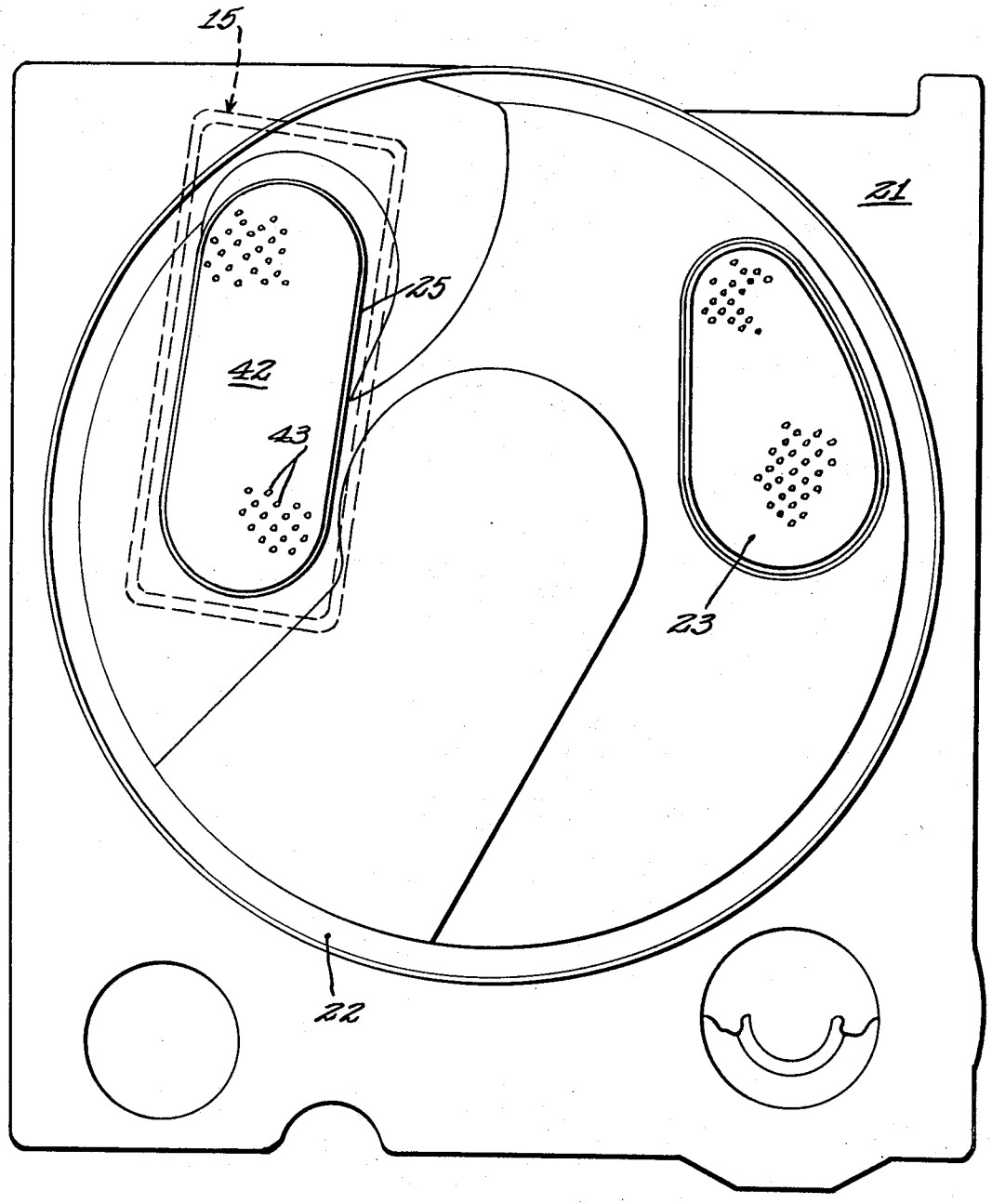

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Fig. 3

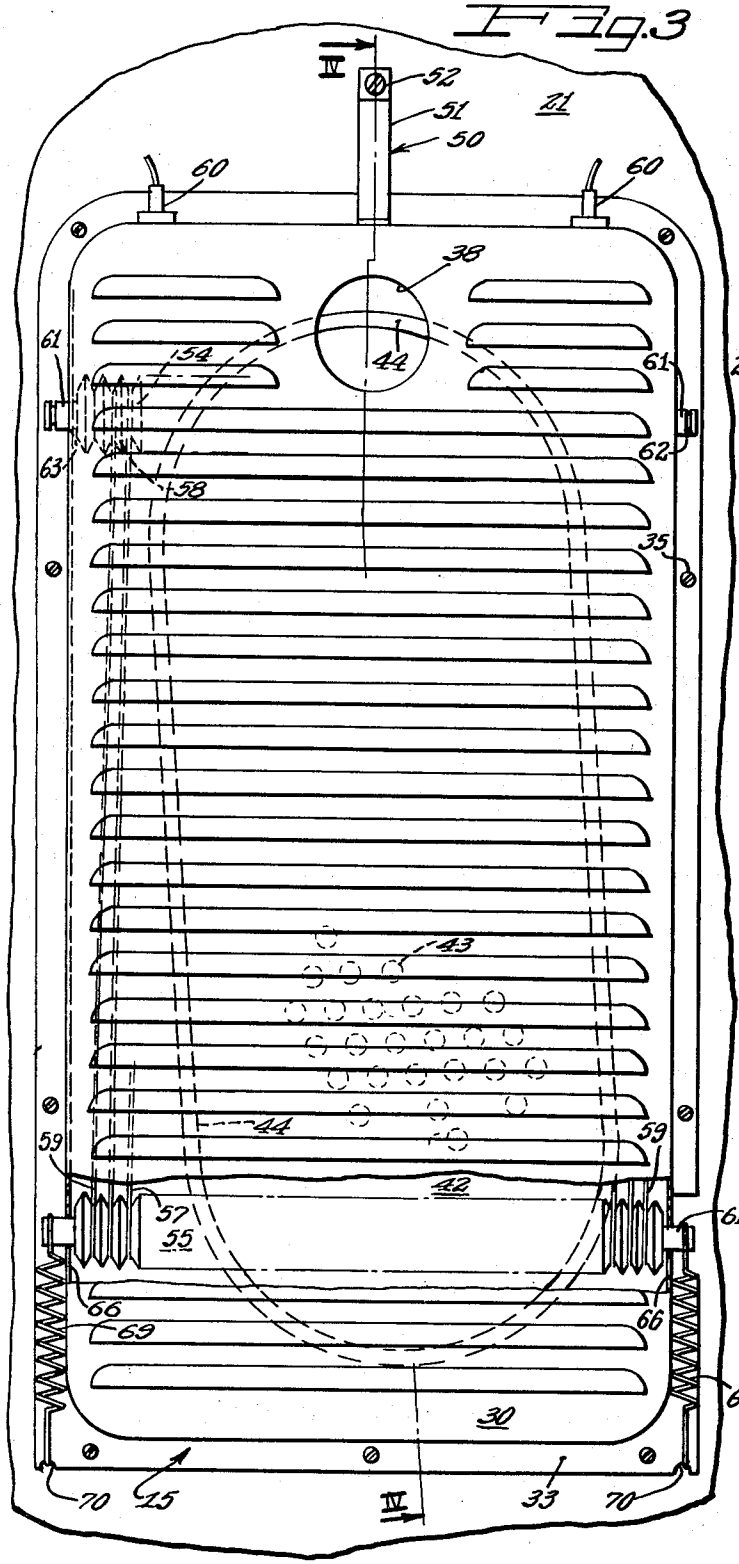

Fig. 4

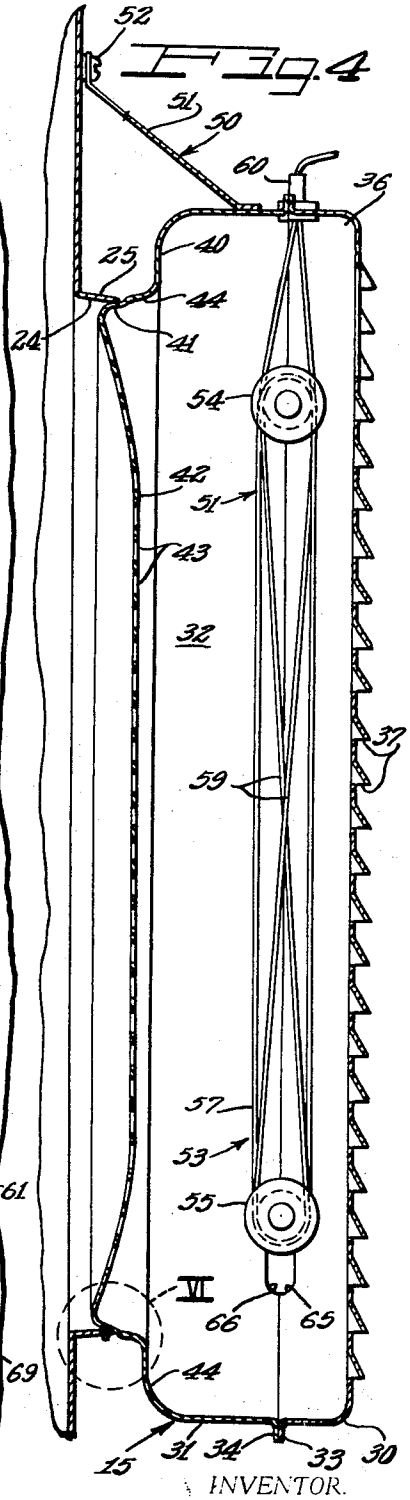

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Fig. 7

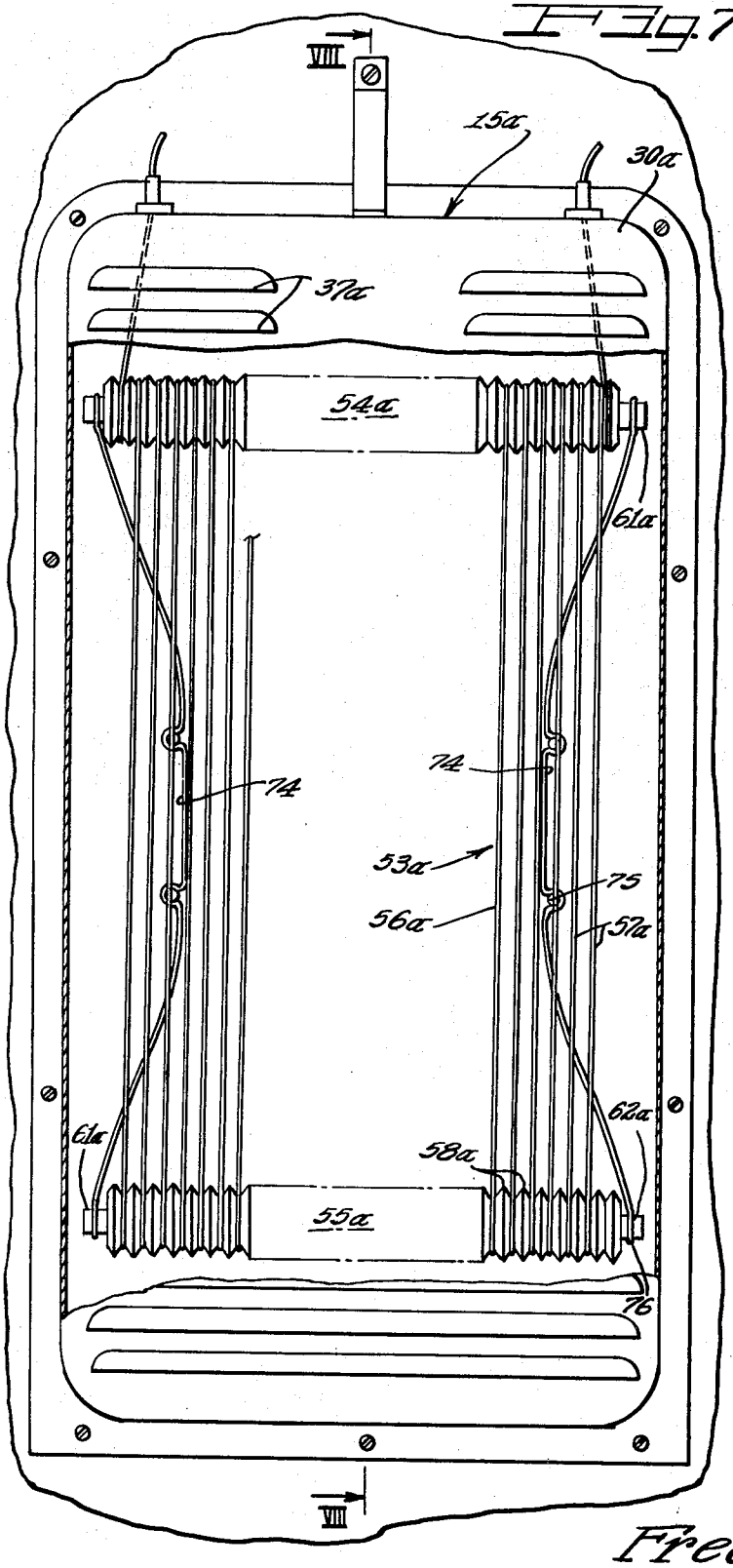

Fig. 8

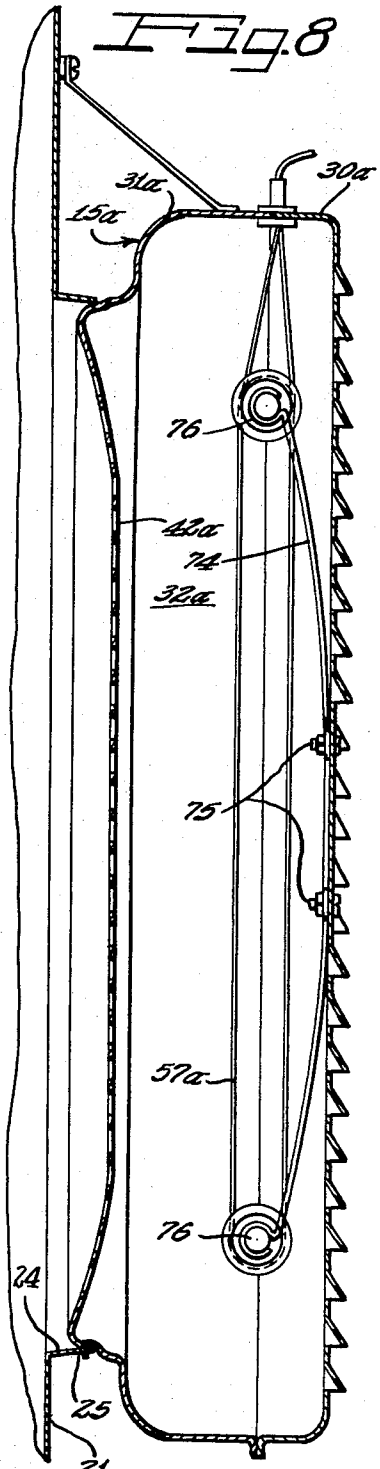

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Fig. 9

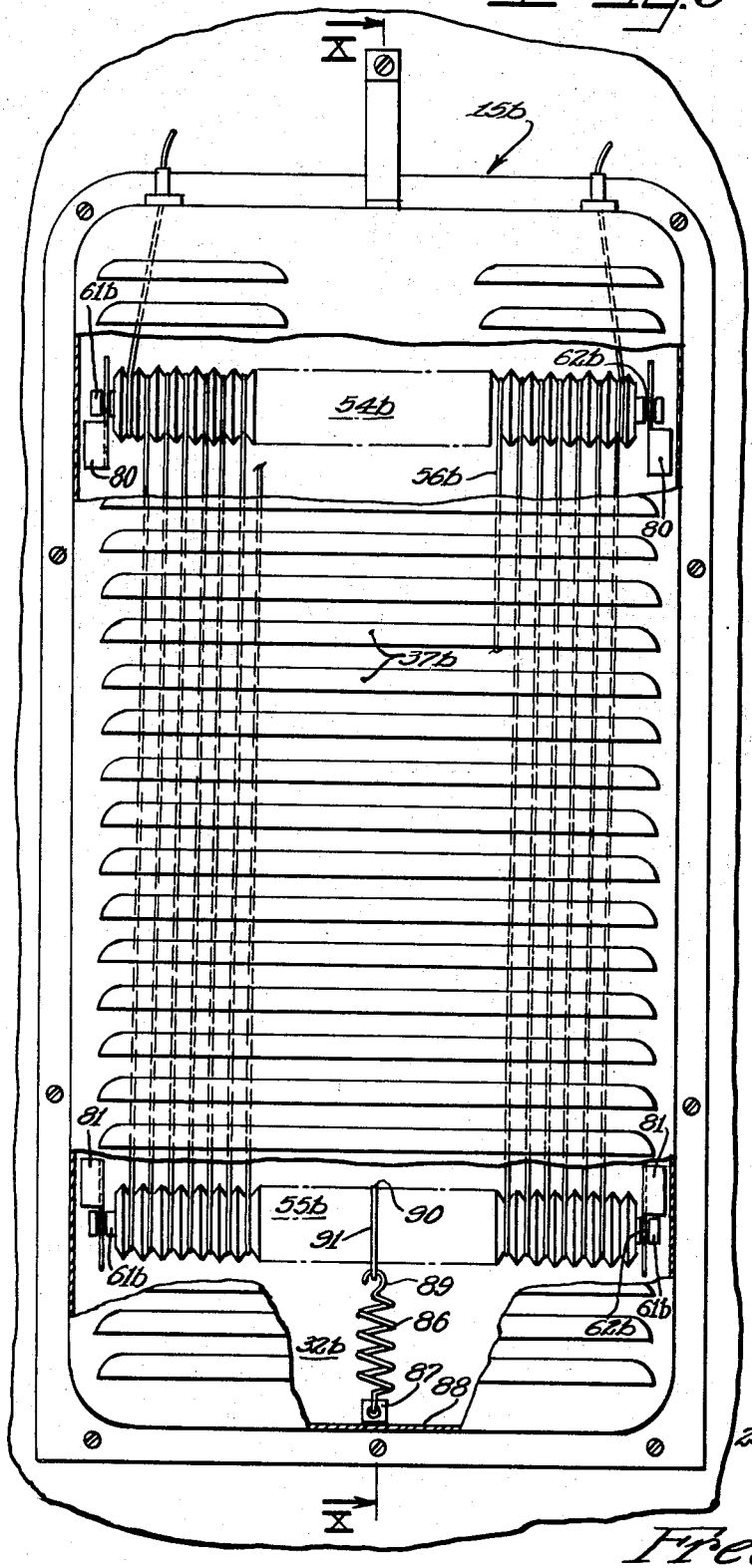
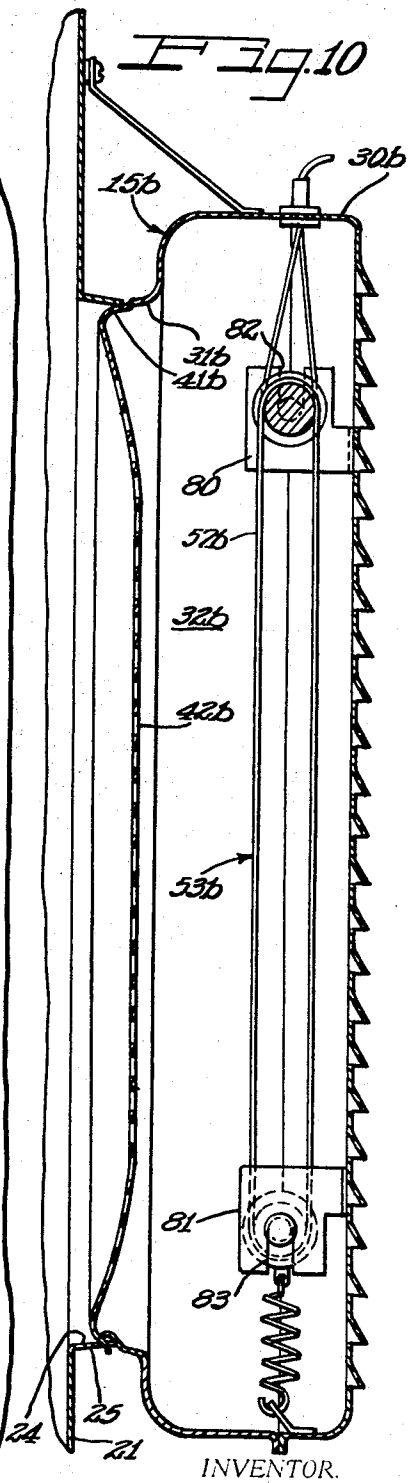


Fig. 10



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ELECTRIC HEATING UNIT FOR CLOTHES DRYERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to a heater box assembly for a laundry device and more specifically to a heater box assembly for electrically heating the inlet air for a clothes dryer.

2. Prior Art

In present heating units used in laundry devices such as clothes dryers, an electrical heating element is a helically coiled wire which wire is formed in a serpentine or sinuous configuration. The heater element is supported or mounted by a plurality of insulators with an insulation at each bend of the configuration. Such a heating unit has the disadvantage of being expensive to manufacture and expensive to install it in an appliance such as a dryer. Many of the heating units used in dryers are disposed with the length of the wire of the heating unit running substantially parallel or at a slight angle to the direction of the air flow so that various sections of the heating element are in contact with air of different temperatures and the unit develops hot spots which cause premature failure.

SUMMARY OF THE INVENTION

The present invention provides a heater box assembly of a box having means of mounting a heating unit therein. Preferably the heating unit comprises a wire element wound between a pair of spaced insulators and mounting means, which biases the insulator apart to compensate for thermal expansion, positioning the heating wire with the wire element extending transverse to the air flow to prevent unequal cooling of the wire element. In the preferred embodiment the box is formed in sections which when secured together provide the mounting means for holding one of the insulators in a substantially rigid position and the other insulator being free for relative movement thereto. The mounting means include springs disposed on the outside of the box for biasing the other insulator away from the one insulator. The present invention also provides an expedient manner for attaching the heater box assembly to an appliance utilizing one or more coacting tabs and slots and a single retaining means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a rear view of a clothes dryer with portions broken away for purposes of illustration showing the heater box assembly of the present invention mounted therein;

FIG. 2 is a front view of a rear bulkhead of a dryer apparatus having the heater box assembly of the present invention mounted thereon;

FIG. 3 is an enlarged view of the heater box assembly of the present invention mounted on the back surface of a bulkhead with portions broken away for purposes of illustration;

FIG. 4 is a cross section taken along lines IV—IV of FIG. 3;

FIG. 5, which is located on the sheet with FIG. 1, is an enlarged view of a resilient mounting means used in the heater box assembly of FIGS. 3 and 4;

FIG. 6 is an enlarged cross-sectional view of a tab and slot arrangement illustrated in the circle identified by VI in FIG. 4;

FIG. 7 is a view similar to FIG. 3 of an embodiment of the heater box assembly of the present invention;

FIG. 8 is a cross-sectional view taken along lines VIII—VIII of FIG. 7;

FIG. 9 is a view similar to FIG. 3 of a third embodiment of a heater box assembly of the present invention;

FIG. 10 is a cross-sectional view taken along lines XI—XI of FIG. 10;

FIG. 11, which is located on the sheet with FIG. 1, is a cross-sectional view of an embodiment of an insulator of the present invention; and

FIG. 12 is a side view of the insulator of FIG. 11 with portions removed for purposes of illustration.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Although the principles of the present invention can be utilized in a heater box assembly for any apparatus, they are particularly useful in a heater box assembly generally indicated at **15** attached to a laundry device such as an electrically heated dryer generally indicated at **16** in FIG. **1**. The electrically heated dryer **16** has an outer casing **17** made up of a back panel **18**, a pair of side panels **19**, **20** and a front panel not illustrated. Extending between the side panels **19** and **20** and extending parallel to the back panel **18** is a wall or bulkhead **21**, which, as best illustrated in FIG. **2**, has an annular beaded embossment **22** formed thereon to receive a sealing means attached to the rear end of a rotatable dryer drum (not shown). The bulkhead **21** is provided with an exhaust or outlet opening **23** which is covered by a grill and an oval opening **24** having a peripheral flange **25** defining an inlet opening for a heating chamber defined by the front surface of the bulkhead and the rotatable drum. The heater box assembly **15** is mounted on the bulkhead **21** at the opening **24** to heat air entering the drying chamber. Disposed on the rear side or surface of the bulkhead **21** is an air duct **26** (FIG. **1**) in communication with the exhaust opening **23** and extending to a blower housing **27** which has an exhaust outlet **28**. During the drying operation a blower mounted in the blower mounting **27** creates a suction causing air to enter the drying chamber by passing through the heater box **15** through the inlet opening **24** following the path of the arrows through the heating chamber to be withdrawn through the exhaust opening **23**. After leaving the heating chamber through the exhaust opening **23**, the air is pulled through the duct **26** to the blower housing **27** and expelled through the exhaust outlet **28** of the blower housing. An example of a laundry dryer and a description of its complete structure and operation is set forth in U.S. Pat. No. 3,398,465 which is assigned to the assignee of this application.

Referring to FIGS. **3** and **4**, the heater box assembly **15** is made up of a pair of metal members **30** and **31** each of which has deformed portions so that when the two members are attached together they define a heating chamber **32**. Both the members **30** and **31** are preferably formed of sheet metal by a metal stamping process which provides a peripheral edge or flange **33** and **34** respectively, which are used for securing the two members together in a conventional manner such as by fastening means **35**.

The member **30**, which has a dished or concave portion **36**, has a series of parallel louvers **37** extending across the bottom of portion **36**, which louvers define inlet means for admitting air into the chamber **32**. The member **30** is also provided with an aperture **38** for receiving a temperature sensing means such as a thermostatic control of a conventional design.

The member **31** has a depressed portion of a cup shape with a bottom **40** which has been further shaped to provide a projecting portion **41** with a reversely bulged or indented bottom **42** which is provided with a pattern of perforations **43** to define an air inlet for the drying chamber of dryer **16**. The projecting portion **41** has side walls **44** and has an oval configuration complementary to the opening **24** in the bulkhead **21**. The size of the projecting portion **41** is selected so that the side walls **44** are received in the peripheral flange **25** in a snug engagement.

As best illustrated in FIG. **6**, the side wall **44** is provided with a bend **45** which abuts against an edge **46** of the peripheral flange **25** to limit insertion of the portion **41** into opening **24**. The side wall **44** is also provided with a tab **47** which is inserted into slot **48** formed in the peripheral flange **25**. The slot **48** and the tab **47** coact as shown in FIGS. **4** and **6**, to attach the lower end of the projecting portion **41** to the peripheral flange **25** of the bulkhead **21**.

To complete the mounting or attachment of the heater box assembly **15** in the opening **24**, a retaining means generally indicated at **50** (FIG. **3**) comprising a strap **51** which is attached at one end to the member **31** and at the other end carries a fastening means such as a screw **52** for securing the strap to

the bulkhead **21**. Thus, by engagement of the coacting slot **47** and tab **48** and the single fastening means of the retainer **50**, the box assembly **15** is secured in the opening **24**. It is to be realized that the coacting tab or tabs and slot or slots can be at other locations on the side wall **44** such as one side. The retaining means **50** would be mounted opposite to the coacting tab and slot retainer regardless of which portion of side wall **44** is utilized.

Disposed in the chamber **32** of the heater box assembly **15** is a heating unit generally indicated at **53** including a pair of spaced elongated or bar insulators **54** and **55** and a wire heating element **56** which is wound or looped around the pair of insulators **54** and **55** to provide wire loops or turns **57**. Adjacent turns are spaced apart by axial spaced fins **58** on each of the insulators **54** and **55**. To anchor the wire heating element, the end turns **59** are passed by the upper insulator **54** on the opposite side relative to the other turns **57** to form the cross wire configuration illustrated in FIG. **4**. Each of the ends of the element **56** are then passed through the box assembly **15** by extending through a hollow insulator **60** and is then connected to a source of electrical energy. Alternately, terminals may be welded or crimped to the ends of element **56** with said terminals being retained by the hollow insulators **60**.

To mount the insulators **54** and **55** of the heating unit **53** the members **30** and **31** are provided with coacting mounting means which receive end portion **61** of the insulators **54** and **55**, which end portions **61** have a reduced diameter and a circumferential groove **62**. As illustrated, each of the members **30** and **31** are provided with a pair of aligned semi-circular cutout portions on the peripheral edge to form a pair of circular apertures or openings **63** to receive each of the end portions **61** of the upper insulator **54** which end portions protrude from the heater box assembly **15**. The openings **63** maintain the upper insulator **54** in a substantially fixed position with respect to the heater box assembly **15**. The lower insulator **55** has its reduced end portion **61** protruding from the heating chamber **32** and being received in elongated cutout portions **65** and **66** formed respectively in the members **30** and **31** which cutout portions **65** and **66** form an elongated aperture enabling relative movement of the insulator **55** when mounted.

The flanges **33** and **34** have portions removed at the respective cutout portions to provide clearance for the end portions **61** of the insulators. It should be realized that insulators **54** and **55** could be provided with rectangular end portions rather than reduced diameter portions **61**. In the event that rectangular end portions be provided, the members **30** and **31** would be provided with appropriately dimensioned cutouts to receive the modified insulators.

To compensate for thermal expansion in the wire heating element **56**, while in use, bearing means such as a pair of springs **69** are provided to maintain a tensioning force on the loops **57** of the wire element **56** by urging the lower insulator **55** away from the upper insulator **54**. As best illustrated in FIGS. **3** and **5**, each of the springs **69** has an end **70** received by a notch on the exterior of the heater box assembly **15** and the other end has a hook or loop **71** which is received in the groove **62** of the end portion **61**.

In operation, air drawn into the dryer chamber by the blower in the blower housing **27**, is drawn through the louvers **37**, which forms the inlet means of the heater box assembly **15**, into the chamber **32**. As the air moves across the loops **57** of the wire heating element, it is heated and then passes through the perforations **43** into the dryer chamber of the dryer **16**. Since a tensioning force is applied to the loops **57** of the wire element **56** by the springs **69** pulling the lower insulator **55** away from the upper insulator, any slack in the loop **57** of the wire element **56**, which slack is the result of a change in length due to thermal expansion, is removed by the tension applied by the springs **69**. By placing the springs on the exterior of the box assembly **15**, the deleterious effect of the heat emitted by the heating element **56** on the spring characteristics is minimized.

In FIGS. **8** and **9**, an embodiment of the heater box assembly is generally indicated at **15*a*** which comprises a pair of members **30*a*** and **31*a*** attached together to define a box means having a heating chamber **32*a***. Members **30*a*** and **31*a*** are substantially similar to the corresponding members **30** and **31** of the previously described embodiment except they do not have cutout portions on their peripheral edges for providing support means for mounting the insulators of a heating unit.

Disposed in the chamber **32*a*** is a heating unit **53*a*** which comprises an upper insulator **54*a*** and a lower insulator **55*a*** which are substantially similar to the previously described insulators except their length is such that the reduced end portions **61*a*** are disposed in the chamber **32*a***. As in the previously described heating unit **53**, a wire heating element **56*a*** is wound between the two spaced insulators **54*a*** and **55*a*** with turns or loops **57*a*** which are spaced apart by fins **58*a*** on each of the pair of insulators. The primary difference in the structure of the heater box assembly **15*a*** over the previously described embodiment is the mounting means for mounting the heating unit **53*a*** in the chamber **32*a***. The mounting means comprises a pair of resilient members **74** which are attached by fastening means **75** to one of the members **30*a*** or **31*a*** and as illustrated to the member **30*a***. The resilient members **74** are provided with eye means **76** at each end to engage a groove **62*a*** formed in each of the reduced end portions **61*a***. The members **74** are of a spring character so that they bias both the insulators **54*a*** and **55*a*** apart to maintain the desired tension on the loops **57*a*** of the wire heating element **56*a***.

As in the previously described embodiment, air enters through the louvers **37*a*** formed in the member **30*a*** and flows substantially perpendicular to the plane formed by the wire loops **57** across the heater element **56*a*** and then passes through the perforated bottom **42*a*** of the projecting portion of the member **31*a*** into the drying chamber formed by the bulkhead **21** and the tumbling drum of the laundry dryer **16**.

A third embodiment of the heater box assembly is generally indicated at **15*b*** and illustrated in FIGS. **10** and **11**. The heater box assembly **15*b*** is made up of a pair of members **30*b*** and **31*b*** which are interconnected at the peripheral edge in a manner similar to the previously described embodiments to form a box structure having a heater chamber **32*b***. The member **30*b*** is provided with louvers **37*b*** to admit air into the heating chamber **32*b*** and the member **31*b*** is provided with a projecting portion **41*b*** having a perforated indented bottom **42*b*** which is complementary in shape and size to be snugly received in a peripheral flange **25** of the opening **24** of the bulkhead **21**. As in the previously described embodiment of FIGS. **8** and **9**, a heating unit generally indicated at **53*b*** comprising an upper cylindrical insulator **54*b*** and a lower cylindrical insulator **55*b*** with the wire heating element **56*b*** wound into turns or loops **57*b*** thereon and between. As in the embodiment of FIGS. **8** and **9**, the insulators **54*b*** and **55*b*** are of a length so that they are completely contained within the heating chamber **32*b***.

To mount the heating unit **53*b*** in the chamber **32*b***, two pairs of brackets **80**,**80**, **81**,**81**, respectively, are attached to one of the members and as illustrated attached to the member **30*b***. Each of the brackets **80** has a slot **82** opening in the upward direction towards a top of the heater box assembly **15*b***. The lower pair of brackets **81** have a slot **83** opening in a direction opposite to the slot **82** and opening at a direction towards the bottom of the heater box **15*b***. As illustrated, the upper insulating **54*b*** is supported in the pair of brackets **80** with its reduced end portions **61*b*** received in the slots **82**. The lower insulator **55*b*** has reduced end portions **61*b*** which are received in the slots **83**. The reduced end portions **61*b*** of both insulators **54*b*** and **55*b*** are provided with grooves **62*b*** which prevent axial shifting of the insulators in the brackets.

To bias the pair of insulators **54*b*** and **55*b*** away from each other, a resilient spring **86** is anchored to an eye **87** attached to the interior of the chamber **32*b*** and as is illustrated is attached to a lower wall **88** of the member **30*b***. The other end **89** of the resilient spring **86** is attached to a wire loop **90** which

is received in a groove **91** formed at the center of the insulator **55***b*. The spring means **86** applies a tension to the loops **57***b* to maintain the upper insulator **54***b* in abutting relation with the bottom of the slots **82** and to maintain a desired tension on the wire element **56***b* to compensate for the expansion during heating of the heating unit.

In each embodiment, the heating unit **53**, **53***a* or **53***b* can be formed by winding the wire element around the two spaced insulators. Then the unit is installed in the box structure with a minimum amount of labor. It is contemplated that a disposable spacer can be utilized to hold the two insulators such as **54** and **55** the desired distance apart to prevent any entanglement of the wire loops of the heating element. In the embodiments of FIGS. **10** and **11** one pair of brackets which can be the brackets **80** or the brackets **81** will need to be assembled onto the member **30***b* after the other pair has received its respective insulator.

In each of the embodiments the air enters the louvers on the member **30**, **30***a* or **30***b* and passes in a direction substantially perpendicular to the direction of the wires **56** and out through the perforated bottom **42** into the drying chamber. By having the air flow in this manner, each of the wire elements is contacted by air of substantially the same temperature so that the desired cooling is obtained throughout the heating element to eliminate the occurrence of any hot spots thereon. Such cooling enables the use of wires of alloys such as iron base alloys to operate at a lower heating temperature and therefore enables the construction of the heating unit **53** using a material which is more economical and available than used in prior heating elements which are typically nickel based wire alloys. Since the two insulators **54** and **55** are mounted with a means biasing them apart to maintain the desired tension on the wire element **56**, the element can be a straight wire instead of the helically turned wire of the previous heating units and the tensioning prevents sagging or buckling of the wire during a heating operation and eliminates the possibility of shorting between turns or loops due to buckling or sagging of the wire.

An alternate embodiment of the insulator generally indicated at **93** is illustrated in FIGS. **12** and **13**. The insulator **93** is provided with fins **94** which are axially spaced along its length to maintain wire loops **95** in spaced relationship to prevent their accidentally contacting or shorting. In between each of the fins **94** the insulator **93** has a passageway **96** to enable a flow of air to cool the insulator. As illustrated in FIG. **13**, a portion of each wire loop **95** overlies the passageway **96** to receive the effect of the cooling air. In the design of the insulator **93**, only a small portion **98** of each wire loop **95** is in contact with the solid portion of the insulator **93**. Thus, the wire loops **95** receive additional cooling to prevent the creation of hot spots thereon during a heating operation.

Each of the embodiments such as the units **15**, **15***a* and **15***b* are provided with a tab for acting with a coacting slot on the flange **25** of the opening in the bulkhead **21** and the retainer means **50**. Thus the unit or heater box assembly **15**, **15***a* or **15***b* can be easily assembled onto the bulkhead **21** of the dryer device **16**. The present structure of the unit not only simplifies the manufacturing of the heating elements **53** and its assembly into the box formed by the members **30** and **31**, but also simplifies the installation of the heating box assembly **15** onto the bulkhead **21** whether during initial installation or in a subsequent removal and installation of repair parts.

Although minor modifications might be suggested by those skilled in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A heater box assembly for a laundry appliance such as an electrically heated clothes dryer, comprising:

a first member having means for forming an air inlet for the laundry appliance;

a second member attached to said first member to provide a box means having an enclosed heating chamber, said second member having means for forming an air inlet to the chamber;

a heating means including a pair of insulators and a wire heating element wound about the insulators with adjacent turns being spaced from each other; and

means for mounting said heating means in the heating chamber with a pair of insulators in spaced relationship and with the ends of each insulator protruding therefrom including biasing means for urging the pair of insulators away from each other thereby applying a tension on the wire to compensate for the thermal expansion of the wire;

said mounting means including aligned cutout portions in each of said first and second members coacting together as the members are assembled to provide an aligned pair of apertures to receive the protruding ends of each of said pair of insulators with one of the pair of apertures maintaining one of the pair of insulators substantially rigid in said chamber and the other pair of apertures being shaped to enable relative movement of said other insulators away from the one insulator under the urging of said biasing means to maintain the wire heating element under tension.

2. A heater box assembly in accordance with claim **1**, wherein the wire heating element is of a material of an iron base.

3. A heater box assembly according to claim **1**, wherein said biasing means comprises a pair of springs disposed on the outside of the heating chamber, each of said springs being anchored to the box means formed by said first and second members and attached to a protruding end of said other insulator so that said springs are removed from the heat generated by the wire heating element to prevent the deleterious effect of the heat thereon.

4. A heater box assembly according to claim **1**, wherein said bias means comprises a resilient spring anchored to said box means and attached to the other of said pair of insulators.

5. A heater box assembly for a laundry appliance such as an electrically heated clothes dryer comprising:

a first member having means for forming an air inlet for the laundry appliance;

a second member attached to said first member to provide a box means having an enclosed heating chamber,

said second member having means for forming an air inlet to the chamber;

a heating means including a pair of insulators and a wire heating element wound about the insulators with adjacent turns being spaced from each other; and

means for mounting said heating means in the heating chamber with a pair of insulators in spaced relationship including biasing means comprising a resilient spring anchored to said box means and attached to one of said pair of insulators for urging the pair of insulators away from each other thereby applying a tension on the wire to compensate for the thermal expansion of the wire, said means for mounting said pair of insulators comprising brackets attached to one of said first and second members, each of said brackets having a slot for receiving an end of said insulators, said brackets being arranged in pairs with the slots of one pair opening in a direction opposite to the slots of the other pair so that the resilient spring holds the other of said pair of insulators against the base of the slots of the one pair of brackets while the one insulator is urged away from the base of its slots of the other pair of brackets.

6. A heater box assembly according to claim **1**, wherein each of the insulators of said pair are cylindrical members provided with axially spaced fins to maintain separation between adjacent turns of the wire heating element thereon.

7. A heater box assembly according to claim **6**, wherein each of said insulators has passageways extending between each of the axially spaced fins to enable the passage of air therethrough for cooling of said insulator.

8. A heater box assembly according to claim 1, wherein the means forming the inlet in the first member has a shape complementary to an opening in a wall of the laundry device and is adapted to snugly fit therein; and further including means for mounting the heater assembly in said opening comprising a tab disposed on said first member coacting with a slot adjacent the opening in the wall, and a fastening means disposed on said box a substantial distance from the coacting tab and slot whereby the heater box assembly is mounted in the opening by engaging the tab in the slot and then securing the fastening member to the wall of the laundry device.

9. A heater box assembly for a laundry appliance such an electrical heated clothes dryer, comprising:

a first member having means for forming an air inlet for the laundry appliance;

a second member attached to the said first member to provide a box means having an enclosed heating chamber, said second member having means for forming an inlet to the chamber;

a heating means including a pair of insulators and a wire heating element wound about the insulator with adjacent turns being spaced from each other; and

means for mounting said heating means in the heating chamber with the pair of insulators in spaced relationship, said means for mounting including biasing means for urging both of the insulators of said pair in a direction away from each other thereby applying a tension on the wire to compensate for the thermal expansion of the wire.

10. A heater box assembly in accordance with claim 9, wherein said mounting means comprises resilient spring means attached to one of said first and second members and resiliently mounting each of said pair of insulators in the heating chamber.

11. A heater box assembly according to claim 1, wherein said mounting means disposes said heating means in the heating chamber with the flow of air substantially perpendicular to the direction of the wire heating element thereby eliminating hot spots on the heating element.

12. A heater box assembly for a laundry appliance such as an electrically heated clothes dryer, comprising:

a first member having means for forming an air inlet for the laundry appliance;

a second member attached to said first member to provide a box means having a heating chamber, said second member having means for forming an air inlet to the chamber;

a heating means including a pair of insulators and a wire heating element of an iron base material wound about the insulators with adjacent turns being spaced from each other;

each of said pair of insulators being a cylindrical member having axially spaced fins to maintain separation between adjacent turns of the wire heating element and each insulator having passageways extending between each of the spaced fins to enable passage of air therethrough for cooling the insulator; and

means for mounting said heating means in the heating chamber with the pair of insulators in spaced relationship including biasing means for urging the pair of insulators away from each other thereby applying a tension on the wire to compensate for the thermal expansion of the wire;

said mounting means comprising means defining cutout portions in both of said first and second members, said cutout portions being arranged in aligned pairs so that the attachment of said first and second member forms pairs of aligned apertures to assemble said pair of insulators in the desired position in the heating chamber, one pair of said pairs of apertures receiving the ends of one of said pair of insulators and maintaining said one insulator in a substantially fixed position relative to said heating chamber, the other of said pair of apertures each having an elongated configuration to receive the ends of the other insulator of said pair of insulators and enabling relative movement of the other insulator away from the one insulator and relative to said heating chamber; and

said biasing means comprising a pair of springs disposed on the outside of the heating chamber, each of said springs being anchored to the box means formed by said first and second members and attached to a protruding end of said other insulator so that said springs are removed from the heat generated by the wire heating element to prevent the deleterious effect of the heat thereon.

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