# United States Patent [19]

**Zenz**

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[45] **Mar. 26, 1974**


[54] **ELECTRIC HEATING UNIT FOR CLOTHES DRYERS**


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



[22] Filed: **Nov. 18, 1971**

[21] Appl. No.: **199,994**

**Related U.S. Application Data**

[62] Division of Ser. No. 29,388, April 17, 1970, Pat. No. 3,670,143.

[52] **U.S. Cl.** ..... **220/18,** 220/3.6, 248/27

[51] **Int. Cl.** ..... **B65d 25/24**

[58] **Field of Search** ..... 220/18, 3.5, 3.6; 206/19.5 F; 248/27; 34/133



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*Attorney, Agent, or Firm*—Hill, Sherman, Meroni, Gross & Simpson



[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.


**2 Claims, 12 Drawing Figures**

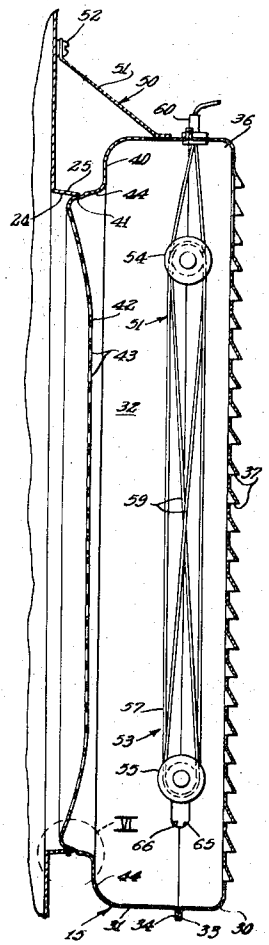


Fig. 1

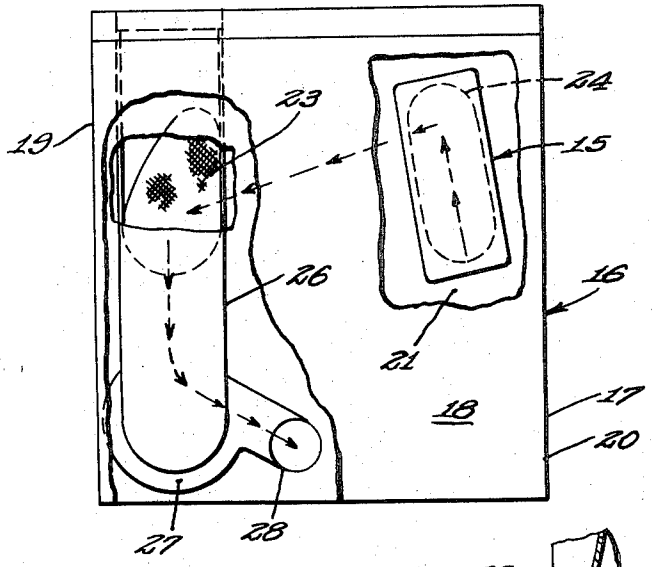



Fig. 5

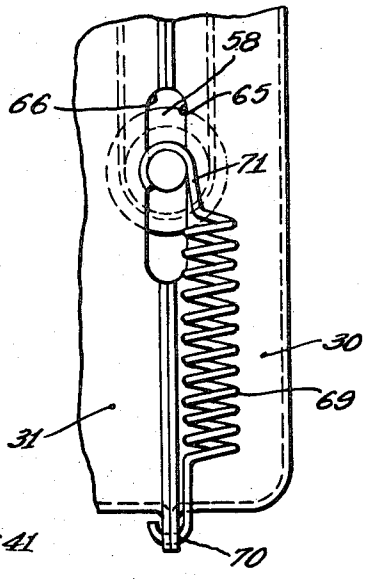
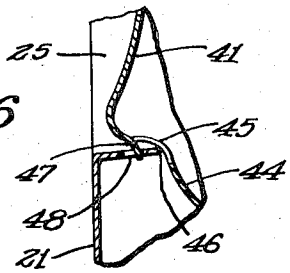



Fig. 6



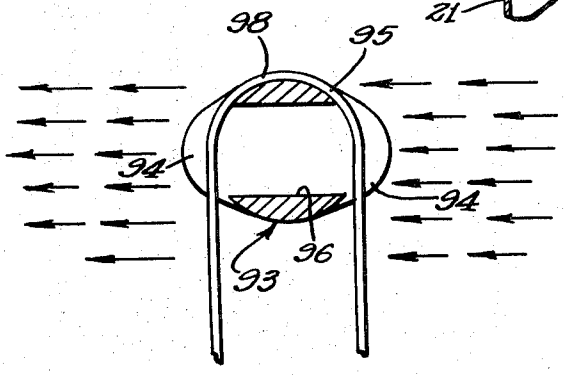




Fig. 11

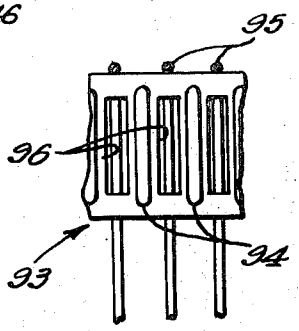



Fig. 12

Fig. 2

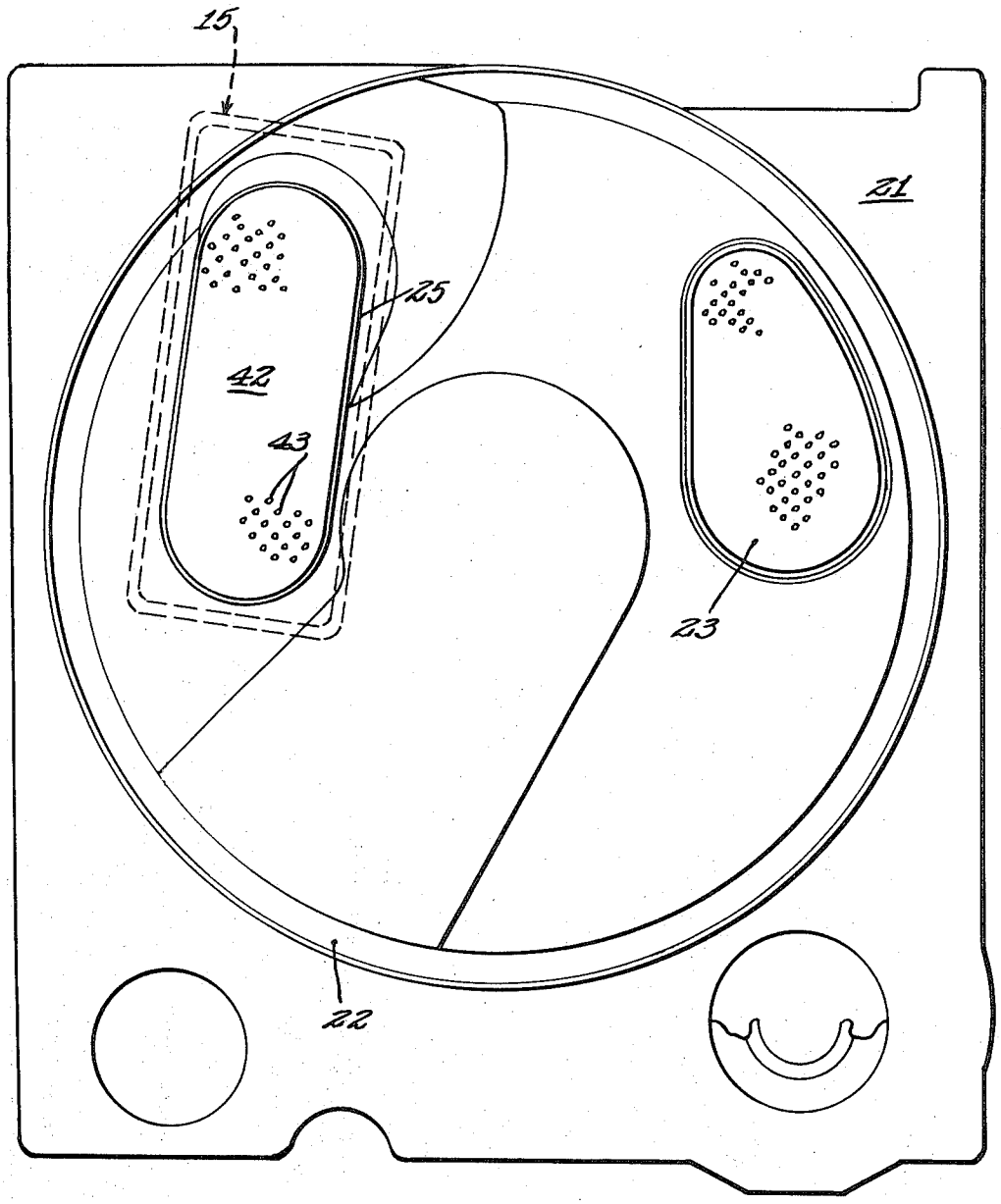


Fig. 3

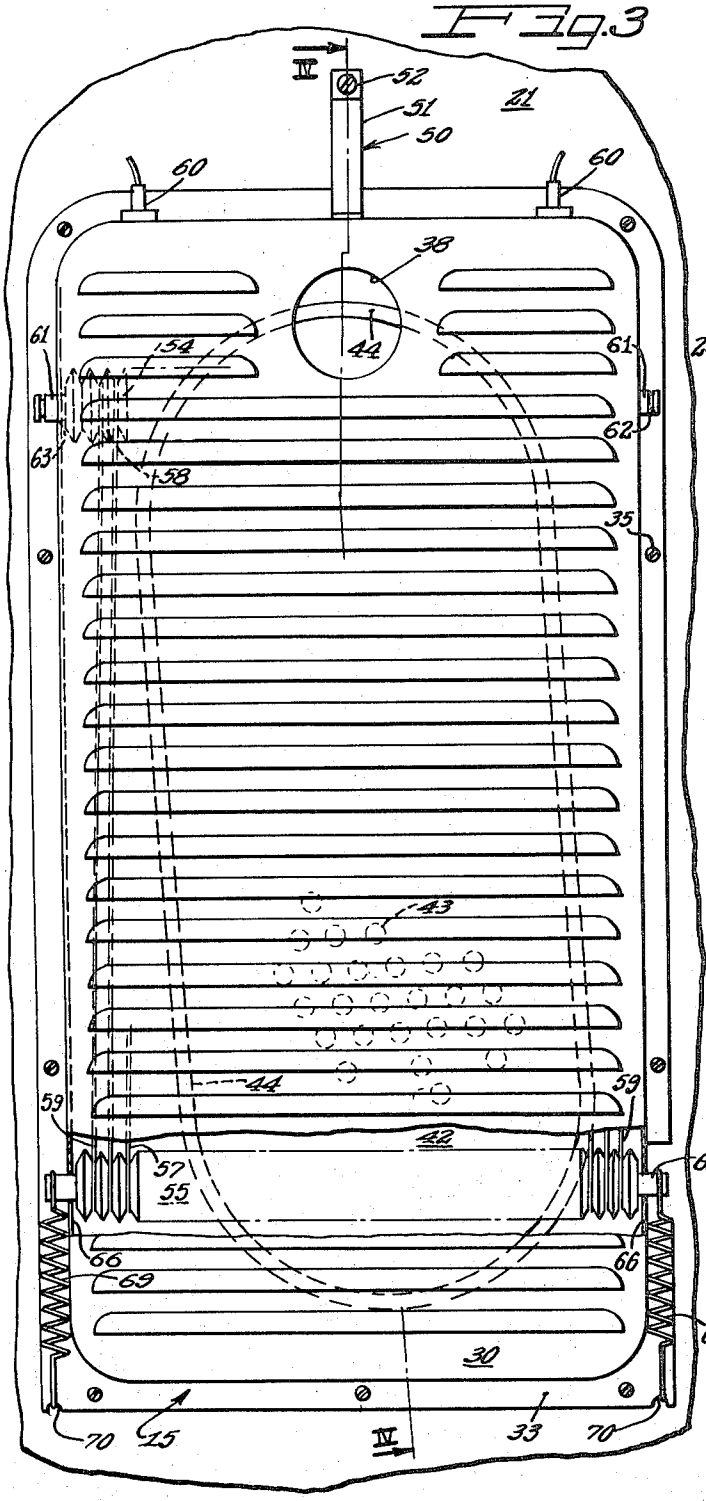

IV
52
51
50
21
60
60
38
44
61
61
54
62
63
58
35
43
44
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59
42
57
55
61
66
66
69
69
30
70
15
IV
33
70

Fig. 4

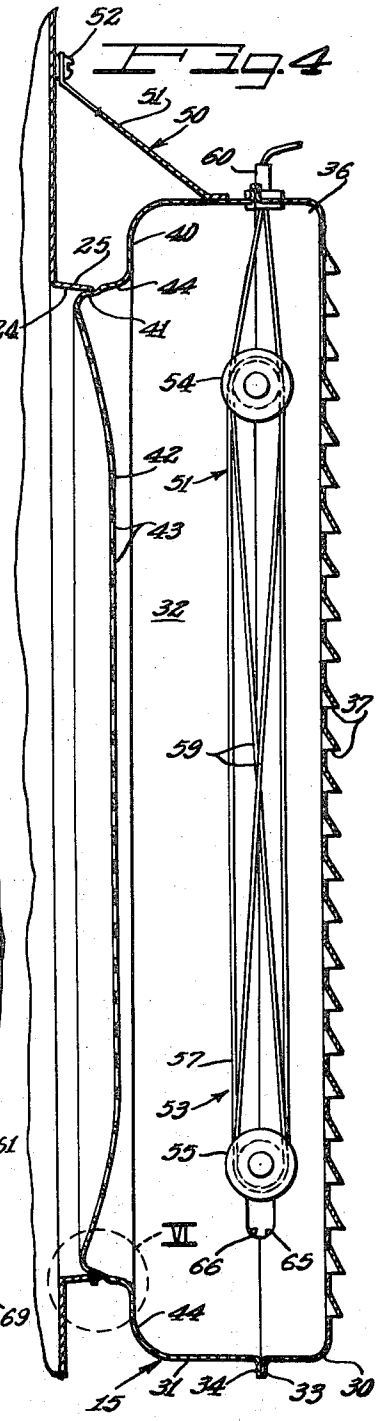

52
51
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60
36
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44
24
41
54
42
51
43
32
37
59
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53
55
VI
66
65
44
15
31
34
33
30

Fig. 7

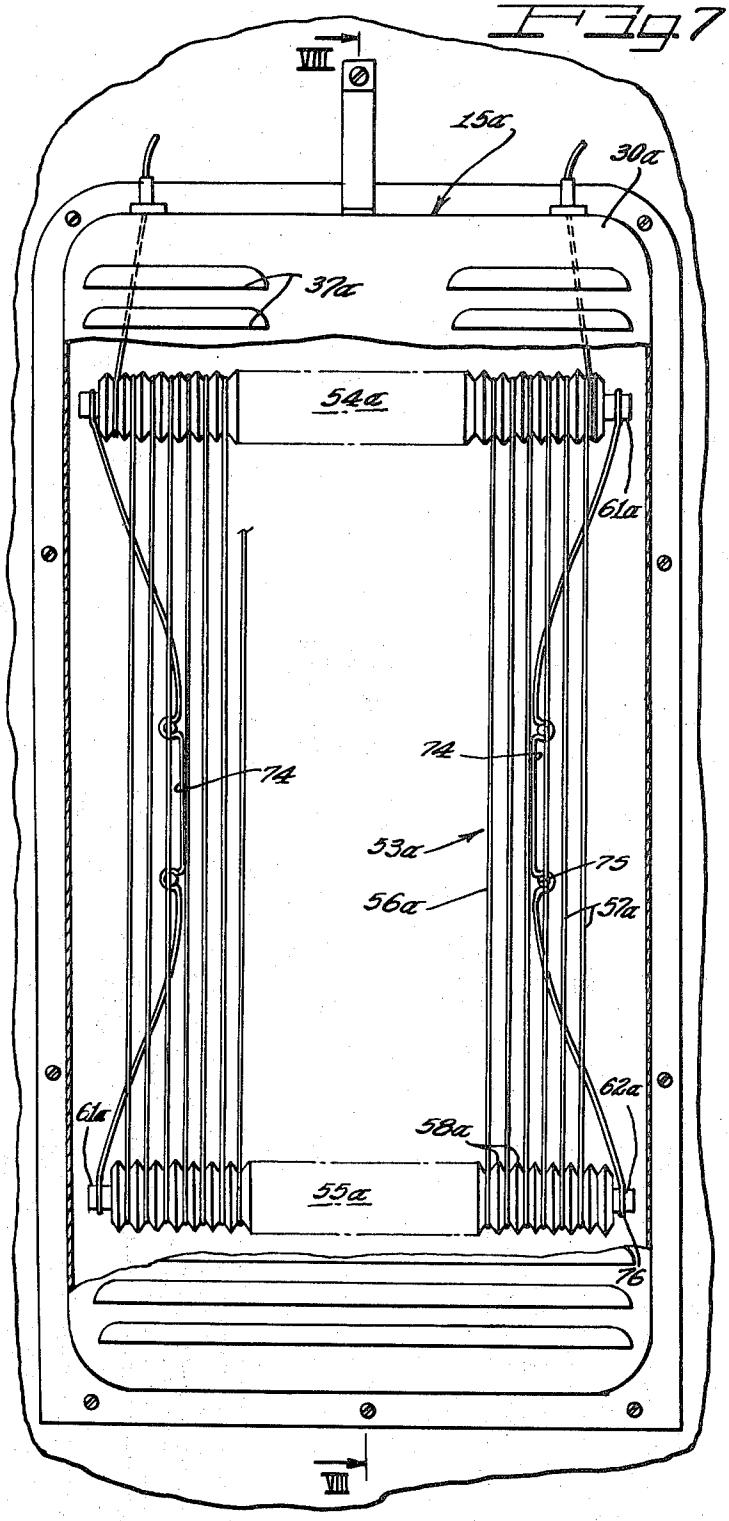

VIII
15a
30a
37a
54a
61a
74
74
53a
75
56a
57a
61a
58a
62a
55a
76
VIII

Fig. 8

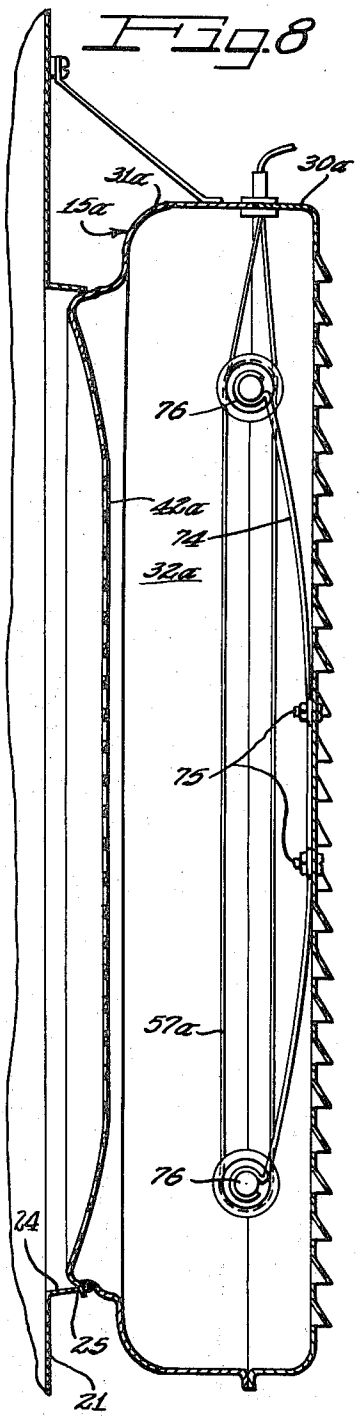

31a
30a
15a
76
48a
74
32a
75
57a
76
74
25
21

Fig. 9

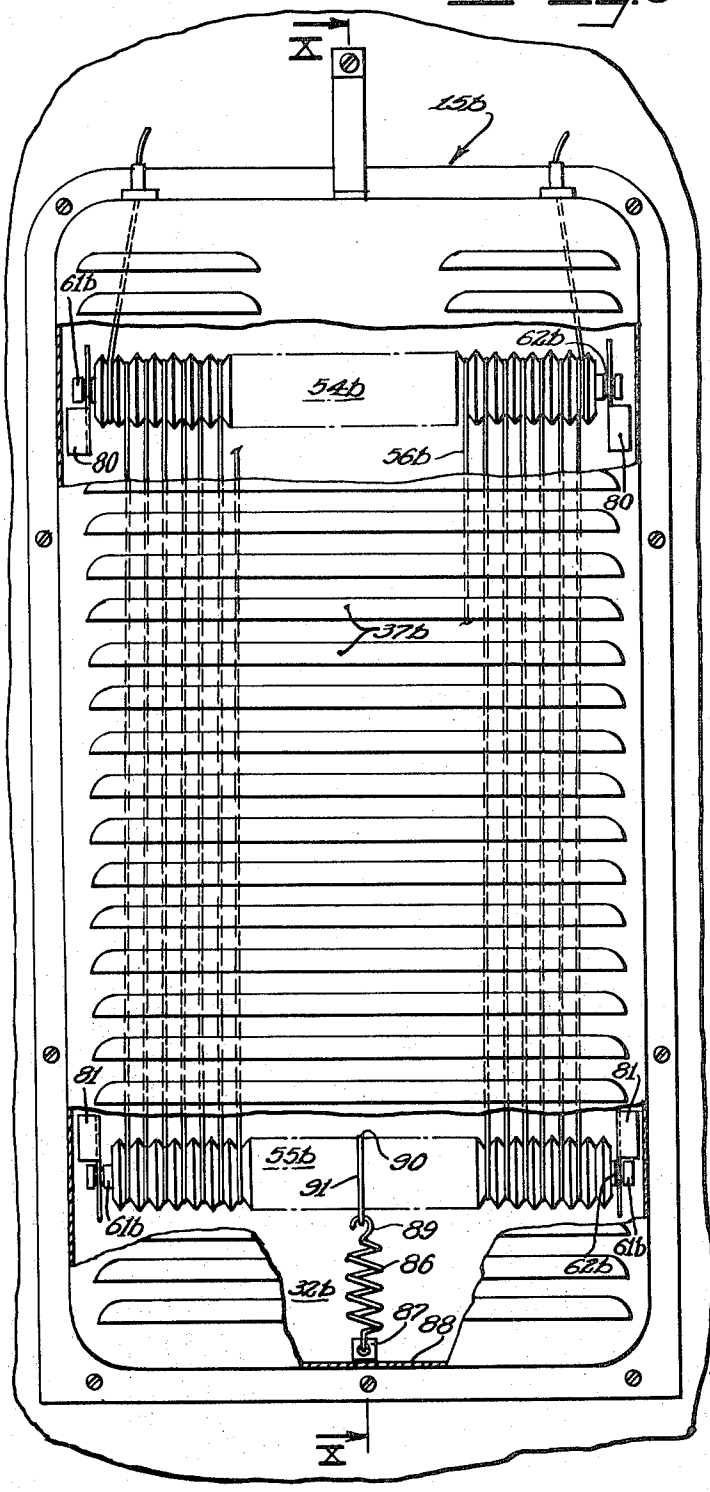
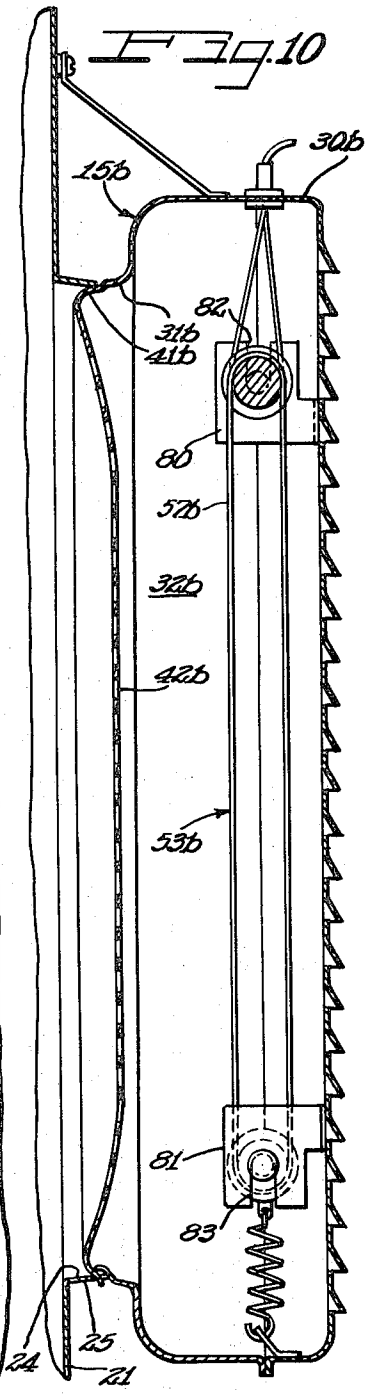

X
15b
61b
62b
54b
80
56b
80
37b
81
81
55b
90
91
61b
89
86
61b
62b
32b
87
88
X

Fig. 10


30b
15b
82
31b
41b
80
57b
32b
42b
53b
81
83
24
25
21

# ELECTRIC HEATING UNIT FOR CLOTHES DRYERS

This is a division of application Ser. No. 29,388 filed Apr. 17, 1970 which application issued on June 13, 1972 as U.S. Pat. No. 3,670,143.

## 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 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 pro-

cess 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 coating 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 heater 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 **54***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 **54***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 mantain 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 in-

stallation 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 box for attachment in an opening in a stationary wall of a laundry appliance, the opening having a peripheral flange extending substantially at a right angle to the plane of the wall, comprising:

means for forming a box including one member having a cup-shape portion with a peripheral wall and a perforated bottom, said cup-shaped portion being complementary to the opening and having a size for enabling a snug fit in the opening with the peripheral wall of the portion being engaged with the peripheral flange; and

securing means for attaching the box on the wall with said cup-shaped portion received in the opening including retaining means disposed on said box for attaching the box to the wall and a coacting tab and slot, said coacting tab and slot comprising a tab formed in the peripheral wall of said portion and said slot being formed in the peripheral flange of the opening and being dimensioned to receive said tab so that securing of the box to the wall is accomplished by engaging the coacting tab and slot and preventing their disengagement by completing the securing with the retaining means.

2. A box for attachment in an opening in a stationary wall of a laundry appliance, comprising:

means for forming a box including one member having a cup-shaped portion with a peripheral wall and a bottom, said portion being complementary to the opening and having a size for enabling a snug fit of the peripheral wall of the portion in the opening; and

securing means for attaching the box on the wall with said portion received in the opening, said securing means including a tab coacting with a slit adjacent the periphery of the opening for holding the portion in the opening, and retainer means disposed on said box for attaching the box to the wall, said retainer means comprises strap attached to a side wall of the box furthest removed from said coacting tab and slot, and a fastening means for securing a portion of said strap to the wall of the laundry device, so that securing of the box to the wall is accomplished by engaging the coacting tab and slot and preventing their disengagement by completing the securing with the retaining means.

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