Jan. 9, 1962 A. W. HACKMAN ET AL 3,016,441

SPLIT STRAP SUPPORTING MEANS FOR ELECTRICAL INSULATORS

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Fig. 1

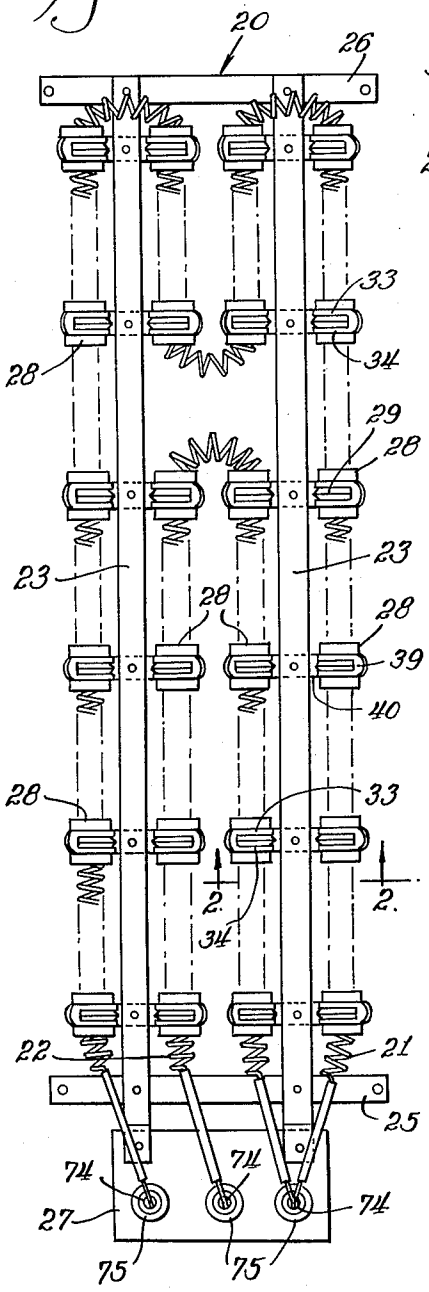


Fig. 2

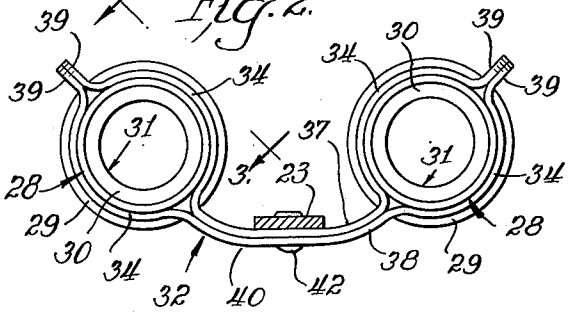


Fig. 3

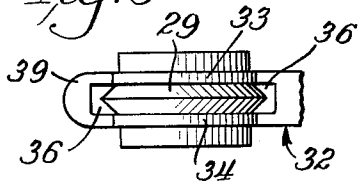


Fig. 4

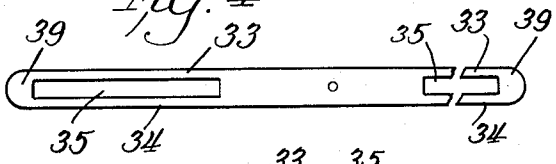


Fig. 5

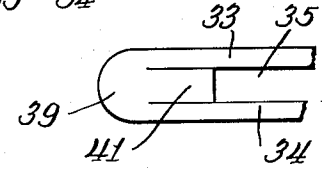
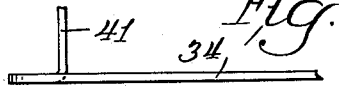


Fig. 6



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SPLIT STRAP SUPPORTING MEANS FOR ELECTRICAL INSULATORS

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Fig. 7

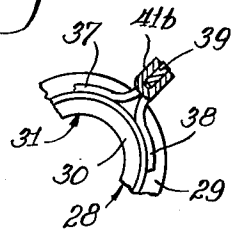


Fig. 9

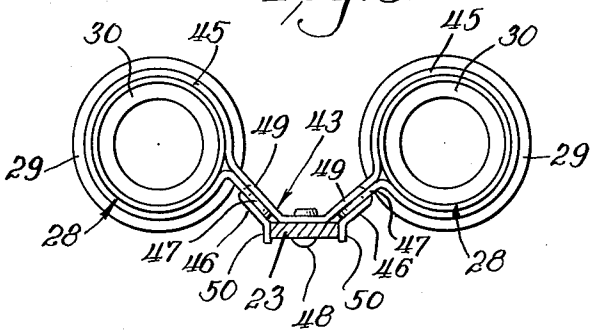


Fig. 8

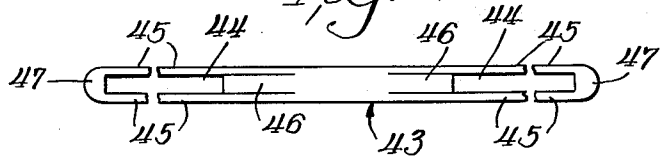


Fig. 17

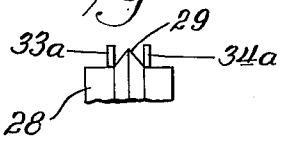


Fig. 10

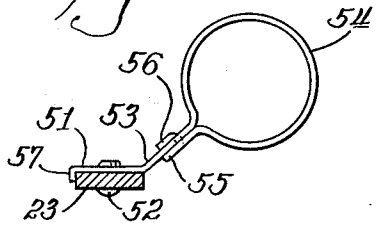


Fig. 12

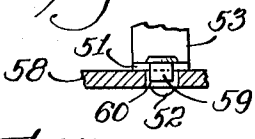


Fig. 11

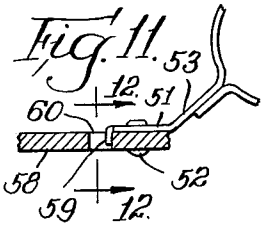


Fig. 14

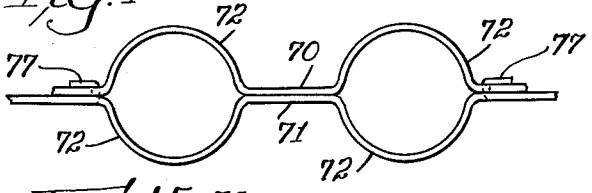


Fig. 13

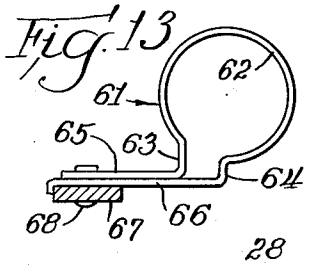


Fig. 15

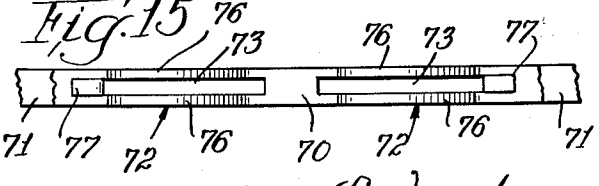
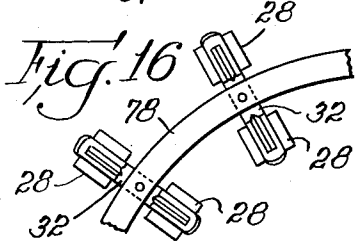


Fig. 16



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3,016,441
SPLIT STRAP SUPPORTING MEANS FOR ELECTRICAL INSULATORS

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Filed May 23, 1960, Ser. No. 31,040
7 Claims. (Cl. 219—19)

This invention is directed to the art of open coil heaters embodying a heating resistance of substantial length which is exposed to an area being heated and particularly relates to improvements in supporting and insulating assemblies for the coils of these heaters.

The coils of these heaters, which are commonly used in appliances of conductive material, such as clothes dryers, are usually supported by metallic frames which must be electrically insulated from the coils. The insulators which are used must support the coil in such fashion that they do not cause hot spots or overheating of the coil at places of support thereof, as such hot spots may result in the resistance burning out. Furthermore, excessive heating of the insulators sometimes causes the insulator to acquire surface conductivity so that there may be some surface creepage of current along the insulator, which is passed through the metallic support and the article used with the heater, thereby offering dangerous shock possibilities to the attendant or operator coming in contact with the article or machine with which the coils are used.

The present invention aims to minimize such hot spots in the coil of these heaters, thereby minimizing the tendency for the coil to burn out and minimizing the surface creepage of current aforementioned, by providing an insulating and supporting assembly that is so formed as to provide for a minimum of contact between the insulator and the support, and greater exposure of the insulator surface for dissipation of heat therefrom and also provide simplicity, convenience and economy in the assembly of the insulators and parts by which they are supported.

The principal objects of the invention are to provide improved open coil metal frame heaters of the type referred to; to provide an improved insulating support for open coil heaters; to facilitate the fastening of supports for insulators of open coil heaters to a supporting member; to form an insulating assembly for such heaters in a manner minimizing overheating of the coil, or hot spots, and also surface creepage of current at the places of insulated support thereof; these and other objects being accomplished as described more particularly hereinafter and as shown in the accompanying drawings in which:

FIG. 1 is a plan view of an open coil heater embodying the present invention;

FIG. 2 is an enlarged sectional view of a portion of the heater illustrated in FIG. 1, taken on the section line 2—2 of FIG. 1, and particularly illustrating one form of insulating support for a pair of coils;

FIG. 3 is a view taken on the line 3—3 of FIG. 2 and particularly illustrating the relation of an insulator to its supporting strap;

FIG. 4 is a plan view of a supporting strap, with portion broken away, used with the assembly illustrated in FIGS. 2 and 3;

FIG. 5 is a view of one end portion of a supporting strap similar to that of FIG. 4 but showing a modification thereof for fastening thereof to a companion strap;

FIG. 6 is an edge view of the strap portion of FIG. 5 showing the fastening tongue thereof bent outwardly therefrom;

FIG. 7 is a side view of a fragmentary portion of an insulator showing the fastening of companion straps thereon with the tongue fastener of FIGS. 5 and 6;

FIG. 8 is a plan view of a single strap which may be used for supporting a pair of insulators.

FIG. 9 shows a side view of a pair of insulators supported by the strap of FIG. 8;

FIG. 10 shows a single insulator modification of the mounting shown in FIG. 9;

FIG. 11 shows another form of single insulator mounting;

FIG. 12 is a sectional view taken on the line 12—12 of FIG. 11;

FIG. 13 is a side view of another form of single insulator mounting;

FIG. 14 is a side view of another plural insulator mounting which is applicable to a series of insulators;

FIG. 15 is a top view of the strap assembly of FIG. 14;

FIG. 16 is an assembly view of a heater support utilizing the principles of the invention as applied to a curvilinear supporting frame member; and

FIG. 17 illustrates a modified form of embrasure of the insulator by the divided portions of the strap.

With particular reference now to the drawings, and in the first instance to FIG. 1, the reference numeral 20 designates a supporting frame as a whole for coils 21 and 22 of an open coil resistance heating assembly. The frame 20 may include a pair of elongated metallic strips 23 which are rigidly secured at their opposite ends to transversely extending opposite end strips 25 and 26 respectively to provide laterally spaced supporting elements on which holders are mounted by which the coils of the heating resistance are supported.

One coil 21 may be longer than the other and supported as an outer coil on the frame, as shown herein, whereas the other coil 22 may be disposed inwardly of the outer coil and in the general position as illustrated in the drawings. It should be understood that the general disposition of the coils 21 and 22 is merely illustrative and other arrangements thereof may be employed. The ends of the coils 21 and 22 lead to terminals 74 which are mounted in insulators 75 extending through a terminal plate 27 which is attached to the frame 20.

In using this class of heater it is important to provide as much exposed area of the convolutions of the coil as possible for maximum heat transferring effect between the heating coils and the area or space being heated.

In accordance with the present invention the coils are supported at spaced intervals along their lengths by ceramic insulating bodies 28. These insulators have a generally tubular or cylindrical form, as is seen in FIGS. 1 and 3, and include an externally formed rib 29 extending circumferentially about the insulator near the center thereof by which the insulator is locked in encircling strap means, said rib also providing extra surface for dissipation of heat. These insulators have an open passage formed therein and extending longitudinally therethrough and this passage is preferably formed with opposite end portions of substantial length defined by outwardly flared or beveled encircling surfaces 30 with a narrow coil supporting surface 31 therebetween which is of a diameter to loosely support the coil and hold it out of contact with the flared or beveled surfaces 30. Surface 31 may have a width (taken longitudinally of the insulator) approximately the width of the rib 29 so that the thickest wall portion of the insulator occurs generally at the central portion thereof. Surface 31 accounts for only a minor portion of the length of the passage through the insulator and the flared portions 30 which are out of contact with the coil provide relatively long distances between the surface 31 and the ends of the insulator.

When supporting the insulators from the framework it is important to support them in such fashion that heat, which is transferred to the insulators during energization of the coils, is dissipated as efficiently as possible. The insulators are supported from the framework by supporting members or insulator holders designated generally at **32**, and which surround the external annular surface of the insulators so as to loosely confine the insulator in the supporting members. Each supporting member is formed with laterally spaced relatively narrow portions **33** and **34** which conform to and engage the periphery of the insulator at opposite sides respectively of the rib **29**, and these portions **33** and **34** may be applied flatwise around the insulator ends as shown in FIGS. 2 and 3 or may be turned up on edge as indicated **76** in FIG. 17 for edgewise contact with the insulator.

The supporting members **32** preferably are lengths of metallic strap stock which are split or divided longitudinally to provide narrow portions **33** and **34** separated by a slot **35** to receive the insulator rib **29** therebetween and in the structure of FIGS. 2 and 3 the supporting member **32** is made of a pair of split straps **37** and **38** such as shown in FIG. 4, each of which is split at longitudinally spaced places to provide at each plate a pair of laterally spaced portions **33** and **34** which are separated by a slot **35** and are correspondingly bent semi-circularly to cooperate with the oppositely bent semi-circular portions **33** and **34** of the other strap and conjointly embrace the insulators **28** therebetween, as shown in FIGS. 2 and 3.

Each strap has a short end portion **39** at each end thereof beyond the outer ends respectively of the slots **35**, each of which said end portions is bent outwardly for face to face engagement with the corresponding end portion **39** of the other strap and these end portions are secured together in such face to face relation, as shown in FIG. 2, as for example by welding, to fasten the straps around the insulators with the insulator ribs **29** in the slots **35** of the straps **37** and **38**.

Suitable portions of the lengths of the straps **37** and **38** are provided between the respective slots **35** thereof and shaped in conformity with one another to mate with one another in face to face relation to provide a composite bridging **40** between the insulator holding semi-circular portions thereof and are conjointly secured at their midlength to the members **23** of the supporting frame, as by a rivet **42** as in FIG. 2 in which the holder **32** is shown as attached to the strip **23**.

The composite bridging **40** preferably extends outwardly beyond the strip **23** at opposite sides thereof as shown in FIG. 2 and is bent upwardly as shown to hold the insulators **28** in an offset position at one side of the strip **23** or **24**, and the slots **35** extend sufficiently into the outer ends of the upturned portions of the bridging and also into the secured together ends **39** of the straps to provide clearance as shown at **36** to straddle the ribs **29**.

It is to be noted, particularly in FIG. 3, that the side portions **33** and **34** are relatively narrow and extend over a very narrow portion of the lengths of the insulator at opposite sides of the rib and leave the entire rib and most of the length of the insulator at opposite sides of the rib exposed for free access of air to the insulator surface for rapid dissipation of heat from the insulator, and to increase the surface exposure of the insulator to free access of air thereto the portions **33** and **34** may be arranged for edgewise engagement with the insulator by turning the portions **33** and **34** outwardly, for example as shown at **33a** and **34a** in FIG. 17.

The straps may be formed with integral tongues for fastening the two parts **37** and **38** together, or for making up insulator holders of other forms and bracing thereof on the strips **23** as hereinafter explained, such tongue fastening for the straps **37** and **38** being shown in FIG. 7.

For the tongue fastening of FIG. 7 the straps **37** and **38**, the stock between the side portions **33** and **34** of one of the straps, for example the strap **38**, is not entirely removed, but instead a tongue portion **41** is left therebetween at the outer end of each slot **35**, as shown in FIG. 5, which may be bent laterally therefrom, as indicated at **41a** in FIG. 6, and this tongue **41** is passed through the slot **35** of the other strap **37** at the outer end of the slot and bent outwardly over the end tab portion **39** of the strap **37**, as shown at **41b** in FIG. 7, to secure the straps **37** and **38** together at their outer ends around the insulators **28** in lieu of welding the strap ends together.

FIG. 9 illustrates another embodiment of the invention in which the supporting member for a pair of insulators **28** is formed from a single split strap **43** such as shown in FIG. 8. This single strap **43** is similar to the straps **37** and **38** of the FIG. 2 construction except that it has slots **44** and narrow portions **45** at opposite sides of the slots which are approximately twice the length of the slots **35** and side portions **33**, **34** of the FIG. 2 construction so as to extend entirely around the insulators **28**, and the slots **44** are provided with tongues **46** of the strap stock at the inner ends of the slots **44**. At their outer ends the slots **44** have tab ends **47** of the strap extending therebeyond.

The portion of the strap **43** between the inner ends of the slots **44** is secured centrally to one of the strips **23**, as by a rivet **48**, and has arm portions **49** extending divergently upward at the outer ends of which the portions **45** at opposite sides of the slot **44** are bent into circular form, as indicated in FIG. 9, to encircle the insulators **28** and straddle the rib **29** thereof.

For locking the portions **44** in the insulator confining circular form, the tab is bent radially from the circularly formed portions **45**, as indicated in FIG. 9, and the tongue **46** is passed downwardly through the slot **44** at the tab end thereof and bent back underneath the tab and the respective divergent arm **49** to clamp the tab **47** against the arm **49**, as shown in FIG. 2, and the tongues **46** may have end portions thereof bent downwardly against the opposite edges of the strip **23**, as indicated at **50** to prevent twisting of the insulator supporting member on the strip **23**.

The principles of the invention may also be applied to a single insulator supporting member, one form of which is shown in FIG. 10, in which a strap is formed at one end with a foot portion **51** for securement by a rivet **52** to a frame strip **23** or any other appropriate support therefor, and has an arm **53** extending angularly upward therefrom and provided with an insulator holding loop **54** at the outer end thereof.

The loop forming portion of the strap of FIG. 10 is slotted throughout its length, as in the FIG. 9 structure to accommodate therein the rib **29** of an insulator **28** and provide opposite side portions similar to the side portions **45** of FIG. 8 to encircle the insulator at opposite sides of the insulator rib **29**, the strip being provided at the outer end with an end tab portion **55** and a tongue **56** like the end tab **39** and tongue **41** of FIG. 5. The outer end portion of the strap of FIG. 10 is bent to lie underneath the angular arm **53** and the tongue **56** is passed through the slot at the inner end of the latter and folded down against the arm portion **53**, as shown in FIG. 10, to secure the loop around the insulator.

The foot portion **51** may be provided with an end portion **57** which projects beyond the lateral edge of the supporting strip and is bent downwardly thereagainst, as shown in FIG. 10, to prevent twisting of the insulator supporting member on the strip **23**.

In the event that the supporting member is of undue width or it is otherwise inappropriate to hold the supporting member against twisting in the manner illustrated

in FIG. 13, as for example when the support member is mounted on a wide strap or plate, such as indicated at **58** in FIGS. 11 and 12, the foot portion **51** may be provided at its end with a narrow downturned tongue and the strap or plate **58** provided with an aperture **60** into which the tongue **59** projects.

It is important that the support surround a sufficient peripheral distance of the insulator to adequately hold the insulator in the intended position. The straps may surround substantially the entire periphery as is illustrated in FIGS. 2, 9 and 10, or may, as illustrated in FIG. 13, surround only a major portion of the periphery thereby leaving a minor portion of the insulator completely exposed. In FIG. 13 a single strap **61** includes a medial portion **62** which is bent into a configuration conforming generally to the size and configuration of the insulator. The remaining ends of the strap may be bent away from the circular configuration thereof as indicated by the portions **63** and **64** and then bent at right angles thereto, as at **65** and **66**, so that the portions **65** and **66** overlap. The overlapped ends may be secured to a supporting frame member **67** as by means of a rivet **68** and the strap **66** may extend beyond the frame member and be bent downwardly, as at **69**, so as to bear against the side surface of the frame member **67**, thereby preventing turning movement of the strap on the frame member.

FIGS. 14 and 15 illustrate a further embodiment of the invention in which two or more insulators **28** may be mounted between straps in laterally spaced relation.

In this construction of FIGS. 14 and 15 two straps **70** and **71** are employed which are alike in the respect that each has correspondingly spaced apart semi-circular portions **72** to mate with the semi-circular portions of the other strap to confine the insulators therebetween, each of said semi-circular portions being slotted, as at **73**, and provided with opposite side portions **76** for engagement with the interposed insulator in the same manner as the opposed semi-circular portions **34** of FIG. 2 engage the insulators **28** for securing the insulators therebetween.

The straps **70** and **71** may be secured together in any desired manner, as for example by spot welding between the semi-circular portions thereof, but in accordance with the present invention it is preferable to fasten the straps **70** and **71** together with tongues formed from the strip stock such as employed in previously described embodiments of the invention.

Thus, as shown in FIGS. 14 and 15, one of the straps, for example, the strap **71** may be provided at one or both ends of its slots **73** with tongues **77** which are bent through the slots **73** of the other strap **70** and folded back over the portions of the strap between the slots thereof, as shown in FIGS. 14 and 15, and of course, if desired, some of the tongues **77** may be provided on one strap and the other tongues on the other strap so that the straps are alike as to the tongues, one having tongues at one side of each insulator and the other strap having tongues at the other side of each insulator, for fastening the straps together.

Each of the insulating assemblies shown and described herein provide relatively large heat dissipating exposed surface areas with relatively short insulators of tubular form. Each insulator provides a relatively small coil supporting area internally thereof with an exposed external rib positioned radially from the supporting area. Since heat will tend to build up most quickly in the coil supporting area, the use of the exposed rib in this position promotes heat transfer from the coil supporting region.

The split straps used in each assembly cooperate with the ribs of the insulators in holding the insulators against displacement and at the same time provide for maintaining the entire circumference of the rib exposed for effective heat transfer therefrom. In this connection it should be noted that the ends of the slots between the split portions of the straps are spaced from the periphery of the insulator ribs so as to promote air circulation and heat transfer.

By using the relatively narrow portions formed from the same material, the split portions are not only held together for strength in supporting the insulators, but also facilitate fastening of the straps, as by the use of the folded tongues of FIGS. 7, 9, 10 and 14.

The insulating supports shown and described herein lend themselves to any shape of coil and any shape of supporting framework. In FIG. 16, for example, a pair of supporting members of the form illustrated in FIG. 2 are shown affixed to a curvilinear supporting frame member **78** with the strap supports extending generally radially with respect to the center of curvature of the frame member **78**. The supporting framework may be formed into any desired shape or configuration and by using the individual supports herein shown and described, the coil will be positioned in a general pattern conforming to the general shape defined by the supporting framework.

While I have shown and described my invention in a preferred form, I am aware that various changes and modifications may be made therein without departing from the principles of the invention, the scope of which is to be determined by the appended claims.

What is claimed is:

1. An insulating support for elongated resistance coils of open coil heaters including a generally cylindrical insulating body having a central passage extending therethrough to provide for a relatively loose support of an elongated resistance coil of the open coil heater type, said insulating body having an externally formed heat dissipating rib extending circumferentially thereof adjacent the center thereof, and a metallic support for said insulating body, said support including laterally spaced relatively narrow portions passed around and conforming closely to the external surface of said insulating body, said portions being spaced on opposite sides of the rib of said body, said support including an offset attaching and securing arm, and said spaced portions being passed around a substantial distance of the periphery of said insulating body, the metallic support being a split strap with the split portions of the strap providing the said narrow portions and said strap having a securing tongue formed from the material of the strap between the split portions thereof at one end of the opening between said split portions and passed through the other end of the opening in the strap and folded over the body of the strap to secure the body to the strap.

2. An insulating support for elongated resistance coils of open coil heaters including a generally cylindrical insulating body having a central passage extending therethrough to provide for a relatively loose support of an elongated resistance coil of the open coil heater type, said insulating body having an externally formed heat dissipating rib extending circumferentially thereof adjacent the center thereof, and a metallic support for said insulating body, said support including laterally spaced relatively narrow portions passed around and conforming closely to the external surface of said insulating body, said portions being spaced on opposite sides of the rib of said body, said support including an offset attaching and securing arm, and said spaced portions being passed around a substantial distance of the periphery of said insulating body, said support being a pair of straps having curved portions cooperatively embracing the wall of said insulating body, said straps being split to provide said narrow portions, one end of each strap being offset to provide an attaching arm portion, the other end of each said strap being offset, one strap having a tongue bent from the material of the strap between said split portions and passed through the opening in the strap adjacent said second-named offset portion and folded thereagainst so as to secure the strap to the insulating body.

3. An open coil electric heater comprising an elongated

electrically energizable resistance coil having thereon a plurality of generally tubular electrical insulators through which the resistance coil extends, the insulators being spaced apart along the resistance coil with substantial portions of the length of the coil extending openly between the insulators, and electrically conductive coil supporting means having electrically conductive loops through which the coil extends with the spaced apart insulators thereon extending through and secured in the loops and electrically insulating the coil from the supporting means and the loops thereof, each loop having arcuate opposite side portions between which an insulator is interposed and each arcuate opposite side portion having a pair of laterally spaced correspondingly arcuate generally parallel strips defining therebetween a slot at one end of which the strips are outturned and interconnected and secured to interconnected ends of the strips of the other arcuate opposite side portion to confine the insulator between the arcuate opposite side portions, and the insulator being formed substantially centrally between the ends thereof with outwardly projecting portions therearound which project into the slots of both said arcuate portions.

4. An open coil electric heater as defined in claim 3 in which the outturned ends of each pair of strips have the slot ends therebetween and are in registering relation to one another.

5. An open coil electric heater comprising an elongated electrically energizable resistance coil having thereon a plurality of generally tubular electrical insulators through which the resistance coil extends, the insulators being spaced apart along the resistance coil with substantial portions of the length of the coil extending openly between the insulators, and electrically conductive coil supporting means having electrically conductive loops through which the coil extends with the spaced apart insulators thereon extending through and secured in the loops and electrically insulating the coil from the supporting means and the loops thereof, each loop having arcuate opposite side portions between which an insulator is interposed and each arcuate opposite side portion having a slot therein with a tongue at the end of the slot of one of the arcuate portions extending into the end of the slot of the other arcuate portion and providing a fastening of the arcuate portions to one another by which the insulator is secured therebetween.

6. An open coil electric heater comprising an elongated electrically energizable resistance coil having thereon a plurality of generally tubular electrical insulators through which the resistance coil extends, the insulators being spaced apart along the resistance coil with substantial portions of the length of the coil extending openly between the insulators, and electrically conductive coil supporting means having electrically conductive loops through which the coil extends with the spaced apart insulators thereon extending through and secured in the loops and electrically insulating the coil from the supporting means and the loops thereof, each loop having arcuate opposite side portions between which an insulator is interposed and each arcuate opposite side portion having a pair of laterally spaced correspondingly arcuate generally parallel strips defining therebetween a slot at one end of which the strips are outturned and interconnected to close the end of the slot, the slot of one of the arcuate portions having a tongue at the closed end thereof extending through the slot of the other arcuate portion and folded over the closed end thereof to fasten the arcuate portions together at the closed ends of their slots and confine the insulator therebetween.

7. An open coil electric heater comprising an elongated electrically energizable resistance coil having thereon a plurality of generally tubular electrical insulators through which the resistance coil extends, the insulators being spaced apart along the resistance coil with substantial portions of the length of the coil extending openly between the insulators, and electrically conductive coil supporting means having electrically conductive loops through which the coil extends with the spaced apart insulators thereon extending through and secured in the loops and electrically insulating the coil from the supporting means and the loops thereof, said loops being formed of elongated metal strips shaped to provide loops with opposite arcuate side portions between which an insulator is interposed, each arcuate side portion having a slot extending throughout the length of the arcuate side portion and the slot of one arcuate side portion having a closed end with a tongue at the closed end, and the slot of the opposite arcuate side portion having a closed end through which said tongue extends and is folded over therebeyond to fasten the opposed arcuate opposite sides together and clamp the insulator therebetween.

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