United States Patent

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[54] **ELECTRIC RESISTANCE HEATER WITH A TENSION COIL SPRING**
9 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **219/536,** 174/138, 219/377, 219/540, 338/280, 338/316, 219/347
[51] **Int. Cl.** **H05b 3/06**
[50] **Field of Search** ..... 219/530-—6, 540, 552—3, 377, 347—8; 338/316, 280; 174/138 (T); 339/17

[56] **References Cited**

UNITED STATES PATENTS

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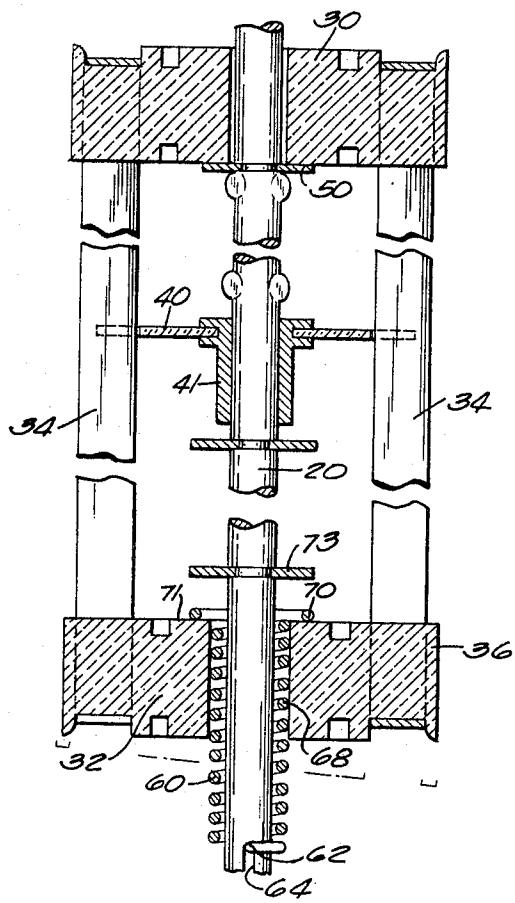
ABSTRACT: In an electric resistance heater having a heating element extended between spaced insulators, improved means for supporting the insulators at variably spaced distances to maintain nominal tightness in the heating element, including a support rod, and a coil spring secured at a first portion over the rod and having a second portion confined axially within an opening in one insulator operable thereby to bias the insulators apart.



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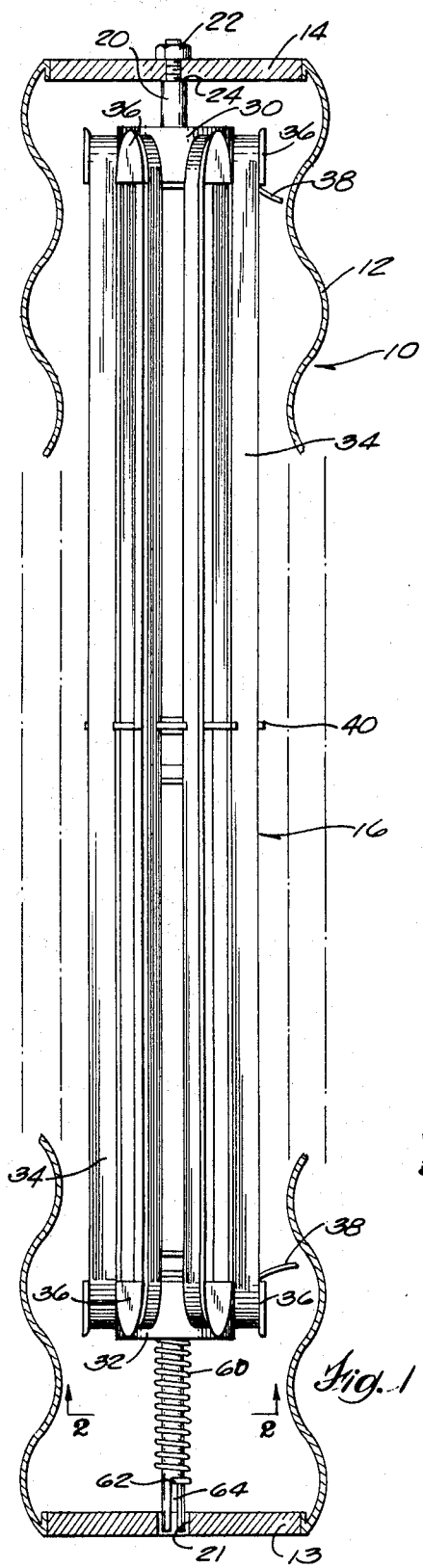

Fig. 1

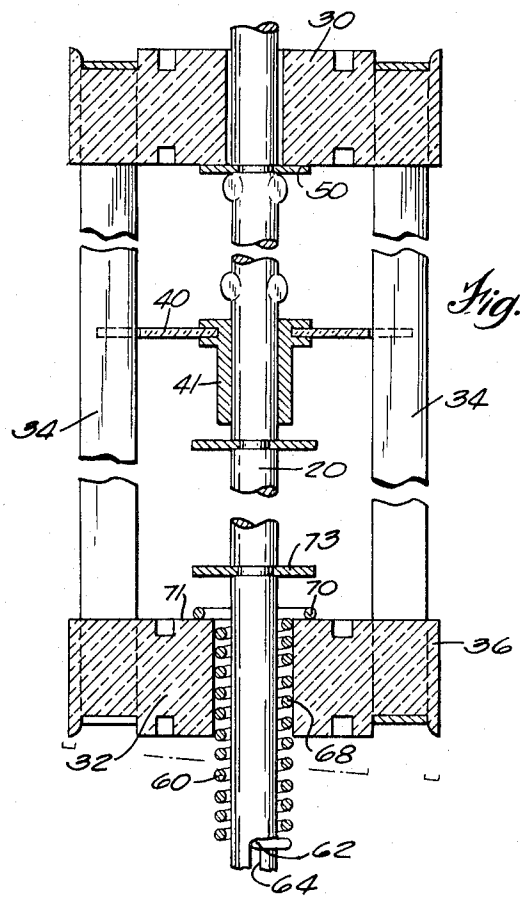

Fig. 3

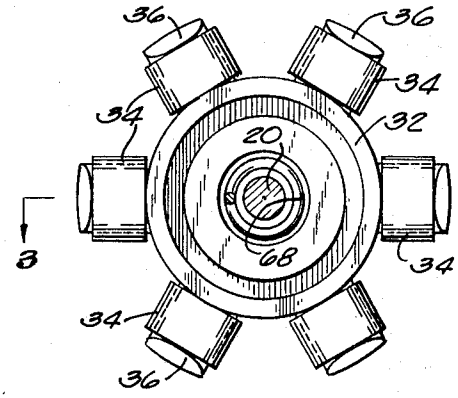

Fig. 2

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ELECTRIC RESISTANCE HEATER WITH A TENSION COIL SPRING

In typical electric resistant heaters, an elongated heating element is extended between insulators which are variably spaced to take up the normal thermal expansion and contraction of the heating element without undue sagging. One such insulator mounting structure is disclosed in the Murray Ireland, U.S. Pat. 2,986,594, issued May 3, 1961.

This invention represents an improvement over the Ireland construction in that it is more economical to fabricate and further provides more flexible support between the insulators to take up undue or uneven tensions in any one of different heating elements extended between the insulators.

Accordingly, a main object of this invention is to provide in an electric resistance heater an economical insulator support construction for maintaining a reasonable and uniform tightness in a heating element extended between spaced insulators even in the face of the normal thermal expansion and contraction of the heating element.

A more specific object of this invention is to provide an insulator support construction characterized by a coil spring which is supported to extend in line between the spaced insulators and which has a portion confined axially within an opening in one insulator for both supporting the one insulator and for urging it away from the other insulator.

These and other objects will be more fully understood after referring to the following specification and the accompanying drawing forming a part thereof, wherein:

FIG. 1 is a plan view of the reflector of an electric resistant heater, and showing associated therewith a preferred embodiment of a heating element and its support according to the subject invention;

FIG. 2 is an enlarged view as seen generally from line 2–2 in FIG. 1; and

FIG. 3 is a sectional view as seen generally from line 3–3 of FIG. 2.

Referring now to FIG. 1, a heater 10 is shown having a case with a curved reflector 12 and forwardly extended opposing end walls 13 and 14. A heater element 16 is supported from the end walls along the focal axis of the reflector 12 as is typical in the art. The case is shown only in its most basic fashion since such structure is immaterial to the heating element support according to this invention.

In this regard, a support rod 20 fits through an opening 21 in end wall 13 and is held in place by nut 22 drawing shoulder 24 against the end wall 14. Spaced insulators 30 and 32 are supported on the rod and an elongated electric resistant heating element 34 is looped around radial ears 36 between the insulators. The insulators are of ceramic typically and are quite brittle, and the heating element typically is a nichrome ribbon. Appropriate leads 38 from the ends of the heating element are provided for external connection (not shown) to a source of electric power. An insulating spacer 40 of mica is supported by bushing 41 on the rod between the insulators, the spacer having an open slot for each loop of the heating element to maintain it separated from all others.

As shown, one insulator 30 has an inner throughbore that is fitted over the rod and held axially in place thereon against a washer 50 which in turn is restrained against ears swagged from the rod. The other insulator 32 is supported on the rod at the proper spacing from the insulator 30 so that the heating element is generally tight or at least not sagging in the cool nonoperating condition. It will be appreciated that upon the heating element being energized, it is heated and thereby expanded. The distances between the insulators thus must be increased to preclude undue sagging and possible shorting contact of the heating element.

The subject invention provides an improved mounting means for the insulator 32 which operates to maintain a reasonably uniform continuous tightness in the extended heating element. A coil spring 60 has one end tab 62 received within end slot 64 in the support rod and is of sufficient inside coil diameter to fit over the support rod with nominal clearance. The insulator 32 has an inner throughbore which is

generally complementary to the underlying portion 68 of the spring 60. This cooperating fit discourages lateral movement but permits rotation of the insulator relative to the bearing spring portion 68. The underlying spring portion 68 on the other hand is sufficiently large to fit loosely on the support rod. The few end turns 70 of the spring has a larger coil diameter and engages outer face 71 of the insulator to confine the insulator axially of the bearing portion 68 at least in the direction toward the insulator 30.

The coil spring is designed to impose a nominal tension on the cool nonoperating heating element sufficient to preclude the element from contacting and shorting out against itself or adjacent heater structure. Further, the spring has sufficient deflectable contraction to separate the insulators as required to prevent undue sagging of the hot operating heating element.

Inasmuch as the bearing area 68 of the spring directly beneath the insulator does not contact the support rod itself, it can in effect be deflected relative to the rod because of its own resiliency to cant the insulator 32 at an angle other than 90° relative to the support rod. This canting accommodates possible misalignment of the insulators as might occur when the heating element is initially wound between the insulators or upon differential expansion of opposite loops of the heating element. This minimizes undue local tension in the heating element or strain on the ears of the insulators. Moreover, the floating support of the insulator and thus the heating element minimizes impact type damage frequently encountered in normal use of the heater.

A snap ring 73 fit within a recess on the rod at a position normally spaced from the insulator 32 even when the heating element is cool and contracted. This ring, with an interposed spacer in an assembly jig (not shown), acts as a locator for the floating insulator 32 during the winding of the heating element about the spaced insulators. The spring 60 exerts the nominal required force against the heating element after removal of the assembly from the jig.

While the particular device shows a tension coil spring that surrounds the support rod, it will be obvious that changes in this arrangement are possible. For example, the spring could be a compression spring and the bearing portion of the spring underlying the insulator could in fact even extend beyond the support rod. Moreover, the cooperation between the spring bearing 68 and insulator 32 might be loose, although such is not preferred.

I claim:

1. In an electric resistance heater having a pair of spaced insulators and a heating element extended therebetween, the combination of means for supporting the insulators in variably spaced relation operable automatically to accommodate normal thermal expansion and contraction of the heating element without incurring undue heating element sagging, said supporting means comprising a coil spring, means holding a first spring portion relative to the other insulator and with its longitudinal axis extended between the insulators, one of the insulators having an opening larger than the outer coil diameter of a second spring portion and receiving said second spring portion, cooperating means between the one insulator and spring axially confining the insulator on the second spring portion and precluding movement relative thereto toward the other insulator, said spring being operable thereby to bias the insulators apart, with a force sufficient to remove undue sag in the heating element and having sufficient deflective capacity to accommodate the heating element thermal expansion and contraction.

2. An electric resistance heater combination according to claim 1, wherein the one insulator opening is generally complementary to the first spring portion outer coil diameter operable to minimize lateral movement of the one insulator relative to the first spring portion.

3. In an electric resistance heater having a pair of spaced insulators and a heating element extended therebetween, the combination of means for supporting the insulators in variably

spaced relation operable automatically to accommodate normal thermal expansion and contraction of the heating element without incurring undue heating element sagging, said supporting means comprising an elongated rod and a coil spring disposed annularly over the rod, means holding a first spring portion relative to the rod, one of the insulators having an opening generally complementary to the outer coil diameter of a second spring portion and receiving said second spring portion, cooperating means between the one insulator and spring axially confining the insulator on the second spring portion and precluding movement relative thereto toward the other insulator, operable thereby to bias the insulators apart to remove undue sag in the heating element.

4. An electric resistance heater combination according to claim 3, wherein said cooperating means includes an enlarged coil section of the spring disposed against a lateral face of the one insulator.

5. An electric resistance heater combination according to claim 3, wherein the inner coil diameter of the second spring portion is significantly larger than the rod to permit limited lateral movement and canting of the one insulator relative to the rod.

6. An electric resistance heater combination according to claim 3, wherein the coil spring is a tension spring, and wherein the holding means is located along the rod on the side of one insulator remote from the other insulator.

7. An electric resistance heater combination according to claim 6, wherein the insulator opening is completely through the one insulator, and wherein the spring extends completely through the one insulator through opening.

8. An electric resistance heater combination according to claim 7, wherein said cooperating means includes an enlarged coil section of the spring disposed against a lateral face of the one insulator that faces the other insulator.

9. An electric resistance heater combination according to claim 8, wherein the inner coil diameter of the second spring portion is significantly larger than the rod to permit limited lateral movement and canting of the one insulator relative to the rod.