June 9, 1942. J. W. HARRISON 2,286,090

HEATING UNIT

Filed May 31, 1940

Fig. 1.

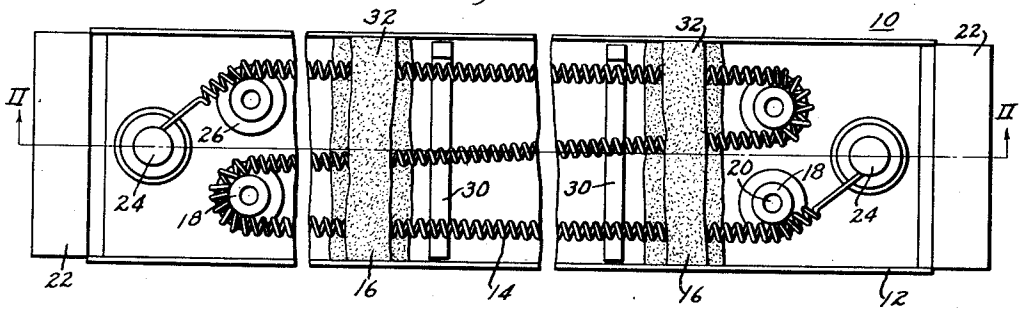


Fig. 2.

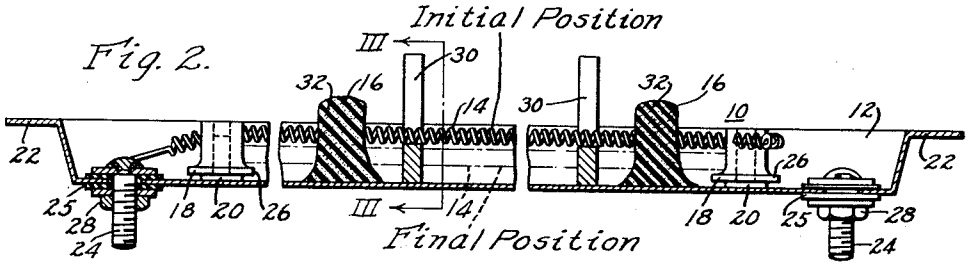


Fig. 3.

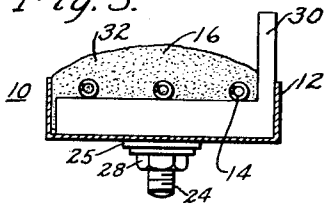


Fig. 4.

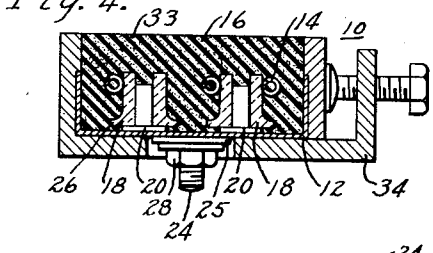


Fig. 5.

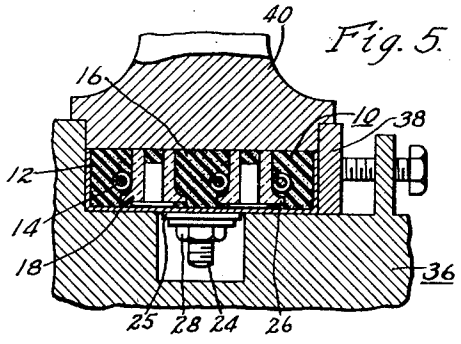


Fig. 6.

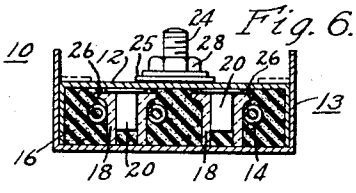
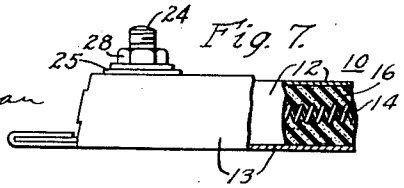


Fig. 7.



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HEATING UNIT

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Application May 31, 1940, Serial No. 338,091

5 Claims. (Cl. 201—67)

My invention relates to heating units and more particularly to a method of making a metal-encased strip heater.

An object of my invention is to provide a rugged, inexpensive metal-encased or sheathed strip type heating unit which has a compressed insulating medium for retaining an electrical resistor and insulating it from the sheath or casing.

A further object of my invention is to provide a simple method of making an elongated metal-encased heating unit.

Still another object of my invention is to provide a method of making a heating unit by utilizing an insulating material which may be positioned about the electrical resistor of such unit so as to retain it in a given position prior to the completion of the unit and for insulating the resistor and retaining it in a second predetermined position after completing the unit.

Other objects of my invention will either be pointed out specifically in the course of the following description of my invention, or will be apparent from such description.

In the accompanying drawing:

Figure 1 is a top plan view of a portion of the device embodying my invention and one step of the process of manufacture thereof,

Fig. 2 is a sectional view taken along the line II—II of Fig. 1,

Fig. 3 is a sectional view taken along the line III—III of Fig. 2,

Fig. 4 is a sectional view illustrating the device shown in Figs. 1 and 2 mounted within a filling jig,

Fig. 5 is a view similar to Fig. 4 illustrating the device after being compressed,

Fig. 6 is a sectional view of the heating unit embodying my invention, and

Fig. 7 is a partial side elevational view of the unit embodying my invention.

Referring to the acompanying drawing, in which like reference characters indicate like parts in the several figures, I show a heating unit **10** comprising an inner partial sheath or gib **12**, an outer partial sheath or casing **13**, an electrical resistor or heating element **14**, insulating material **16** for positioning and insulating the electrical resistor **14** from the gib and outer casing **13** and suitable insulating members **18** attached to the gib **12** by means of rivets **20**. The gib **12** and casing **13** are, in this instance, formed of light sheet metal such as steel, or the like, so as to mechanically support and protect the heating unit embodying my invention.

The gib **12** is formed into substantially an elongated dish or channel-shaped member having upstanding sides and end portions and outwardly extending lips or ledges **22** at either end thereof. The lips or ledges **22** are extended outwardly in order to rigidly attach the heating unit **10** to any desired supporting structure, in a well known manner.

The casing **13** is, in this instance, an elongated metallic channel like member which is adapted to receive the filled gib and to be bent over tightly thereagainst to form a complete metallic sheath for the heating unit **10**, as hereinafter described.

The electrical resistor **14** is, in this instance, an elongated helically wound resistor which is adapted to be wound back and forth within the gib **12**. Suitable terminals **24** insulated from the sheath, are rigidly attached to the free ends of the resistor **14** to provide means for electrically associating the resistor with a suitable power supply (not shown). The terminals **24** are rigidly attached to the free ends of the resistor by having the upper ends thereof riveted tightly over against the ends of such resistor (see Fig. 2). The terminals **24** are adapted to pass through and to be insulated from the lower surface of the gib **12** by means of suitable insulating members **25** in a well known manner. It is to be understood that any other desired terminals may be used in lieu of the terminals **24**, and that such terminals may be rigidly attached to the free ends of the resistor **14** in any desired manner.

The insulating material **16** is preferably initially formed of a mixture comprising magnesium oxide suspended in volatile alcohol. Such insulating material is not only a good electrical insulator but is also a good heat conductor. The suspended insuating material is of a consistency similar to that of suitable pancake batter so as to be capable of being poured into the gib, and if desired to be formed into suitable ridges, as hereinafter described. The alcohol suspension of the insulating mixture is very porous as it dries and must be compressed before the heater is finally completed, as hereinafter described.

Because of the compacting of the insulating material **16**, it is necessary to locate the heating resistor **14** at a greater distance from the lower surface of the gib during the pouring operation than it will occupy in the finished heater. This position of the heating element is necessary because in the pressing or compacting operation the thickness of the insulating mass is reduced from ⅓ to ½ of its original cast or poured thickness, as hereinafter described. It is to be understood that any other suitable insulating material

may be used in place of the preferred insulating material.

Suitable grommet or eyelet-like insulating members 18 are formed of a ceramic insulating material for positioning and retaining the electrical resistor in the desired position within the gib 12. The grommets 18 are preferably formed in a cylindrical manner with a lower outwardly extending lip 26 thereon for restricting the downward movement of the electrical resistor along the outer surface thereof.

Suitable mounting members such as flat headed rivets 20 are spot welded or rigidly attached to the inner surface of the gib 12 at the points where it is desired to have the insulating members 18. In this case the rivets are placed at the corners of an imaginary rectangle, although other arrangements may be employed. The rivets are of such diameter as to permit the insulating members to closely fit thereover. It, therefore, follows that the insulating members 18 are mounted on the gib or housing 12 by means of the rivet-like members rigidly attached to the inner surface thereof.

When assembling the heating unit embodying my invention, the casing 13, gib 12, terminals 24, resistor 14, and the insulating material 16 are manufactured or formed in the usual manner as individual items. The terminals 24 are rigidly attached to the free ends of the resistors 14 prior to their positioning or attachment to the gib 12. The rivets 20 are spot welded or rigidly attached to the inner surface of the gib 12 at the predetermined points thereon. The insulating members 18 are then positioned over the rivets 20, whereupon the resistor 14 may be wound about the corresponding insulating members 18 with the terminals 24 thereof rigidly attached to the gib 12, say by nuts 28 (see Figs. 1 and 2). The resistor 14 is positioned about the upper portion of the insulators 18 and is maintained in such position by means of the tension within the resistor itself.

Suitable preferably metallic members (two being shown), spacing bars or tools 30 are positioned beneath the resistor 14 at spaced points so as to rest upon the inner surface of the gib 12 and to space the resistor 14 the desired amount above such surface. A small portion of the insulating material 16, somewhat stiffer than the regular insulating material, may then be poured into and relatively close to each tool 30 and between the insulating members 18, and formed into one or more relatively narrow upstanding partitions 32, see Figs. 2 and 3. The alcohol or volatile material within the insulating material than evaporates from the partitions 32 leaving porous solid insulating masses which retain the resistor 14 in its predetermined upper or preliminary position (see dark lines, Fig. 2), whereupon the spacing tools 30 may be removed from under the resistor 14.

The gib 12 including the resistor 14 and insulating portions 32, is positioned within a suitable jig 34 (Fig. 4) which is adapted to retain the gib and permit the remainder of the insulating material 16 to be flowed or poured therein up to the top of the jig. In accordance with a familiar practice, a suitable vibrating device (not shown) may be attached to the jig 34 and operated as the insulating material 16 is poured into the gib 12 and jig 34. This aids in the distribution of the insulation material and insures that such material will be uniformly distributed throughout the gib 12.

After positioning the insulating material to this height within the jig 34 and levelling it off, the alcohol within such material is permitted to evaporate either by normal drying, or by artificial drying within a suitable oven, for example. Upon the removal of the volatile alcohol suspension material, the jig 34 may be removed from the gib 12, leaving an upstanding mass 33, rectangular-sectioned, of insulating material with the resistor in its upper position within and above the gib 12.

Such gib and insulating mass may then be positioned upon a suitable press illustrated as a press 36, including necessary guide members 38. The movable portion 40 of the press 36 is then lowered so as to completely compact or compress the insulating material 16 in a single operation. With the compacting or compressing of the insulating material 16, the resistor 14 is moved downwardly along the sides of the insulating grommets 18 to the predetermined midpoint or final position.

The upper or preliminary position of the resistor 14 is illustrated by means of the solid lines in Fig. 2 and the final position of the resistor is illustrated by means of dotted lines in such figure. The upper position of resistor 14 is further illustrated in Figs. 3 and 4, while the lower position of such resistor is illustrated in Figs. 5, 6 and 7.

The gib 12 including the compacted insulating material and the centrally located resistor 14 may then be removed from the press 36 whereupon such partially completed heating unit may be turned over and positioned within the channel shaped casing 13 (see Fig. 6). The terminals 24 of the heating unit will then be located in an upright position. The sides of the channel shaped casing 13 are adapted to extend above the top portion of the gib 12. These upwardly extending side portions of the casing 12 are formed inwardly and tight against the upper face of the gib 12 (see dotted lines in Fig. 6). In this manner a compact rigid heating unit is provided with the electrical resistor thereof centrally located and positioned about the ceramic insulating members and insulated from the gib and casing by means of a compact homogeneous insulating mass.

I have found that the forming of the upwardly extending side portions of the casing 13 inwardly and tightly against the upper portion of the gib 12, need not in any manner further compress the insulating material 16, as this material was previously compressed sufficiently in the press 36. The casing 13 is, therefore, bent over the gib 12 only tightly enough to properly hold the parts in the desired final position.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

I claim as my invention:

1. The method of making a heating unit having a metallic sheath member which comprises mounting insulating members within said sheath member, winding an electrical resistor about the insulating members, placing spacer means beneath the resistor intermediate certain of said insulating members for positioning the resistor a predetermined distance from one part of said sheath member, and placing an insulating ma-

terial about the resistor and within the sheath member for retaining the resistor in position and for insulating it from the housing.

2. The method of making a heating unit having a metallic sheath member which comprises attaching rivets to the inner surface thereof, placing insulating grommets about said rivets, winding an electrical resistor having terminals attached thereto about the grommets and attaching the terminals to the sheath member, placing a spacer bar beneath the resistor intermediate the grommets for retaining the central portion of the resistor a predetermined distance above the bottom of the sheath member, placing a small strip of insulating material about the resistor to retain it in such predetermined position, removing the spacer bar, and filling the sheath member with insulating material for retaining the resistor in its predetermined position therewithin and for electrically insulating said resistor therefrom.

3. The method of making a heating unit having a sheath member and an electrical resistor which comprises positioning insulating members within the sheath, initially positioning the resistor about such insulating members to one side of its final operating position, overfilling the sheath member with an insulating material, and compressing such material so as to form a solid homogeneous mass and to slide the resistor at substantially right angles to its length along the surface of the insulating members from its initial to its final operating postion.

4. The method of making a heating unit having a metallic sheath member which comprises attaching mounting members to the inner surface thereof, placing insulating members about said mounting members, winding an electrical resistor about the insulating members, placing spacer means in engagement with the resistor intermediate certain of the insulating members for positioning the resistor a predetermined distance from one part of said sheath member, placing insulating material in engagement with the resistor to retain it in such position, removing the spacer means and filling the sheath member with insulating material.

5. The method of making a heating unit having a sheath member and an electrical resistor which comprises positioning insulating members within the sheath with their axes extending in a predetermined direction, initially positioning the resistor about such insulating members in a direction at substantially right angles to said axes, said resistor being located to one side of its final operating position, overfilling the sheath member with an insulating material, and compressing such material to slide the resistor substantially parallel to said axes along the surface of the insulating members from its initial to its final operating position.

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