July 31, 1928.

1,678,838

E. L. WIEGAND

HEAVY DUTY ELECTRIC HEATER

Filed July 31, 1925

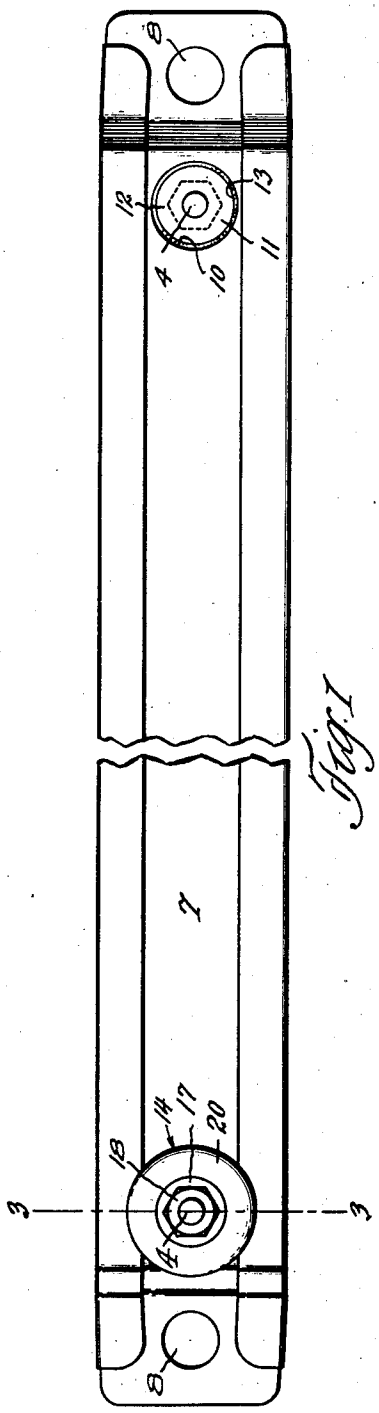


Fig. 1

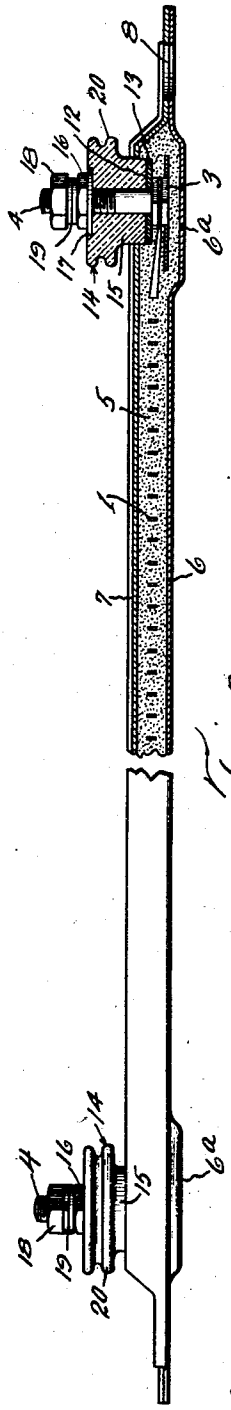


Fig. 2

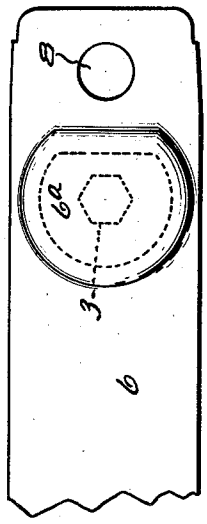


Fig. 4

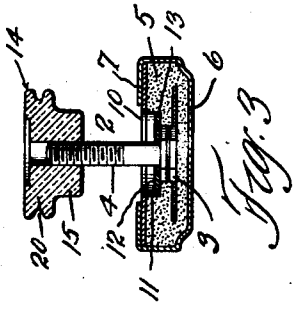


Fig. 3

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Patented July 31, 1928. 1,678,838

UNITED STATES PATENT OFFICE.

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HEAVY-DUTY ELECTRIC HEATER.

Application filed July 31, 1925. Serial No. 47,223.

This invention relates generally to the class of sheathed electrical heating elements which, in brief, consist of a resistor provided with terminals and enveloped in a mass or body of suitable embedding material that is encased in a metal sheath having apertures for the accommodation of the terminals, examples of such heaters being found in my former applications Serial Nos. 660,294 and 697,446, filed, respectively, August 31, 1923, and March 7, 1924, the latter application being a division of the former and restricted to an electrical heating element of the strip type, known as an electric strip heater.

The present invention has to do more particularly with an improved means of insulating the terminals of heaters of the above mentioned class, the same being peculiarly adapted for use in heavy duty strip heaters employed for car heating or other purposes where the heaters are energized from high voltage power sources running anywhere from 500 to 1500 volts. In such cases as this it is necessary to provide very effective insulation to guard against short circuiting which may result from a breakdown of the insulation or an accumulation of foreign matter or moisture between the terminals and the metal sheath of the heater.

The fundamental purpose of the invention is to provide, in electric heaters of the class referred to, an extra long path between the exposed end of the binding post or terminal and the sheath or casing of the heater. More specifically, to provide a sheathed heater having a comparatively large opening in the sheath through which the binding post or terminal protrudes and which is countersunk about the post or terminal for a material depth below the plane of the sheath and within the body of refractory material that is encased by the sheath, and, preferably, to apply to the binding post or terminal a high voltage insulator of suitable design having a part extending into the opening and seating upon the refractory material or upon an insulating washer applied thereto, to the end that the path of possible electrical transmission between the binding post or terminal and the sheath or casing is considerably lengthened. Preferably, the part of the high voltage insulator which extends through the opening in the sheath closes said opening to the exclusion of foreign substances, or moisture, and the sealing of the opening may be rendered more effective by a deposit of suitable cement. Outwardly beyond the opening in the sheath, the insulator may be provided with an enlargement designed to increase the effective distance between the sheath and the exposed end of the binding post or terminal along the surface of the insulator.

An embodiment of the invention by which the foregoing objects, with others hereinafter appearing, are attained is illustrated in the drawing accompanying and forming a part hereof and wherein Fig. 1 is a plan view of an electric strip heater embodying the invention, the insulator having been removed from the terminal appearing at the right hand end of the view; Fig. 2 is a side elevation of the heater, broken away intermediate its ends, as in Fig. 1, for the purpose of permitting a larger scale drawing, the right hand end of the heater being shown in central vertical section; Fig. 3 is a section through the heater on the line 3—3 of Fig. 1, the insulator being shown as partially withdrawn from the terminal; and Fig. 4 is a bottom plan view of one end of the heater.

As already stated, the present invention is peculiarly suited for use in connection with heavy duty strip heaters of the kind employed for car heating, and for this reason I have elected to show the invention in such environment. It is not to be assumed from this, however, that the invention is not of more general application. It is just as well adapted to other types of electrical heaters, several examples of other styles being found in the first of the above mentioned applications.

Referring to the various parts by reference characters, 1 designates a resistor which preferably, but not necessarily, consists of a suitable metallic ribbon or flat wire that is desirably bent into sinuous form. To each end of the resistor is connected a terminal designated generally by the reference character 2 and consisting, in the present instance, of a body portion or base 3 and a binding post 4. This terminal is preferably similar to that disclosed in my co-pending application Serial No. 701,318, filed March 24, 1924. The resistor 1 and the inner ends or body portions of the terminals 2 are completely enveloped in a highly compacted body or mass 5 of refractory, electrical insulating, heat conducting material which

not only supports the resistor at all points due to its intimate contact therewith but also prevents oxidation of the resistor. This refractory material may be of any substance suited to the purpose, such as aluminum or magnesium oxid or zirconium silicate.

The body or mass 5 of refractory material is encased within a metal sheath that is shown as composed of a channel like casing member 6 and a cover 7. The cover lies upon the top of the body or mass 5 of refractory material, while the casing member 6 extends beneath and up the sides of said body and has its edges flanged over the edge portions of the cover 7. Beyond the ends of the body of refractory material the cover 7 is extended downwardly and thence outwardly in contact with the extreme end portions of the bottom wall of the casing member 7 and these superposed parts are provided with perforations 8 for the accommodation of means for attaching the heater to a suitable support (not shown), preferably constituting a secondary insulation means. It may be explained that the unit is desirably compressed after being constructed as above set forth to bring all engaging parts into firm contact. In order to accommodate the requisite amount of refractory insulating material beneath the terminals, the bottom wall of the casing member 6 is depressed throughout areas somewhat larger than the bases of the terminals, as indicated at 6^a.

Relatively large openings 10 are provided in the cover 7 to accommodate the binding posts 4, and a recess 11 of substantial depth is made in the body or mass of refractory material 5 beneath each of said openings, the opening and recess being shown as circular and of the same size and in perfect register. An insulating washer 12 of mica or the like is preferably, but not necessarily, placed within the bottom of each recess 11 and a deposit 13 of suitable sealing cement may be filled in about the washer.

Applied to each of the binding posts 4 is a high voltage insulator 14 having a neck 15 that extends through the opening 10 and fits within the recess 11, said neck being preferably of a size to comfortably fill the opening 10 and thus close it against the entrance of moisture or other foreign substance. The binding post 4 is threaded for the application of a nut 16 by means of which the insulator may be very firmly drawn down against the bottom of the recess or, in the present instance, more accurately speaking, against the washer 12. A metallic washer 17 is shown as interposed between the nut 16 and the adjacent end of the insulator, the insulator having a depression for the accommodation of said washer. The outer ends of the binding posts may be treated in any suitable manner for the attachment of electrical conductors, in the present case nuts and washers 18 and 19, respectively, being shown applied to the ends of the binding posts for this purpose. To further guard against the high voltage current that is used in heaters of this particular class, as hereinbefore explained, from passing from the portions of the sheath adjacent the openings 10, through any conductive matter which may have accumulated upon the insulator, to the exposed parts of the binding posts, the insulators are formed with enlargements 20 that are shown as grooved or corrugated circumferentially to increase the distance along the surface of the insulators between the sheath and the binding posts.

While the highest efficiency is realized only through the use of practically all of the insulating elements included in the above described terminal assembly, marked advantages over the prevailing practice ensue from the simple construction of a sheathed unit having, in the sheath, a relatively large opening through which access to the terminal may be had, and wherein a recess of material depth is formed in the refractory material surrounding the terminal, thereby to increase the path of possible electrical transmission between the terminal and the sheath.

Having thus described my invention, what I claim is:—

1. In an electric heater, the combination of a resistor, a terminal comprising a body portion to which the resistor is connected, a body of refractory, electrical insulating, heat conducting material enveloping said resistor and the body portion of the terminal, and a thin metal sheath encasing said body of material and having opposed walls one of which is provided with a relatively large opening through which a part of the terminal is exposed, while the other wall has a depressed portion to accommodate the refractory material underlying the body portion of the terminal, said body of material having a recess surrounding the terminal and registering with the aforesaid opening.

2. In an electric heater, the combination of a resistor, a terminal extending from the resistor, a body of refractory, electrical insulating, heat conducting material enveloping the resistor and a part of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the terminal is exposed, and the body of material having a cavity surrounding the terminal and registering with said opening, and a washer of insulating material surrounding the terminal and occupying the bottom of the cavity.

3. In an electric heater, the combination of a resistor, a terminal extending from the resistor, a body of refractory, electrical

insulating, heat conducting material enveloping the resistor and a part of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the terminal is exposed, and the body of material having a cavity surrounding the terminal and registering with said opening, a washer of insulating material surrounding the terminal and occupying the bottom of the cavity, and a deposit of sealing cement about said washer.

4. In an electric heater, the combination of a resistor, a terminal extending from the resistor, a body of refractory, electrical insulating, heat conducting material enveloping the resistor and a part of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the terminal is exposed, and the body of material having a cavity surrounding the terminal and registering with said opening, a washer of insulating material surrounding the terminal and occupying the bottom of the cavity, and an insulator extending through said opening and having a part occupying said cavity and surrounding the terminal, the inner end of said insulator engaging said washer.

5. In an electric heater, the combination of a resistor, a terminal extending from the resistor, a body of refractory, electrical insulating, heat conducting material enveloping the resistor and a part of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the terminal is exposed, and the body of material having a cavity surrounding the terminal and registering with said opening, a washer of insulating material surrounding the terminal and occupying the bottom of the cavity, a deposit of sealing cement about said washer, and an insulator extending through said opening and having a part occupying said cavity and surrounding the terminal, the inner end of said insulator engaging said washer.

6. In an electric heater, the combination of a resistor, a terminal comprising a base and a binding post extending from said base, the resistor having connection with said base, a body of refractory, electrical insulating, heat conducting material enveloping the resistor and the base of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the binding post extends and the body of material having a recess surrounding the binding post and registering with said opening, said body serving to rigidly support the terminal with its binding post spaced from the surrounding material of the sheath, a tubular insulator removably applied to the binding post and having a neck occupying the opening and the recess, and means applied to the binding post for maintaining the insulator in position thereon.

7. In an electric heater, the combination of a resistor, a terminal comprising a base and a binding post extending from said base, the resistor having connection with said base, a body of refractory, electrical insulating, heat conducting material enveloping the resistor and the base of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the binding post extends and the body of material having a recess surrounding the binding post and registering with said opening, a washer of insulating material set within the bottom of said recess adjacent the base of said terminal, a tubular insulator applied to the binding post and having a neck occupying the opening and the recess, and means applied to the binding post for maintaining the insulator in position with its inner end pressed against the aforesaid washer.

8. In an electric heater, the combination of a resistor, a terminal comprising a base and a binding post extending from the base, the resistor having connection with said base, a body of refractory, electrical insulating, heat conducting material enveloping the resistor and the base of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the binding post extends, and the body of material having a recess surrounding the binding post and registering with said opening, a high voltage insulator applied to the binding post, said insulator having an enlarged outer end and a neck extending inwardly therefrom which fits within the aforesaid opening and within the recess in the said body of material, and means applied to the outer end of the binding post for securing the insulator in place.

9. In an electric heater, the combination of a resistor, a terminal comprising a base and a binding post extending from the base, the resistor having connection with said base, a body of refractory, electrical insulating, heat conducting material enveloping the resistor and the base of the terminal, a metal sheath encasing said body of material, the sheath having a relatively large opening through which the binding post extends, a high voltage insulator applied to the binding post, said insulator having an enlarged outer end and a neck fitting within the opening in the sheath, and means applied to the outer end of the binding post for securing the insulator in place.

10. In an electric heater, the combination of a resistor, a terminal comprising a body portion to which the resistor is connected, a

body of refractory, electrical insulating, heat conducting material enveloping said resistor and the body portion of the terminal, and a thin metal sheath encasing said body of material and having a relatively large opening in one of its walls through which a part of the terminal is exposed, there being a layer of the aforesaid insulating material of substantial thickness between the body portion of the terminal and the wall of the sheath opposed to the one having the opening, said body of material being formed with a recess surrounding the terminal and registering with the said opening.

In testimony whereof, I hereunto affix my signature.

E. L. WIEGAND.