Jan. 31, 1928. 1,657,479

F. MacFARLAND

ELECTRIC HEATING DEVICE

Filed Dec. 2, 1922 2 Sheets-Sheet 1

Fig. 1.

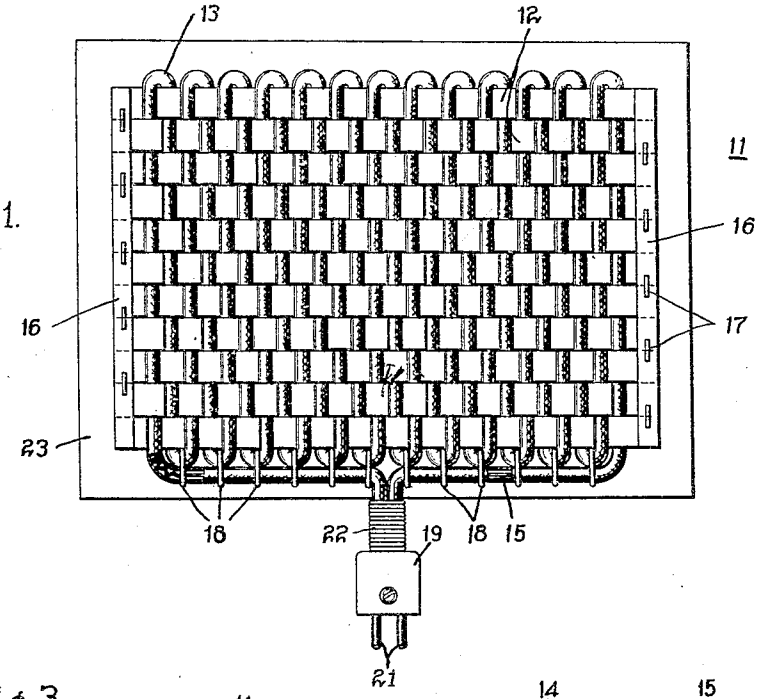


Fig. 3.

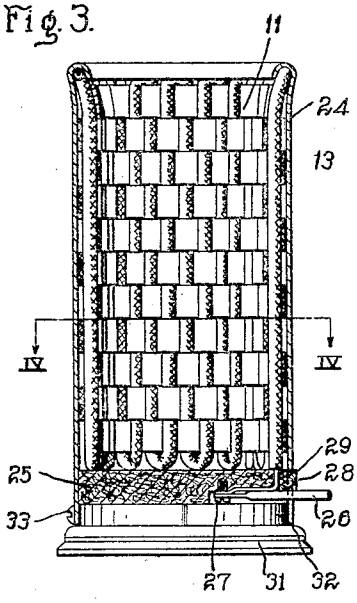
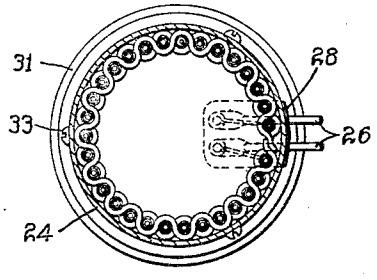




Fig. 2.

Fig. 4.



WITNESSES:

H. B. Funk

C. N. Cochran

INVENTOR

Florence Mac Farland

BY

H. M. Biebel

ATTORNEY

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F. MacFARLAND

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Fig. 5.

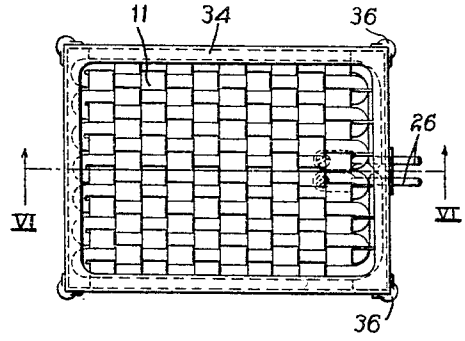
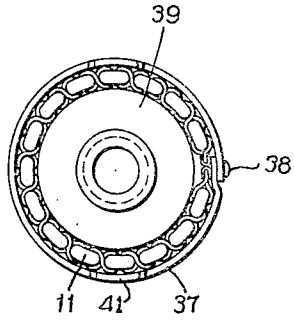


Fig. 8.



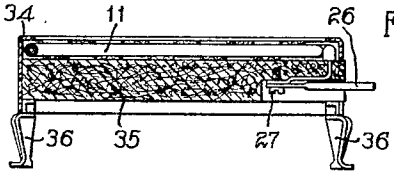
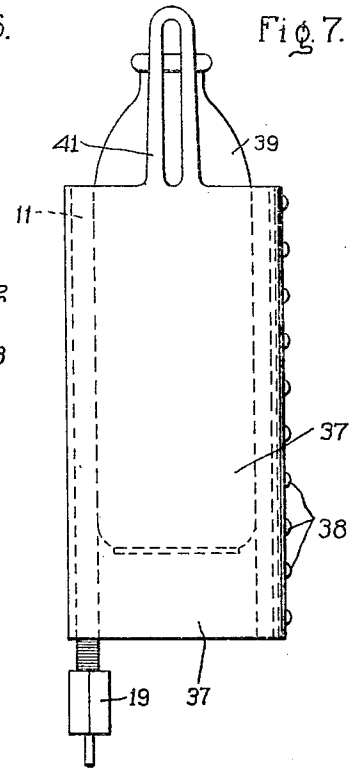


Fig. 6.

Fig. 7.



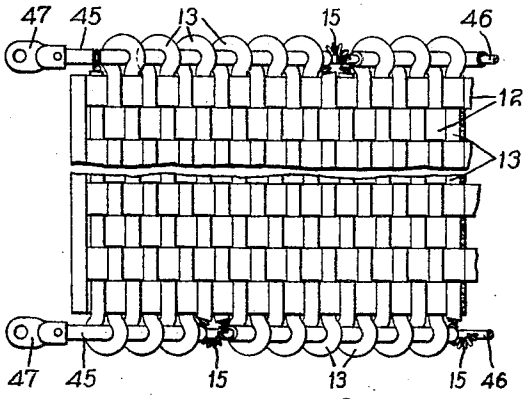


Fig. 10.

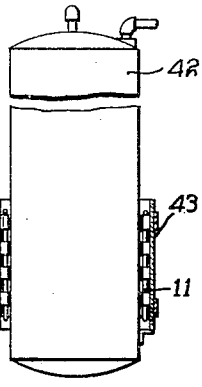


Fig. 9.

WITNESSES:

H. B. Funk.

C. M. Cochran

INVENTOR

Florence Mac Farland.

BY

W. M. Bichel

ATTORNEY

Patented Jan. 31, 1928. 1,657,479

UNITED STATES PATENT OFFICE.

FLORENCE MacFARLAND, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTRIC HEATING DEVICE.

Application filed December 2, 1922. Serial No. 604,484.

My invention relates to electric heating devices and particularly to flexible electric heaters.

One object of my invention is to provide a flexible heater fabric that may be manufactured in relatively long lengths and then divided into relatively short lengths as required, each fabric of relatively short length constituting a separate heating unit.

Another object of my invention is to provide a flexible heater fabric that shall comprise a braided or woven, tubular, refractory covering for the resistor wire.

Another object of my invention is to provide a flexible heater fabric that shall not require additional insulation when it is located on an electrical conducting surface.

Another object of my invention is to provide a flexible heater fabric that shall constitute a holder or support for a container to be heated thereby.

Another object of my invention is to provide a flexible heater fabric that shall conform to the contour of an appliance to be heated thereby.

Another object of my invention is to provide a flexible heater fabric that shall comprise a flexible, refractory, non-inflammable, electric-insulating, and heat-conducting covering.

Another object of my invention is to provide a flexible heater fabric comprising a weft consisting of a helically-wound resistor wire located in a flexible, braided, refractory, electric-insulating covering and a warp consisting of strips of flexible refractory material.

In practicing my invention I provide a plurality of strips of woven asbestos which constitute the warp of the heater fabric, and a weft therefor comprising a woven or braided tubular covering of asbestos within which is located a helically-wound resistor wire. The fabric is woven in relatively long lengths and of any suitable or desired width, after which it is divided into units of relatively short length. The end of the warp strips are suitably secured to laterally-extending strips of asbestos which serve as binding strips therefor. The helically-wound resistor wire is straightened out in the two end portions of each unit and a suitable terminal device is secured thereto. The flexible heater fabric constituted by the above described unit may be employed as a self-contained heater unit or it may be mounted on a suitable support such as a plane heat-insulating member, or it may be placed within a suitable metallic casing, or it may be placed within a suitable flexible casing such as cloth.

The flexible heater fabric constituted by the warp and weft members may be held against a suitable fluid container and covered with an outer layer of heat-insulating material.

In a modification I may employ a plurality of bolt-ropes at each edge of the heater fabric, the bolt-ropes being constituted by flexible insulated cables, and a plurality of spaced electrical connections may be made between the resistor member and the respective bolt-ropes whereby a plurality of parallel connected resistor circuits is provided between the bolt-ropes which serve also as terminal members.

In the drawings

Figure 1 is a top plan view of a heating device embodying my invention;

Fig. 2 is a view, in longitudinal section, through a portion of the resistor element and its covering;

Fig. 3 is a view, in vertical longitudinal section, of a fluid heater comprising the device embodying my invention;

Fig. 4 is a view, in horizontal lateral section therethrough, taken on the line IV—IV of Fig. 3.

Fig. 5 is a top plan view of a flexible heater fabric embodying my invention located in a table stove;

Fig. 6 is a longitudinal vertical section therethrough, taken on the line VI—VI of Fig. 5.

Fig. 7 is a view, in side elevation, of a flexible heating fabric embodying my invention illustrated with a fluid container located therein;

Fig. 8 is a top plan view of the parts illustrated in Fig. 7;

Fig. 9 is a view, partly in side elevation and partly in section, of a flexible heater fabric embodying my invention as applied to a hot water tank; and

Fig. 10 is a top plan view of a modification of the device embodying my invention.

A flexible heater fabric 11 comprises a plurality of parallel extending warp members 12 which are severally constituted by strips of braided asbestos material, and a weft member 13, which comprises a flexible outer braided or woven, tubular, covering 14 of a suitable refractory, heat-conducting, electrical-insulating, and non-inflammable material such as asbestos. Within the tubular covering is a flexible resistor member 15 constituted by a helically-wound resistor wire of suitable dimensions. The combination of the flexible resistor wire located within a braided or woven tubular casing or covering provides a flexible extended heater element of relatively small lateral dimensions.

The weft 13 constituted as hereinbefore described may be made of any suitable or desired length laterally of the fabric, and the length of the warp strips may be made relatively great in order to make it relatively easy to weave the heater fabric when once the necessary machinery has been set up and the warp and the weft members have been provided for use therein. The relatively long strip of heater fabric may then be sub-divided as may be suitable or desired, or in accordance with the voltage of a supply circuit to which any one individual unit is to be connected. At each end of the individual unit of the heater fabric a laterally extending strip 16 of asbestos is located, and may be secured to each of the warp strips by metal staples 17, the edge strip 16 therefore constituting a binding strip at each end of the heater fabric unit.

The end portions of the weft member may be so located as to extend parallel to the direction of the warp members, as illustrated more particularly in Fig. 1 of the drawings, and in order to reduce the amount of heat generated in these end portions, the helically-wound wire may be pulled out straight. The end portions of the weft member may be secured to the ends of the weft members by suitable binding means 18 which may be constituted by asbestos thread, or if desirable or necessary by metal wire. The two end portions may extend from the respective ends of the unit to substantially the middle portion thereof, and may then extend away therefrom a small distance to permit of securing thereto a terminal plug member 19, the two contact pins 21 of which are electrically connected to the two ends of the resistor member 15. The end portions adjacent the terminal plug may be suitably bound together by a plurality of turns of an asbestos string 22.

In Fig. 1 of the drawing I have illustrated the hereinbefore described flexible heater fabric unit as being located on a suitable supporting means 23 of substantially the same contour as the heating fabric unit 11 and slightly larger in surface dimensions. If it be desired to employ the heater unit fabric 11 as a plate warmer on a dining table or on a sideboard, the support 23 may be constituted by an asbestos pad, or it may be constituted by an ordinary plate, in which case the flexible heater fabric will conform more closely to the shape of the surface of the plate to be heated.

In Figs. 3 and 4 of the drawings I have illustrated the use of the hereinbefore described heater fabric in a tubular metal casing 24, which is open at both ends and is provided, at its upper end, with an outwardly flaring and return bent integral portion adapted to receive one edge portion of the heater fabric 11 located therein. It is of course understood that the length of the heater fabric placed within the casing 24 is just sufficient to take up all of the available peripheral space immediately adjacent to the inner surface of the container. A block 25 of a suitable heat-insulating material such as asbestos lumber is located immediately beneath the lower edge of the heater fabric and carries a plurality of terminal members or contact pins 26. The inner end of each of the contact members 26 is suitably secured by screws 27 against the body of the block 25 in order to support them in proper operative positions relatively thereto.

A block 28 of a suitable electrical-insulating material is located in an opening in the casing 24 and the pins 26 extend therethrough in order to be maintained in proper spaced relation so that the contact plug of a conductor cord may operatively engage the same to permit of energizing the heater fabric as desired. The ends of the resistor member 15 extend through suitable openings 29 in the block 25 and may be electrically connected to the members 26 by the same screws 27 which secure these members against the block 25. A supporting block or base 31 has an upwardly extending portion 32 located within the lower edge of the casing 24, a plurality of screws 33 being employed to secure the casing 24 on the base 31.

The height of the casing 24 is such that it will receive substantially all the length of an ordinary nursing bottle, the flare of the upper part of the casing 24 being sufficient to permit placing such a bottle easily and quickly in the casing. When the resistor member is energized the heat will traverse the tubular covering and flow through the walls of the container, and it may be noted that substantially all of the peripheral surface of such a container is subjected to the heat generated in the heating fabric. The flexible tubular covering over the resistor wire constitutes also a substantially resilient means interposed between the metallic resistor member and the outer surface of a fluid container. This permits of obtaining a pressure between the material of the tubu-

lar covering and the outer surface of the container whereby a more ready transference of heat is effected from the resistor member to the container. Any tendency of the heater fabric to follow the fluid container when the same is removed upwardly, is prevented by the return-bent upper portion of the casing 24. While a handle may be secured to the casing for lifting the device it can be easily lifted by the operator grasping the base 31, thus making a carrying handle unnecessary.

In Figs. 5 and 6 there is illustrated a table stove comprising a flexible heater fabric 11 as the heating element. The table stove may comprise a suitable open-top casing 34 of metal, and a plate 35 of a suitable refractory heat-insulating material on the upper surface of which is located the heater fabric 11 adjacent the open top of the casing 34. A plurality of terminal pins 26 may have their inner ends secured by machine screws 27 against the under surface of the plate 35 and extend through the casing 34 so that they may be operatively engaged by a suitable contact plug (not shown) to permit of energizing the heating element. A plurality of supporting members 36 may be provided for the casing 34.

In Fig. 7 there is illustrated a modified form of a nursery bottle warmer in which the flexible heater fabric 11 is suitably secured against a suitable piece of cloth 37 which may be provided with metal snap fasteners 38 in order to permit of securing the edges together, the dimensions of the cloth and of the heater fabric and the location of the snap fasteners being such that a nursery bottle 39 will fit closely within the flexible heating unit constituted thereby and be held in substantially the position illustrated in Fig. 7 of the drawing. The cloth 37 may be provided with a loop member 41 to permit of hanging the heater unit and the fluid container located therein from any suitable supporting means.

In Fig. 9 I have illustrated the application of my flexible heater fabric to the heating of water located within an ordinary hot water tank 42. The flexible heater fabric 11 may extend only partially around the periphery of the tank, or it may extend entirely therearound and it may extend for any portion of the length of the water tank, as may be suitable or desired. A layer 43 of a suitable heat-insulating material may be employed to cover the outer surface of the heater fabric 11 in order to reduce the loss of heat outwardly therefrom. A plurality of suitable clamping members 44 may be provided to hold both the heat insulating material 43 and the heater fabric 11 in their proper operative positions tightly against the outer surface of the tank 42.

In Fig. 10 I have illustrated a modification of the flexible heater fabric constituted by the plurality of warp strips 12 and the weft member 13 as hereinbefore described. In addition to the warp and weft members as described in connection with the heater fabric 11, I employ what may be termed a bolt-rope 45 constituting the end warp member at each edge of the heater fabric. The bolt-rope 45 comprises a flexible insulated cable having the usual core 46 of relatively thin copper wires. Terminal members 47 may be provided for the respective bolt-ropes. After the heater fabric has been woven as hereinbefore described, with the bolt-ropes in the position illustrated in Fig. 10 of the drawings, the relatively long strip may be subdivided as hereinbefore described, and the two ends of the resistor member 15 electrically connected to the respective bolt-ropes 45, or, if desired, a plurality of electrical connections may be made between the resistor member 15 and the respective bolt-ropes to provide a plurality of sections of the resistor member 15 which are electrically connected in parallel to the bolt-ropes 45. If the electrical connections are symmetrically spaced relatively to the individual bolt-ropes, and if the connections to the respective bolt-ropes are located in staggered relation a plurality of parallel-connected paths of substantially the same length are provided. The larger the number of such parallel-connected paths, the greater will be the amount of energy translated into heat. The shorter the length of each path the greater will be the amount of energy translated into heat for any given voltage of the supply circuit. Consequently a wide latitude is offered as to the amount of energy translated into heat when the heating fabric is connected to a given supply circuit, the number of connections and the spacing therebetween providing such latitude. It is also obvious that if such a heater fabric translates only a relatively small amount of energy when connected to a supply circuit of say, 110 volts, it will translate a much greater amount of energy when connected to a supply circuit having a higher voltage, for example 220 volts.

The device embodying my invention thus provides a flexible heater fabric comprising a flexible resistor member having a flexible refractory non-metallic covering therearound, which heater fabric does not require any additional electric insulating material between it and an electrical conducting surface to be heated by direct contact therebetween. The device embodying my invention further provides a flexible heater fabric which will easily adapt itself to the contour of a surface or of a container to be heated thereby.

The device embodying my invention furthere provides a method of building or man-

ufacturing a flexible heater fabric in relatively long lengths, and thereafter severing the same at predetermined points to subdivide the long strip into shorter individual units, which when provided with suitable binding strips and terminal members individually constitute complete heating units in themselves. Each of these heating units may be employed as a flexible heater without any further container or casing, or they may be located in either a metal or cloth container as may be desired.

Various modifications may be made without departing from the spirit and scope of my invention, and I desire that only such limitations shall be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

I claim as my invention:

1. An electric heating device comprising a flexible, braided asbestos sleeve, and a flexible metallic resistor member located in said sleeve and substantially co-extensive therewith.

2. An electric heating device comprising a flexible, braided asbestos sleeve, and a flexible metallic resistor member located in said sleeve, said resistor member being much longer than said sleeve.

3. An electric heating device comprising a resistor wire wound in a continuous helical coil and a woven or braided flexible asbestos covering substantially co-extensive with said coil.

4. In a flexible heating and material-supporting fabric, in combination, a weft of a flexible heater cord comprising a helically-wound resistor wire and a flexible tube of woven or braided asbestos material covering said resistor, a warp of strips of flexible refractory material, and refractory binding strips for the ends of said warp strips.

5. A heating element, comprising a tube of woven asbestos fibre, and a spirally coiled resistance wire arranged within and enclosed by said tube.

In testimony whereof, I have hereunto subscribed my name this 28th day of November, 1922.

FLORENCE MacFARLAND.