Nov. 7, 1950 H. S. MOORE ET AL 2,528,966

HEATING UNIT

Filed March 22, 1949

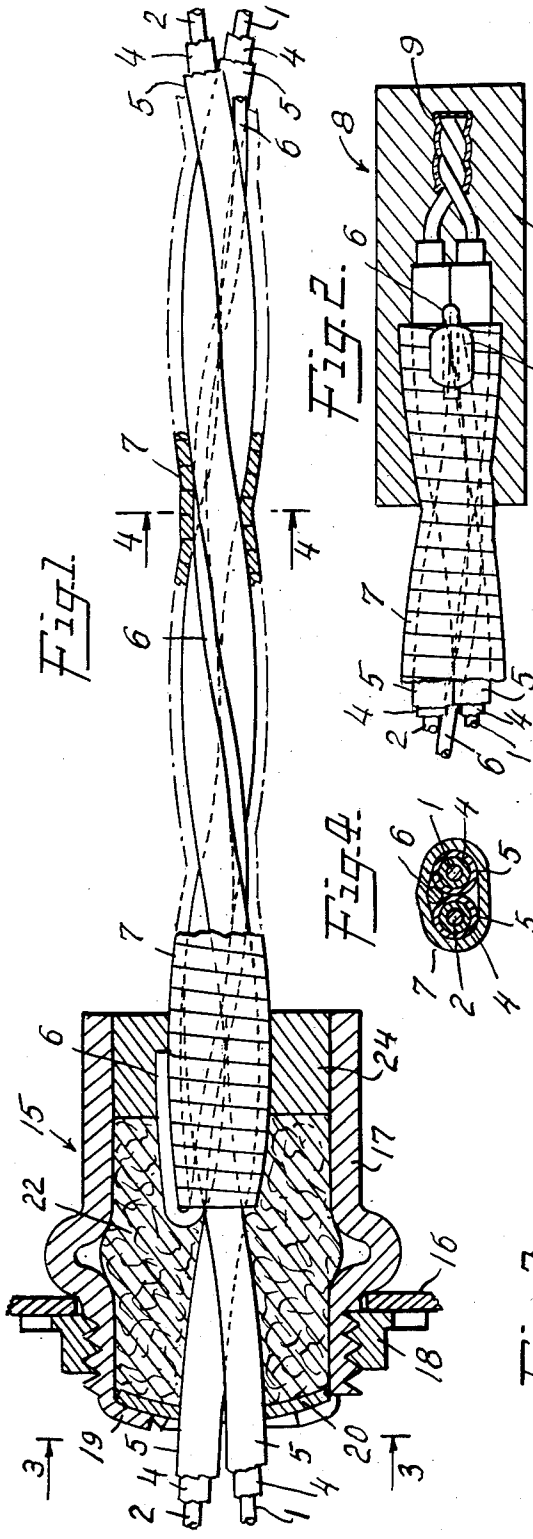


Fig. 1.

Fig. 2.

Fig. 4.

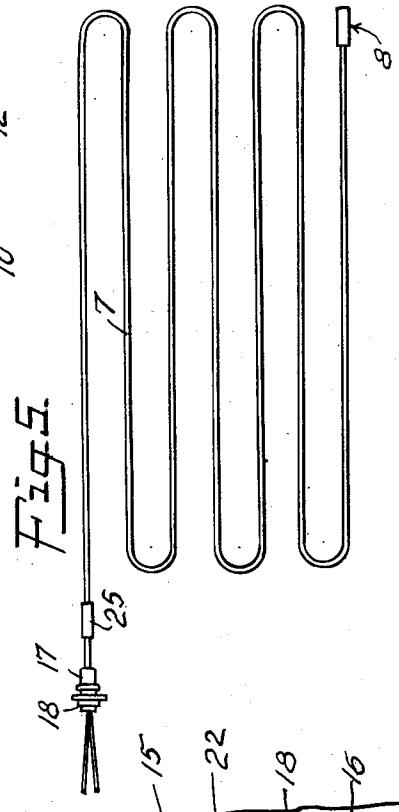


Fig. 5.

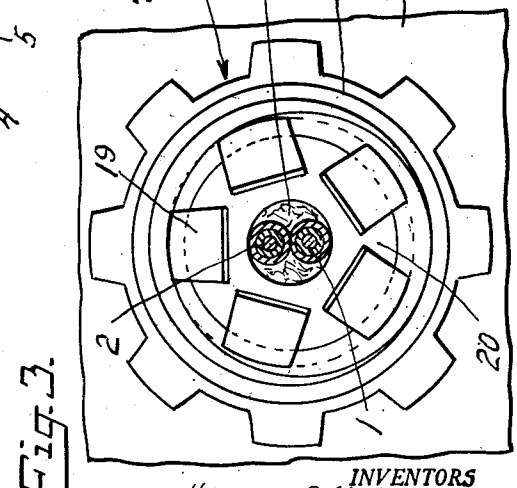


Fig. 3.

INVENTORS
HAROLD S. MOORE
CHARLES A. BERLEPSCH
BY
Pennie, Edmonds, Morton & Barrows
ATTORNEYS

Patented Nov. 7, 1950 2,528,966

UNITED STATES PATENT OFFICE

2,528,966

HEATING UNIT

Harold S. Moore and Charles A. Berlepsch, North Haven, Conn., assignors to Rockbestos Products Corporation, New Haven, Conn., a corporation of Massachusetts

Application March 22, 1949, Serial No. 82,802

3 Claims. (Cl. 219—19)

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This invention relates to the radiant heating of rooms or buildings by electrical heating elements in the walls, floors, or ceilings and has for its object the provision of an improved electrical heating element having definite electrical characteristics in a complete ready-to-install unit.

The heating unit of our invention is constructed for the efficient and safe installation in the walls, floors, or ceilings of rooms as in homes or other buildings and in a present practical use, the heating elements are mounted over the lathing or other plaster base and then the plaster is applied in the usual way completely covering the heating elements. They may also be buried in concrete floors where floor heating is desired.

Our invention provides a complete heating unit comprising a heating element formed of two insulated wires forming a complete circuit which may be formed of a single loop twisted together or laid parallel, or two separate wires twisted together or laid parallel and connected at their ends, an armored covering over the two wires, means for grounding and establishing a low resistance bond between the elements of the armor so as to insure operation of protective devices in event of a short circuit between conductors and armor and other means for connecting the free ends of the wires to a source of electricity. In an especially effective embodiment of the invention, the twisted insulated wires of the heating element are covered with a helically wrapped metal armor and the ground means is preferably a bare wire intertwisted with the heating wires and in contact with the armor throughout the length of the unit to provide a low resistance path to ground in the event of a short circuit and prevent overheating of the armor by the short circuit current.

The heating element of our invention is constructed and proportioned to consume a definite wattage and is completely fabricated from end to end, one end being the terminal end where the twisted wires are joined and the other end having a permanently attached coupler, such as a standard conduit bushing, for attachment to a standard junction box of the type used for domestic wiring. The heating wires pass through the coupler and the free ends are long enough to make suitable connections to the power circuit and are insulated from the coupler. The armor and ground wire are both permanently connected to the coupler, as by soldering, and accordingly become connected to the ground line of the building.

In its more complete embodiment our invention provides an electrical heating unit as previously described with means to prevent alterations in the length of the heating element resulting in different electrical characteristics from those specifically determined for each element. Our heating elements are provided in definite lengths to give definite results under the voltages specified, and to this end means are secured to the exterior of the armor at or near each end to prevent shortening the heating wires without mutilating the said means and making self evident the alteration. We prefer to enclose the terminal end with a molded plastic cap and cover a short length of the armor with a molded plastic sleeve near the coupler, the plastic being so tough and in such intimate connection with the armor that it cannot be removed without mutilation. Advantageously, the identifying electrical characteristics such as voltage and wattage are suitably marked in the plastic. Our invention accordingly provides heating elements having predetermined electrical characteristics and capable of giving reliable and safe heating results. The heating units reduce to a minimum errors in construction and in inspection and they may be inspected by building inspectors without resort to careful measurements and other tests.

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In a further embodiment, the invention provides a voltage indicator, such as a colored member, in permanent connection with the coupler and so located that it can be seen easily from the inside of the junction box. We prefer to provide a colored plate or washer secured in the end of the coupler to indicate the voltage of the power line intended to be connected to the heating wires. The insulation is also colored to designate the type of conductor so as to facilitate inspection and prevent errors.

These and other objects of the invention will be better understood after considering the following discussion taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a longitudinal view of an electrical heating unit with parts in section illustrating an embodiment of the invention;

Fig. 2 is an enlarged view, partly in section, of the terminal end;

Fig. 3 is a view at 3—3 of Fig. 1 of the coupler end;

Fig. 4 is a sectional view at 4—4 of Fig. 1, and

Fig. 5 illustrates a complete electrical heating unit of the invention as arranged for installation on a radiating surface.

The electrical heating element illustrated in the drawings comprises two twisted heating wires 1 and 2, each covered with a suitable insulation. The wires are formed of any suitable metal, for example, the nickel-base iron alloy sold under the name Hytemco, nickel, commercial bronze or copper. The insulation should be of a relatively durable type and capable of withstanding the temperature for long periods. An extruded nylon sheath 4 covered with a layer of felted asbestos 5 is suitable. However, spun glass and/or asbestos may be used in other known combinations. The exterior of the insulation may be colored to designate the type of conductor. A bare wire 6, such as copper wire, is in direct contact with the insulation and is twisted together with the heating wires to serve as a grounding conductor. The three twisted wires are covered with a suitable metal armor 7, preferably formed of a wrapping of flat or half oval galvanized steel wire which is in direct contact with the ground wire 6. The armored circuit thus assembled is a heating element in a preferred embodiment of our invention. Since the heating element is formed in fixed predetermined lengths of, say, 100, 500 or 1000 feet, it is expedient from a manufacturing point of view to produce the stock of the heating elements in indeterminate lengths and to cut them to size. As thus cut, the two heating wires are separate and must be connected together at the terminal end 8 (Fig. 2). The insulation is removed for about ½ inch and the ends are twisted together and bonded with the solder 9. The ground wire 6 is bent over the end of the armor and electrically connected thereto by the solder 10.

To safeguard any tampering with the terminal end, particularly to indicate shortening with a resulting change in the electrical characteristics, the cap 12 of a hard tough plastic material which is also a good insulator is molded or otherwise pressed onto the end so that it cannot be removed without mutilation. This cap may be formed of a thermoplastic resin, such as vinylite, and it may advantageously include an identifying color, characters giving the length of the heating element, and the intended voltage and wattage. The terminal end cap accordingly serves a multipurpose as insulation, identification, and protection against alteration whereby inspection is greatly facilitated.

The coupler end of the heating unit is best shown in Figs. 1 and 3 and comprises coupler 15 of a type which can be attached to a standard junction box 16. As shown, the coupler comprises a threaded sleeve or bushing 17 which is inserted through a hole in the box 16 and held in position by the nut 18. The front of the sleeve has a plurality of inwardly bent petals 19 leaving a central opening. A voltage identification member 20, such as a colored fiber washer or a body of colored plastic material, is inserted into the sleeve and held against the petals by a filling of felt 22. The armor 6 is removed from the measured heating element for about six inches. The bare ground wire is cut off and the end bent over the armor. The projecting insulated wires 1 and 2 are inserted through the felt and the identification member, and the armor is inserted about ¼ inch inside the sleeve 17, as shown in Fig. 1. The space surrounding the armor is filled with solder 24 which not only effects a good physical connection of the unit to the coupler but establishes a certain electrical connection of the armor and ground wire to the coupler sleeve which becomes grounded to the junction box. An inspector can very readily see if a heating element of the required voltage is used merely by looking into the junction box where the identifying member is in full view.

In order to indicate if the heating element has been shortened by cutting off the coupler and reconnecting it on the shortened wires, we mold or otherwise permanently secure a sleeve 25 over the armor a few inches from the coupler. This sleeve is of a material which cannot be removed without mutilation and its presence is a ready assurance to the electrical inspector that the coupler end of the heating unit has not been shortened. This sleeve may be made of the same material as the terminal cap, may be similarly colored, and may have the length, voltage, wattage, and other technical data suitably marked thereon.

The electrical characteristics of each heating unit are such as to produce the desired amount of heat, when energized at the designated voltage, to suit the particular room to be heated.

In a new house the elements would be installed after the rough wiring and boxes are in place and after the lath has been erected but before plastering. The supply ends of the elements would be assembled in the outlet boxes and the element of proper length stapled to the ceiling beams or studs (if wall heating is required) right over the wood, plasterboard, or metal lath. Ordinary wire staples can be used as the element is protected by its armor.

The element should be led back and forth over the surface to be heated with a space of about 1½ inches to 2½ inches between successive runs until the length is used up, as shown in Fig. 5. If more space remains to be heated, one or more additional heating units may be installed in the same manner.

After all elements are in place and have been tested or inspected, the plaster is applied and the heating elements are thereby encased and covered by the plaster. Subsequent operation of the elements heats the entire plaster surface for the purpose of providing radiant heat in the space below or in front of the heated surface.

If desired, the space behind the plaster can be filled with the usual types of heat insulating material to prevent heat loss and increase the efficiency of the installation.

The following is a list of advantages of our heating unit:

1. Each heating unit is complete and ready for installation.

2. The armor protects each unit from damage during installation or subsequently by nails driven into plaster.

3. The ground wire under the armor protects against overheating of the heating wires or armor in cases of short circuit by blowing a fuse or circuit breaker.

4. Easy identification of length, voltage, and wattage for which the heating unit is designed at time of electrical inspection of the installation.

5. Odd shaped rooms or ceilings or wall surfaces can easily be accommodated by laying the heating element wherever desired or required.

6. Both terminals for electrical connections are at the same end of the heating unit, thus simplifying installation.

7. Having both conductors under a single armor prevents the possibility of A. C. hum such as has been experienced with single strand elements over metal lath.

We claim:

1. An electrical heating unit which comprises an electrical heating element formed of two insulated heating wires in contact with each other throughout their length, a bare ground wire in contact with the insulation of the wires throughout their length, a metal protecting armor over the three wires and in contact with the ground wire, a terminal end for the heating element where the heating wires are connected together and a terminal insulating cap for the terminal end permanently connected thereto the presence of which shows that the element has not been shortened on that end, and a coupler on the other end electrically connected to the armor for connection to a grounded junction box, and means near the coupler permanently attached over the armor the presence of which shows that that end of the heating element has not been shortened, the free ends of the heating wires projecting through the coupler and being available for connection to the source of power at the junction box.

2. A heating unit according to claim 1 which comprises two separate insulated wires twisted together and electrically connected at the terminal end.

3. An electrical heating unit which comprises an electrical heating element enclosed within a grounded armor, a terminal end for the heating element, means to prevent shortening at the terminal end without evidence thereof, a coupler permanently connected at the other end of the element to the armor with means for connecting to a grounded junction box, and means at the coupler end of the element in permanent connection thereto to prevent shortening without evidence thereof.

HAROLD S. MOORE.
CHARLES A. BERLEPSCH.

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