(No Model.)

J. V. CAPEK.

ELECTRICAL HEATER.

No. 424,921. Patented Apr. 1, 1890.

Fig. 1.

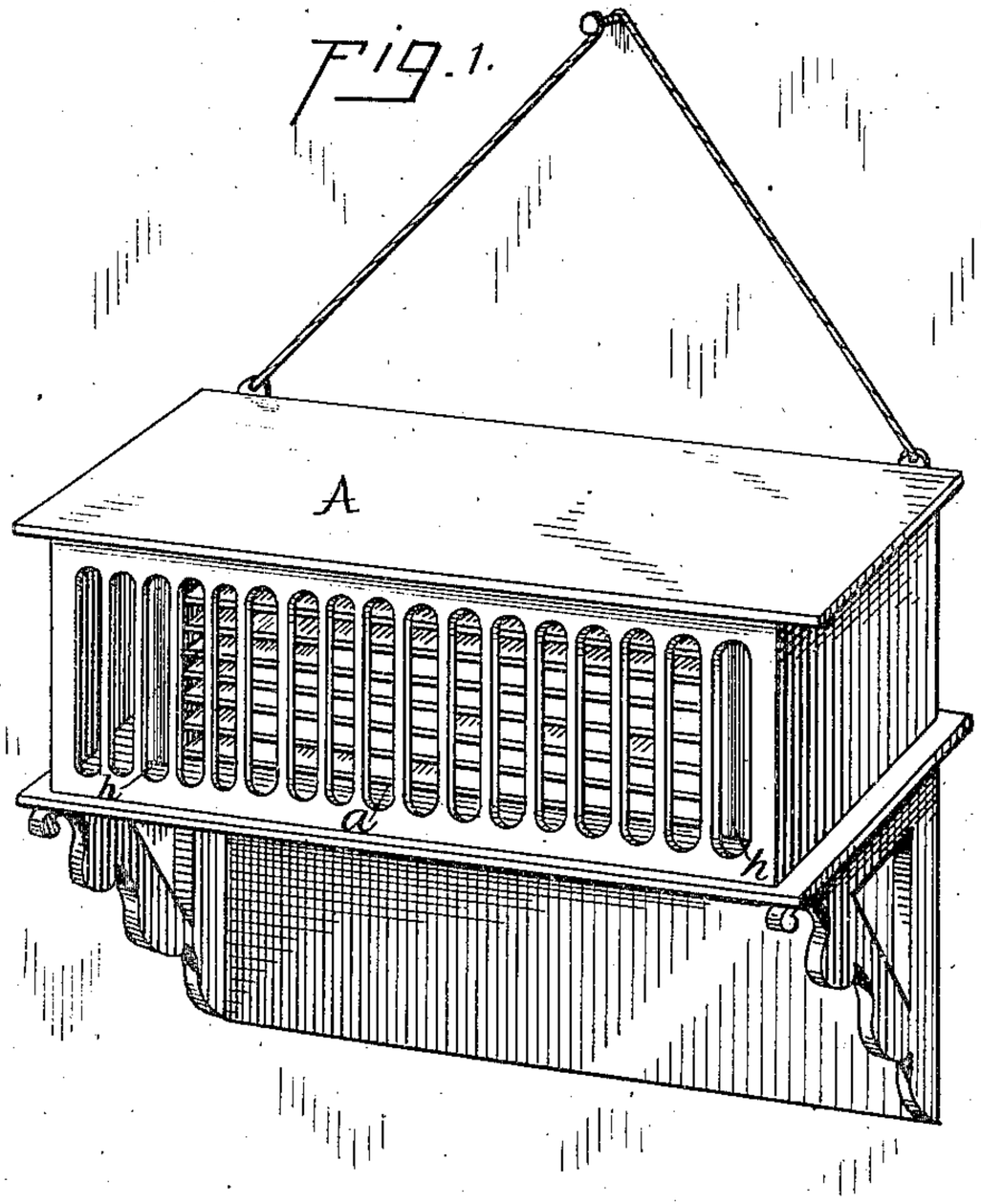


Fig. 2.

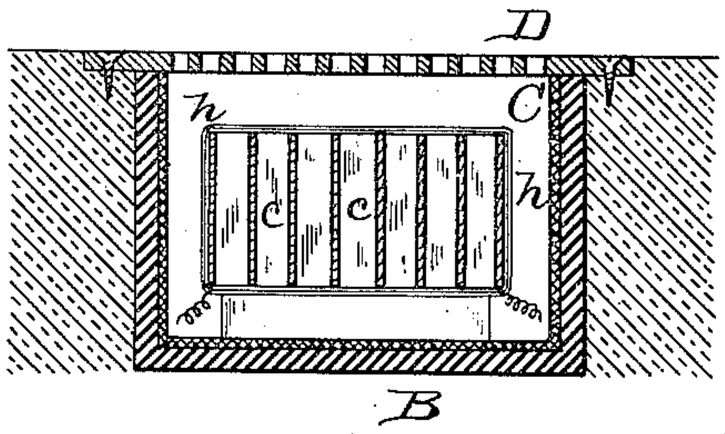


Fig. 3.

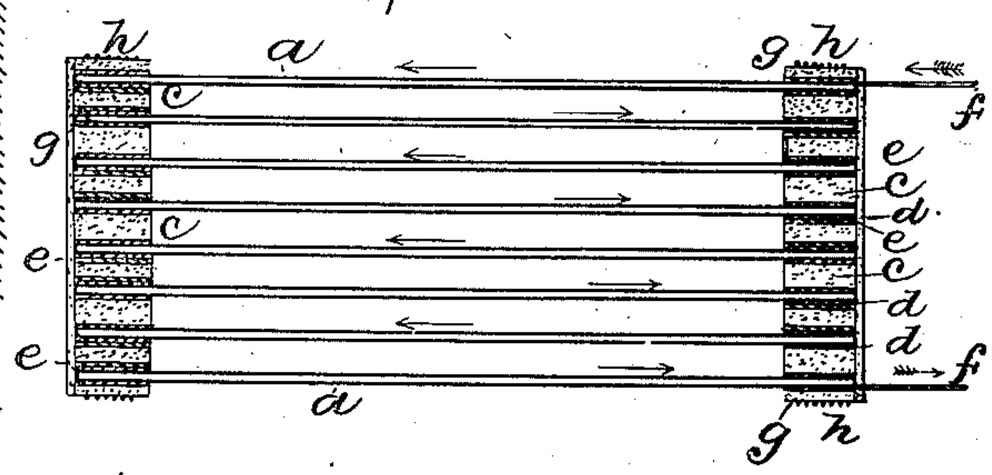
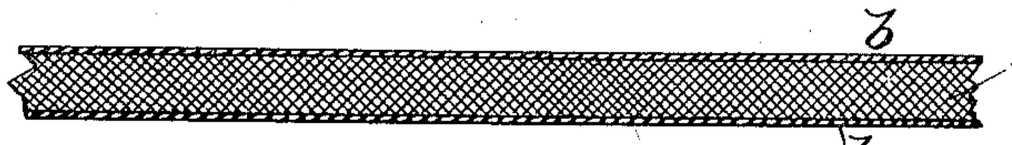


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL HEATER.

SPECIFICATION forming part of Letters Patent No. 424,921, dated April 1, 1890.

Application filed October 26, 1889. Serial No. 328,271. (No model.)

To all whom it may concern:

Be it known that I, JOHN V. CAPEK, a citizen of the United States, residing at New York city, in the county and State of New York, have invented a certain new and useful Improvement in Electrical Heaters, of which the following is a specification.

In my patent, No. 395,950, dated January 8, 1889, is set forth a form of electrical heater consisting of a widely-diffused and very thin body of electrical conducting material placed upon the walls of a room or on any other large surface and arranged to be heated to a comparatively low temperature, the conducting material more especially set forth being graphite. This arrangement of spreading a carbon surface over the walls of a room has been found undesirable in some situations, for the reason that it interfered with decoration and ornamentation of the walls, and because in many places the walls of a room are so broken by doors, windows, &c., that a continuous heating-surface cannot be produced.

The object of my present invention is to provide an electrical heater of an economical and effective character which shall have all the advantages of the form of heater set forth in the patent above referred to, but in which the heating-surface shall be concentrated so as to occupy only a small space, and so that the heater can be placed in any convenient situation. To this end I provide an electrical heater which consists of thin strips of insulating material, each of which is covered on both sides with a thin coating of conducting material—such as carbon—such strips being piled one upon another, separated by suitable insulation and by air-spaces, and the strips being electrically connected together at alternate ends, so that a zigzag conductor of considerable length and small cross-sectional area is formed. These heating-strips are preferably placed in a suitable open or perforated box or inclosed in a case, which may be placed under the floor of a room or set into the wall, or supported against the wall, or situated and supported in any other suitable and convenient way. The strips may be of any suitable insulating material, such as paper or pasteboard or thin wood. These combustible materials may be used because it is not designed that the temperature of the heater shall be raised to a degree higher than the igniting-point of such materials, the necessary heat being obtained by the large radiating-surface which is provided; but in order to guard against danger of fire most effectively I prefer to employ a non-combustible insulating material, and more especially I prefer to use asbestus.

In constructing the heater I take a suitable number of the asbestus or other strips covered with carbon, and I cover their ends with thin metal, preferably by wrapping such ends with tin-foil. I then pile such strips one upon another, placing between them at each end a small block of asbestus or other suitable insulating material, alternate blocks of asbestus at each end being covered with metal or wrapped with tin-foil. By this means alternate strips are connected together at their ends. I also wrap a strip of asbestus around each end of the pile of strips and secure the same by a binding of wire at each end. Previous to this, however, I insert at the ends of the strips where the external connections are to be made a thin metal strip, which is held between the end of one of the heating-strips and the tin-foil wrapped upon such end.

As stated, I prefer to use powdered graphite for the carbon covering of the strips. Such material may be applied to paper and like material by rubbing the graphite upon the paper, the paper or the graphite being preferably slightly moistened before rubbing. I have found, however, that the material may be more readily applied by moistening the paper with a sticky solution—such as a solution of sugar or chromic acid—and then rubbing the graphite upon the paper. With asbestus, however, this method cannot be readily employed, because when the asbestus is rubbed the surface is rubbed off and destroyed. To obviate this I first soak the asbestus in a solution of a substance which will fill up the pores of the asbestus and solidify, so as to make a stronger and harder strip. After the material has become dried I graphitize it, as described. I may soak the asbestus

with such materials as glue, varnish, a solution of sugar, or chromic acid. I have found the last two materials most satisfactory for the purpose. This hardened asbestus forms a particularly effective material for carrying the conductor in electrical heaters, it being of sufficient strength and hardness, a good electrical insulator, and non-inflammable.

In my patent before referred to the graphite was applied on one side only of the carrying-strips. In my present invention I graphitize the strips or plates on both sides, whereby I give double the heating capacity in the same space and with the same amount of inactive supporting material.

The above may be more readily understood by reference to the accompanying drawings.

Figure 1 illustrates a heater embodying my invention, the same being shown in perspective and as supported on a bracket on the wall. Fig. 2 is a cross-section of the heater placed under the floor; Fig. 3, a longitudinal vertical section of the heater, and Fig. 4 a longitudinal vertical section of a part of one of the heating-strips upon a much exaggerated scale.

Referring first to Figs. 2, 3, and 4, thin strips *a*, of asbestus treated in the manner described, are thinly covered on both sides with coatings *b* of powdered graphite. A suitable number of such strips are put together side by side, as shown in Figs. 2 and 3, with blocks *c* of asbestus between, their ends being wrapped with tin-foil *d*. Alternate blocks of asbestus at each end are also wrapped with tin-foil *e*, so that at these points electrical connection is made between the ends of adjacent strips, whereby all the strips are joined together in series and a zigzag conductor of high resistance is formed, through which the current flows, as indicated by the arrows in Fig. 3. Connection may be made to the ends of the series by thin strips or wires *f*, inserted between the ends of the outer strips and their tin-foil coverings. Around each end of the bundle of strips is wrapped a strip of asbestus *g*, such wrappings being secured by tight bindings of wire *h*.

The complete heater is shown in Fig. 1 placed inside a box or bracket A, hung on the wall of the room and having an open or perforated front.

In Fig. 2 the heater is supported in a pocket or case B, placed under the floor and lined with asbestus C and covered with a perforated lid or cover D. It is evident that the heaters may be arranged or disposed in any other suitable and convenient manner besides those shown. It is also evident that any desired number of heaters can be placed in a room, and also that, if desired, two or more heaters may be placed in the same open inclosing-case, such heaters being connected in multiple arc or in series with each other, or in multiple series, according to the character of the current with which they are used. In any case I prefer to so proportion the resistance and radiating surface of the heaters with regard to the current that their temperature will not be raised to a point higher than the igniting-point of ordinary combustible materials, so that the heaters may be placed wherever desired without danger of fire. This, however, is not absolutely essential, since the supporting parts of the heater are non-combustible material, and such heater may be placed so as to be surrounded entirely by such material.

It will be seen that by arranging the heating-strips in the manner set forth I get a high resistance and a large radiating-surface very compactly arranged in a small space, and such arrangement has also the advantages that the structure has considerable strength, although the individual strips are very thin, that each plate protects the surfaces of the adjacent plates, so that, if desired, any external protection may be done away with, and that the surfaces of the plates, whose dark color would be objectionable in many places, are hidden, only the edges of the plates being visible, and such edges may be bronzed or otherwise ornamented, so that the heater can be placed anywhere and may become an ornament rather than a disfigurement to the place.

The manner of making connections between the ends of the plates is an exceedingly simple and effective one, especially where tin-foil is used, as I prefer. Tin-foil does not readily oxidize. It is cheap and is very easily applied, and in addition its melting temperature is very low, being lower than the igniting-point of most combustibles, and it therefore furnishes protection from fire, since if a dangerous temperature is attained by the heater from any cause the tin-foil connections will melt and break the circuit.

What I claim is—

1. In an electrical heater, the combination of thin electrical conducting-strips secured together and facing one another and pieces of insulating material interposed between said strips at their ends, the middle portions of said strips being separated by air-space, substantially as set forth.

2. In an electrical heater, the combination of thin strips of electrical insulating material covered with a coating of conducting material and secured together side by side and separated by insulating material and air-space, substantially as set forth.

3. In an electrical heater, the combination of thin strips of electrical insulating material covered on both sides with a coating of conducting material and secured together side by side and separated by insulating material and air-space, substantially as set forth.

4. As a heating resistance for electrical heaters, a strip of hardened asbestus coated with graphite, substantially as set forth.

5. As a heating resistance for electrical heaters, a strip of asbestus coated or impregnated with a material which fills its pores and

covered with graphite, substantially as set forth.

6. In an electrical heater, the combination of strips of asbestus covered with thin coatings of electrical conducting material and secured together side by side and separated by insulating material and air-space, substantially as set forth.

7. In an electrical heater, the combination of strips of asbestus covered with thin coatings of graphite and secured together side by side and separated by insulating material and air-space, substantially as set forth.

8. In an electrical heater, the combination of thin electrical conducting-strips secured together and facing one another, pieces of insulating material interposed between said strips at their ends, the middle portion of said strips being separated by air-space, and electrical connections between the strips at alternate ends of the bundle, whereby all the strips are connected in series, substantially as set forth.

9. In an electrical heater, the combination of conducting-strips placed side by side and blocks of insulating material between the strips at their ends, alternate blocks being covered with conducting material, substantially as set forth.

10. In an electrical heater, the combination, with conducting-strips having their ends wrapped with metal and placed side by side, of insulating-blocks between their ends, alternate blocks being wrapped in metal, substantially as set forth.

This specification signed and witnessed this 30th day of August, 1889.

JOHN V. CAPEK.

Witnesses:
D. H. DRISCOLL,
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