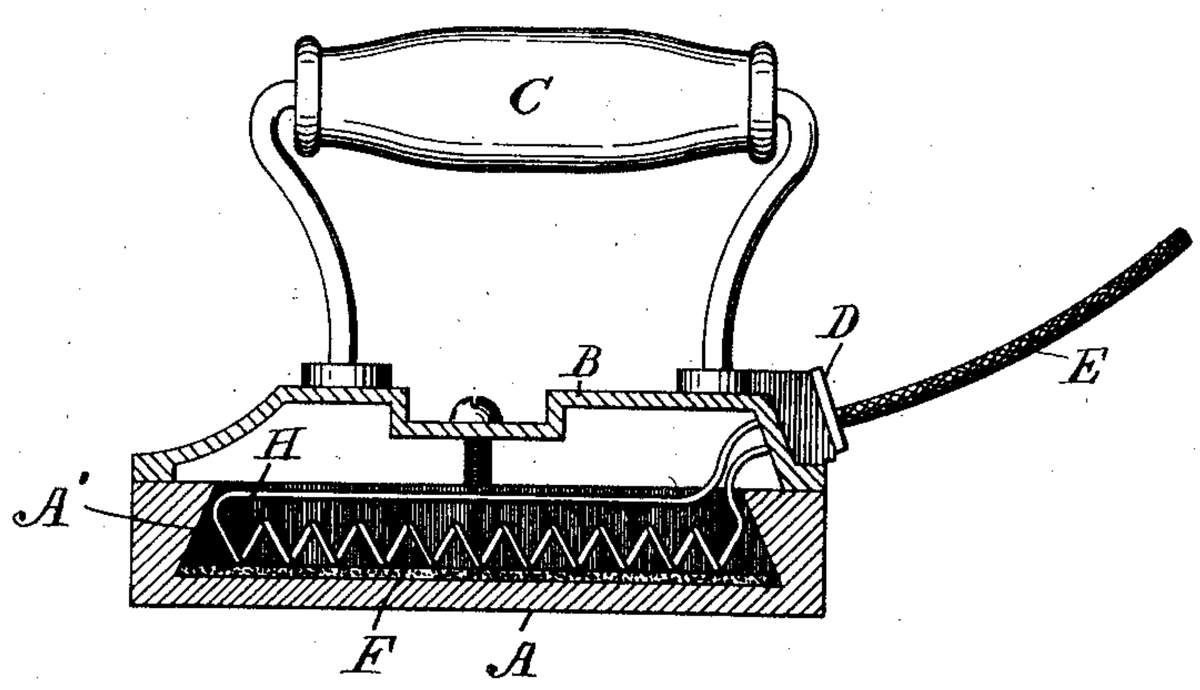
No. 620,307. Patented Feb. 28, 1899.

W. S. HADAWAY, JR.

PROCESS OF FORMING MAGNESIA INSULATION UPON CONDUCTORS.

(Application filed Jan. 26, 1898.)

(No Model.)



Attest:
L. Lee.
Edw. F. Kinsey.

Inventor
William S. Hadaway, Jr.,
per Thomas S. Crane, atty.

UNITED STATES PATENT OFFICE.

WILLIAM S. HADAWAY, JR., OF NEW YORK, N. Y.

PROCESS OF FORMING MAGNESIA INSULATION UPON CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 620,307, dated February 28, 1899.

Application filed January 26, 1898. Serial No. 667,970. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM S. HADAWAY, Jr., a citizen of the United States, residing at New York, county of New York, State of New York, have invented certain new and useful Improvements in Processes of Forming Magnesia Insulation Upon Conductors, fully described and represented in the following specification and the accompanying drawing, forming a part of the same.

The present invention relates to a means for producing an insulating-coating of great efficiency and durability upon the wires which are used for electric heating; and the invention consists in a process for coating heating-wires with magnesia and in the combination of the same with a heater-body. In the present invention the wire is first coated with metallic magnesium and the magnesium then oxidized to form an insulating envelop or environment of magnesia. Such process is practiced by disposing the magnesium-coated wire *in situ* for use with an environment of an oxygen-bearing element, as manganese oxid, and applying heat or a heated fluid adapted to liberate the oxygen from the manganese oxid to oxidize the magnesium.

The invention also includes the combination, with the body to be heated and the electric heating-wire having a coating of magnesia, of a protecting agent (preferably of a heat-conducting character) packed permanently about the wire to retain the same *in situ*. Such heating-wires are employed in electrically-heated tools, furnaces, and appliances for warming air and are in all cases exposed to great alterations of heat and cold. The temperature to which such wires are exposed requires the use of a highly-refractory insulation, and such insulation when firmly adherent to the wire or of a rigid character, like porcelain, is liable to be cracked and displaced by the extreme alterations of temperature. The expansion and contraction consequent upon such alterations sooner or later impair the insulation, form short circuits, and destroy the efficiency of the apparatus. These difficulties are avoided in the present invention by forming an insulating-coating of magnesia about the heating-wire when arranged in situation for use, such coating permitting by its character the necessary expansion and contraction of the wire, and thus preserving the insulation indefinitely.

In practice the metallic magnesium is applied to the wire by drawing it through a bath of melted megnesium in a suitable furnace, and the wire is then coated with an adhesive paste of manganese oxid. The wire is then disposed in its permanent position and the manganese heated to free the oxygen. Such heating may be effected by the electric current or by pouring melted soapstone, metal, or other suitable material over the wires in their permanent situation.

The invention will be understood by reference to the annexed drawing, in which the figure is a longitudinal section of a sad-iron, showing the magnesia-coated wire disposed within its body and surrounded by the metal poured thereon in a fluid condition.

A is the body of the sad-iron, provided with a recess A′ to contain the coils contiguous to the lower surface, which is used for hot-pressing. The recess also serves to contain the material H, which is poured in a melted state around the coils to oxidize the same.

B is the cover, secured upon the body and having the handle C attached thereto, as well as a porcelain insulator D, to which an electric cable E is connected. The coil F, which is shown within the body A, is represented with its ends extended to such insulator for connection therein with the terminals of the cable.

In practice numerous coils are connected together within the body. The coil is made by coating an iron or steel wire with the metallic magnesium in a furnace having an atmosphere of hydrogen, then winding the wire into the required coil, and dipping such coil in a semifluid paste of manganese oxid to form a covering over the magnesium. The coil is shown arranged within the heater-body in the recess A′ and a suitable melted substance H poured over such coil to heat the manganese oxid and inclose the coils. The high temperature to which the manganese oxid is raised serves to free the oxygen and transform the magnesium into magnesia, as desired. The magnesia occupies a larger space than the metal from which it is pro-

duced, and the wire is thus secured firmly in its permanent situation, while the yielding character of the magnesia permits each of the coils to expand and contract separately in the insulation and without such expansion affecting the adjacent coils. When the magnesium and its coating of manganese oxid are heated by an electric current, it is desirable to use a current of low voltage, as the manganese oxid is a very imperfect insulator; but a comparatively low temperature suffices to generate the oxygen where the electric current is employed, as the current assists by electrolysis to transfer the oxygen from the manganese to the magnesium. The combination of the oxygen with the magnesium also operates to generate a very considerable degree of heat, which serves to not only liberate the oxygen, but to maintain the wire and its environment at an elevated temperature during the entire conversion of the magnesium, so that the environment and the wire are able to shrink by cooling in substantially the same ratio when the conversion is completed. Such mutual shrinkage of the wire and its environment prevents the surrounding mass from crowding the coating of magnesia upon the cooling of such mass. As the magnesia has very little coherence, it requires some permanent protection, which, if a heat-conducting environment be required, may be formed of a metallic filling, as iron, steel, or brass particles. In practice melted soapstone may be used, which requires such a temperature to fuse it that it forms crystals upon cooling, which possess a good degree of heat-conducting quality. Where the environment of the wire does not require heat-conducting properties, it may be covered before the magnesium is coverted with any suitable powder or plastic material, as asbestos, plaster-of-paris, and similar substances. By any of these substances it is permanently protected and is thus preserved from derangement or from any such agitation as might displace the magnesia coating.

A melted substance obviously performs the double function of, first, furnishing the heat to decompose the manganese oxid, and, second, of furnishing when cooled the permanent protection for the coating.

It is well known that magnesia is highly refractory and is thus able to endure without injury the highest temperature to which the wire may be heated by an electric current. The magnesia is also an excellent non-conductor of electricity, and it is thus adapted to maintain the insulation of the coils and prevent any short-circuiting of the current. As the magnesia is thus formed in a relatively soft condition, it is incapable of injury by jars and by the expansion and contraction of the wire, which would operate to crack and loosen a hard or scaly insulation, like porcelain, and the magnesia is thus in every way adapted to form a most effective and durable insulation for the electric wire in a heating device.

Any agent adapted to furnish the required oxygen may be used as a covering for the coating of magnesium metal upon the heating-wire, provided such agent may be readily decomposed to furnish the necessary oxygen for conversion of the magnesium into an insulator.

Although the insulation described is by reason of its highly-refractory character especially useful upon a wire to be used for heating, it is obvious that it may be formed upon wires to be used for other purposes, and the invention is not therefore limited to the combination of such wire with any special appliance.

Having thus set forth the nature of my invention, what I claim herein is—

1. The process of coating electric wire with an insulation of magnesia for use in electric heaters, which consists in first coating the wire with metallic magnesium, and second, applying an oxygen-bearing substance, as manganese oxid, to the coating of magnesium, and heating the whole to decompose the manganese oxid and oxidize the magnesium upon the wire, substantially as herein set forth.

2. The process of coating electric wire with an insulation of magnesia for use in electric heaters, which consists in first coating the wire with metallic maguesium, second, applying manganese oxid in a paste to such coating of magnesium, and third, placing a heated mass about the said wire to decompose the manganese oxid and thus oxidize the magnesium upon the wire, substantially as herein set forth.

3. The process of coating electric wire with an insulation of magnesia for use in electric heaters, which consists in first coating the wire with metallic magnesium, second, surrounding the wire with an oxygen-bearing substance, as manganese oxid, and third, pouring abont the said wire a melted substance having sufficient heat to decompose the manganese oxid, substantially as herein set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM S. HADAWAY, Jr.

Witnesses:
THOMAS S. CRANE,
EDWARD F. KINSEY.