W. H. FULTON.

ELECTRIC HEATER.

APPLICATION FILED AUG. 26, 1908. RENEWED FEB. 20, 1914.

1,111,790. Patented Sept. 29, 1914.

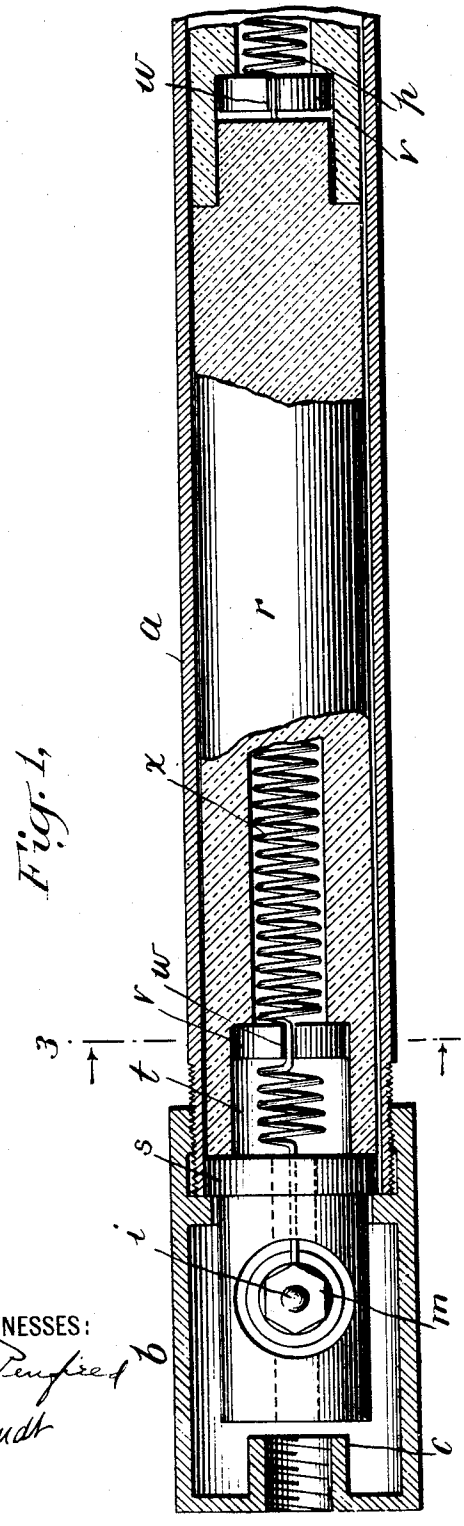


Fig. 1,

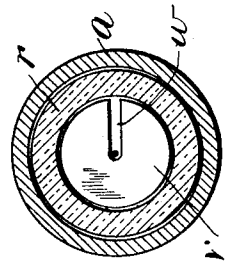


Fig. 3,

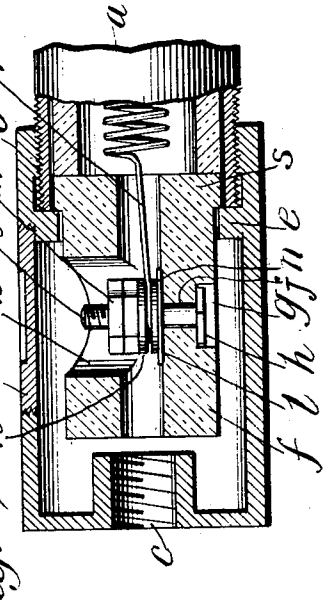


Fig. 2,

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ELECTRIC HEATER.

1,111,790. Specification of Letters Patent. Patented Sept. 29, 1914.

Application filed August 26, 1908, Serial No. 450,337. Renewed February 20, 1914. Serial No. 820,049.

To all whom it may concern:

Be it known that I, WILLIAM H. FULTON, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Electric Heaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains, to make and use the same.

My invention relates to certain new and useful improvements in electric car heaters, and is designed to furnish a construction and arrangement of parts wherein the heater may be readily assembled and disassembled, adjusted as to its capacity to radiate heat for any given section of its length, which is of moderate initial cost of construction and which cannot be readily tampered with or disarranged by malicious or careless persons.

In the accompanying drawing, Figure 1 represents a longitudinal sectional view of a portion of an electric heater embodying my improvements, certain of the parts being shown in plan; Fig. 2 represents a partial longitudinal sectional elevation on a plane thereof; and Fig. 3 represents a sectional elevation taken on a plane indicated by line 3, 3 of Fig. 1.

Similar letters of reference indicate similar parts throughout the several views.

Referring to the drawing, *a* indicates a suitable metal pipe which may conveniently be of wrought or cast-iron and of any suitable length, provided at its ends with terminal caps as *b*, which may be screw-threaded thereon, as shown. The cap *b* is provided with a screw-threaded inwardly projecting nipple *c* for connecting the heater to the conduit in which the line conductor or conductors are conveyed and is likewise provided with a counter-sunk cover-plate *d* screw-threaded into a corresponding recess and removable therefrom so as to afford access to the interior. The cap is likewise provided with a flange or ledge *e* against which is adapted to rest the hollow porcelain plug or support *f* for carrying the terminal or binding post of the heating conductor.

The binding post plug *f* is provided with a square recess *g* for the reception of the similarly squared head *h* of a screw-threaded pin *i* which projects upwardly through the longitudinal hollow center *j* of the plug and the aperture *k* communicating therewith. A thin nut *l* engages the thread on the pin *i* and is adapted to draw the head *h* into close contact with the inner wall of the recess *g*, and, upon this nut rest the two washers *n*, which, through the intermediacy of the pressure and lock nuts *m* are adapted to firmly clamp between them the incoming wire from the conduit and the outgoing wire *p* leading into the main body of the heater.

The main body portion of the heater is occupied by a series of similar sections *r*, of porcelain, the initial section bearing against the head *s* of the binding post plug, as shown. At this end, each section is provided with an enlarged recess *t* terminating at a shoulder against which fits the spacing piece comprising an insertible and removable porcelain disk *v* having a radial slot *w*. Beyond the washer *v*, each section *r* is perforated longitudinally, as shown at *x* to its opposite end, which is of reduced diameter and projects into the next succeeding end recess *t*.

It will be apparent that by inserting a series of the individual sections *r* in the tube *a*, a porcelain lined conduit of corresponding length may be made, the extent of the conduit depending upon the will of the constructor. The function of the disks *v* is as follows: Interposed in the length of the coils *z* of the resistance wire, these disks permit the coil of the resistance wire to be stretched out as desired so as to establish in any particular porcelain section *r* end to end the length of wire that may be desired to be located in that individual section. The disks *v* furthermore sustain the spring stress exerted by the coils of the resistance wire in the individual sections, thereby correspondingly relieving the wire in any individual section from excess of tension, and permitting, in each section, such distension or contraction of the coils as may be suited to their individual intended heating effects, and, furthermore, not only taking off the tension from the binding posts, but permitting the wire to have a fair degree of flexibility at the ends of the heater, which is found convenient to its ready manipulation in connecting it up with the binding posts.

In assembling the parts, the binding post plug *f* is first inserted in the end piece *b*, the sections *r*, together with the disks *v*

and the resistance wire are inserted in the metal pipe *a*, and the pipe is screwed into the end piece *b*. The connection to the binding post is then established by unscrewing the cover cap *d*, as is also the connection to the line wire, it being understood, of course, that the pipe itself may be suitably grounded. Before inserting the sections *r* and the washers *v* in the pipe *a*, the coils of the resistance wire are distended or drawn apart in the several individual sections *r* until a sufficient length of wire is obtained in each of said sections corresponding to the local heat desired. It will be apparent that the parts as thus put together are likewise readily accessible for replacement or substitution of broken parts, or removal, when desired, the individual sections and their appurtenances for units of pipe length being identical, so that the heater can be indefinitely lengthened or shortened according to the particular requirements of use, and without calling upon the services of one possessed of more than the usual amount of skill.

It is characteristic of my invention that the coils of the naked resistance wire, being in contact with the walls of the porcelain sections *r*, and the sections themselves being in contact with the walls of the pipe *a*, the heat of the resistance wire is transmitted by conduction to the pipe. Moreover, the facilities afforded for locating in any individual section the exact length of wire that is desired for obtaining the heat effect required at such section, permit the appropriate distribution of the heat throughout the heater to suit the requirements of different points along its length, and, inasmuch as the heater is indefinitely extensible, it can be made of the entire length of the car, or can be branched or duplicated for any particular car, as circumstances may suggest or dictate. Furthermore, by virtue of the fact that the lining is made in sections and is separate from the radiating pipe, and of the fact that the current-carrying wire is in itself extensible, the heater as a whole is not injuriously affected by the different amounts of expansion, under variations in temperature, of its individual parts, but, on the contrary, these individual parts may freely expand without injury. In this connection it will be noted that the sections of the lining have a loose fit within the radiating pipe and that the projection of reduced diameter at one end of each section *r* fits loosely within the recess *t* of the next section and terminates short of the spacing piece *u*. It will also be observed that by reason of this projection of the end of each section into a recess in the next section, there is afforded a long air gap to prevent short-circuiting or leakage when, by reason of the expansion of the parts, the sections of the lining are separated. If it were not for these projections the path of leakage would be measured by the distance from the conductor to the wall of the radiating pipe, whereas, with these projections the length of that path is very much increased, as will be understood.

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

1. An electric heater having an outer radiating pipe, a plurality of sections of lining of electrically insulating and heat transmitting material arranged end to end within the pipe, and an inner current-carrying conductor within the lining; substantially as described.

2. An electric heater having an outer radiating pipe, a plurality of sections of lining of electrically insulating and heat transmitting material arranged end to end within the pipe, and an inner current-carrying conductor within the lining, said current-carrying conductor consisting of naked coiled wire; substantially as described.

3. An electric heater having an outer radiating pipe, a lining of electrically insulating and heat-transmitting material, an inner current-carrying conductor within the lining, a terminal plug carrying a binding post and a protecting end-piece for said terminal; substantially as described.

4. An electric heater having an outer radiating pipe, a lining therefor made up in sections, spacing pieces for the several sections, and a current-carrying conductor made up of coils or convolutions engaged by the spacing pieces, whereby the length of conductor in any individual section of the lining may be varied by appropriately distending the convolutions therein; substantially as described.

5. An electric heater having an outer radiating pipe, a lining therefor made up in sections of electrically insulating and heat-transmitting material, said sections being recessed at one end and having a hollow interior bore of less diameter than the recess, slotted disks bearing against the ledges constituting the bottoms of the recesses, and a current-carrying conductor made up of coils or convolutions, said conductor being straightened out at intervals so as to pass through the slots of the disks; substantially as described.

6. An electric heater having an outer radiating pipe, a lining of electrically insulating and heat-transmitting material, said lining being made up in sections, a current-carrying conductor passing through the lining sections, and a terminal plug carrying a binding post, a recess being provided between the lining and the terminal plug, within which recess is located a spacing piece and an end portion of the coiled conductor; substantially as described.

7. An electric heater, having an outer radiating pipe, a lining therefor made up of a series of sections of porcelain recessed at one end and having a longitudinal bore of less diameter than the recess, slotted disks located in the several recesses, a coiled current-carrying conductor passing through the several sections and disks, a terminal plug carrying a binding post, and a protecting cap or cover for the plug; substantially as described.

8. An electric heater having an outer radiating pipe, a lining of electrically insulating and heat-transmitting material in contact with the pipe, a current-carrying conductor passing through the lining, a terminal plug carrying a binding post, said terminal plug forming a continuation of the lining, and a protecting cap for the terminal plug; substantially as described.

9. An electric heater having an outer radiating pipe, a lining of electrically insulating and heat-transmitting material in contact with the pipe, a current-carrying conductor passing through the lining, a terminal plug carrying a binding post, said terminal plug forming a continuation of the lining, and a protecting cap for the terminal plug, said protecting cap being provided with a ledge against which rests a flange of the terminal plug; substantially as described.

10. In an electric heater, a terminal plug consisting of electrically insulating material, said plug having a central bore, a binding post located within the plug and extending laterally through a recess or aperture which communicates with the central bore, and a protecting cap for the plug; substantially as described.

11. In an electric heater, a terminal plug consisting of insulating material, said plug having a central bore, a binding post located within the plug and extending laterally through a recess or aperture which communicates with the central bore, and a protecting cap for the plug, said protecting cap having a removable cover plate so that access may be obtained to the binding post; substantially as described.

12. An electric heater having an outer radiating pipe, a lining of electrically insulating and heat-transmitting material made up in sections, each section having a reduced end which fits into a corresponding recess in the end of the next section, and an inner current-carrying conductor in contact with the lining; substantially as described.

13. An electric heater having an outer radiating pipe, a lining of electrically insulating and heat-transmitting material made up in sections fitting loosely within the pipe, each section having at one end a portion of reduced diameter which fits loosely within a corresponding recess in the end of the next section, and an inner current-carrying conductor in contact with the lining; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

WILLIAM H. FULTON.

Witnesses:

FRANK HENNESSY,

L. B. PENFIELD.