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E. L. SMALLEY.

ELECTRICALLY HEATED BOILER.

APPLICATION FILED AUG. 2, 1921.

1,430,927.

Patented Oct. 3, 1922.

3 SHEETS—SHEET 1.

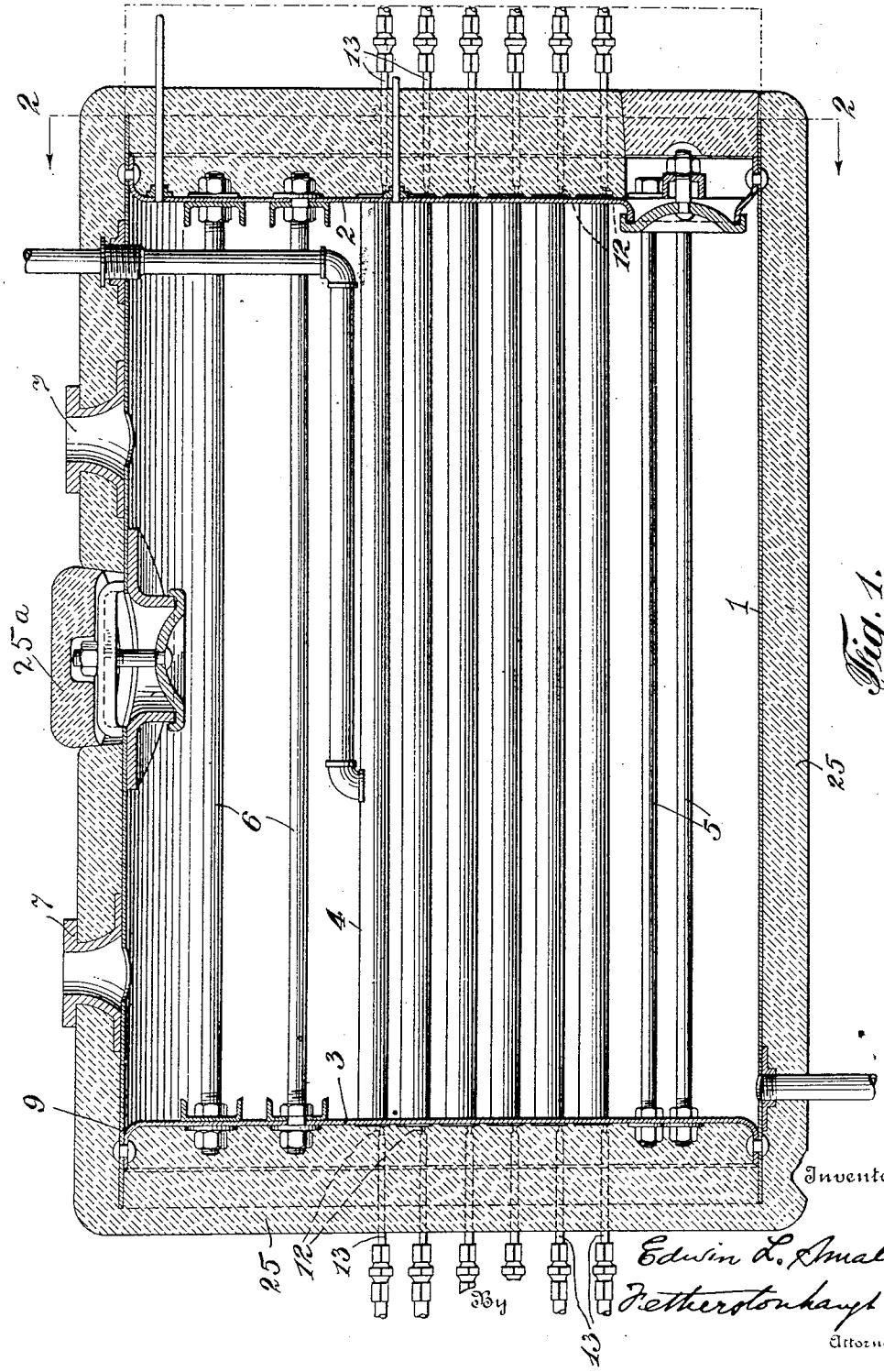


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

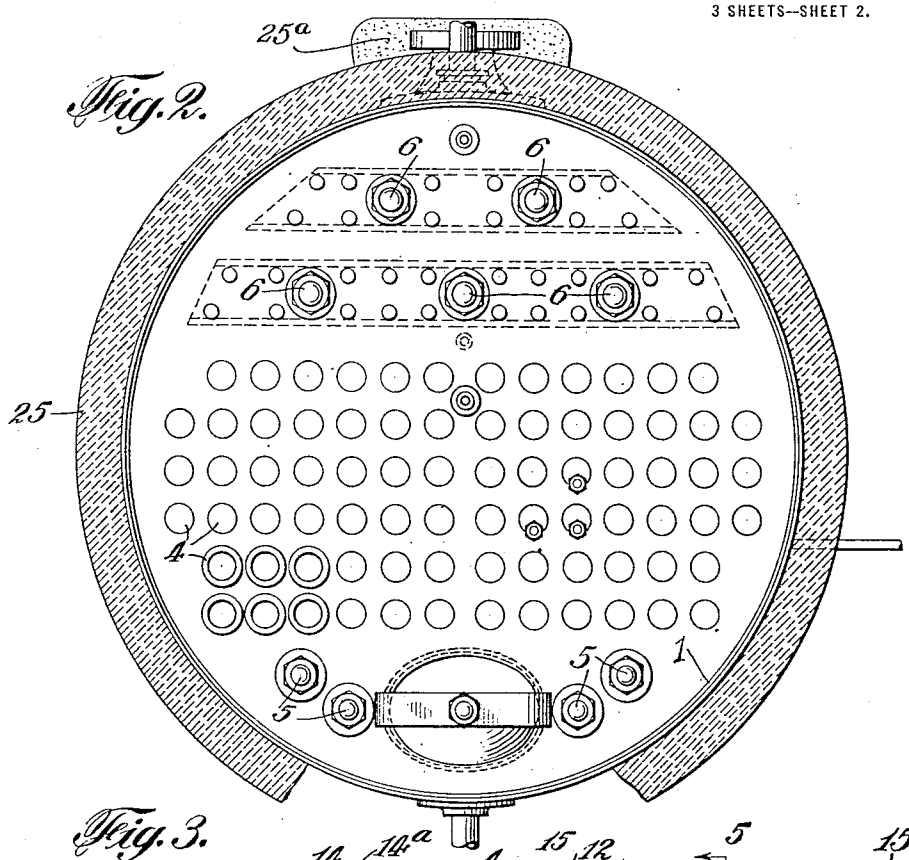
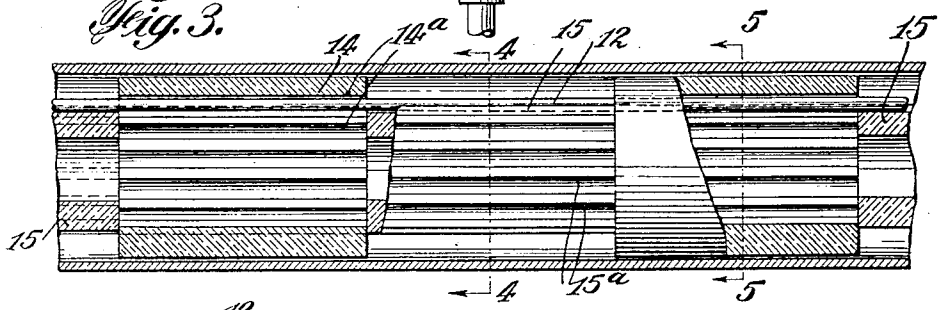


Fig. 3.



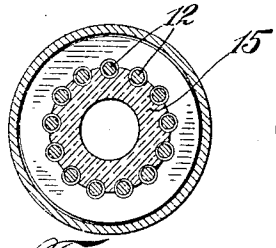


Fig. 4.

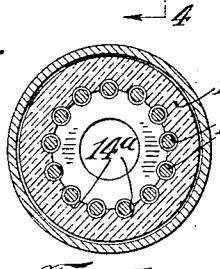


Fig. 5.

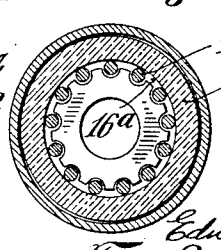


Fig. 6.

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3 SHEETS—SHEET 3.

Fig. 7.

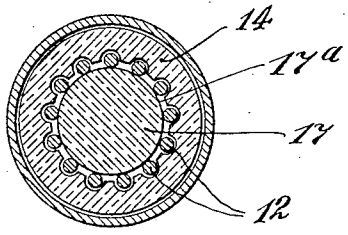


Fig. 8.

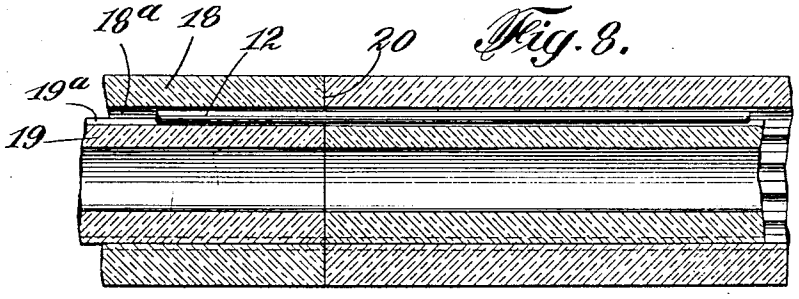


Fig. 9.

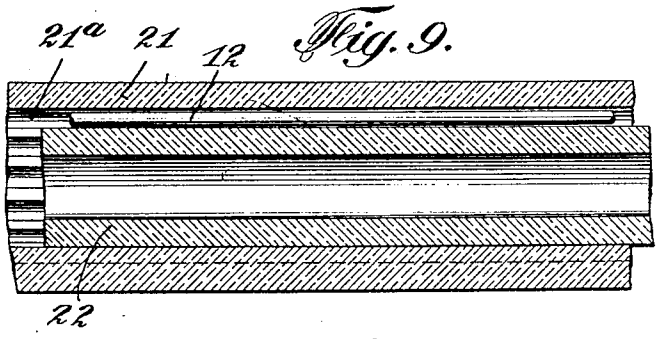
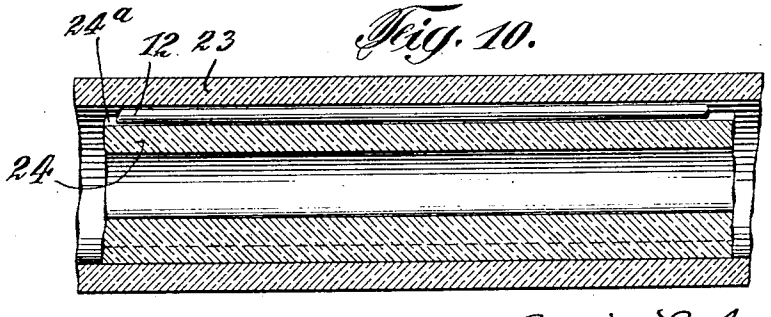


Fig. 10.



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UNITED STATES PATENT OFFICE.

EDWIN L. SMALLEY, OF SOUTH ORANGE, NEW JERSEY.

ELECTRICALLY-HEATED BOILER.

Application filed August 2, 1921. Serial No. 489,192.

To all whom it may concern:

Be it known that I, EDWIN L. SMALLEY, a citizen of the United States, and resident of 240 Irving Ave., South Orange, in the county of Essex and State of New Jersey, have invented certain new Improvements in Electrically-Heated Boilers, of which the following is an exact description, reference being had to the drawings which form a part of this specification.

This invention relates to the generation of steam by the use of electrical energy and my improvement is directed to boilers of the fire tube type which I provide with resistance conductors, carried within the boiler tubes by insulation of highly refractory and dielectric nature, so arranged with relation to the tubes as to afford maximum heating efficiency.

While by no means limited as to the means whereby electrical energy is generated for boiler heating purposes, it is contemplated by me to employ water power as the prime source of power, because I realize that in certain localities where fuel is unavailable, except at high cost for transportation, but which possess water power, the conversion thereof into heat by electrical means enables the economical production of steam for power and other commercial uses.

Therefore my invention consists of a boiler having water supply means and a series of heater tubes extended within said boiler to be surrounded by the water therein. Each of said tubes contains a resistance conductor which is supported therein and insulated therefrom by refractory material of suitable character.

In one example of my invention the insulation may be in longitudinal sections of different diameters, relatively large diameter sections that fit within a heater tube alternating with relatively small diameter sections that are disposed in concentric, spaced relation within the tube, and a return bend resistance conductor that is seated respectively upon the outer peripheral surfaces of the small diameter sections and against the inner peripheral surfaces of the large diameter sections; means also being provided whereby the return bends of the conductor are held in spaced and insulated relation from each other.

Insulation is provided exteriorly of the boiler with apertures for the passage of the terminals for the respective resistance conductors, said terminals preferably being of larger cross-sectional area than the resistance conductors to avoid loss of electrical energy exteriorly of the furnace.

In the drawings:—

Figure 1 is a longitudinal, sectional elevation of one form of my improved electric boiler.

Figure 2 is an end view thereof.

Figure 3 is an enlarged, partial, sectional elevation of a heater tube with its resistance conductor and its sectional refractory insulation support.

Figure 4 is a section on the line 4—4 of Figure 3.

Figure 5 is a section on the line 5—5 of Figure 3.

Figure 6 is a section showing a modified form of insulating support.

Figure 7 is a sectional view of a further modified form of support.

Figure 8 is a longitudinal, sectional elevation of a form of support for the resistance conductor composed of interfitting elements.

Figure 9 is a similar view of a modified form of support, and

Figure 10 is a similar view showing a still further modification.

In carrying out my invention I provide a boiler having a cylindrical shell 1, heads 2, 3, heater tubes 4 extended between the heads, lower brace or tie rods 5, and upper brace or tie rods 6.

The heater tubes 4, which may be of steel or other suitable material, each contain a resistance conductor 12, here shown in the form of return bend coils, which, with the exception of their terminals 13, are entirely enclosed within the tubes, in which they are suitably supported and insulated.

As insulating means I employ material of a highly refractory nature, having means maintaining the parallelism of the return bend resistance strands and of effectively insulating them from each other and from the metallic containing tube.

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A particular manner of insulation adopted by me comprises the employment of alternate cylindrical sections 14 and 15 which are respectively of larger and smaller diameters, they being arranged in lengthwise abutting relation, and said sections constituting respectively outer and inner localizing insulation supports for the resistance conductor. To this end the larger sections 14 must be hollow because the resistance conductor is to lie against its inner surface, but the smaller sections 15, shown in Figures 3 and 5 as tubular, may be solid in cross-section, since their outer surfaces furnish the supporting means for the resistance conductor.

In Figures 3 and 4 I have shown the sections 15 as having exterior longitudinal parallel grooves 15^a to receive and localize the strands of the resistance conductor, and in Figures 3 and 5 I have shown the tubular sections 14 as having internal longitudinal parallel grooves 14^a to receive and localize the same strands at alternate portions of their length. Thus, alternate length portions of said strands are exposed to the tube 4 containing the resistance conductor and provided with internal insulation material, and the length of exposure for the resistance conductor strands, between succeeding larger diameter sections 14 is insufficient to permit appreciable sagging of the strands, under heat expansion, so that no liability exists for them to enter into contact with the wall of their containing tube 4.

In some instances, where the resistance conductor is of very stout sectional character it may not be necessary for both the larger and smaller insulation sections to be grooved, and I have, in Figure 6, shown a larger or tubular section 16 as having an ungrooved or plain inner peripheral surface 16^a, to co-act with the grooved outer surface of section 15; and also, in Figure 7, I have shown a smaller section 17 as provided with an ungrooved or plain outer peripheral surface 17^a to co-act with the grooved inner surface of section 14.

While the greatest heat efficiency may be attained by means of the alternate smaller and larger insulating sections my invention also contemplates the employment of concentric interfitting, insulating supports of refractory material, which may be either in abutting sections or of continuous lengths and adapted to contain between them the resistance conductor. Thus, in Figure 8 I have shown a modified form of support composed of an outer tubular length 18 of insulation material, having the inner grooves 18^a, and a concentric inner length 19, having outer grooves 19^a, the grooves 18^a and 19^a containing between them the strands of conductor 12.

As indicated by dividing line 20, these concentric lengths of insulation material may, if desired, be in abutting sections.

In Figure 9, having concentric lengths 21, 22 in interfitted relation, the outer support 21 only may have grooves 21^a for the localization of conductor 12; and, in Figure 10, having similar supports 23, 24, the inner support 24 only may be provided with localizing grooves 24^a for conductor 12.

The boiler shell and its heads may be covered for a suitable thickness with heat insulating material, indicated at 25, plugs 25^a of the same material being for convenience fitted therein in the regions of the manholes.

The terminals 13, of the resistance conductors 12, extend out through the heat insulation material 25, for inclusion in an electrical circuit which derives its current from a source of energy not herein shown.

Variations within the spirit and scope of my invention are equally comprehended by the foregoing disclosure:—

I claim;

1. The combination, in an electric steam generator, of a shell having a series of heater tubes fitted therein, said tubes containing refractory insulation in the form of longitudinal, abutting sections, alternate sections having relatively larger and smaller diameters, the sections of larger diameter being hollow, and a return bend resistance conductor for a heater tube engaging the outer surfaces of the sections of smaller diameter and the inner surfaces of the sections of larger diameter.

2. The combination, in an electric steam generator, of a shell having a series of heater tubes fitted therein, said tubes containing refractory insulation in the form of longitudinal, abutting sections, alternate sections having relatively larger and smaller diameters, the sections of larger diameter being hollow, and a return bend resistance conductor for a heater tube engaging the outer surfaces of the sections of smaller diameter and the inner surfaces of the sections of larger diameter, and means for localizing said resistance conductor to maintain the parallelism of its return bends.

3. The combination, in an electric steam generator, of a shell having a series of heater tubes fitted therein, said tubes containing refractory insulation in the form of longitudinal, abutting sections, alternate sections having relatively larger and smaller diameters, the sections of larger diameter being hollow and having parallel grooves in their inner surfaces, and a return-bend resistance conductor for a heater tube to engage the grooves in the larger sections and the surfaces of the sections of smaller diameter.

4. The combination, in an electric steam generator, of a shell having a series of heater

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tubes fitted therein, said tubes containing refractory insulation in the form of longitudinal, abutting sections, alternate sections having relatively larger and smaller diameters, the sections of larger diameter being hollow and the sections of smaller diameter having parallel grooves, and a return bend resistance conductor for a heater tube engaging the grooves of the sections of smaller diameter and the inner surfaces of the sections of larger diameter.

Signed at New York, in the county and State of New York, this 28th day of July, 1921.

EDWIN L. SMALLEY. [L. S.]