W. A. SMITH.

ELECTRIC FURNACE.

APPLICATION FILED JUNE 15, 1909.

935,937.

Patented Oct. 5, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

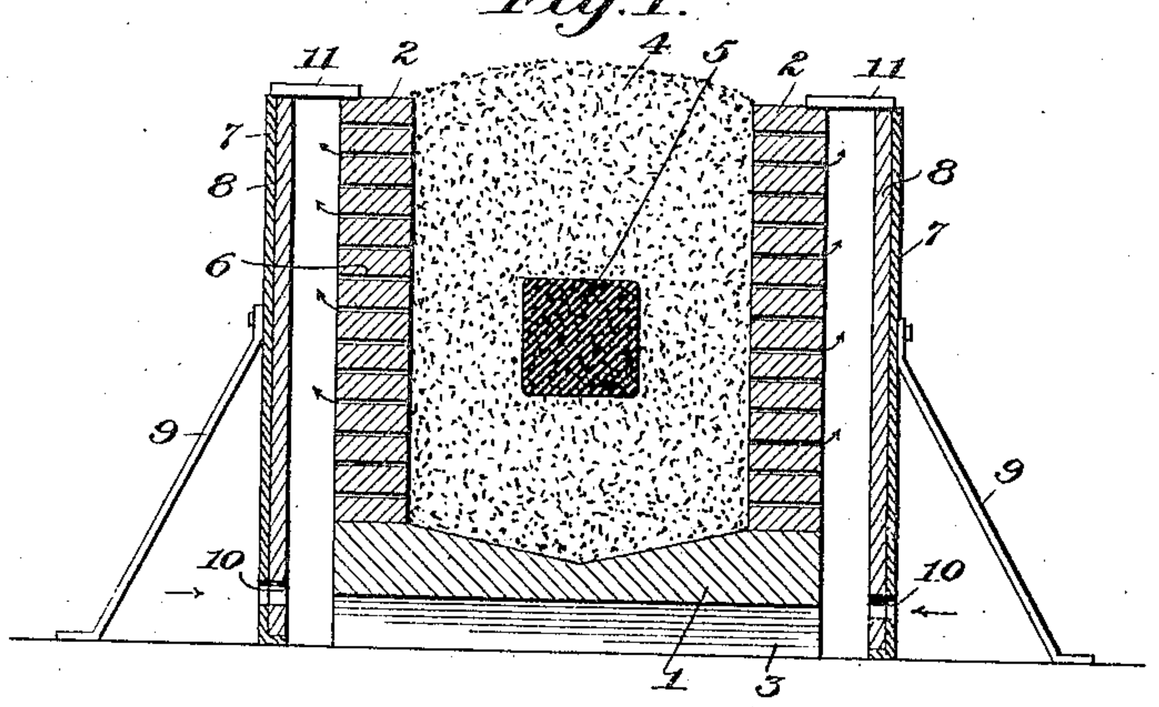


Fig. 2.

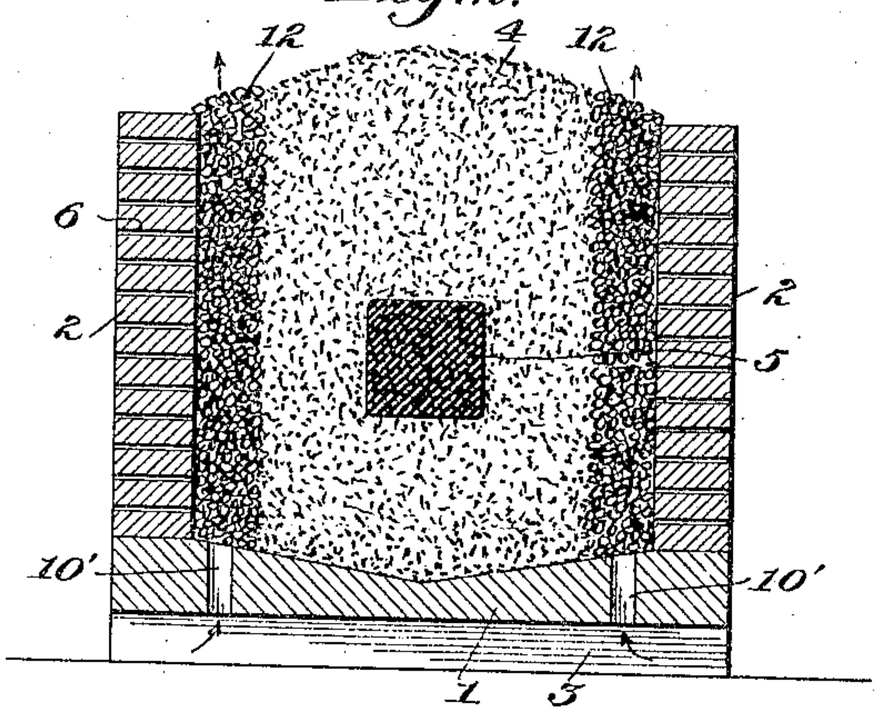
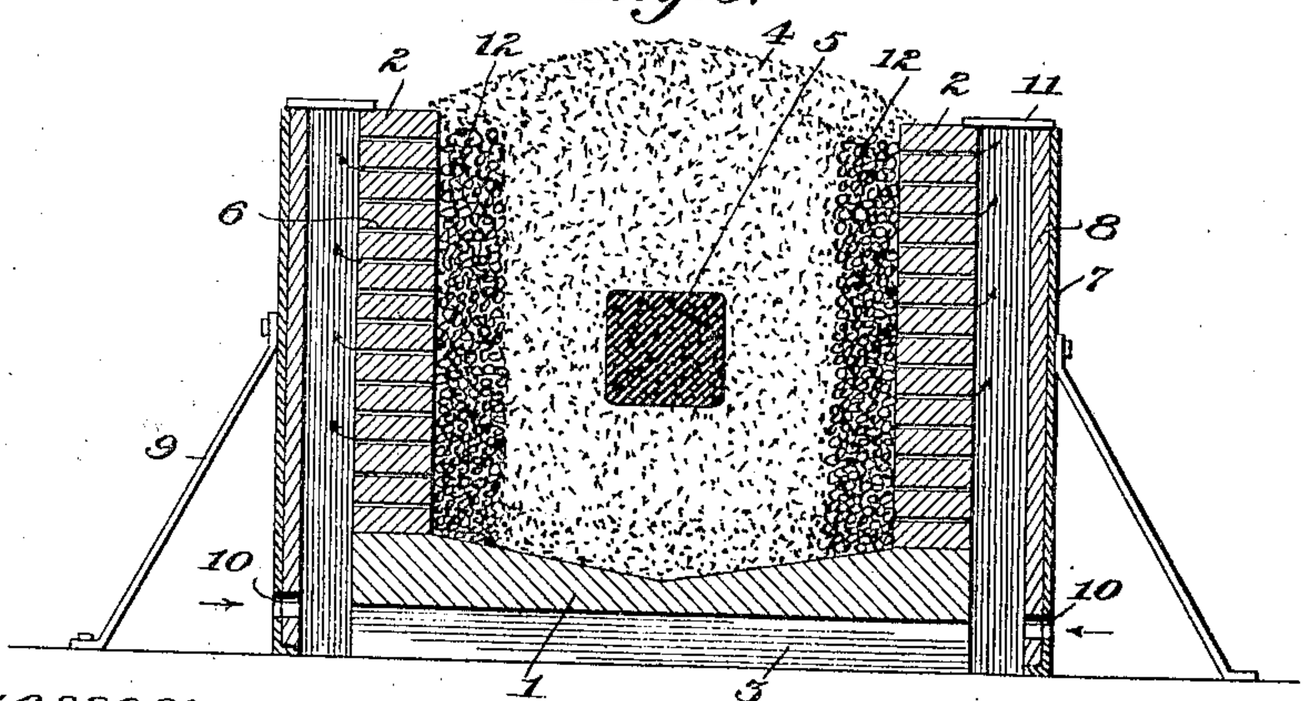


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

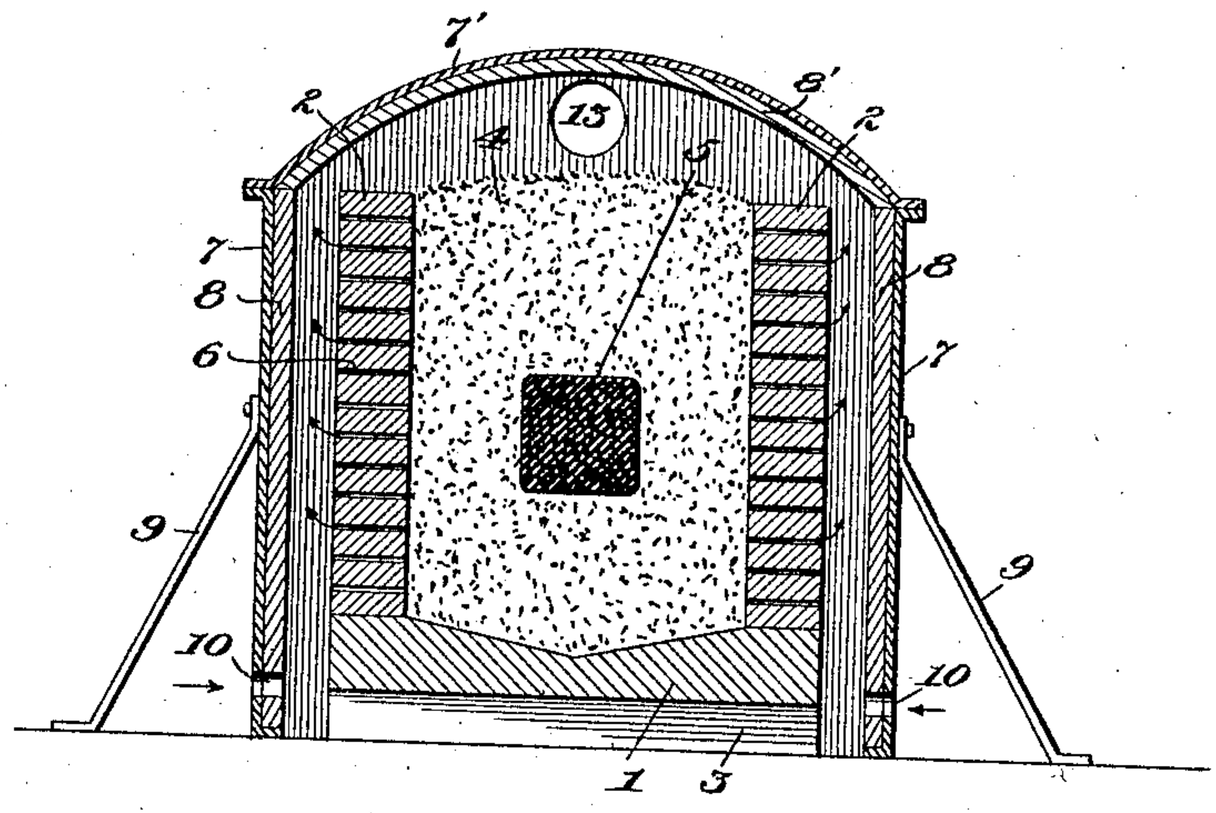
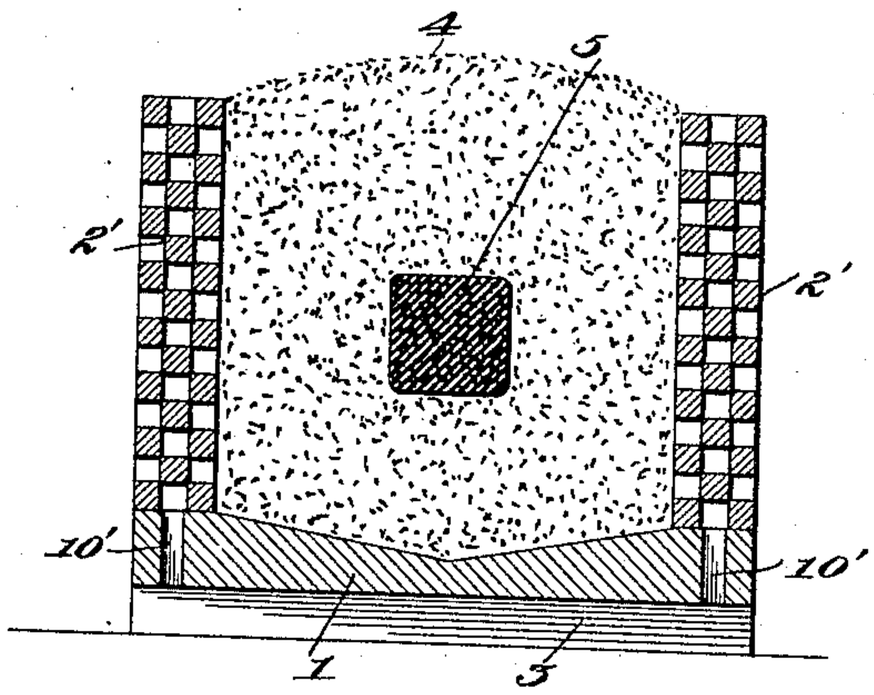


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM ACHESON SMITH, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO INTERNATIONAL ACHESON GRAPHITE COMPANY, OF NIAGARA FALLS, NEW YORK.

ELECTRIC FURNACE.

935,937. Specification of Letters Patent. Patented Oct. 5, 1909.

Application filed June 15, 1909. Serial No. 502,354.

To all whom it may concern:

Be it known that I, WILLIAM ACHESON SMITH, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

This invention relates to electric furnaces, and consists essentially in the provision in a furnace having walls which are permeable to the gaseous reaction products, of means for effecting the combustion of such reaction products under conditions which will effectively check or reduce heat loss from the charge.

For a full understanding of the invention the same will be described by reference to certain specific embodiments thereof as illustrated in the accompanying drawings, wherein:

Figure 1 is a transverse vertical section of an electric furnace of the resistance type embodying the invention; Figs. 2, 3, 4 and 5 are similar views of certain modified constructions.

Referring to the drawings, the furnace is shown as comprising a base 1 and lateral charge-retaining walls 2, carried by the base, the walls 2 being preferably simply constructed of one or more courses of brick and readily taken down at the conclusion of each run of an intermittently operated furnace to facilitate removal of the product. As illustrated, the base is provided with transverse air passages 3, serving both to cool the base and to equalize conditions on opposite sides of the furnace.

4 represents the charge and 5 the heating resister embedded therein, the ends of the resister being in electrical connection with the respective terminals of the electric circuit as is well understood in the art. The charge is assumed to be one yielding a combustible gas as a reaction product, as carbon monoxid, hydrogen, hydrocarbon vapors, or the like, examples of charges of this character being the mixture containing sand and carbon employed in the manufacture of silicide of carbon, the petroleum coke, anthracite coal or other form of carbon used in the production of graphite and graphite articles, etc. The charge-retaining walls 2 are illustrated as built of loosely set bricks, the interspaces of which afford a free passage for the gaseous reaction products from all portions of the charge; these interspaces are indicated at 6, and for clearness are shown on a somewhat exaggerated scale. For the purposes of the invention it is essential merely that the walls 2 should be so constructed as to afford free passage for the entire volume of reaction gases.

In furnaces constructed as above described the gas is found to burn freely at the points of escape, but to be comparatively ineffective in heating the wall of the furnace or in reducing the loss of heat from the charge. I have found however that if the burning gases, and the heated products of combustion thereof, be confined in or in proximity to the permeable walls, the temperature of these walls becomes comparatively high with a corresponding diminution of the rate of flow of heat from the charge, the result being that a very considerable economy of current is effected in maintaining any given temperature or range of temperature in the charge. A further result is that in the production of materials requiring more or less definite temperature conditions, as for example silicide of carbon, the productive zone of the furnace is greatly extended; that is to say, with any given temperature in and adjacent the heating resister, the temperature conditions which are suitable for the reaction and which are therefore productive are extended much farther into the body of the charge. It follows from this that the provision of such spaced walls or equivalent means for confining the burning gases in or adjacent the walls effects a double economy, in that it economizes the current required to maintain a given temperature range, and also increases the product of the furnace by widening the limits within which a reacting temperature is maintained.

The foregoing results are secured in the furnace illustrated in Fig. 1 by the provision of heat-retained walls 7, spaced from the permeable walls 2. These heat-retaining walls may be of sheet metal, preferably interiorly faced with material of low heat conductivity 8, and provided with supports 9, the construction being of a character permitting the ready removal of the heat-retaining wall at the close of the operation in case it is desired to take down the brick walls 2 to give access to the product. Air in excess is admitted to the spaces between the

permeable walls 2 and the heat-retaining walls 7, as by a series of apertures or perforations 10, or more simply by providing air inlets beneath the outer walls. Ordinarily, the heat-retaining walls 7 may comprise merely plane sheets, extending substantially the whole length of the furnace on each side thereof, the end spaces being open or closed as may be desired. To further retain the heated gases plates 11 of any suitable non-combustible material may be arranged to close, either wholly or partially, the top of the intermediate space. A further economy of heat and current may be secured by extending the heat-retaining wall over the top of the charge, at a suitable distance therefrom as indicated at 7′, 8′ in Fig. 4: in this case the products of combustion may be permitted to escape through suitable orifices from the upper portion of the heat-retaining structure, or they may be led off through a flue indicated at 13.

A modified construction is illustrated in Fig. 2, wherein a vertical layer, bed or wall 12 of coarse material, as coke, broken firebrick or the like is disposed between the charge and the permeable wall 2, in which position it serves as an interior extension of this wall, supported between the charge and the wall 2. This material is highly permeable and owing to its coarse or granular character it contains a comparatively large volume of heated gas, and acts therefore as a very effective heat insulator. Air may enter this layer or wall either through the outer walls 2, which then perform also the functions of the heat-retaining walls 7, or through flues 10′, and effect the combustion of gases in and around the granular material 12, thus providing a highly heated zone adjacent the charge; or in case the gases are not permitted to escape freely from the upper surfaces of the layers or interior walls 12, as for example in case the charge 4 be extended over these as indicated in Fig. 3, or in case these are made of comparatively finely subdivided material, the gases may be burned outside the permeable walls 2, or between these and the heat-retaining walls precisely as described in connection with Fig. 1 and as further illustrated in Fig. 3. Thus in the construction illustrated in Fig. 2, according to the particular conditions, the air may either pass inwardly through the permeable walls 2, effecting combustion of the gases in the layer 12, or these gases may pass outward through the walls 2, burning on their outer faces. In the latter case spaced heat-retaining walls are preferably provided as shown in Fig. 3. The specific conditions must be chosen in any particular case, with reference to the character and volume of the reaction gases, to effect the greatest degree of economy of heat consistent with the avoidance of all danger of explosions from accumulations of unburned gases. Obviously the construction may be otherwise modified to effect the purposes of the invention: for example, the charge-retaining walls may be of a hollow or checkered construction as illustrated by way of example at 2′ in Fig. 5, whereby the gases are burned within these walls, the outer or heat-retaining walls being used or not as may be desired. In this construction air may be admitted to the interior of the wall, or to the interstices thereof, as by flues 10′.

I claim:

1. An electric furnace comprising a furnace chamber having a wall constructed to afford free passage for reaction gases and means for confining the burning gases in proximity to said permeable wall.

2. An electric furnace comprising a furnace chamber having a wall constructed to afford free passage for reaction gases, a heat-retaining wall outside said permeable wall, and means for effecting combustion of the furnace gases between said heat-retaining wall and the charge.

3. An electric furnace comprising a furnace chamber having a wall constructed to afford free passage for reaction gases, a heat-retaining wall outside said permeable wall and spaced therefrom, and means for effecting combustion of the furnace gases between said heat retaining wall and the charge.

4. An electric furnace comprising a furnace chamber having a wall constructed to afford free passage for reaction gases, a heat-retaining wall outside said permeable wall, and means for effecting combustion of the furnace gases between said heat-retaining wall and the permeable wall.

5. An electric furnace comprising a furnace chamber having a permeable wall, a removable heat-retaining wall disposed in proximity to said permeable wall, and means for admitting air to effect combustion of gases traversing said permeable wall.

6. An electric furnace comprising a furnace chamber having a permeable wall, and a wall or layer of broken or granular material interposed between said permeable wall and the charge.

7. An electric furnace comprising a furnace chamber having a permeable wall, a wall or layer of broken or granular material interposed between said permeable wall and the charge, and means for effecting combustion of gaseous reaction products traversing said interior wall.

8. An electric furnace comprising a furnace chamber having a permeable wall, a wall or layer of broken or granular material interposed between said permeable wall and the charge, and means for effecting combustion of gaseous reaction products within said interior wall.

9. An electric furnace comprising a furnace chamber having a permeable wall, and means for effecting combustion of gaseous products of r action within the interstices of said wall.

10. An electric furnace comprising a furnace chamber having a wall constructed to afford free passage of reaction gases, and a heat-retaining wall, said heat-retaining wall extending above the furnace charge.

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

WILLIAM ACHESON SMITH.

Witnesses:

WILLIAM H. ARISON,

EBEN C. SPEIDEN.

Certificate of Correction in Letters Patent No. 935,937.

It is hereby certified that in Letters Patent No. 935,937, granted October 5, 1909, upon the application of William Acheson Smith, of Niagara Falls, New York, for an improvement in "Electric Furnaces," an error appears in the printed specification requiring correction as follows: Page 1, line 100, the compound word "heat-retained" should read *heat-retaining;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of December, A. D., 1909.

[SEAL.]

E. B. MOORE,

Commissioner of Patents.