No. 871,971. PATENTED NOV. 26, 1907.

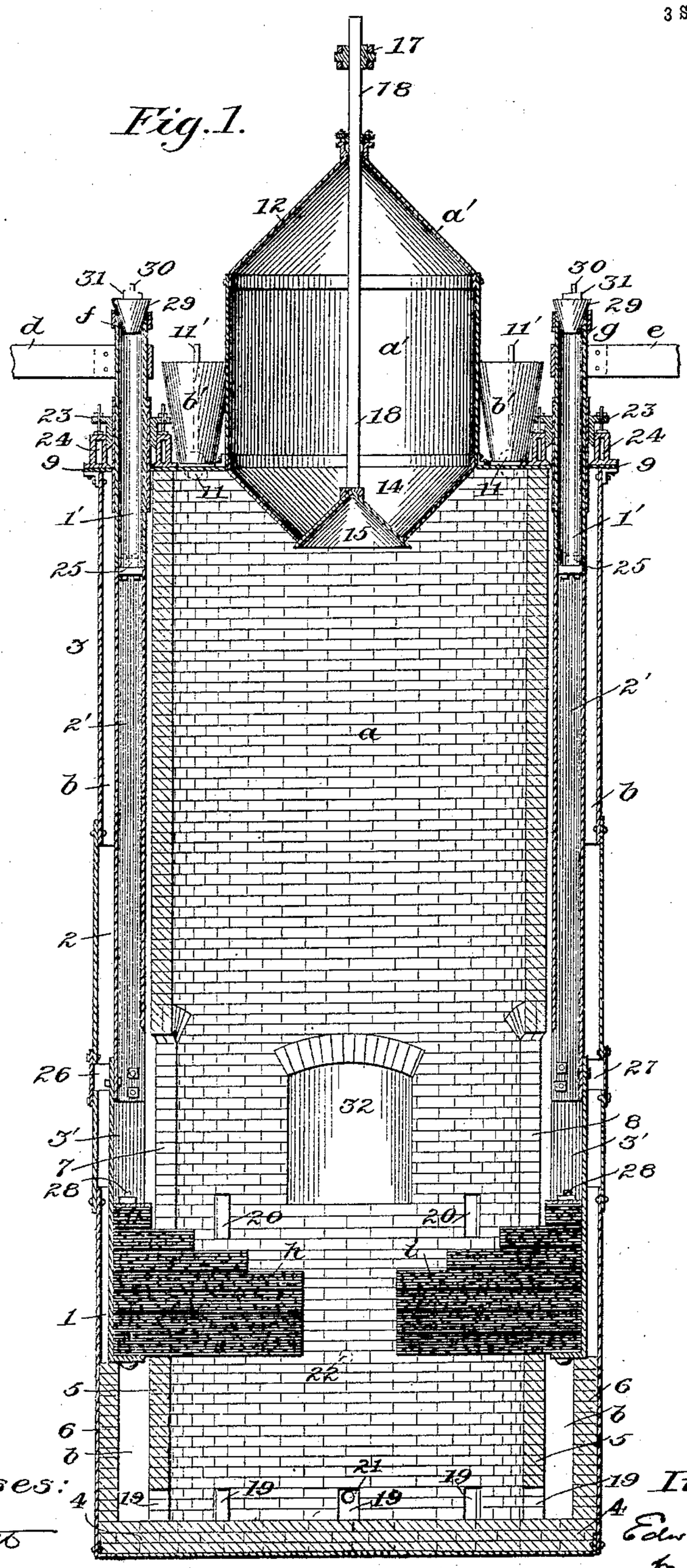
# E. R. TAYLOR.

## ELECTRIC FURNACE.

APPLICATION FILED SEPT. 5, 1906. RENEWED APR. 15, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

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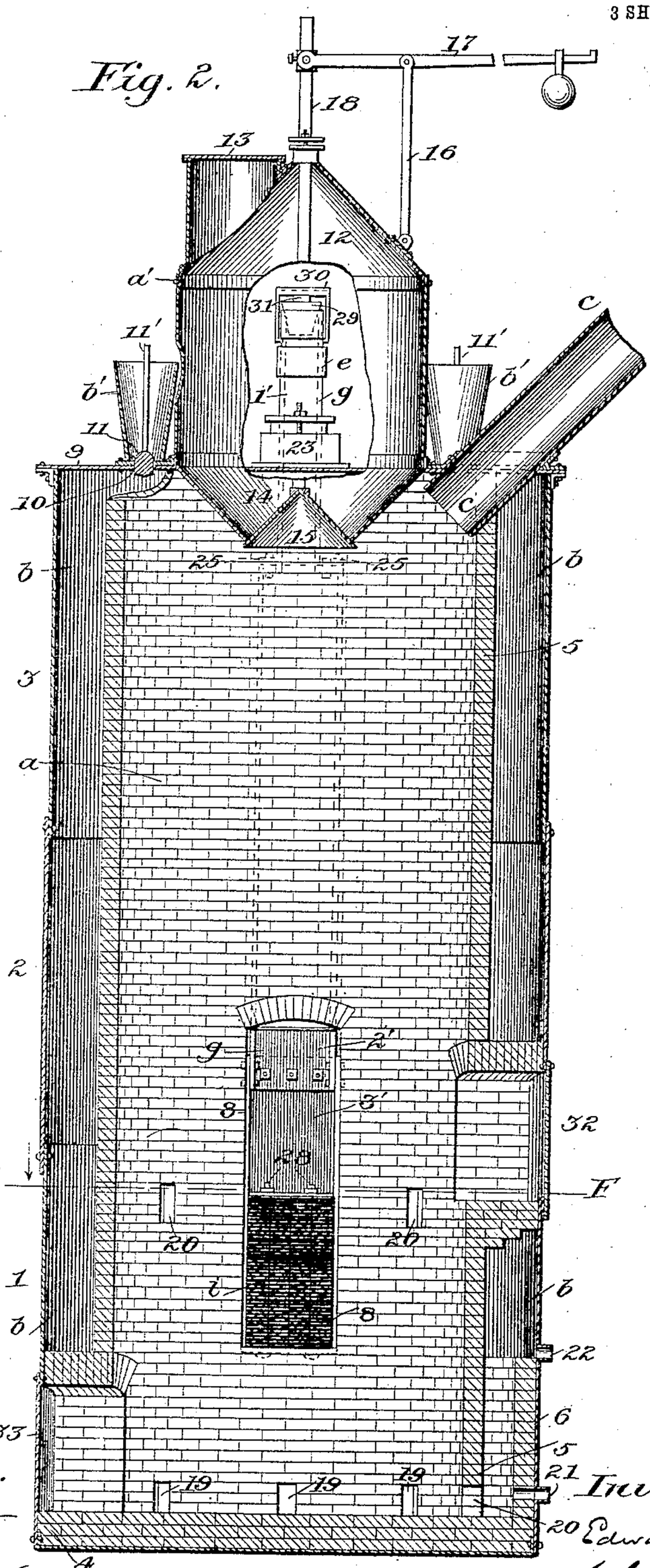
3 SHEETS—SHEET 2.

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 3.

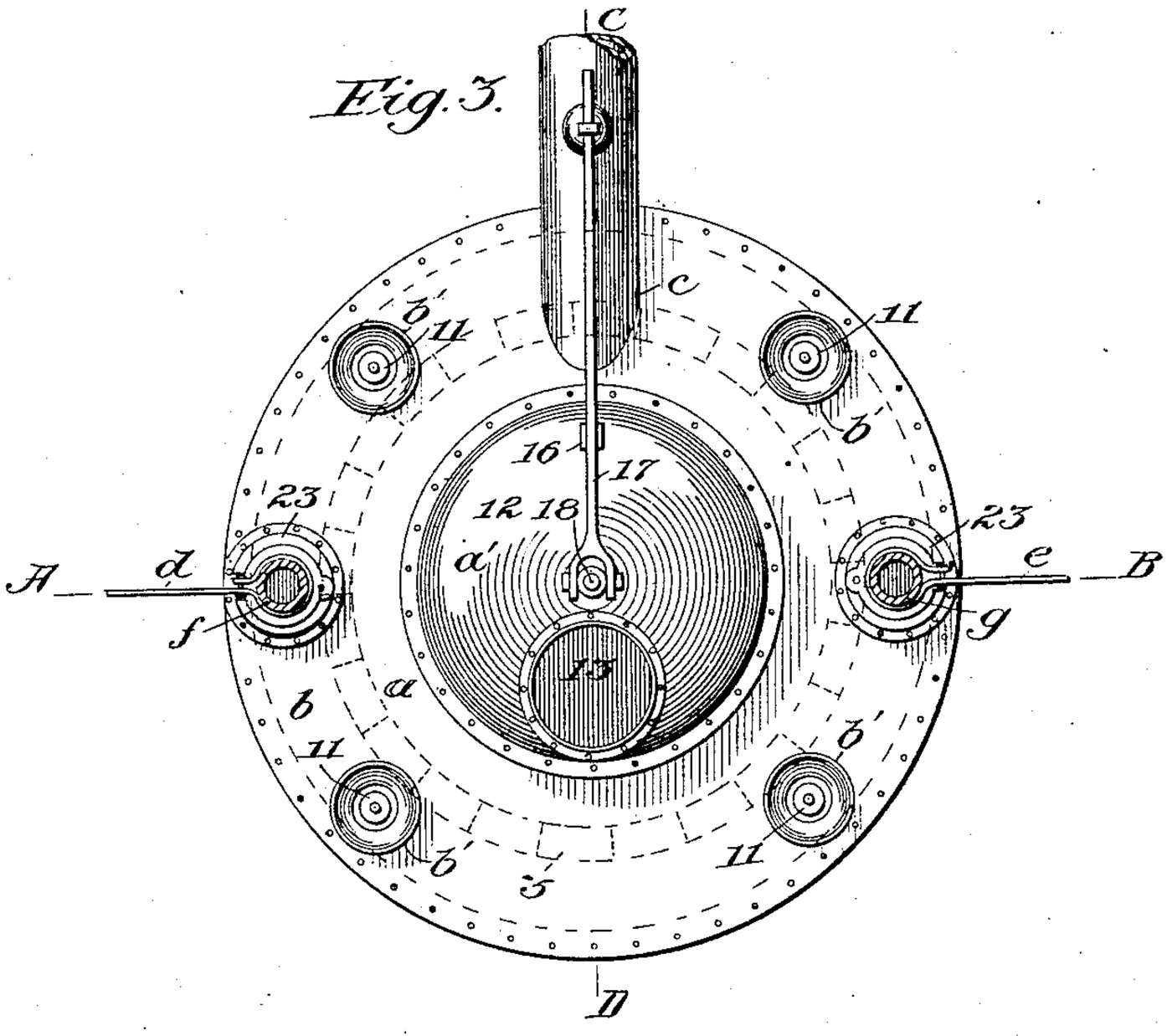
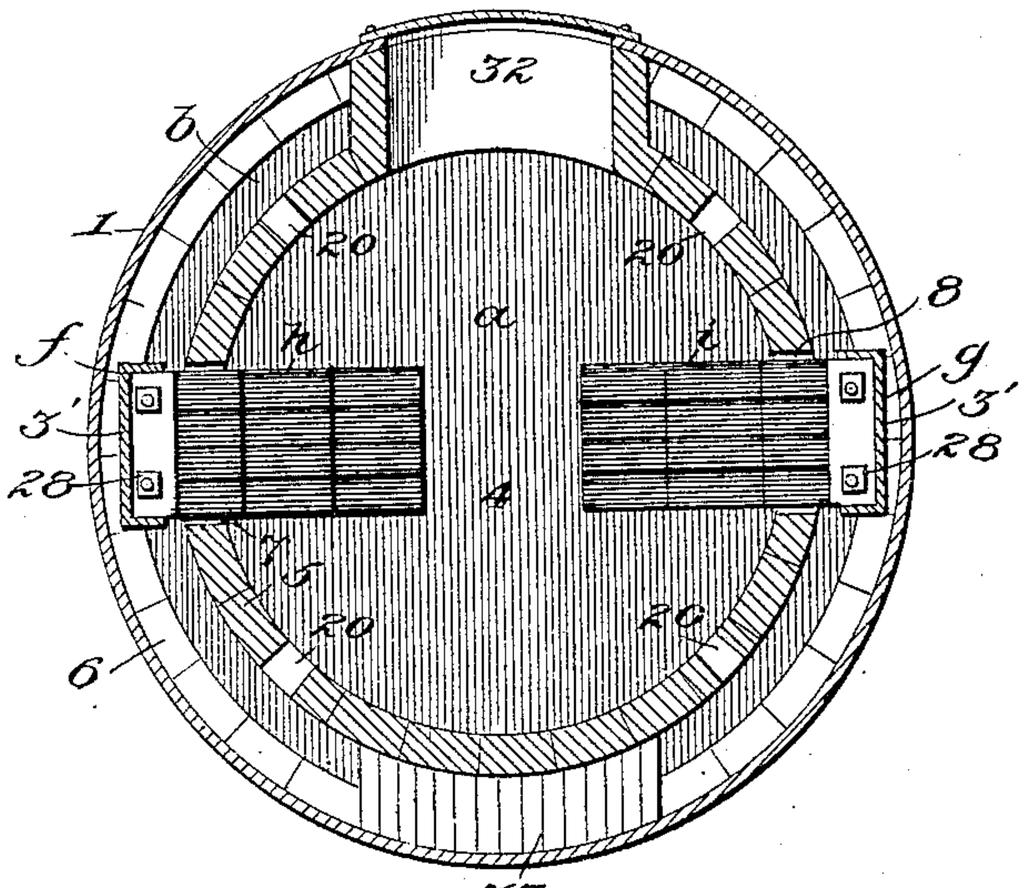



Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## ELECTRIC FURNACE.

No. 871,971. Specification of Letters Patent. Patented Nov. 26, 1907.

Application filed September 5, 1906, Serial No. 333,368. Renewed April 15, 1907. Serial No. 368,248.

*To all whom it may concern:*

Be it known that I, EDWARD R. TAYLOR, a citizen of the United States of America, and a resident of Penn Yan, in the State of New York, have invented a new and useful Improvement in Electric Furnaces, of which the following is a specification.

This invention relates to "resistance" furnaces supplied with selfmoving material, for reducing mineral substances and effecting chemical reactions and conversions by the aid of electricity, and is primarily additional to the improvement in electric furnaces described and claimed in my previous specification forming part of United States Letters Patent No. 688364 dated December 10, 1901. In common with the specific furnace set forth in said previous specification, the herein described furnace is primarily designed for the economical manufacture of carbon bisulfid ($CS_2$). Several practical difficulties are involved in the construction and operation of such "resistance" electric furnaces supplied with self-moving material when reduced to a comparatively small scale.

Some of such difficulties it is the object of the herein described invention to overcome; the leading object of this invention being the production of a furnace which can be made to work successfully on a relatively small scale, and at the same time to utilize some of the principles of the discovery more fully set forth in said previous specification.

The present invention consists in certain novel features of construction and combinations of parts hereinafter described and claimed.

Three sheets of drawings accompany this specification as part thereof.

Figure 1 is a sectional elevation of a small electric furnace for the manufacture of carbon bisulfid; Fig. 2 is a sectional elevation with the plane of section at right angles to that of Fig. 1, and with portions broken away at top to expose parts behind the plane of section; Fig. 3 is a top view on which the planes of Fig. 1 and Fig. 2 respectively are indicated by broken lines A—B and C—D; and Fig. 4 represents a horizontal section on the line E—F, Fig. 2.

Like reference characters refer to like parts in all the figures.

The improved furnace includes an outer metallic shell (of iron or steel) made conveniently in three sections numbered respectively 1, 2 and 3 in Figs. 1, 2 and 4. Within the lower shell section, 1, a flat hearth or floor, 4, Figs. 1, 2 and 4, of fire brick or the like, supports a circular wall, 5, of like material within which is the working chamber, *a*, of the furnace, and an outer wall, 6, concentric with said wall, 5, extending upward a short distance and terminating substantially on a level with the bolster-forming lower ends of a pair of diametrically opposite embrasures, 7 and 8. Said wall 5 of the working chamber *a* is continued upward to the top of the outer shell, 1, 2, 3, a feed chamber *b* Figs. 1, 2 and 4, for sulfur being formed between the walls 5 and 6 at bottom and between the wall 5 of the working chamber and the outer shell above the top of said outer wall 6.

The shell, 1, 2, 3, terminates at top in a horizontal annular top portion, 9, Figs. 1, 2 and 3 which is provided at suitable intervals with hoppers *b'* and with openings, 10, Fig. 2, at their bottoms communicating with said feed space *b*, each of the hoppers being provided with a suitable plug, 11, having a handle, 11', extending above the top of the hopper, so that the hoppers may be filled above the plugs, and the plugs then lifted to drop the contents of the hoppers into the feed space, *b*, and quickly replaced to prevent the escape of fumes and the admission of air. Within the central opening of said top portion, 9, of the shell, a charcoal hopper, *a'*, Figs. 1, 2 and 3, of suitable capacity is supported; the same being preferably and conveniently constructed with a conical top, 12, provided with a capped charging neck, 13, through which the charcoal is introduced into the hopper, and a conical bottom, 14, depending within the upper end of the working chamber *a* and provided with a central opening closed by a bell, 15; the top of the hopper being further provided with the supporting link, 16, of a weighted lever, 17, connected with said bell, 15, by a rod, 18, and rendering the hopper *a'* normally closed at bottom. A suitable discharge pipe, *c*, Figs. 2 and 3 extends from the working chamber *a* through said top portion 9 of the shell, in an oblique direction, as shown in Fig. 2.

Suitable sulfur openings, 19 and 20, Figs. 1, 2 and 4, are formed in the working chamber wall 5 immediately above the floor 4, and at one or more higher points, connecting the feed space *b* with the working chamber *a;* and pipe openings, 21 and 22, extend through the outer wall 6 and the lower shell section 1

at different heights for drawing off the liquid sulfur at will. Metallic conductors, *d* and *e*, Figs. 1 and 3, connected with a suitable source of electricity, are attached respectively to the protruding upper ends of metallic electrode stems, *f* and *g*, which extend downwardly therefrom to the top of said outer wall 6, and rest upon the top of this wall, as in Fig. 1. Each of said electrode stems *d* and *e* is preferably and conveniently made in three sections, numbered respectively 1′, 2′ and 3′ in Fig. 1; the upper section 1′ of each of the stems being hollow and cylindrical, and extending through a stuffing box, 23, mounted on the top of the shell, and preferably constructed with a water chamber, 24, through which to circulate water for keeping the gland sufficiently cool. The lower end of such upper section has flanges, 25, on opposite sides adapting it to be coupled to the partly closed upper end of a flat middle section, 2′, which is tubular excepting its lower end, and this end is trough-shaped in common with the lowermost section, 3′, which is detachably bolted to said trough-shaped lower end of the middle section 2′. A pair of manholes, 26 and 27, Fig. 1, in the middle section 2′ of the outer shell, afford access to the bolts connecting said middle and lowermost sections, 2′ and 3′, of the electrode stems, and facilitate disconnecting the lowermost sections 3′ when the latter need to be renewed.

The electrodes proper, *h* and *i*, are of carbon, made in convenient sections of different lengths, but all of them preferably and conveniently of one and the same size and all rectangular in cross section. Compare Figs. 1 and 2. Such carbon sections project at right angles from the lower ends of the stems *f* and *g*, and may be clamped within the trough-shaped stem sections 3′ by suitable bolts, 28, or in any known or improved manner. A sufficient number of the longer carbon sections are united at bottom to form the main body of each electrode, and above these the shorter sections are arranged in steps as shown in Fig. 1. The electrodes *h* and *i* project inwardly, as shown in Figs. 1 and 4, and are supported beneath by said bolster forming lower ends of the embrasures 7 and 8, through which the respective electrodes extend toward each other, into the working chamber *a*, as shown in Fig. 1.

The tubular or hollow stem sections 1′ and 2′ provide for feeding fragmentary material downward therethrough upon the electrodes to regulate the operation of the furnace in the manner set forth in said previous specification. The upper end of each stem is provided with a conical plug, 29, and with a "gallows" or yoke, 30, between which and the top of the plug 29 a wooden wedge, 31, is driven to render the closure air and gas tight.

In charging the furnace the lower part of the working chamber *a* is filled with broken sulfur to the plane of the electrodes *h* and *i*, and a sufficient quantity of charcoal is superimposed. The lower part of the furnace is then tightly closed and sealed, and the working chamber *a* is thereafter filled with charcoal to any desired extent by way of the charcoal hopper *a′* by depressing the bell 15 by means of the lever 17. The hopper *a′* is then automatically closed at bottom by the reëlevation of the bell 15. Crushed sulfur is fed into the annular feed space *b* surrounding the working chamber wall from time to time as required by way of the hoppers *b′*, which are filled with the sulfur, and may serve to measure the quantity introduced, and are emptied into the feed space *b* by partly withdrawing their plugs 11 and replacing them immediately to prevent the entrance of air and the escape of fumes. The bisulfid vapor as it is formed passes off through the pipe *c* into a suitable condenser (not shown) which forms no part of the present invention.

An upper manhole, 32, extending outward from the working chamber *a* through the shell sections 1 and 2, as shown in Figs. 1, 2 and 4, facilitates access to the interior of the furnace when it is cold for adjusting or renewing the electrodes *h* and *i* and for arranging the charge at the beginning of an operation; and a subjacent manhole, 33, Fig. 2, facilitates removing the ash from time to time as may be necessary.

The electrode stems *f* and *g* and their stuffing boxes 23 may be insulated in the manner set forth in said previous specification forming part of Letters Patent No. 688,364, or in any known or improved manner; and the metallic shell may be insulated from the brickwork or its equivalent as set forth in said previous specification.

The furnace may be oval or elliptical in cross section as the equivalent of round; closures of any suitable form may be substituted for the described closures; and other like modifications will suggest themselves to those skilled in the art.

Having thus described said improvement, I claim as my invention and desire to patent under this specification:

1. An electric furnace adapted to be supplied with self-moving material and having an embrasured wall of fire brick or the like inclosing a vertical working chamber, an outer shell surrounding said wall and inclosing an annular feed space between said wall and said shell, connections with a suitable generator of electricity, electrode stems to which said connections are attached and which extend downwardly therefrom within said feed space, and a pair of electrodes attached to the lower ends of said stems, located and supported wholly within said shell, and extending into the working chamber and toward each other.

2. In an electric furnace having a vertical working chamber and a feed space external to said chamber for self-moving material such as sulfur, a metallic electrode stem which extends downwardly within said feed space, and a carbon electrode attached to the lower end of said stem and composed of a number of sections clamped together side by side and substantially at right angles to said stem.

3. In a resistance electric furnace adapted to be supplied with self-moving material and having a vertical working chamber and a feed space external to said chamber for sulfur or the like, an electrode extending from within said feed space into said chamber and a tubular electrode stem extending downward within said feed space and through which fragmentary material can be fed downwardly upon the electrode to regulate the electrical action, the electrode projecting substantially at right angles from said stem.

4. A resistance electric furnace having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing an annular feed space between said wall and said shell, means for supplying said feed space with self-moving material for treatment, connections with a suitable generator of electricity, metallic electrode stems to which said connections are attached and which extend downwardly therefrom within said feed space, and a pair of carbon electrodes attached to the lower ends of said stems, located wholly within said shell, and supported beneath by bolster forming portions of said wall within embrasures through which the respective electrodes extend into the working chamber and toward each other.

5. A resistance electric furnace having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing an annular feed space between said wall and said shell, means for supplying said working chamber and said feed space with self-moving material for treatment, connections with a suitable generator of electricity, metallic electrode stems to which said connections are attached and which extend downwardly therefrom within said feed space, and carbon electrodes attached to the lower ends of said stems, located wholly within said shell, and supported beneath by bolster forming portions of said wall within embrasures through which the respective electrodes extend into the working chamber and toward each other.

6. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing an annular feed space between said wall and said shell, an outer wall at the bottom of said feed space, connections with a suitable generator of electricity, metallic electrode stems to which said connections are attached and which extend downwardly therefrom within said feed space, and a pair of carbon electrodes attached to the lower ends of said stems, located wholly within said shell and supported beneath by bolster forming portions of said wall within embrasures through which the respective electrodes extend into the working chamber and toward each other, the lower ends of said stems being further supported upon said outer wall.

7. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing a feed space between said wall and said shell, connections with a suitable generator of electricity, metallic electrode stems to which said connections are attached and which extend downwardly therefrom within said feed space, and a pair of carbon electrodes each composed of a number of sections clamped together side by side and at right angles to said stems, located wholly within said shell and extending into the working chamber and toward each other.

8. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing a feed space between said wall and said shell, connections with a suitable generator of electricity, metallic electrode stems to which said connections are attached and which extend downwardly therefrom within said feed space, and a pair of carbon electrodes each composed of a number of sections of different lengths clamped together side by side, projecting at right angles to said stems and arranged in steps with the longer sections at bottom.

9. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing a feed space between said wall and said shell, connections with a suitable generator of electricity, metallic electrode stems to which said connections are attached, each extending downwardly therefrom within said feed space, and each made in sections, means for separably uniting the stem sections with each other, and carbon electrodes projecting at right angles to said stems and toward each other.

10. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working cham-

ber, an outer shell surrounding said wall and inclosing a feed space between said wall and said shell, connections with a suitable generator of electricity, metallic electrode stems made in sections including a cylindrical upper section, an adjoining flat section trough shaped at its lower end and a trough-shaped lowermost section, and a pair of carbon electrodes attached to the lower ends of said stems and each composed of sections clamped together side by side within said lowermost stem section and projecting at right angles therefrom into the working chamber.

11. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing a feed space between said wall and said shell, connections with a suitable generator of electricity, tubular electrode stems extending downward from said connections within said feed space and through which fragmentary material can be fed downwardly upon the electrodes to regulate the electrical action, and carbon electrodes projecting at right angles to said stems and toward each other.

12. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing a feed space between said wall and said shell, connections with a suitable generator of electricity, tubular electrode stems extending downwardly from said connections within said feed space and made in sections including a cylindrical upper section, an adjoining flat section trough-shaped at its lower end and a trough-shaped lowermost section, and carbon electrodes projecting at right angles to said stems from within said lowermost stem sections and toward each other.

13. A resistance electric furnace adapted to be supplied with self-moving material and having, in combination, a wall of fire brick or the like inclosing a central working chamber, an outer shell surrounding said wall and inclosing a feed space between said wall and said shell, connections with a suitable generator of electricity above said shell, tubular electrode stems extending downwardly from said connections within said feed space and made in sections including a cylindrical upper section, an adjoining flat section trough-shaped at its lower end and a trough-shaped lowermost section and provided at their upper ends with suitable air and gas tight closures, carbon electrodes projecting at right angles to said stems from within said lowermost stem sections and toward each other, and stuffing boxes upon the top of said shell interacting with said cylindrical stem sections, substantially as hereinbefore specified.

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