(No Model.) 4 Sheets—Sheet 1.

# A. A. BRENEMAN.

## MUFFLE FURNACE.

No. 514,698. Patented Feb. 13, 1894.

Fig. 1.

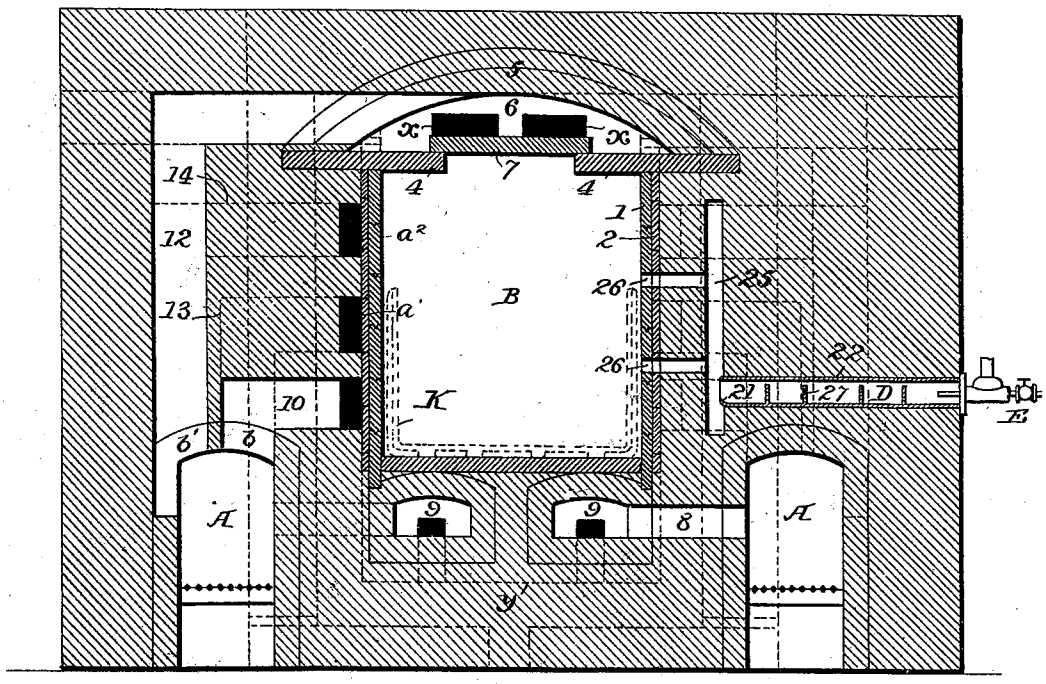


Fig. 5.

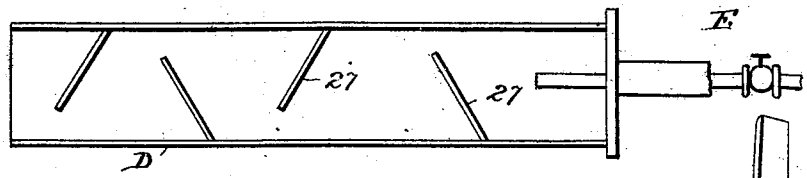


Fig. 9.

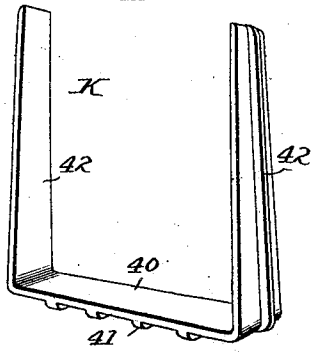


Fig. 10.

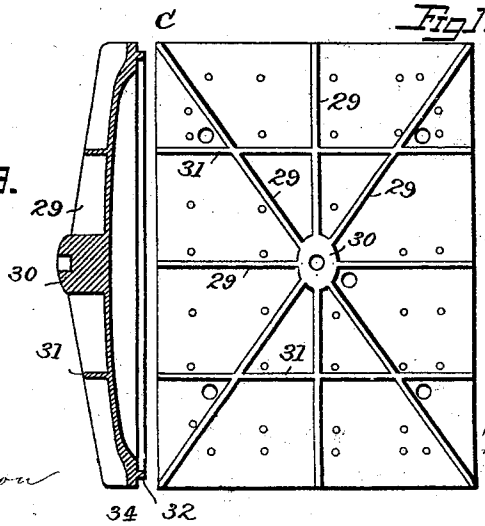


Fig. 8.

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## MUFFLE FURNACE.

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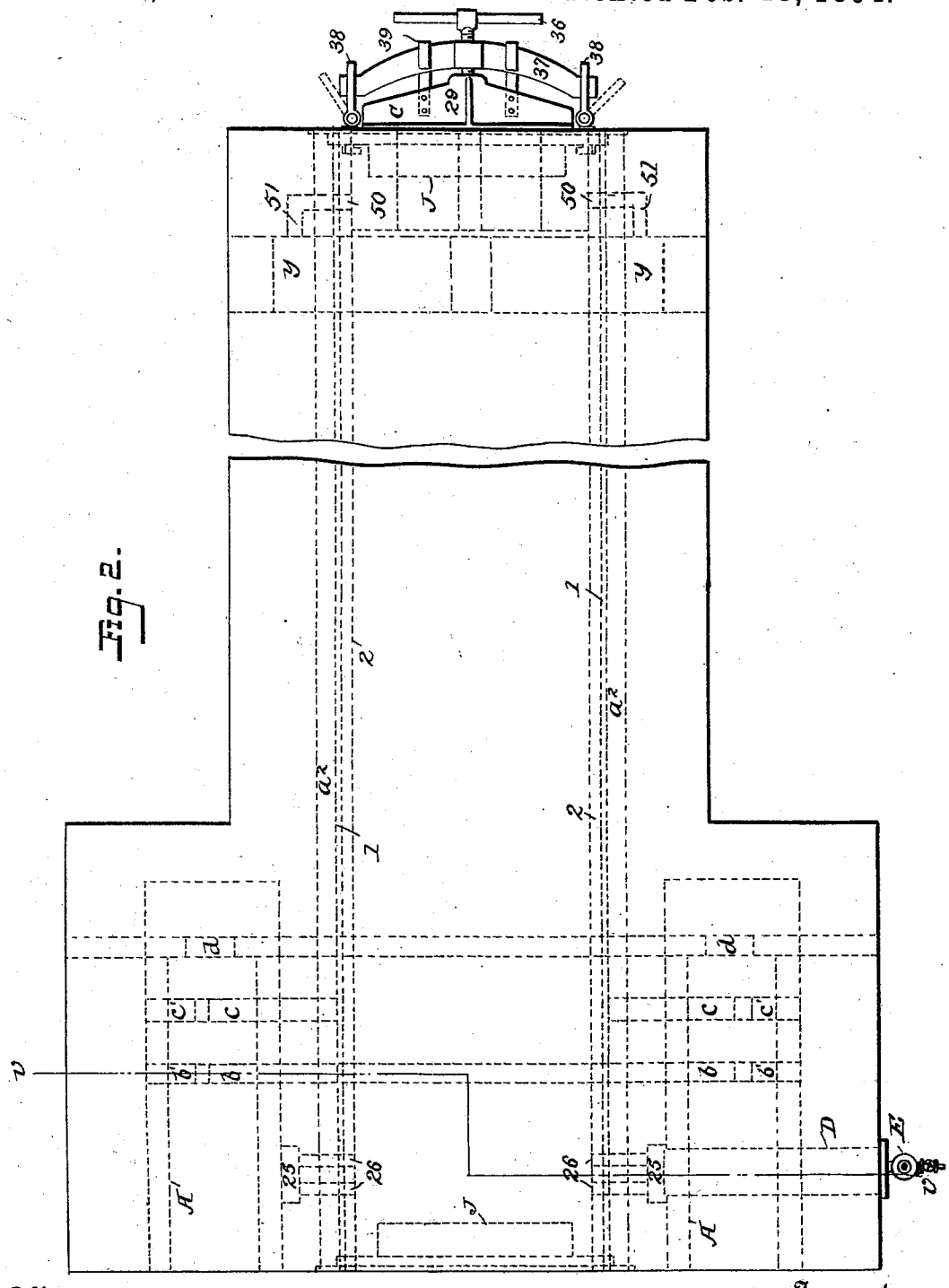


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## MUFFLE FURNACE.

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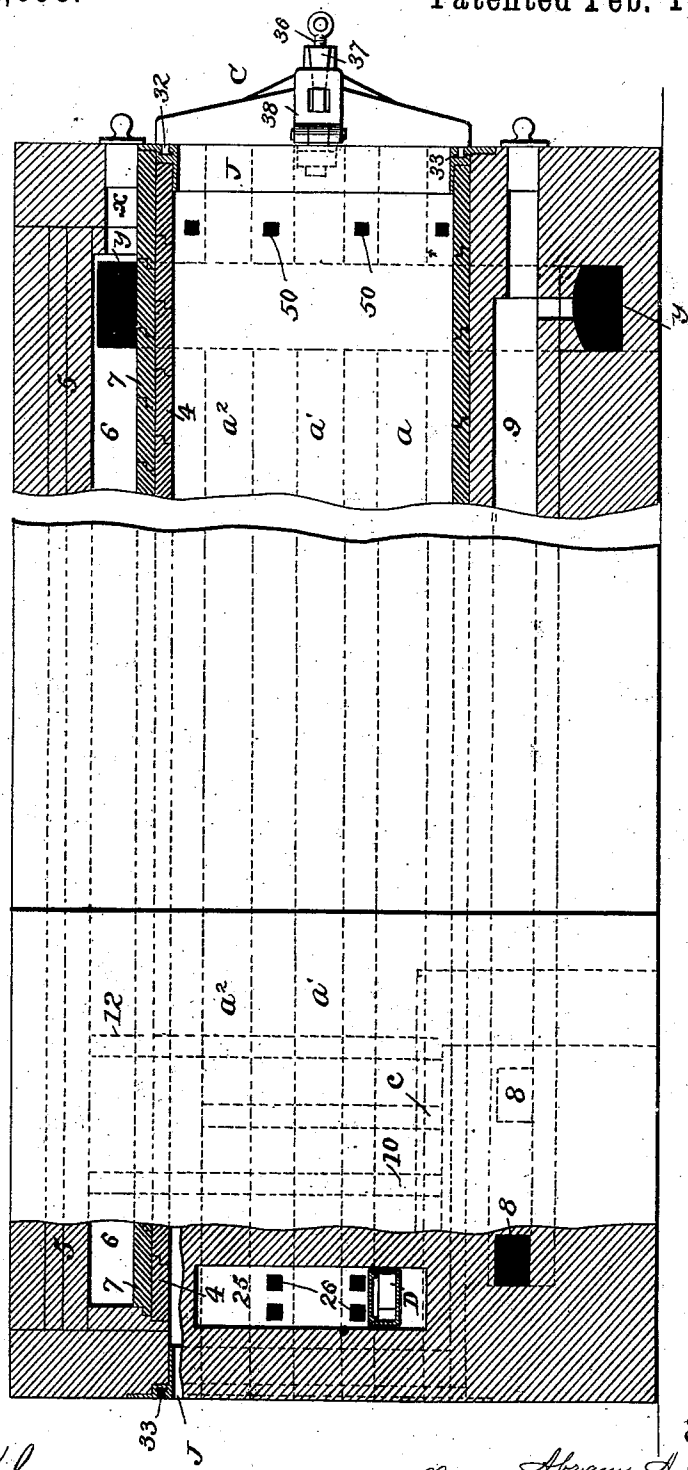


Fig. 3.

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## MUFFLE FURNACE.

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Fig. 4.

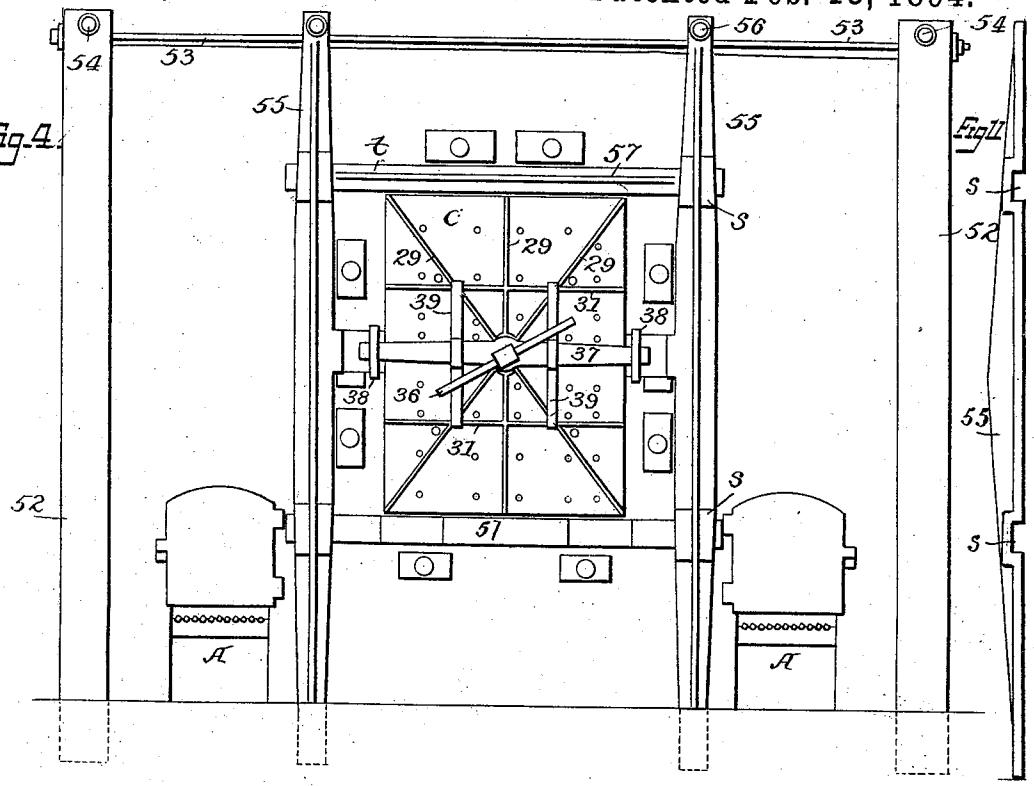



Fig. 7.

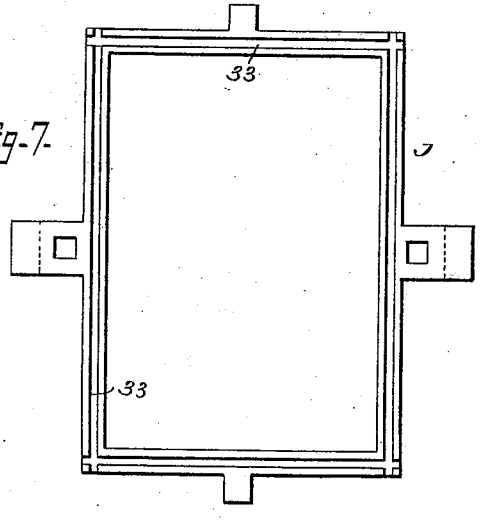
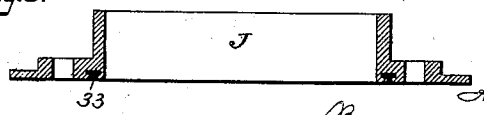



Fig. 6.

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# UNITED STATES PATENT OFFICE.

ABRAM A. BRENEMAN, OF BROOKLYN, NEW YORK.

## MUFFLE-FURNACE.

SPECIFICATION forming part of Letters Patent No. 514,698, dated February 13, 1894.

Application filed August 13, 1892. Serial No. 443,022. (No model.)

*To all whom it may concern*

Be it known that I, ABRAM A. BRENEMAN, a citizen of the United States, residing at Brooklyn, Kings county, State of New York, have invented certain new and useful Improvements in Muffle-Furnaces, of which the following is a specification.

My invention relates to muffle furnaces, and consists in the construction of the muffle and arrangement of flues and appliances connected therewith as fully set forth hereinafter, and as illustrated in the accompanying drawings, in which—

Figure 1, is an elevation of my improved furnace, the two halves from the central line being in transverse section on different planes as shown by the line *v v*, Fig. 2. Fig. 2, is a plan view. Fig. 3, is a side elevation in part section or in different planes. Fig. 4, is an end elevation. Fig. 5, is a plan of the receptacle for chemicals. Fig. 6, is a section of the door frame. Fig. 7, is a plan of the door frame. Fig. 8, is a section of the door; Fig. 9, a perspective of one of the chairs for supporting articles within the muffle. Fig. 10, is a plan of the door. Fig. 11 is a side view of one of the stays.

The body of the furnace consists of masonry preferably of ordinary brick lined with fire brick the furnace being of a T-shape in plan, as shown in Fig. 2, the wide end having two furnaces A, A, on opposite sides of a muffle B, which muffle extends from the front to the rear end of the furnace, each end being closed by a suitable door which when open permits a thorough inspection and access to the entire length of the muffle, and there are certain longitudinal flues hereinafter described, which also extend the entire length of the furnace, and are provided with plugs at the end, whereby to permit more ready inspection and cleaning than could be effected if the flues did not extend from end to end.

The muffle B, is preferably rectangular in cross section and the vertical sides consist of tiles 1, 1, which are preferably tongued and grooved as shown in Fig. 1, and outside of these tiles is a layer of "split brick" being a thin brick used in the art arranged to break joint with the tiles, the object of the split brick layer being to protect the tiles, and prevent the passage of gases to the interior of the muffle, which must be practically air tight without interfering to too great an extent with the conduction of heat from the outside flues hereinafter described to the walls of the muffle.

The bottom of the muffle consists of thick tiles made of fire-clay, and as an arched top of brickwork would involve many joints, and render the top more or less porous, and permit the entrance of the gases, I have devised the following construction: Across each side wall of the muffle extends a tile 4, of fire-brick, the greater length of which is embedded in the masonry of the furnace, so as to afford a requisite support, the outer ends serving as a partial abutment for the arch 5, above the flue 6, that extends along the entire length of the furnace above the muffle. About one-third of the tile 4, projects inward beyond the side wall of the muffle, and preferably the entire series of tiles 4, at their meeting edges are rabbeted and the joints are sealed or cemented with fire-clay as are other joints of the fire-clay bricks of the furnace. The opening between the edges of the two series of tiles 4, 4, is closed by a series of tiles 7, which slightly overlap the edges of the tiles 4, and the meeting edges of which are rabbeted, and in the front and back walls of the furnace opposite the ends of the flue 6, are openings *x*, to which are adapted suitable plugs which may be removed to give access to the flue.

The fire-boxes A, A, are of any suitable length, and are built in the masonry of the furnace with suitable fire-brick linings, and they communicate each through a series of lateral flues 8, with the interior of a longitudinal flue 9, extending beneath one side of the muffle for the entire length of the furnace, crossing however, a transverse collecting chamber or flue *y*, which is crossed by all of the longitudinal flues, the latter extending to the rear end wall of the furnace, and being plugged up. By this means the products of combustion passing to the longitudinal flues are finally concentrated into the transverse collecting flue *y*, from which they are conducted to any suitable take-up. Along the

outside of each side wall of the muffle B, extends a series of longitudinal flues, three flues $a$, $a'$, $a^2$, being shown, which flues are made as deep vertically as possible, but narrow, and each of which communicates with the adjacent fire-box, so that the products of combustion from the upper portion of the said fire box will flow to the said flues and along the said walls of the muffle, and the flue 6, also communicates at each side with the adjacent fire-box. The bottom flues 9, 9, and the side flues $a$, and the top flue 6, are therefore supplied by the products of combustion from the fire-boxes, which products of combustion are conducted very nearly the entire length of the muffle from the front to the collecting flue $y$, and heat the muffle practically uniformly upon the bottom, sides and top, but without any direct entrance of the gases into the muffle, and, owing to the construction specified, without danger of leakage, which in many instances would be destructible of the annealing or other operations performed in the muffle.

There may be different arrangements of connecting flues between the fire boxes and the longitudinal flues. I, however, prefer to make in the top or arch of each fire box when there are three side flues $a$, $a'$ $a^2$ five openings $b$, $b'$, $c$, $c'$, and $d$, as indicated in dotted lines, Fig. 3. The opening $b$, communicates by a lateral flue 10, with the lower flue $a$. Opening $b'$, communicates through an L-shaped flue 12, (dotted lines, Fig. 1) with the top flue 6. The flue $c$, communicates by means of an L-shaped flue 13, with the flue $a'$, and the flue $c'$, communicates with the flue $a^3$, through an L-shaped flue 14, while a terminal flue opening $d$, communicates through a flue like the flue 12, with the flue 6, which being larger than the flue $a$, requires an additional amount of heat.

In certain processes it is necessary to introduce chemicals in solid, liquid or gaseous form, into the muffle to act upon the articles therein contained, and for this purpose I provide a receptacle D, which may be made in the form of a tube or trough open at the top, and both ends, and provided with a sealing cap 20, and turned up at the inner end to form a flange 21, that will tend to hold any materials that may be liquid. A cap piece 22, serves to close the top of this trough, which is embedded in the masonry of the furnace, so as to extend transversely from the outside over the top of one of the fire-boxes to a vertical flue 25, which communicates through lateral openings 26, with the interior of the muffle.

The receptacle D, is arranged in the forward part of the furnace between the front wall and the openings $b$, $b'$, as best indicated in Fig. 3, and the gases or liquid material may be injected into the receptacle D, by means of any suitable injector E, and the material thus introduced may be deflected by deflector blades 27, shown in Figs. 4 and 5, so as to reach the interior of the muffle in a vaporous or gaseous condition.

While any suitable door may be employed for closing the end of the muffle, it has been found extremely difficult to make a door and connect it so as to be readily operated, of a large size that must be used in apparatus of the character shown, and I have therefore devised the construction and arrangement of closing devices, best illustrated in Figs. 6, 7, and 8. The door C, is a rectangular plate flat at the edges and arched toward the center, and provided with lateral ribs 29, extending from a central hub, 30, and with transverse ribs 31, which ribs are all narrow and deep to impart great strength without excessive weight, and the inner side of the door is provided with a bearing rib 32, which bears against a packing in an edge recess 33, in the flange 34, of a door frame J, which is embedded in the wall. The recess 33, is cut away preferably, of a T-shape in cross section, and the four portions of the said recess which intersect at right angles extend completely to the edges of the flange 34, so that the packing strips, which may be of any suitable material preferably of thin asbestus paper or fabric, may be introduced endwise into said recesses, one strip being laid upon the other until the inner enlarged portion of the recess is filled. The bearing flange 32, of the door enters the recess 33, and bears upon the packing, being forced firmly thereupon by a screw 36, provided with a suitable handle, and passing through a yoke 37, the ends of which may be brought into pivoted links 38, connected with bolts or bearings upon the door frame J.

It is desirable to swing the door away from the end of the muffle, and lift it out of place by means of a crane or other suitable elevating device, and to this end it is desirable to preserve the relative positions of the yoke and door, and the screw, and I therefore make use of metallic straps or brackets 39, 39, each of the constructions illustrated in Fig. 2, and bolted at each end to ribs upon the door, and bent to receive the yoke 37, without interfering with its movements but serving to support the said yoke in relation to the door when the links 38, are swung to one side.

In operating upon some kinds of material, as for instance iron bars, it is desirable to maintain them from contact with the faces of the muffle, and I, therefore, make use of chairs K, shown as having cross bars 40, with lugs 41, bearing upon the under side of the muffle, and with side bars 42. A series of these are inserted in the muffle at proper points to receive and support the bars laid therein.

To permit gases and vapors to escape from the muffle when there are any, I make holes 50, which communicate through channels 51 with the flue or chamber $y$.

In order to impart strength and solidity to the masonry structure and enable it to resist the effects of the heat, I make use of corner

stays 52, of angle iron connected by cross bolts 53, 54, and end stays 55, connected by bolts 56, and end transverse stays 57, each of which passes at either end beneath an arch or recess *s*, of one of the stays 55, the stays 57, being thereby held in place while all of the vertical stays are inserted in the ground at their lower end and the stays 55, 57, are preferably strengthened by ribs *t*. The end stays 55 and 57, cross or cover the edges of the door frame to an extent to aid in holding the latter in place.

There may be a box D, at either or both sides of the furnace and the heavy tiles on the floor of the muffle are preferably rabbeted at their contiguous transverse edges. Additional flues *d* may also be provided for heating the boxes D which can be led off from the fire boxes A, and passed under or around the said boxes and communicating with any of the side flues, as for instance with the second flue along the muffle. These additional flues may be provided with suitable dampers.

Without limiting myself to the precise construction and arrangement of parts shown, I claim—

1. A muffle furnace consisting of masonry, with a muffle built in the same, and having its side walls formed of tiles tongued and grooved with an outer covering of split brick, and with longitudinal flues extending along the sides, bottom and top of the muffle, substantially as set forth.

2. A muffle furnace, having the sides of the muffle composed of tiles and split brick, with flues formed in the body of the furnace at the outer sides of the split brick covering extending longitudinally, and communicating with fire boxes, substantially as set forth.

3. A furnace consisting of masonry, supporting a longitudinal muffle with a top consisting of side tiles extending across the tops of the sides of the muffle, projecting inward for a part of their length, and supporting intermediate tiles overlapping the side tiles, the said tiles having their abutting edges rabbeted, substantially as set forth.

4. The combination of a furnace, the muffle extending longitudinally through the furnace and provided with doors at the sides, fire boxes, and longitudinal flues extending the length of the furnace, and provided with stoppers at the ends, a collecting flue *y*, near the rear end of the furnace extending round the muffle and crossing and intersecting the longitudinal flues the latter opening into the flue *y* and a chimney communicating with the flue *y*, substantially as set forth.

5. The combination with the furnace and muffle thereof of a receptacle D, extending laterally into a vertical flue, connecting with the muffle by openings 26 and provided with deflector plates, substantially as set forth.

6. The combination with the muffle, of chairs K, having cross bars and side bars and lugs at the lower edges of the cross bars substantially as set forth.

7. The combination of the furnace, muffle, and external connected vertical stays having arched portions *s*, and the cross stays extending at their ends into the said arched portions, substantially as described.

8. The combination with a furnace and the muffle thereof, of a receptacle D, extending laterally to a vertical flue communicating with the muffle said furnace being provided with small flues which communicate with the fire chambers thereof and pass under the receptacle D, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ABRAM A. BRENEMAN.

Witnesses:
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VALENTINE J. BADER.