

No. 797,901.

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A. M. MACDUFFEE.

ASSAY FURNACE.

APPLICATION FILED MAR. 7, 1905.

Fig. 1.

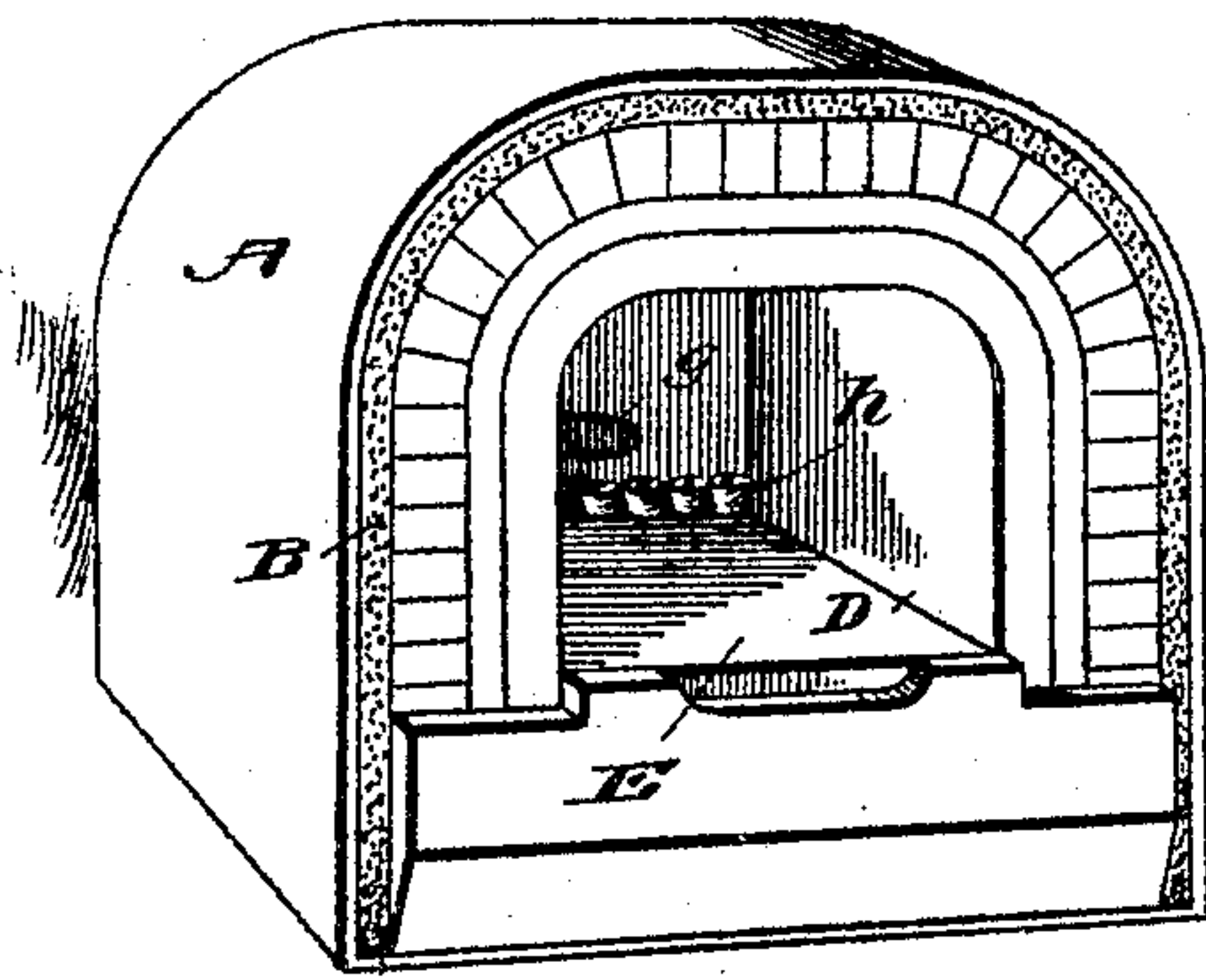


Fig. 2.

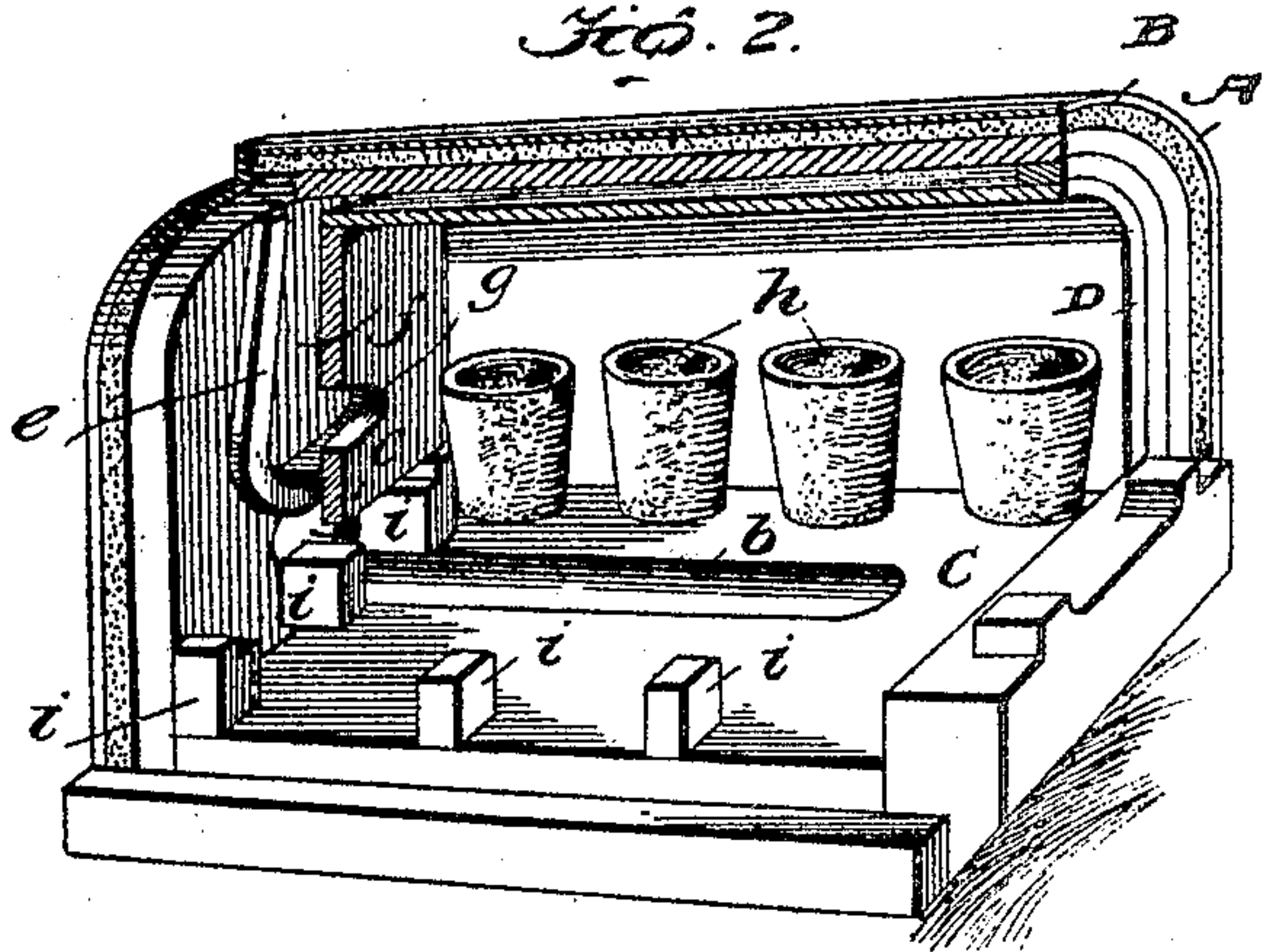


Fig. 3.

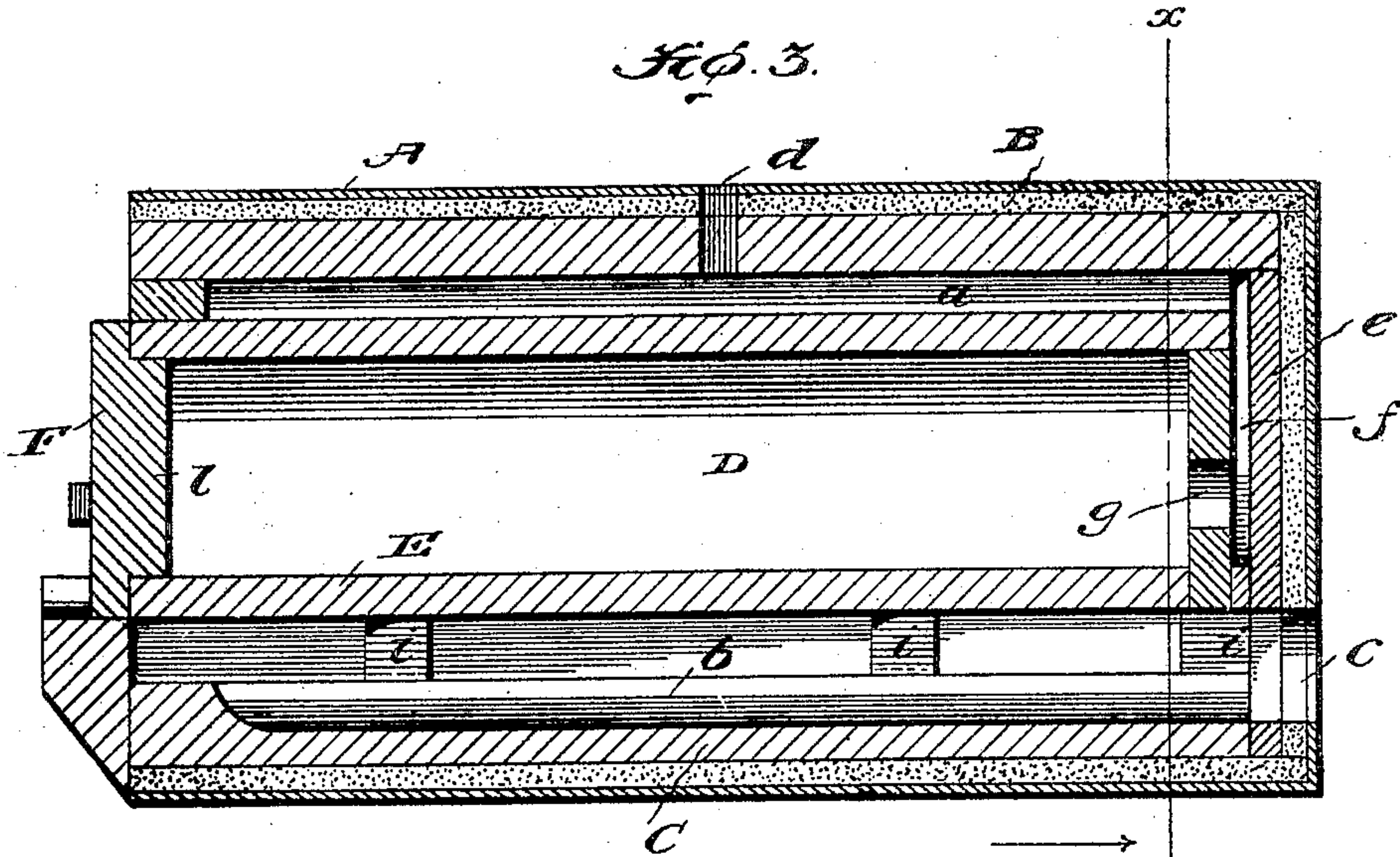
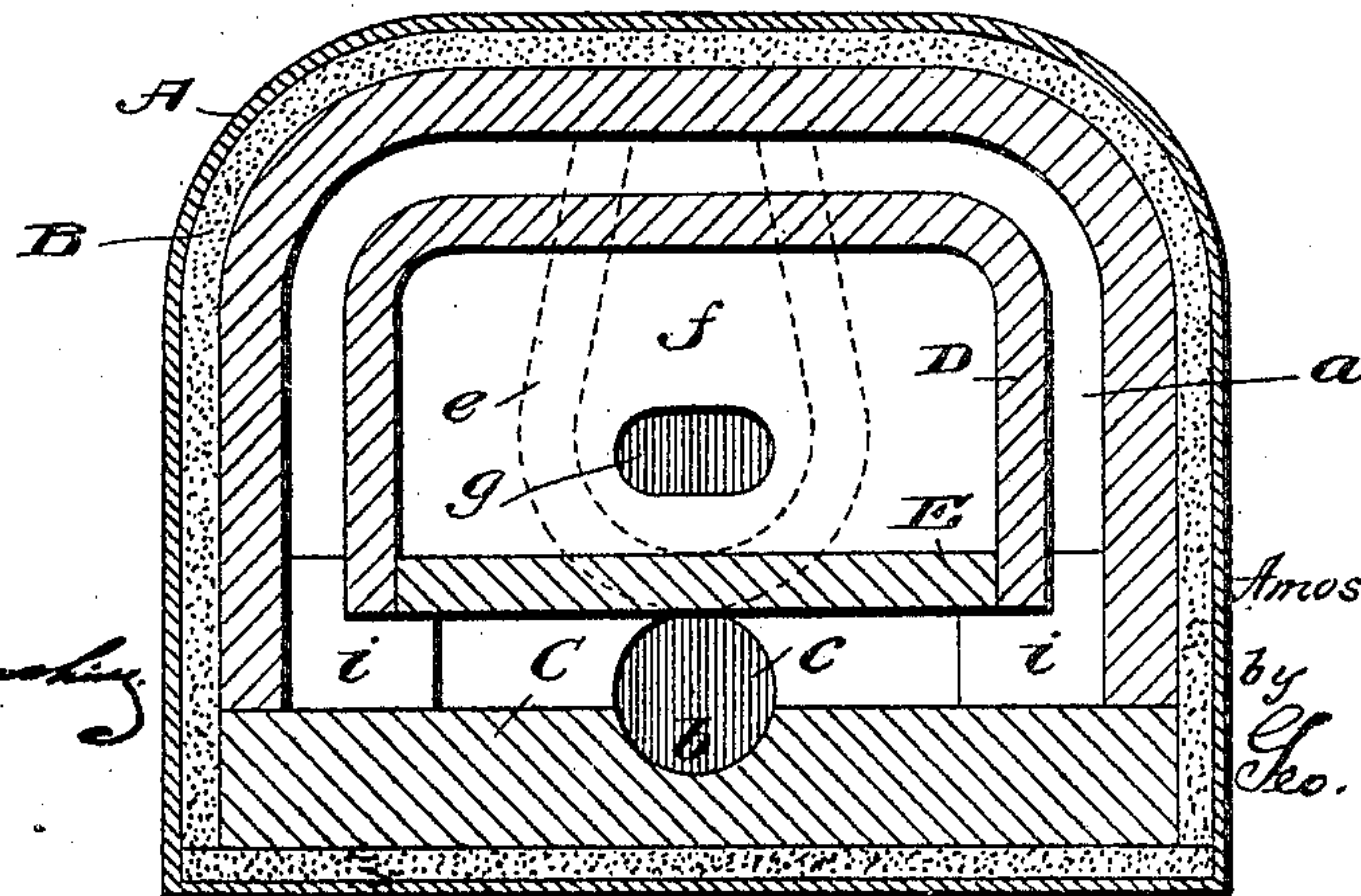


Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

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ASSAY-FURNACE.

No. 797,901.

Specification of Letters Patent.

Patented Aug. 22, 1905.

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To all whom it may concern:

Be it known that I, AMOS M. MACDUFFEE, a citizen of the United States, residing at Chloride, in the county of Mohave and Territory of Arizona, have invented new and useful Improvements in Assay-Furnaces, of which the following is a specification.

My invention relates to certain new and useful improvements in that class of furnaces particularly designed for assay-work and wherein the furnace is of a simple portable type and wherein liquid or gaseous fuel may be used for obtaining the requisite heat, and the utmost facility is afforded for the insertion, removal, or repair of the muffle; and my invention consists of the parts and the constructions and combinations of parts, which I will hereinafter describe and claim.

In the accompanying drawings, in which similar letters of reference indicate like parts throughout the several views, Figure 1 is a perspective view showing the front of the furnace removed and showing the removable bottom of the muffle in position ready for cupeling. Fig. 2 is a perspective view with the front and rear sides of the furnace removed, showing the bottom flue or channel and fuel-inlet and showing the bottom of the muffle removed and crucibles along one side of the muffle. Fig. 3 is a longitudinal sectional view of the furnace. Fig. 4 is a cross-sectional view of the furnace on the line *x x* of Fig. 3.

In constructing my furnace I have kept in view its availability for the prospector, mine examiner, and general assayer. Therefore I have made it as light as practicable to insure its being readily transported substantially in the manner of the usual hand-satchel. The general dimensions of the furnace may vary, of course; but a total length of about fifteen (15) inches, a width of about eleven and one-half (11½) inches, and a height of about nine (9) inches will be sufficient for the ordinary purposes for which the furnace is designed.

The general design of the furnace does not depart essentially from some of the assay-furnaces in use in that it has a muffle the general configuration of which and of the outer casing of the furnace is dome-shaped.

Referring now to the drawings for a more complete understanding of the furnace, A represents a sheet-iron or other outer covering interior to which and protected thereby is arranged an asbestos or other suitable lagging B. Within this lagging is an inner lining

material of about one-half (½) inch in thickness, more or less.

The bottom C of the furnace and likewise the front and back ends are composed of fire-clay or equivalent material, the said bottom being, say, one and one-half (1½) inches thick and the said ends about one (1) inch thick in a furnace of the dimensions first above given, while the hearth-piece may constitute a further extension of the bottom of about one (1) inch.

Within the fire-clay lining and conforming to the general shape thereof and separated therefrom a sufficient distance—say about one quarter (¼) inch—to form a flue or passage *a* between the two is the muffle D, composed of fire-clay or equivalent material of about one-quarter (¼) inch in thickness. This muffle consists of the arched top and the sides and a rear end. It is open at the front end and is made without a fixed bottom, thus adapting the furnace for melting in crucibles, as shown in Fig. 2, or for cupeling, as shown in Fig. 1.

To facilitate the melting operation and also the operation of cupeling, which I will hereinafter refer to, I construct the inner wall of the bottom of the furnace with a longitudinal channel *b*, preferably of semicircular or concaved form and uncovered at the top, so that the heat delivered thereto through the fuel-inlet *c* in the back end of the furnace will be equally distributed over each crucible, the flame and heat products whirling and circulating in the muffle and among the crucibles arranged therein. Sufficient pressure is thus generated in the muffle to force the flame or heat under the lower side edges of the muffle, whence the flame or heat passes into the flue space or passage *a* and rises therein and passes over the arched top of the muffle and finally escapes through an opening *d* in the outer casing.

On the inner face of the back end of the furnace is a projection *e*, of substantially a horse-shoe shape, having a depth of about one-half (½) inch and having the ends presented upwardly. The space *f*, inclosed by this projection, converges toward the top of the furnace, and the rear end of the muffle is designed to seat firmly against said projection, with an opening *g* in said end communicating with the space *f*, whereby cool outside air is caused to be drawn into the muffle during the process of cupellation, which is essential to the best results in this operation.

In connection with the muffle I employ when cupeling a removable bottom E for supporting the cupels h, said bottom being composed of fire-clay or equivalent material, and which removable bottom is supported at the sides and ends over bottom channel or flue b by means of suitable blocks or projections i, formed on the bottom of the furnace, as shown in Figs. 3 and 4, and which bottom and the front and rear ends of the furnace may be constructed as a rigid unitary structure, the front end having the usual door-controlled opening for the insertion and removal of the muffle.

The front opening is closed by a removable door F, composed of fire-clay or an equivalent heat-resisting medium, said door conforming to and closely fitting the opening, so that when the door is tightly closed the furnace will be practically air-tight; but when this door is pulled out, say, a distance about equal to one-half its thickness and which is represented by the projecting part l, of reduced diameter, which enters the open front end of the muffle, sufficient outside air will be drawn in under the bottom of the door for cupellation purposes, while the door remains practically closed. This prevents the furnace from cooling, as it would necessarily do if the door were entirely removed.

When the door is fully open, the draft induced in the furnace by the escape of the heat products through the outlet in the top of the furnace causes fresh air to be drawn into the mouth or open front end of the muffle.

In operation, as when melting in the crucibles, the removable bottom of muffle is dispensed with and heat is admitted to the muffle and circulates about the crucibles and finally escapes, as before pointed out. After the "melts" have been poured the removable bottom of the muffle is placed in position, as before described and as shown in Fig. 1, and a little bone-ash is distributed around the edges, thus making it tight, after which the furnace is ready for cupeling purposes.

Among the advantages which flow from the construction described are speed and capacity, for I find that I can do nearly double the work in a given time that I have been able to accomplish with other furnaces that I have used. Only about fifty per cent. of gasolene for fuel is required as compared with said other furnaces. My furnace is light and portable, and the heat is so nicely equalized that melts in front are ready to pour first, whereas in many other furnaces those at the rear must receive first attention, greatly to the inconvenience of the operator.

Another and decided advantage of my muffle over ordinary muffles is that its arrangement not only evenly distributes and utilizes all the heat, but it can be made at less cost and its life is many times prolonged, as the bottom, which is the destructible part of any muffle, does not receive any of the heat during

melting in crucibles and can be made and replaced for a few cents if broken by accident. Also during operation all the heat is utilized inside, while the outside of the furnace is practically kept cool. Also less air-pressure is required than with the ordinary assay-furnaces.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A muffle for an assay-furnace, said muffle having a separable bottom adapted to be detached from the muffle and removed through an opening in the furnace whereby said muffle is adapted for both melting and cupeling operations.

2. An assay-furnace, having a muffle-chamber and means for admitting heat thereto, and a muffle fitting the chamber and having a bottom which is detachable and readily separable from the balance of the muffle whereby the muffle is adapted for both melting and cupeling operations.

3. In an assay-furnace, the combination with a furnace casing or shell having a muffle-chamber and means for admitting a flame thereto, of a muffle fitting said chamber and having its bottom open, and a normally disconnected readily-separable bottom fitting the opening in the bottom of the muffle and forming a removable closure therefor.

4. An assay-furnace comprising a base and ends and a body portion forming a muffle-chamber, one of said ends having a projection on its inner face inclosing an air-space, a muffle in said chamber having an opening in its back end to connect said air-space with the interior of the muffle, said muffle having a normally loose, readily-separable bottom thereby adapting the muffle for both melting and cupeling operations, means for admitting flame to the muffle, and means whereby the spent products are allowed to escape from the furnace.

5. An assay-furnace having a base and ends and a connecting-shell, said shell including an inner lining composed of heat-resisting material and forming a muffle-chamber, a heat-resisting lagging surrounding the lining and an exterior metallic jacket, said base having a longitudinal open flue or channel into which heat is admitted and delivered directly into the muffle-chamber, and a removable muffle having a normally disconnected and readily-separable bottom whereby the muffle is adapted for both melting and cupeling operations.

6. An assay-furnace comprising a base and ends and an arch-shaped body portion, said body portion having a fire-clay lining, an exterior metallic jacket, and an asbestos lagging between the lining and jacket, a muffle in the body portion and separated from said lining to form a passage for the escape of heat products, said muffle having a bottom which is normally disconnected and readily separable from

the main portion whereby the muffle is adapted for both melting and cupeling operations, means for admitting flame to the furnace, and means for admitting fresh accretions of air to the muffle-chamber.

7. An assay-furnace comprising a base and ends and a shell or casing forming a muffle-chamber, a muffle in said chamber and supported above the floor of the base, said muffle having a false bottom which is normally disconnected and readily separable to permit the muffle to be used for melting and cupeling operations, an open-top flue in the base below the muffle, and a door for closing the open

front end of the muffle, said door having a portion of reduced diameter to project into the open end of the muffle and form a tight closure therewith, and said projecting portion serving to admit fresh air beneath the lower edge of the door when said door is only partially removed.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

AMOS M. MACDUFFEE.

Witnesses:

FRED N. CHANDLER,

EDWIN S. POBEY.