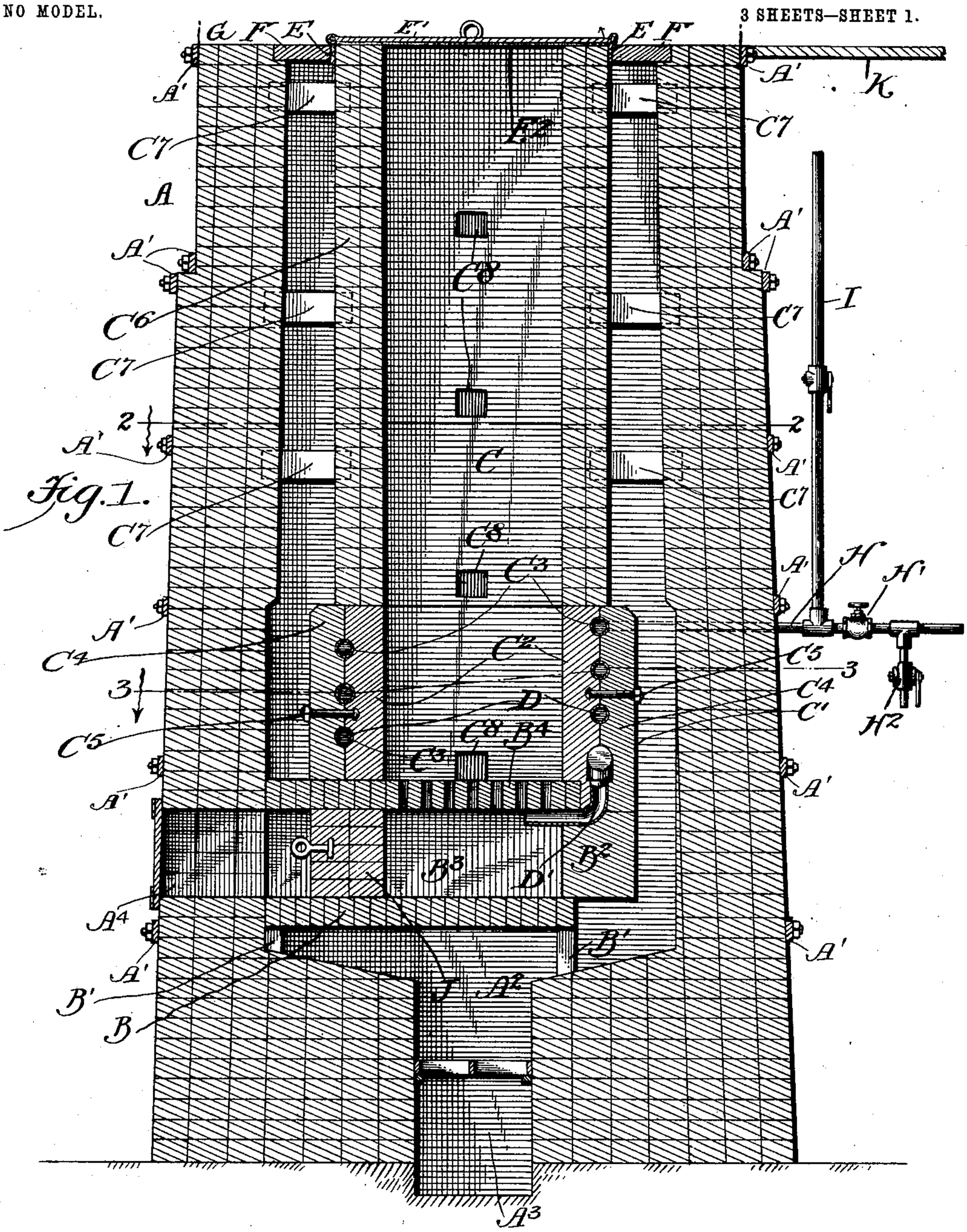
No. 755,867. PATENTED MAR. 29, 1904.

G. W. GESNER.

METALLURGICAL APPARATUS.

APPLICATION FILED DEC. 13, 1899.

NO MODEL. 3 SHEETS—SHEET 1.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.

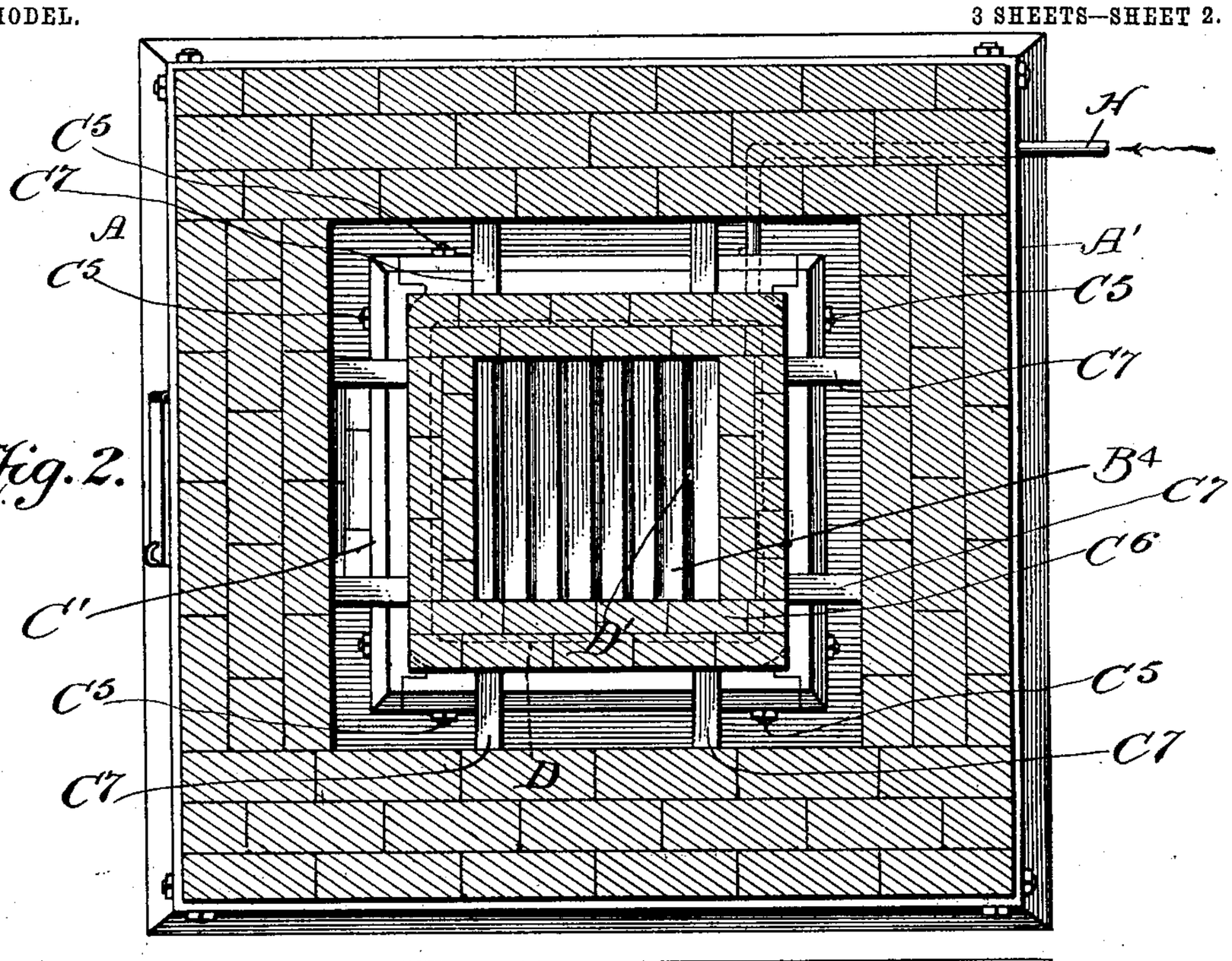
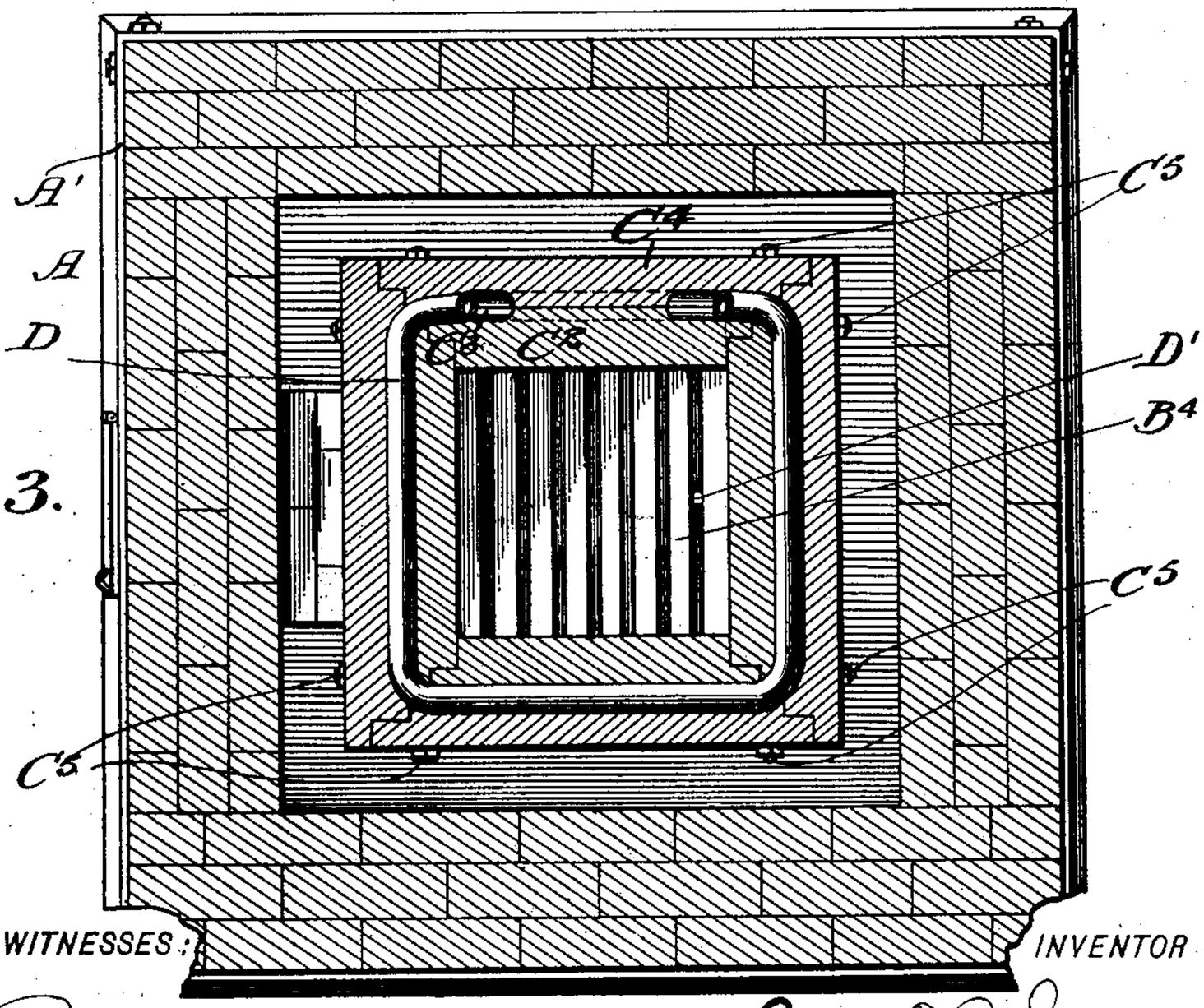



Fig. 3.

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APPLICATION FILED DEC. 13, 1899.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 4.

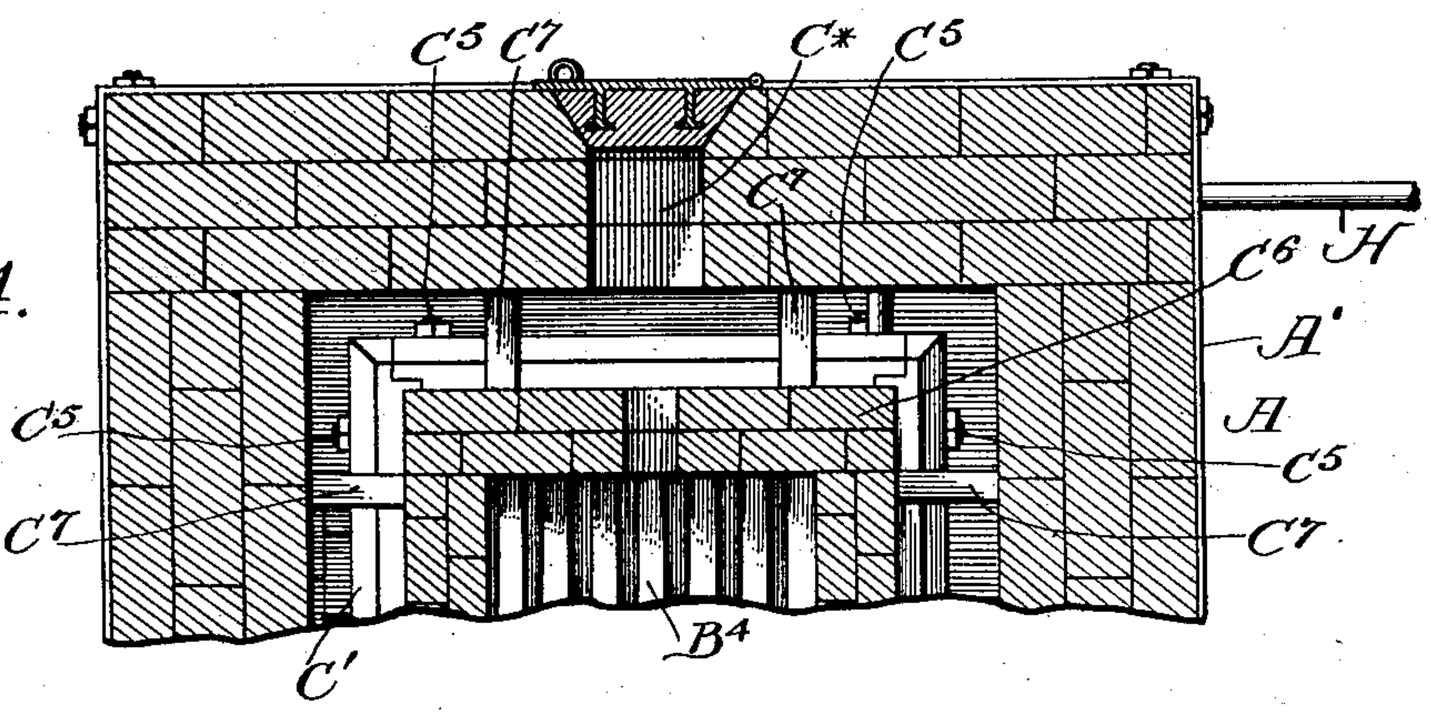



Fig. 5.

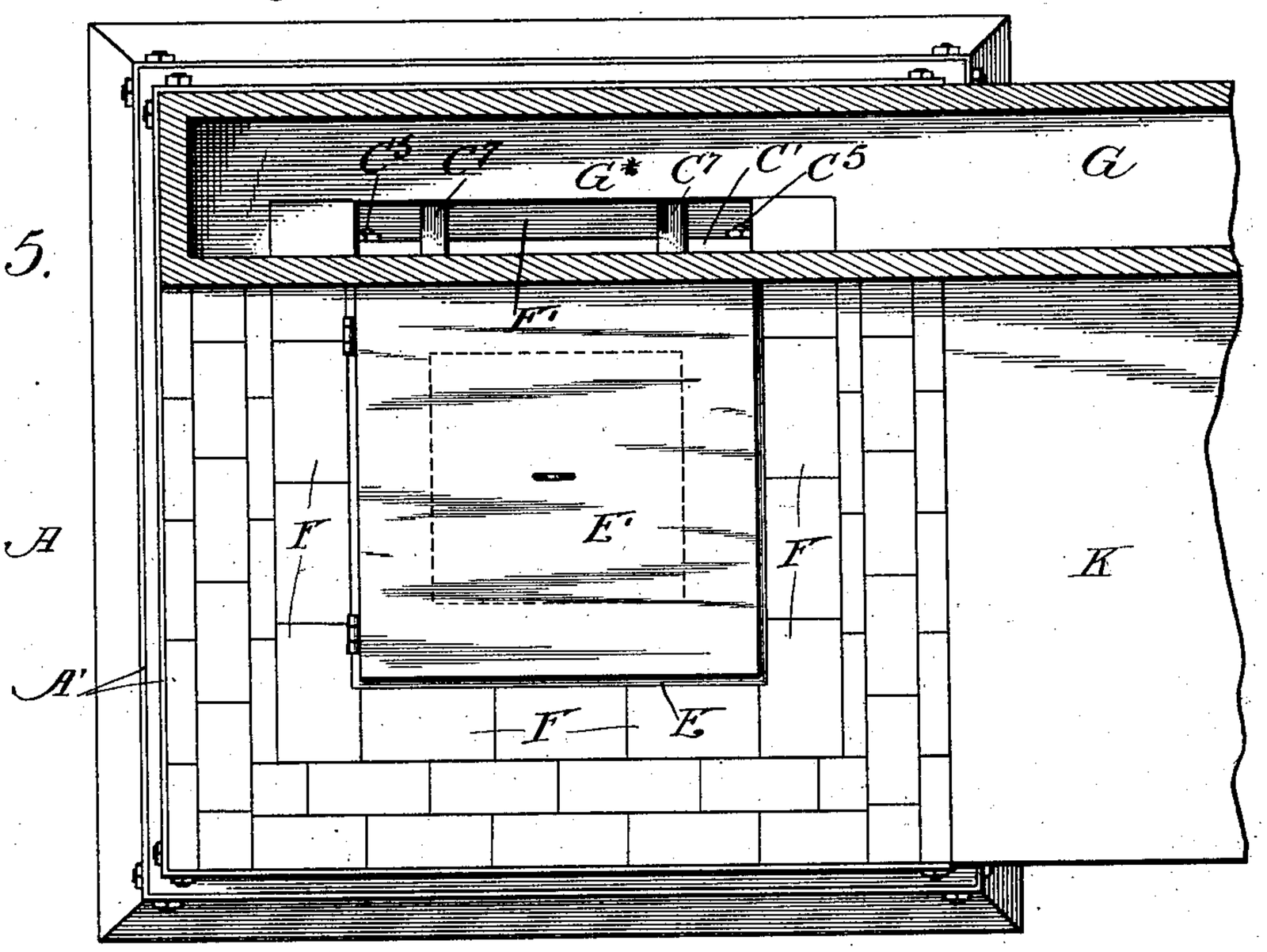
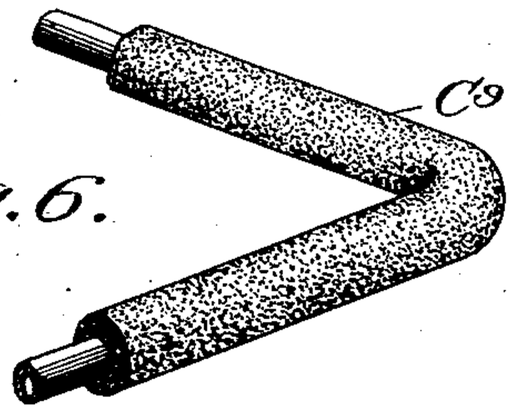



Fig. 6.

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No. 755,867. Patented March 29, 1904.

# UNITED STATES PATENT OFFICE.

GEORGE W. GESNER, OF NEW YORK, N. Y., ASSIGNOR TO HARLESTON CORBETT GESNER, OF BROOKLYN, NEW YORK.

## METALLURGICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 755,867, dated March 29, 1904.

Application filed December 13, 1899. Serial No. 740,153. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE W. GESNER, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Metallurgical Apparatus, of which the following is a specification.

The subject of my invention is an improved apparatus more particularly designed for the production of an alloy of iron and hydrogen. The present improvements relate more especially to a novel construction and arrangement of parts whereby the production of the alloy can be economically and conveniently carried on and the plant required for the same appreciably compacted and simplified.

In an application of mine filed May 2, 1899, Serial No. 715,323, I have set forth a process for producing an alloy of iron and hydrogen mainly by subjecting heated iron while presenting an extended surface to the action of hydrogen gas and removing and utilizing the alloy, which forms as a scale. The apparatus disclosed for carrying out said process comprises a vertical furnace containing an upright retort with which communicates a pipe leading from a coil within a second furnace and having suitable accessories for the production of hydrogen gas in quantity, said gas being caused to act upon the iron within the retort and result in the formation of scales of the alloy, as before mentioned. In the present invention the second furnace is dispensed with, the hydrogen-generating coils being efficiently and economically heated by the same furnace that acts on the iron within the retort, the coils being preferably located within the walls of the retort, near the base thereof. This and other important features I will now proceed to describe in detail.

Similar reference characters indicate like parts throughout the several figures of the drawings, in which—

Figure 1 is a vertical section of an apparatus embodying my improvements. Figs. 2 and 3 are horizontal sections of the construction illustrated in Fig. 1, the sections being taken in the plane indicated by the dotted lines 2 2 and 3 3, respectively. Fig. 4 is a horizontal section of a portion of the apparatus and showing one of the door-covered openings in the furnace-wall through which access may be had to and through one of the retort-openings to agitate or stir the charge. Fig. 5 is a horizontal section of the apparatus in a plane slightly above the retort-cover and illustrating the provision for conveying the products of combustion of the furnace to the stack, and Fig. 6 is a modification of a portion of the hydrogen-conveying coil.

The furnace A is represented as being of an extended vertical type rectangular in cross-section and having its walls securely held by horizontally-arranged metal bands A′. In the base is a fireplace and grate $A^2$, to which access can be had through a suitable door, an ash-pit $A^3$ being provided beneath. The vertical chamber within the furnace is in communication with the fireplace and is of increased diameter at its base. At one side of the furnace, at a point preferably at a right angle to the general disposition of the fireplace, is a door-closed aperture $A^4$, a plate B or flooring B extending from the lower edge of said aperture, at the inner side thereof, over and slightly beyond the fireplace. This plate or flooring B is of highly refractory or heat-resisting character, is firmly supported by a suitable framework or underpinning B′, and of a plan area considerably less than the enlarged base portion of the vertical chamber within the furnace. Walls $B^2$ form three sides of a rectangular compartment $B^3$, of which the plate B forms the bottom, a grid or grate section $B^4$ resting on the top of the walls $B^2$.

Upon the top of the solid marginal portion of the grid-section $B^4$, I build up a vertical retort C, smaller in horizontal dimensions than the vertical furnace-chamber, but generally conforming in external shape to the interior thereof. The enlarged base C′ of the retort is of compound character, comprising inner sections $C^2$, resting on the section $B^4$ and rectangularly disposed relatively to each other. The outer face of each of these sections has a series of inclined channels or grooves $C^3$, which register at the ends with those of the

other sections $C^2$. The terminal end of the lowest groove communicates with a descending angular passage in the wall $B^2$ below. A square coiled pipe D has its coils corresponding with the registering channels $C^2$ and partially lies therein, the terminal of the lower coil communicating with the bent pipe D′ within and extending beyond the angular passage in one of the walls $B^2$, the horizontal discharge portion of the pipe D′ extending beneath the grid proper of the section $B^4$. It is desirable that this pipe shall be of stable character to resist the heat and avoid any alloying tendency or combination with the hydrogen gas which is to be discharged therefrom. A suitable material for such pipe is provided by a combination of plumbago and German clay. A supplemental function of the square coiled pipe D is that it serves rigidly to hold the four sections $C^2$ in position, the inclination of the pipe-bends augmenting this effect. Outer sections $C^4$, corresponding with the sections $C^2$, also rest on the grid margin and mask those portions of the pipe not protected by the inner sections, the four sections $C^4$ being held in place by horizontal bolts $C^5$ and nuts, the former anchored in the sections $C^2$. The balance of the retort is presented by a vertical square tube $C^6$, which may be in one or more sections, its vertical diameter corresponding with that of the interior space presented by the inner sections $C^2$. The large vertical tube $C^6$ is firmly braced at each side by a vertical series of tiles $C^7$, intermittently arranged and preferably six at each side, as shown. A vertical series of square openings $C^8$ in one side of the tube $C^6$ are opposite suitable door-covered openings $C^\times$ (not shown) in the outer wall, through which access may be had to the interior of the tube $C^6$ to work or agitate the contents of the same by means of a rod or bar. The top of the square tube is embraced by a metal frame E, to which is hinged a door E′, faced on its lower side by a section $E^2$ of asbestos or equivalent material capable of resisting heat and protecting the iron from the alloying effects of the ascending hydrogen gas. The top of the flue presented between the four sides of the retort and the furnace is closed by tiling F, leaving an opening F′ at one point sufficiently capacious to permit the discharge of the gases of combustion into a horizontal flue $G^\times$, delivering to the stack G.

H is a pipe leading to the upper end of the coiled pipe D from a source of steam. This pipe H has a valve H′ and a pet-cock $H^2$, the latter for testing to determine the condition of the steam before opening the cock H′ to turn the steam into the coil. A valve-controlled naphtha-supply pipe I intersects the pipe H between its valve H′ and the coil.

The operation of the furnace is as follows: The open side of the chamber $B^2$ being closed and sealed by luted plug J, the charge of the iron in the form of scrap, twisted or otherwise distorted to afford free circulation of hydrogen gas through it and present a large surface for the gas to act on, is introduced at intervals through the temporarily-uncovered top of the retort, to which it may be conveniently delivered from the platform K. The temperature of the furnace and the retort being sufficiently elevated, the valve H′ is opened to admit steam through the pipe H to the coiled pipe D, which will effect the decomposition of the steam therein, the oxygen uniting with the metal, while the liberated hydrogen is discharged from the angular pipe D′ beneath and flows up through the grid and body of scrap-iron in the retort. The gas unites with the surface of the metal and forms the alloy scale. It being desirable to secure this scale as it forms, the apertures in one side of the furnace are opened from time to time and the charge of metal shaken by a bar introduced through said apertures to shake the metal and detach the scale therefrom, the latter dropping through the grid into the chamber $B^2$. At suitable periods the closed door-aperture $A^4$ of the furnace is opened, the plug J detached and taken out, and the accumulated alloy scale removed from the chamber $B^2$. The chamber $B^2$ may again be sealed by the luted plug J, the outer door A closed, and the alloying operation continued. It will be appreciated that the peculiarly-disposed coiled pipe D constitutes a highly efficient hydrogen-generator. After the steam has been admitted for a certain period the supply thereof is cut off and the valve of the naphtha-pipe opened. The action of this liquid hydrocarbon on the oxid of iron lining the coils of the pipe D is to rapidly reduce the same again to the metallic state, the oxygen leaving the iron and uniting with the carbon. Thus the coils of the pipe are revivified and made available for the repeated generation of hydrogen gas. I supply a slight excess of the hydrocarbon, so that some will pass up through the retort uncombined and will remove any oxygen which may by any chance have combined with the scales of my alloy or with the iron where the scale has been removed.

It will be noted that the vertical flues are on all four sides, insuring that the retort throughout its length will be efficiently bathed in the flame and products of combustion from the furnace.

Modifications may be made without departing from the principle or sacrificing the advantages of my invention. Instead of the pipe D being inclosed between the sections $C^2$ $C^4$ it may be encased in tubing $C^9$, of refractory or other material not subject to the reducing action of the high heat or the alloying effect of the hydrogen.

The details and proportions of both the retort and furnace may be varied.

I claim as my invention—

1. In apparatus for manufacturing hydro-

gen alloy, a furnace A, a large flue leading therefrom, an upright retort mounted concentrically in such flue, and a coil of pipe D embedded in the material of such retort, with provisions for passing steam through such coil into the retort all combined and arranged substantially as herein specified.

2. In apparatus for the manufacture of scale alloy, or analogous use, the combination of the upright retort C a surrounding flue and an adjacent furnace arranged to discharge its products of combustion through such flue, a pipe-coil D partially exposed within fire-brick to the heat of such flue, with the open end of such pipe discharging into such retort, a connection for introducing fluid to the other end of such pipe, a chamber $B^3$ arranged low so that the material will descend by gravity from the retort into such chamber, provisions for opening and closing such chamber, and the grate $B^4$ of refractory material separating such chamber from the retort and the tight floor B of refractory material separating such chamber from the furnace, arranged to allow the descent of fine material only, all arranged for joint operation substantially as herein specified.

3. In a metallurgical apparatus, the combination with a vertical retort, an inclosing wall and means for heating the same comprising the furnace A, a capacious flue leading upward therefrom, a thick exterior wall around such flue, and tiles $C^7$ in such flue placed at intervals to serve as distance-pieces to maintain the positions of the retort and the inclosing wall, of a pipe-coil discharging into said retort and subject to the same heating means, and a valve-controlled source of hydrogen-supply connecting with said pipe-coil, substantially as herein specified.

4. In apparatus for the production of a hydrogen alloy the combination with a heating-furnace A and a capacious ascending flue therefrom, of the upright retort C with removable cover E′, series of poke-holes $C^8$ in the sides of the retort, grate $B^4$ in the lower portion of the retort, the chamber $B^3$ below such grate and a removable plug J and luted door $A^4$ controlling the access to such chamber, all arranged to serve substantially as herein specified.

5. In apparatus for the production of a hydrogen alloy, the combination with a heating-furnace A and a capacious ascending flue therefrom, of the upright retort C mounted in such flue with a removable cover E′, the pipe-coil D also within such flue, the valve-controlled pipes I and H connected at one end with such coil and bringing naphtha and steam respectively and discharging from the other end into the retort, series of poke-holes $C^8$ in the sides of the retort, grate $B^4$ in the lower portion of the retort, the chamber $B^3$ below such grate and a removable plug J and luted door $A^4$ controlling the access to such chamber, all arranged to serve substantially as herein specified.

6. In a metallurgical apparatus, the combination with a vertical retort and means for heating the same, of a pipe-coil embracing a portion of said retort and embedded in the material thereof, a pipe for bringing steam and a separate pipe for bringing naphtha, arranged to pass the mixture through said coil into the retort and provisions for controlling such flow, combined and arranged to serve substantially as herein specified.

7. In a metallurgical apparatus, the combination with a heated retort having its lower portion of compound construction comprising a flooring B at the base, an exterior part C′ and an interior part $C^2$ and means for heating said retort, of the chamber $B^3$ below such retort, a pipe-coil D embraced in such compound sectional portion and the part D′ forming an extension of such pipe arranged to discharge from such coil into such chamber, substantially as herein specified.

8. In a metallurgical apparatus, the combination with a vertical retort and means for heating the same, of a pipe-coil protected by refractory material and a terminal portion D′ composed of a combination of graphite and clay and discharging into the retort, the said coil being heated by the same heating means, substantially as herein specified.

Signed at Washington, in the District of Columbia, this 10th day of November, A. D. 1899.

GEORGE W. GESNER.

Witnesses:
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