No. 843,950. PATENTED FEB. 12, 1907.

S. A. KENNEDY.

BLAST FURNACE.

APPLICATION FILED FEB. 23, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

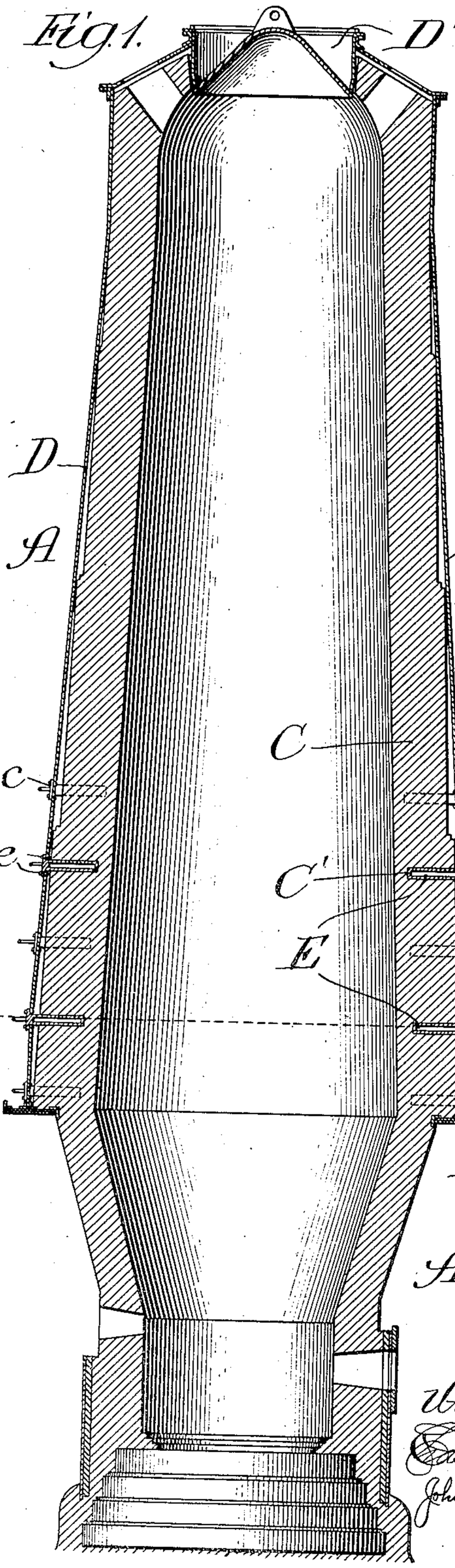


Fig. 2.

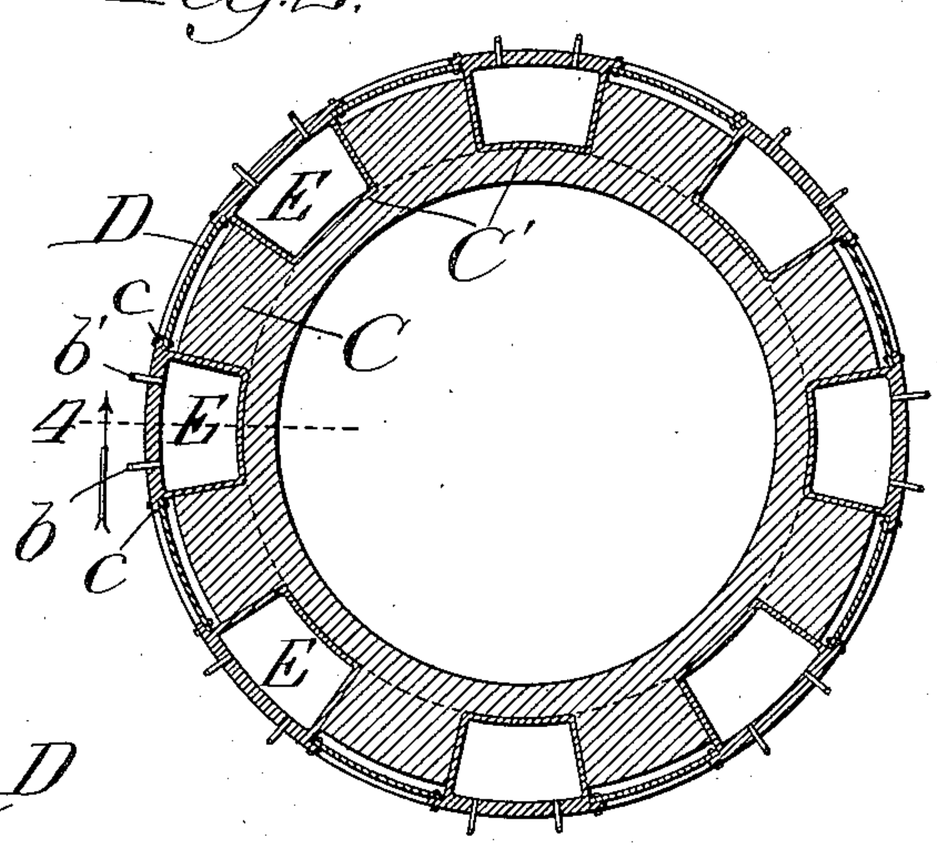
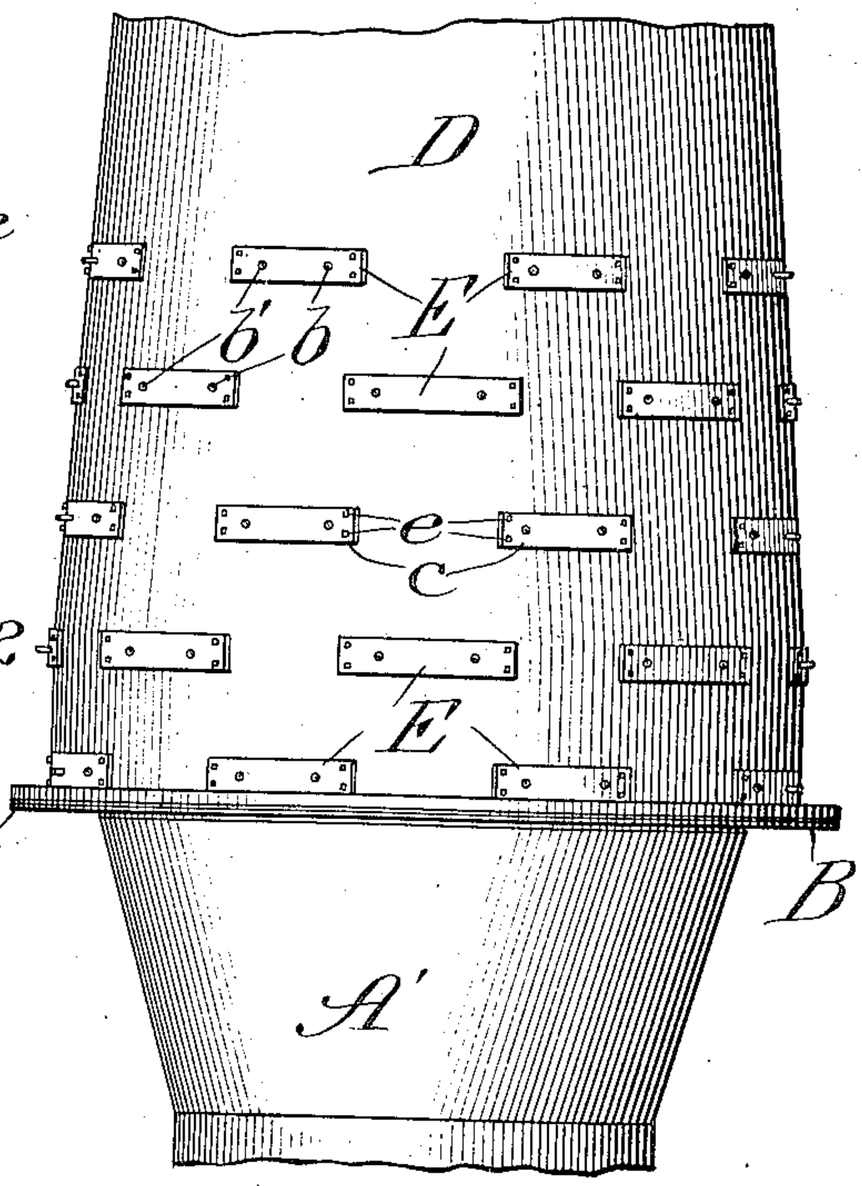


Fig. 3.



Witnesses.
Chas. E. Gaylord.
John Enders.

Inventor:
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Attys

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3 SHEETS—SHEET 2.

Fig. 4.

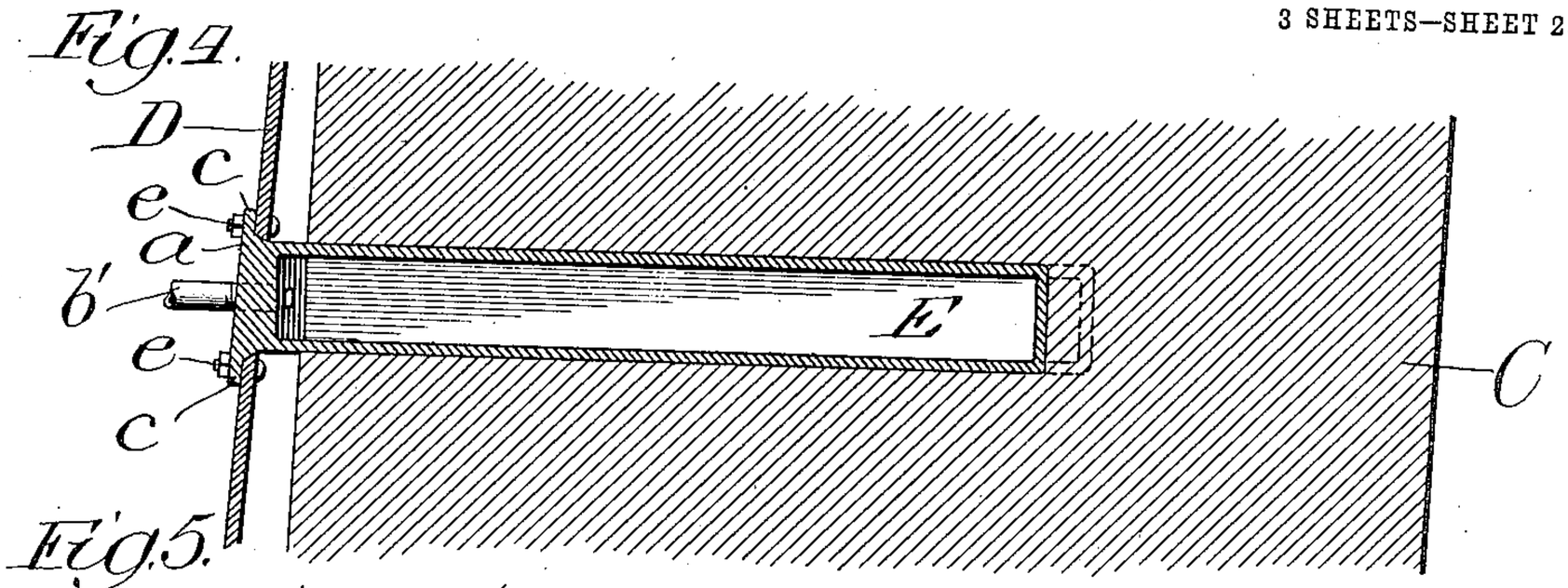


Fig. 5.

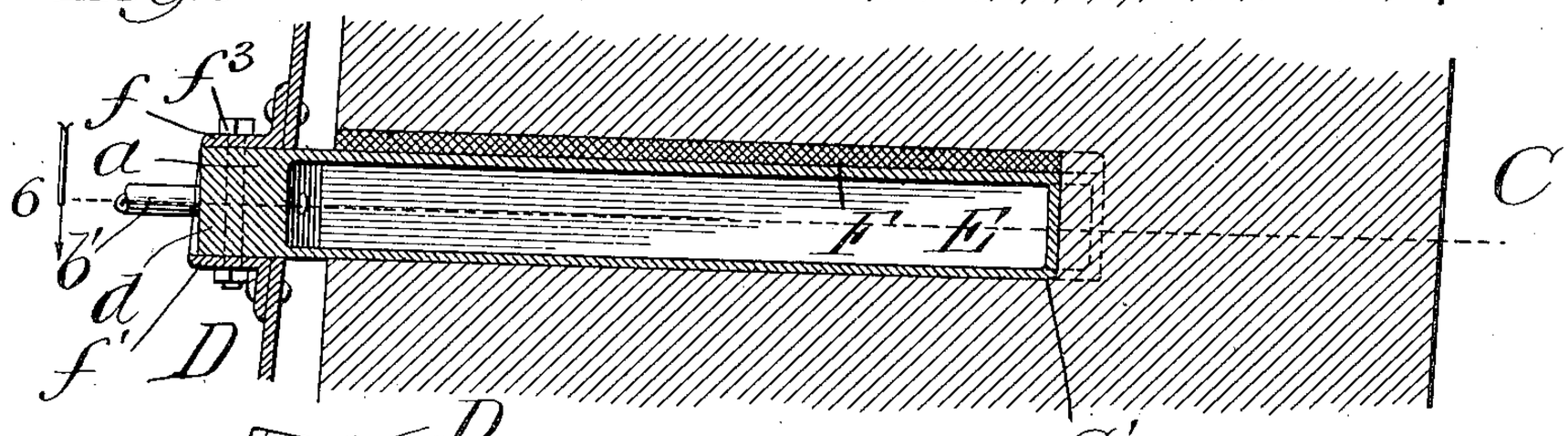
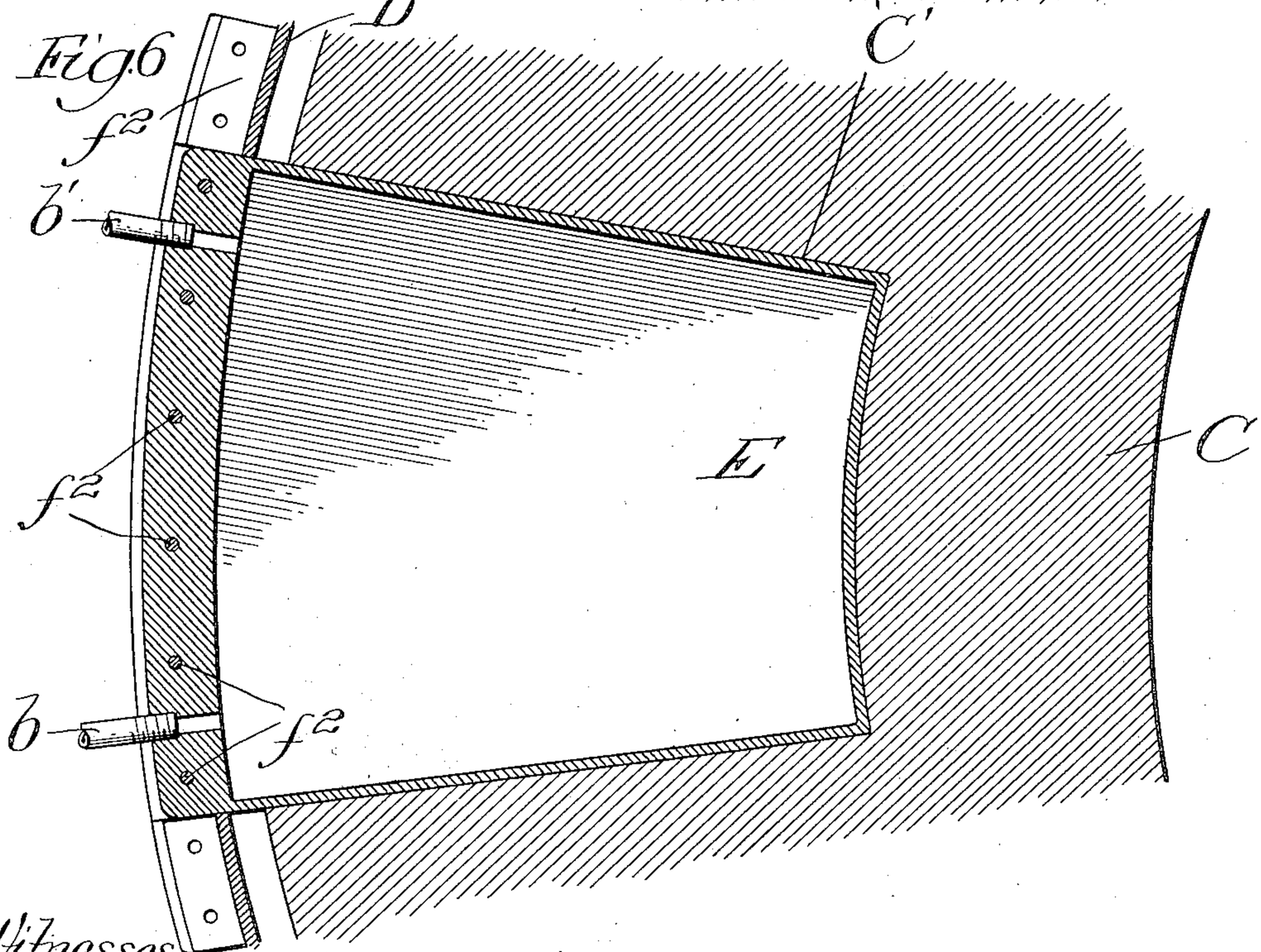


Fig. 6



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3 SHEETS—SHEET 3.

Fig. 7.

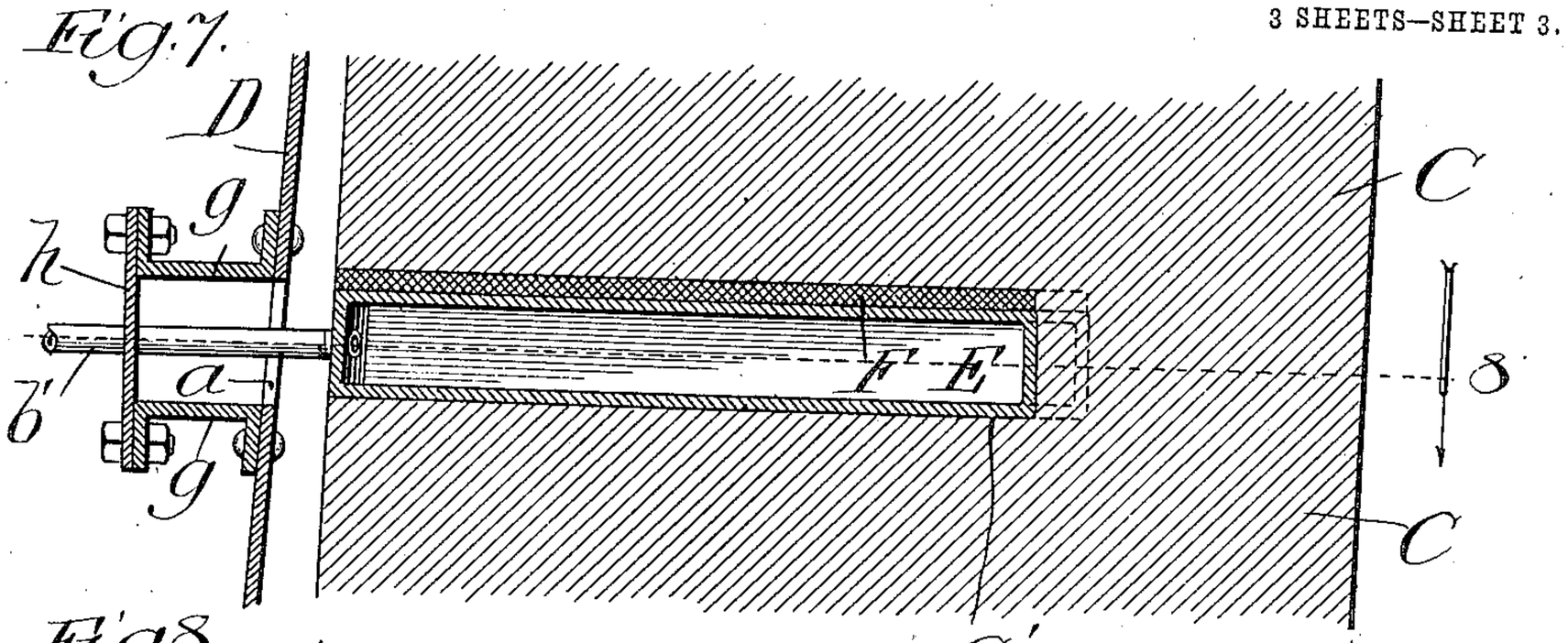
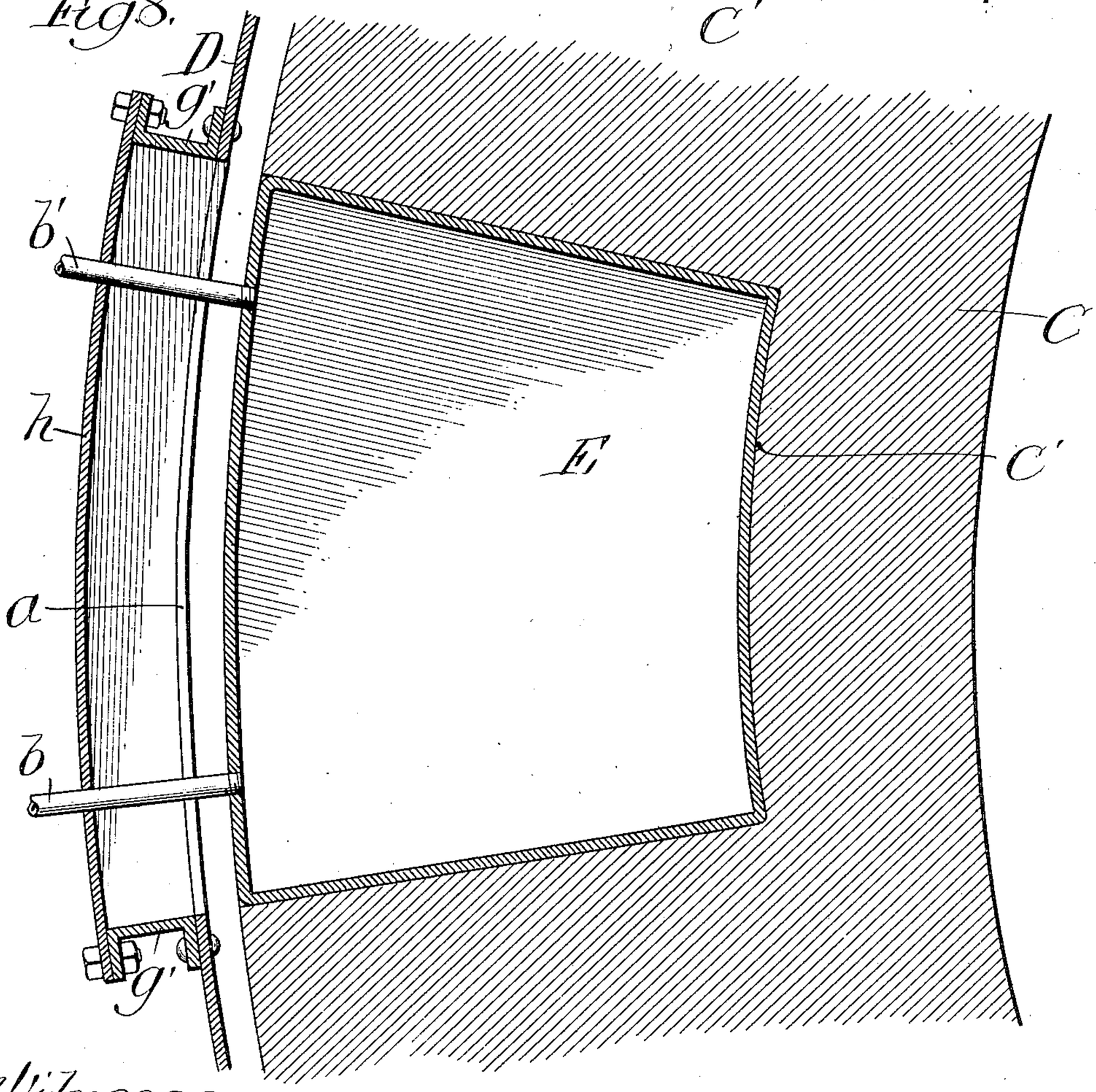


Fig. 8.



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UNITED STATES PATENT OFFICE.

SAMUEL A. KENNEDY, OF CHICAGO, ILLINOIS.

BLAST-FURNACE.

No. 843,950. Specification of Letters Patent. Patented Feb. 12, 1907.

Application filed February 23, 1906. Serial No. 302,458.

To all whom it may concern:

Be it known that I, SAMUEL A. KENNEDY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Blast-Furnaces, of which the following is a specification.

My invention relates particularly to an improvement in the hollow cooling-plate which is embedded in the lining of a blast-furnace adjacent to its hottest zone to afford a medium for the circulation of water for cooling the lining, and thus protecting it against injury by the heat. These cooling-plates are frequently rendered useless for their purpose by cracking or melting under the heat to which they are subjected, and require to be removed and replaced by new ones to prevent destruction of the lining in the absence of the cooling medium, circulation of which is prevented by the impairment of the plates; but the matter of removing an impaired cooling-plate as hitherto provided is attended with much difficulty besides incurring material injury to the lining to free the plate and stoppage of the operation of the furnace, which entails loss. Moreover, it is usually impossible to locate an injured cooling-plate, so that the entire lining must be destroyed to find and remove it, and this entails great expense.

Heretofore it has been the practice in constructing a blast-furnace to embed and envelop the cooling-plates in the shell-enveloped upper section of the lining, thus making impracticable the location and removal of any one of them when it becomes impaired, as described, without the removal of the entire lining, the rebuilding of which necessarily puts the furnace out of use.

My primary object is to overcome the disadvantages referred to by a construction which enables any injured plate to be readily located and removed and as readily replaced by a perfect one without interfering with the operation of the furnace.

Referring to the accompanying drawings, Figure 1 is a view in vertical section of a blast-furnace provided with my improvements. Fig. 2 is a section taken at the line 2 on Fig. 1 and viewed in the direction of the arrow. Fig. 3 is a broken view of the furnace, showing in elevation the part equipped with my improved cooling-plates. Fig. 4 is an enlarged broken view, in vertical section, taken at the line 4 on Fig. 2 and viewed in the direction of the arrow. Fig. 5 is a similar view showing a modification of the cooling-plate. Fig. 6 is a broken view, in horizontal section, taken on line 6 in Fig. 5 and viewed in the direction of the arrow. Fig. 7 is an enlarged view, in vertical section, similar to Fig. 4, showing another modification of the cooling-plate; and Fig. 8, a broken view, in horizontal section, taken at the line 8 on Fig. 7 and viewed in the direction of the arrow.

A is a blast-furnace of usual type comprising a base A′, a mantle B, a lining C, of refractory material, such as fire-brick, and a plate-metal shell D enveloping the lining and surmounted by the metal top structure D′.

C′ C′ are recesses or chambers formed of desired depth in the lining C to open at its outer surface and arranged in circumferential series, the chambers of each series being in staggered relation to those of the adjacent series. The preferred shape of each chamber C′ is that represented of flaring outwardly. Openings *a*, provided in the shell, register with the chambers C′ to permit the withdrawal and introduction through them of the cooling-plates, as hereinafter described. The sides of the openings *a* are preferably beveled, as shown in Fig. 4, to insure a close fit between them and the sides of the plates.

In Figs. 1, 2, 3, and 4 is illustrated the preferred embodiment of my invention, in which E E represent hollow inwardly-tapering water-cooling plates each provided with water inlet and outlet pipes *b b′*, connected with a suitable source of water-supply (not shown) for maintaining a constant circulation of water through the plates. The plates E are withdrawably confined in the chambers C′ and protrude at their pipe-equipped ends through the respective openings *a* in the shell. The projecting closed ends of the plates are provided with flanges *c*, at which they are secured to the outer surface of the shell, as by bolts *e*.

The modified form of cooling-plate shown in Figs. 5 and 6 differs from that just described in having a thickened outer end *d* protruding through the respective shell-opening *a* and embraced at its protruding end between upper and lower angle-plates *f f′*, the lower angle-plate terminating in end lugs f^2, projecting from its inner face to lap the joints between the sides of the opening in the shell and the protruding end of the plate. The angle-plates are riveted or otherwise fastened

to the shell and are fastened together, as by bolts f^3, passed vertically through them and through the thickened end of the plate.

In the modified form of cooling-plate E illustrated in Figs. 7 and 8 the outer end comes flush with the corresponding open end of its containing-chamber. For closing the opening *a* in the shell which registers with the plate the opening is flanked by upper and lower similar channel-bars *g g* and similar end channel-bars *g' g'*, fastened, as by rivets, to the shell, with a covering-plate *h* bolted or otherwise fastened to the outer flanges of the bars *g g'*, and through suitable openings in which the supply and discharge pipes *b* and *b'* pass for connection with the cooling-plate.

The chambers in the lining may be greater in vertical diameter than the cooling-plates to provide spaces between the plates and the top walls of the chambers for receiving a filler F, Fig. 5, of suitable cementing material after the plates are in position in the recesses, this filler being readily removable by breaking it out when it is desired to remove a plate.

For removing a plate when the aforesaid preferred construction is employed the bolts *e* are removed, thus permitting the plate E to be withdrawn out of its chamber C' through the respective opening *a* and a new one to be inserted into the chamber and fastened, and this while the furnace is in operation. When either one of the modified forms of construction is employed, withdrawal of an injured plate may be effected upon removing the respective fastening-bolts, and upon introducing a new plate through the opening into the place of that thus removed the parts are fastened in the manner described.

It is necessary in blast-furnaces where openings are provided in the shell above the bosh to provide means for closing these openings to prevent escape through the shell of gases from the interior of the furnace, which at this point are intense and penetrate the lining. In each of the constructions shown in the drawings means are provided for accomplishing this purpose. In the preferred construction flanges are provided entirely around the outer end of the cooling-plate. In the construction shown in Fig. 5 flanges are secured to the outer surface of the shell about the opening in it to embrace between them the protruding end of the cooling-plate, and in Figs. 7 and 8 a housing in the form of a chamber is provided over the opening and through which the water inlet and outlet pipes communicating with the cooling-plates extend.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a blast-furnace, the combination with the lining and its surrounding shell, of a plurality of chambers in the lining, hollow cooling-plates removably confined in said chambers, openings in the shell registering with said chambers, and means coöperating with said cooling-plates for closing said openings in the shell to render said shell substantially gas-tight.

2. In a blast-furnace, the combination with the lining and its surrounding shell, of a plurality of chambers in the lining, hollow cooling-plates removably confined in said chambers, openings in the shell registering with said chambers through which said cooling-plates extend, and means coöperating with said cooling-plates for closing said openings in the shell to render said shell substantially gas-tight.

3. In a blast-furnace, the combination with a lining and its surrounding shell, of a plurality of chambers in the lining, hollow cooling-plates flanged at their outer ends and removably confined in said chambers, and openings in the shell registering with said chambers, said cooling-plates extending at their flanged ends through said openings and being fastened to the shell, and said flanges affording means for rendering the shell gas-tight at its portion containing the openings.

SAMUEL A. KENNEDY.

In presence of—
J. H. LANDES,
G. A. CHRITTON.