

No. 760,172.

PATENTED MAY 17, 1904.

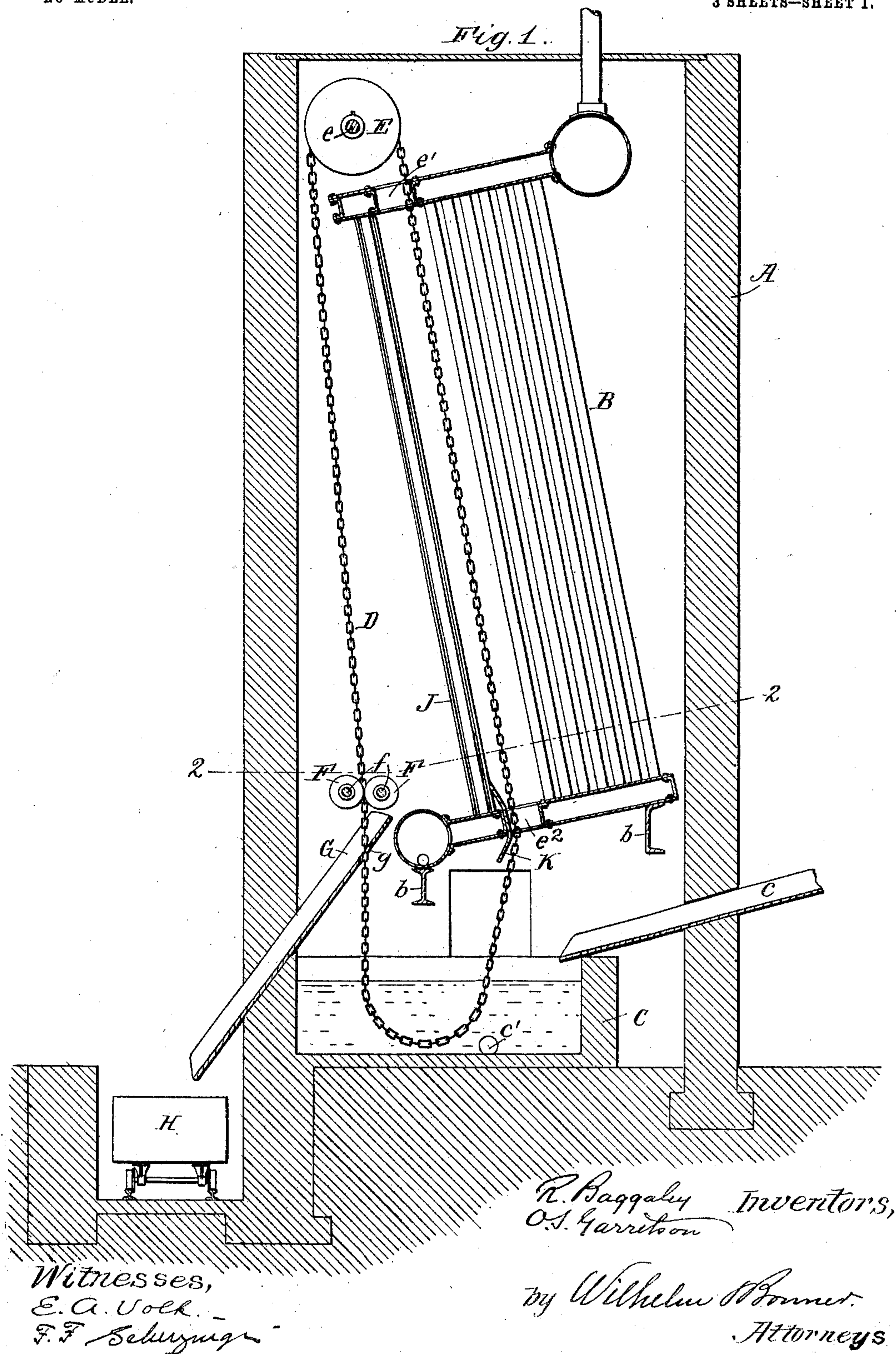
R. BAGGALEY & O. S. GARRETSON.

SLAG FURNACE.

APPLICATION FILED FEB. 20, 1902.

NO MODEL.

3 SHEETS—SHEET 1.



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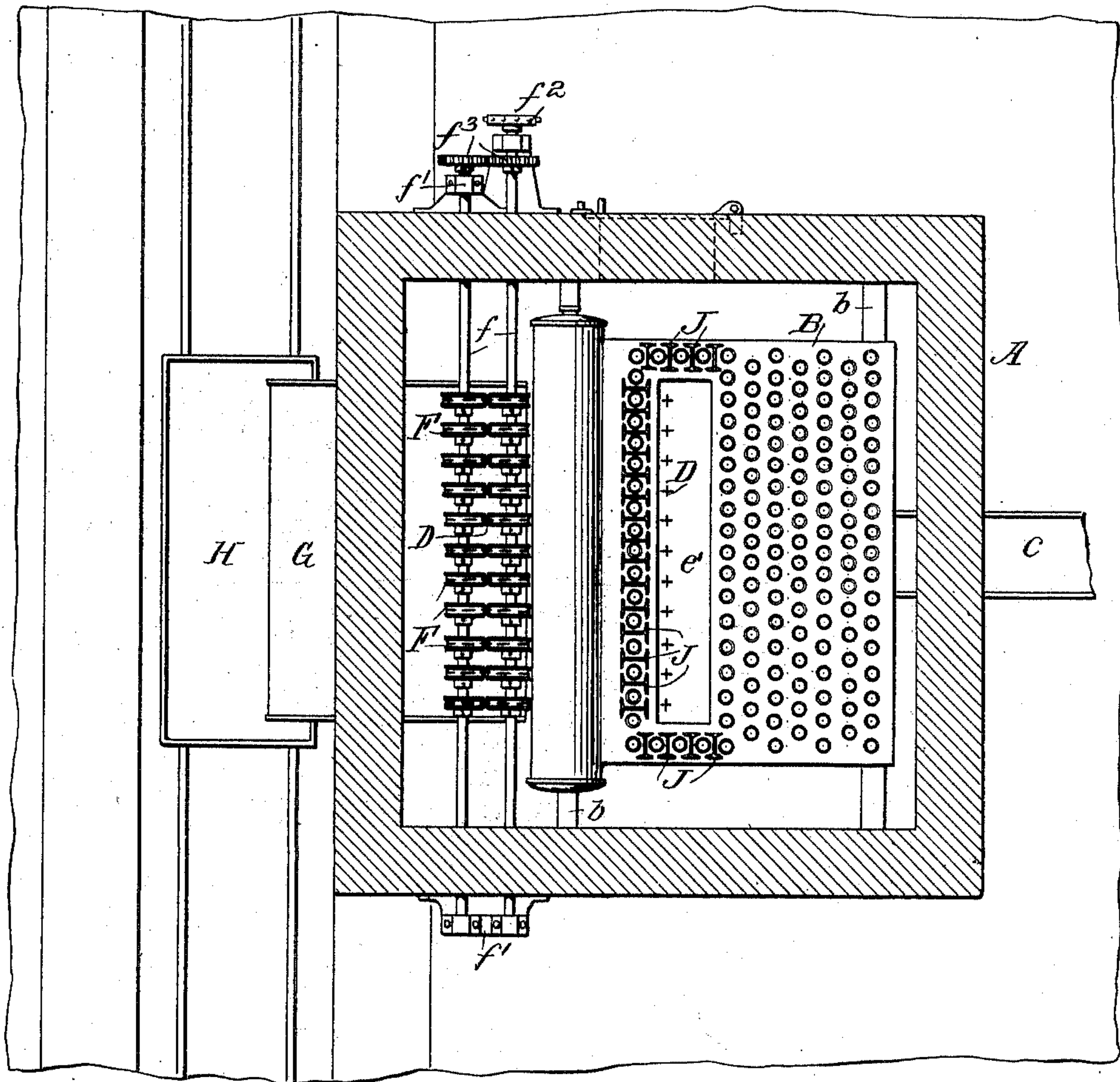
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NO MODEL.

3 SHEETS—SHEET 2.

Fig. 2.



Witnesses,  
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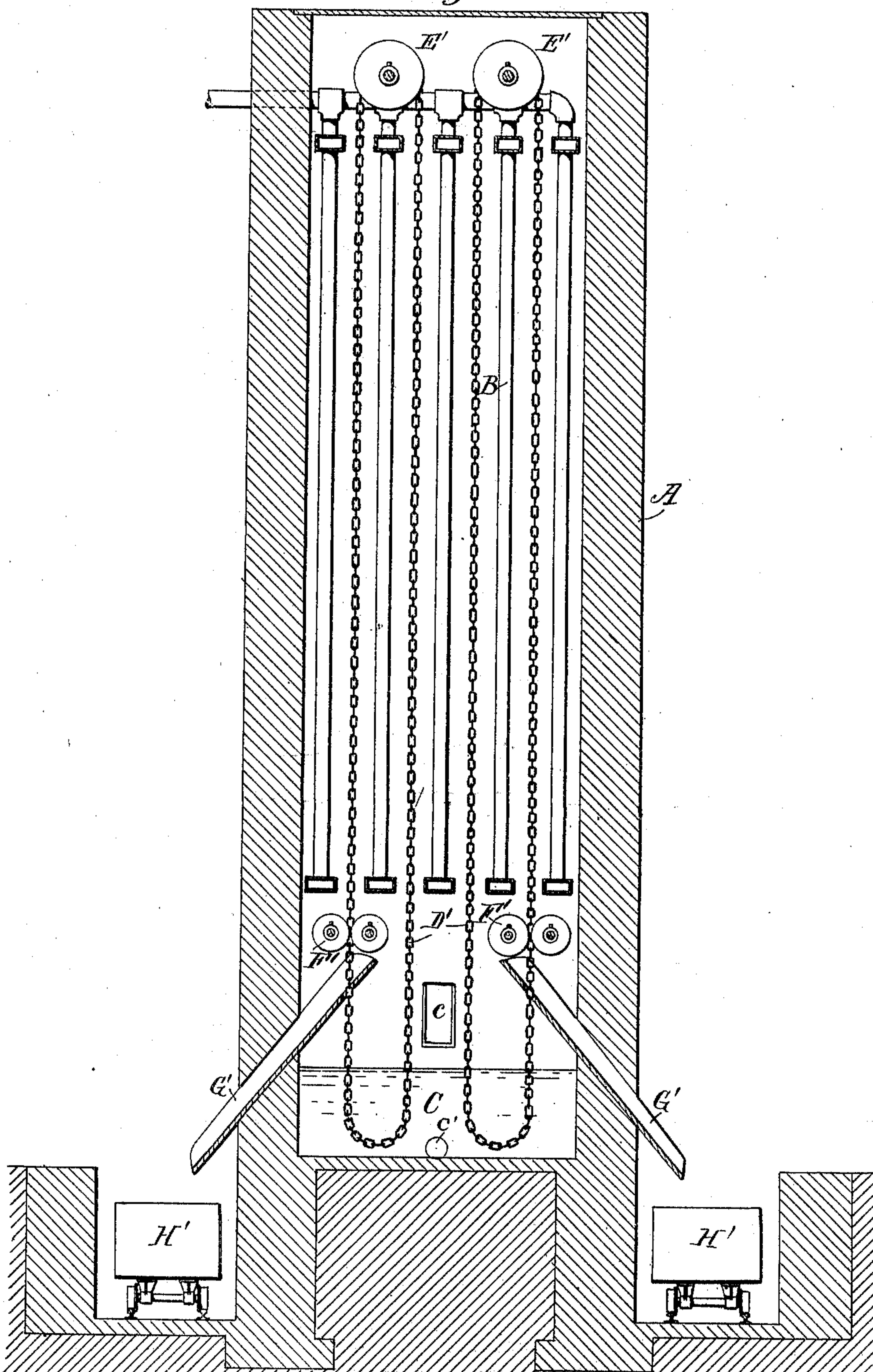
SLAG FURNACE.

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NO MODEL.

3 SHEETS—SHEET 3.

*Fig. 3.*



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# UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURG, PENNSYLVANIA, AND OLIVER S. GARRETSON, OF BUFFALO, NEW YORK, ASSIGNORS TO GARRETSON FURNACE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF WEST VIRGINIA.

## SLAG-FURNACE.

SPECIFICATION forming part of Letters Patent No. 760,172, dated May 17, 1904.

Application filed February 20, 1902. Serial No. 94,864. (No model.)

*To all whom it may concern:*

Be it known that we, RALPH BAGGALEY, residing at Pittsburg, in the county of Allegheny, in the State of Pennsylvania, and OLIVER S. GARRETSON, residing at Buffalo, in the county of Erie and State of New York, citizens of the United States, have invented new and useful Improvements in Slag-Furnaces, of which the following is a specification.

This invention relates to a furnace for utilizing the heat contained in molten slag to heat a steam-boiler or other vessel or apparatus and in which the molten slag is carried past the heating-surface of the boiler or other vessel or apparatus by an endless flexible carrier.

The object of the invention is to produce a furnace of this nature which is very simple in construction and easy of operation and in which the heat contained in the slag is fully utilized.

In the accompanying drawings, consisting of three sheets, Figure 1 is a sectional elevation of a steam-boiler furnace embodying the invention. Fig. 2 is a horizontal section through the furnace on the line 2 2, Fig. 1. Fig. 3 is a sectional elevation of a furnace of slightly-different construction.

Like letters of reference refer to like parts in the several figures.

A represents a closed heating-chamber or furnace of any suitable form or construction, in which the steam-boiler B or other vessel or apparatus to be heated is arranged in any suitable manner. As shown in the drawings, the furnace is rectangular and of considerable height, the inclosing walls being made of or protected by some suitable non-conducting material to better retain the heat. The boiler, which, as shown in the drawings, is of the upright-water-tube type, is arranged in a slightly-inclined position in the heating-chamber. The boiler is supported in any suitable manner—for instance, as shown, by horizontal beams b.

C represents a receptacle for molten slag, formed or located in the lower part of the furnace or heating-chamber beneath the boiler. This receptacle is supplied with molten slag directly from the smelting-furnace, as by a slag-spout c, leading through one of the furnace-walls. The slag-receptacle may be provided with a tap-hole c' for drawing off the molten slag when the receptacle requires to be cleaned.

D represents the endless carrier for elevating the molten slag from the slag-receptacle and carrying the same up into close proximity to the heating-surface of the boiler or other apparatus, so as to impart the heat of the slag to the same. As shown in the drawings, Figs. 1 and 2, the endless carrier is composed of a series of endless chains hung side by side in the form of loops from a series of sheaves or pulleys E, arranged in the upper part of the heating-chamber, so that the lower ends of the chain-loops dip into the molten slag in the receptacle, whereby the chains become coated with the molten slag. The supporting-sheaves for the carrier-chains are arranged above the boiler and mounted on a horizontal shaft e, supported at its ends in any suitable manner. The upwardly-moving runs of the carrier-chains pass through openings e' e'', provided for this purpose in the upper and lower heads of the boiler and run between adjacent rows of the boiler-tubes.

The carrier-chains are driven by any suitable means, but preferably by sprocket-wheels F, which are arranged in pairs on opposite sides of the downwardly-moving runs of the chains. The several sprocket-wheels, which are arranged on the same side of the several chains, form a set and are secured to the same shaft f. The shafts of the two sets extend through the opposite walls of the heating-chamber and are journaled outside of the chamber in bearings f'. These shafts are driven in opposite directions by any suitable mechan-



ism to cause each pair of sprocket-wheels to grip the carrier-chain and propel the latter in the proper direction. The mechanism shown for driving these shafts consists of a driving sprocket-wheel  $f^2$ , secured to the end of one of the shafts, and a pair of gear-wheels  $f^3$ , connecting the shafts.

The sprocket-wheels F for driving the carrier-chains also serve to detach the congealed slag from the chains by gripping the latter, and thereby breaking and detaching the slag which adheres to the chains as a thin film or scale, and which by the time it reaches these sprocket-wheels has become so brittle as to be easily detachable from the chains. This congealed or chilled slag as it is removed from the carrier-chains by the sprocket-wheels is caught by a chute G, having its upper end located beneath the sprocket-wheels and its lower end extending through the adjacent wall of the heating-chamber at a suitable point to discharge the removed slag into a car or other receptacle H outside of the furnace. The chute is provided near its upper end with holes g, through which the downwardly-moving runs of the carrier-chains pass.

The tubes of the boiler, which lie adjacent to the upwardly-moving runs of the carrier-chains, are shown to be inclosed and protected by I-beams J, the webs of which are arranged between adjacent tubes and the flanges of which extend toward each other on the front and rear sides of the tubes. The beams thus incase the tubes and prevent the carrier-chains or any slag which might drop from the same from coming in contact with the tubes and injuring the same.

K represents a shield or wear-plate which extends through the opening in the lower boiler-head. The upwardly-moving runs of the carrier-chains bear against this shield, which wipes any surplus molten slag from the chains and prevents contact of the latter with the adjacent side of the opening  $e^2$  in the lower boiler-head.

In the form of the furnace shown in Fig. 3 the tubes of the boiler are arranged in vertical rows and two endless carriers D' are employed, each composed, as in the first-described construction, of a series of chains hung in loops on a series of sheaves E'. Each run of each carrier-chain is located between two rows of boiler-tubes. The chains are each driven by opposite sets of sprocket-wheels F', which also serve to detach the chilled slag. The latter is conveyed by chutes G', one for each carrier, from the furnace and discharged into a car or other receptacle H'.

In both forms of the furnace the receptacle for the molten slag is located beneath the boiler in the closed heating-chamber. The heat contained in the slag is thereby confined within the chamber and utilized partly by carrying the slag past the heating-surface by means of an endless carrier and partly by radiation from

the body of slag in the receptacle. As there is always a considerable body of the molten slag in the receptacle beneath the boiler or other vessel, the latter is evenly heated and the slag in the receptacle is kept from cooling.

We claim as our invention—

1. The combination of a steam-boiler, or the like, having an upright heating-passage, a receptacle for molten slag arranged below said heating-passage, an endless traveling slag-carrier suspended in the form of a loop which dips with its lower portion into the slag-receptacle, elevating slag therefrom and passing with its ascending portion, coated with molten slag, through said heating-passage for imparting heat to said boiler, and mechanism acting upon the carrier after it has passed through said heating-passage for detaching the congealed slag from the carrier, substantially as set forth.

2. The combination of a steam-boiler, or the like, having upright heating-passages, a receptacle for molten slag arranged below said passages, an endless traveling slag-carrier suspended in the form of a loop which dips with its lower portion into the slag-receptacle, elevating slag therefrom and passing with its ascending and descending portions through said passages, and mechanism acting upon the carrier after it has passed through said passages for detaching the congealed slag therefrom, substantially as set forth.

3. The combination of a steam-boiler, or the like, having a heating-passage, a receptacle for molten slag located below said passage, an endless traveling slag-carrier which dips into said receptacle, elevating slag therefrom and passing with its ascending portion through said heating-passage, and wheels between which said carrier runs and which are arranged beyond said heating-passage for detaching the congealed slag from the carrier, substantially as set forth.

4. The combination of a heating-chamber provided in its lower portion with a receptacle for molten slag, an apparatus to be heated arranged in said heating-chamber above said slag-receptacle, an endless flexible carrier suspended in said heating-chamber in the form of a loop, one run of which extends through a space in said apparatus, and means for driving said endless carrier to elevate the slag through said space in said apparatus, substantially as set forth.

5. The combination of a heating-chamber, a receptacle for molten slag located in said chamber, an endless flexible carrier located in said chamber and which extends into said slag-receptacle, and wheels for driving said endless carrier to convey the slag within said heating-chamber, said carrier passing between said driving-wheels whereby the congealed slag is detached from said carrier, substantially as set forth.

6. The combination of a heating-chamber provided in its lower portion with a receptacle



for molten slag, an apparatus to be heated arranged in said heating-chamber above said slag-receptacle, an endless flexible carrier consisting of a series of chains suspended in the  
5 form of loops in said heating-chamber with the lower ends of said loops dipping into the slag in said receptacle, a pair of oppositely-arranged sprocket-wheels for each carrier-chain between which the chain passes for detaching the congealed slag therefrom, and  
10 means for discharging the detached slag from said chamber, substantially as set forth.

In testimony whereof we have signed our

names to the specification in the presence of two subscribing witnesses.

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OLIVER S. GARRETSON.

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