(No Model.)

3 Sheets—Sheet 1.

E. BOUTCHER.

FURNACE GRATE.

No. 366,450. Patented July 12, 1887.

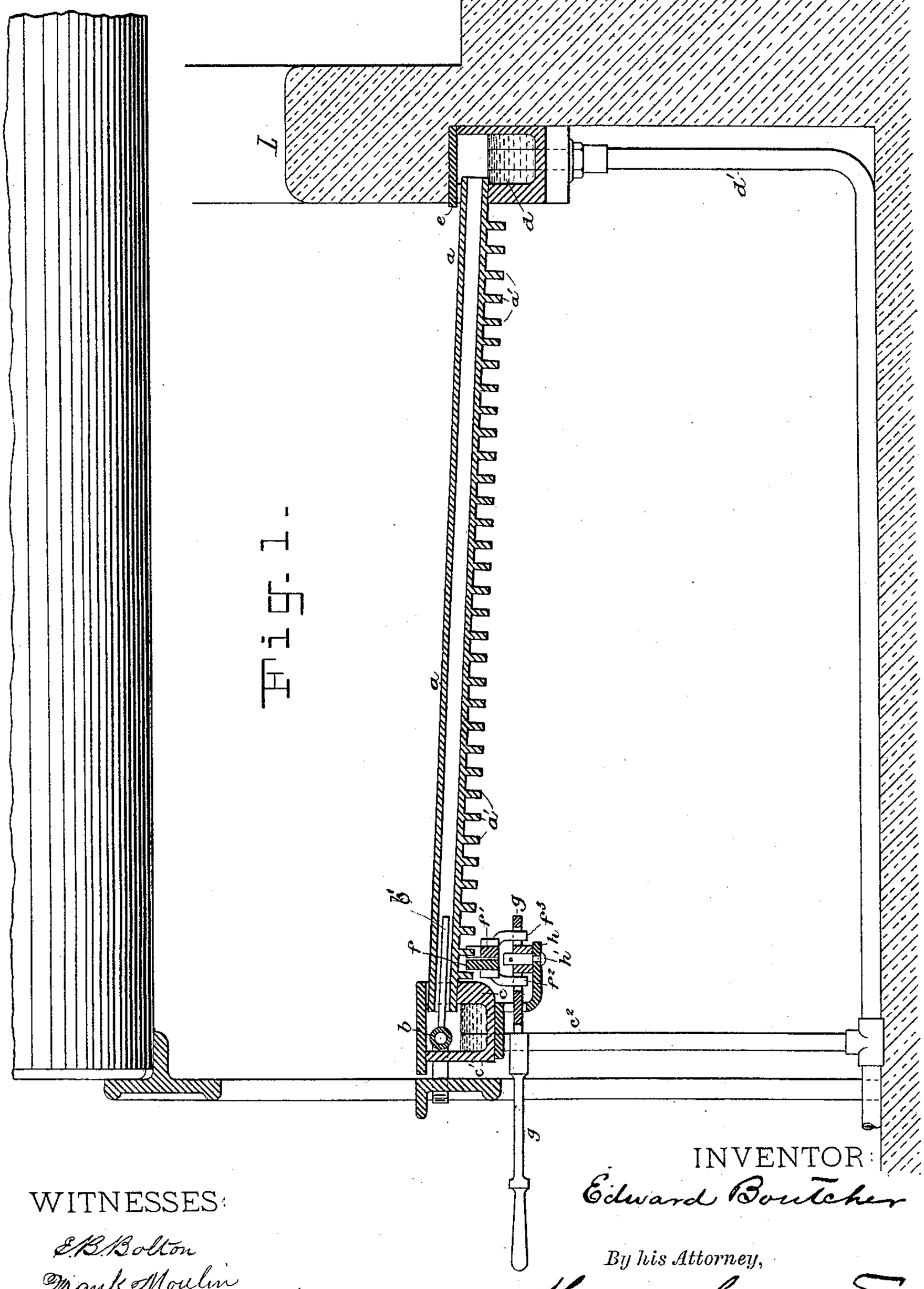

Fig. 1.

WITNESSES:

E. B. Bolton

Mank Moulin

INVENTOR:

Edward Boutcher

By his Attorney,

Henry Connett

(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

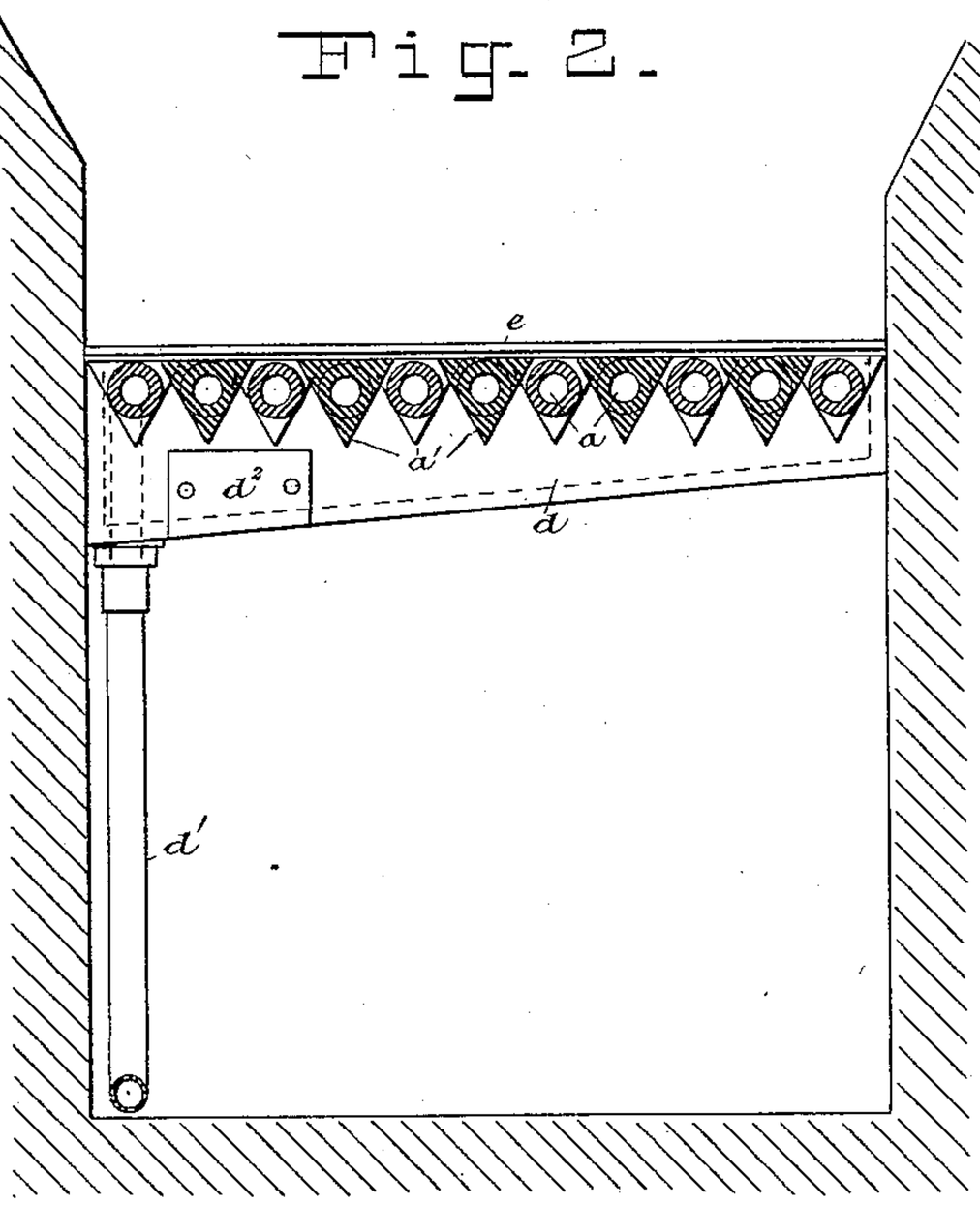
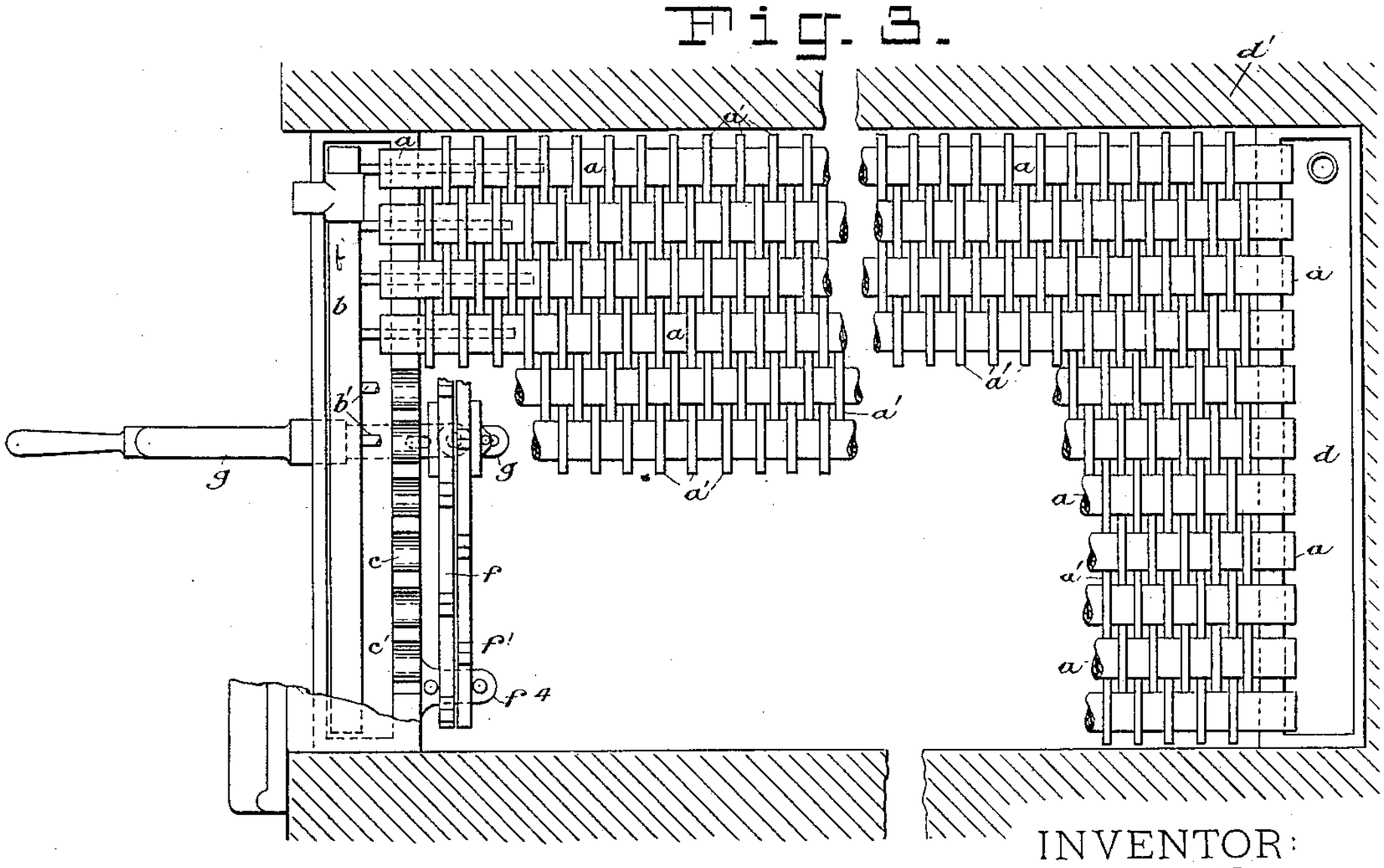


Fig. 3.



WITNESSES:

E. B. Bolton

Frank Moulin

INVENTOR:

Edward Boutcher

By his Attorney,

Henry Connett

(No Model.) 3 Sheets—Sheet 3.

E. BOUTCHER.

FURNACE GRATE.

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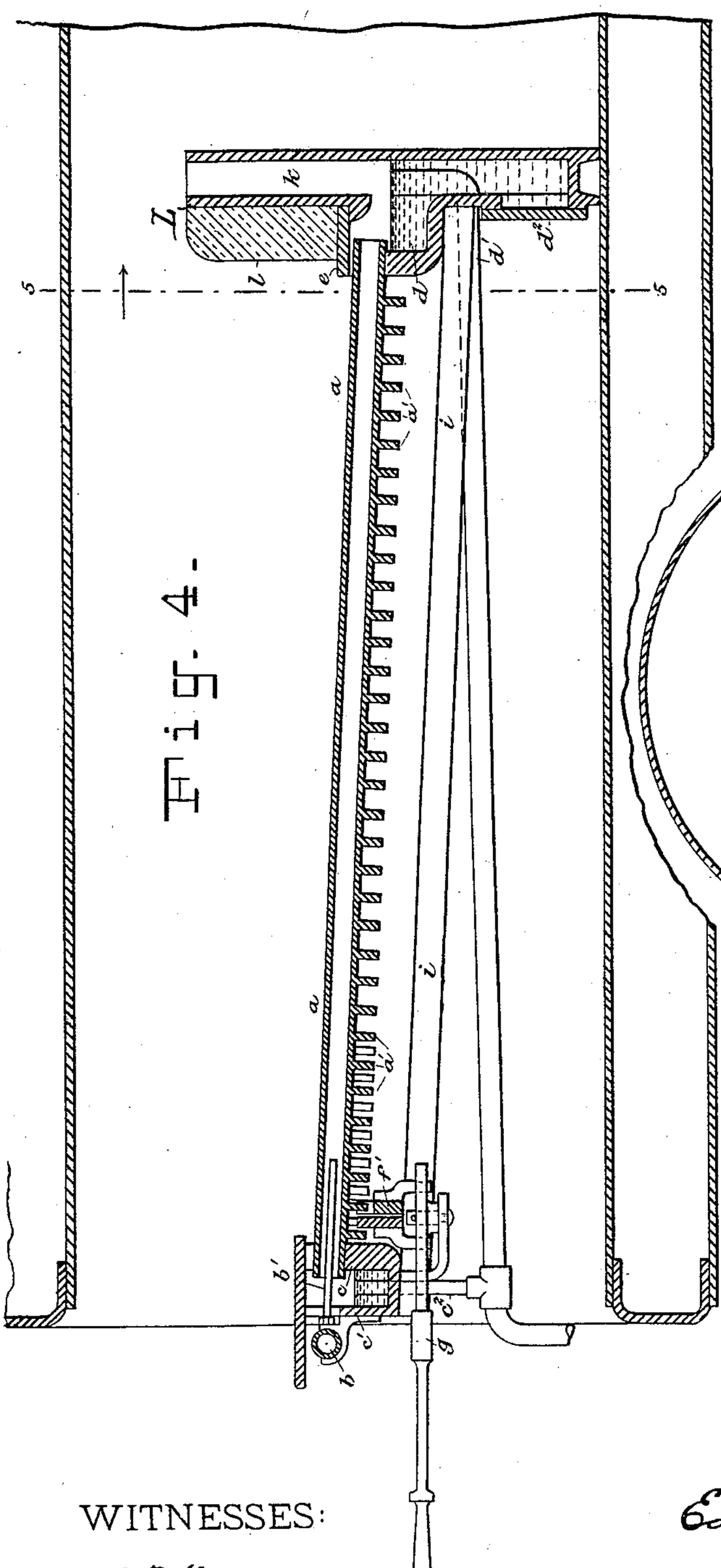

Fig. 4.

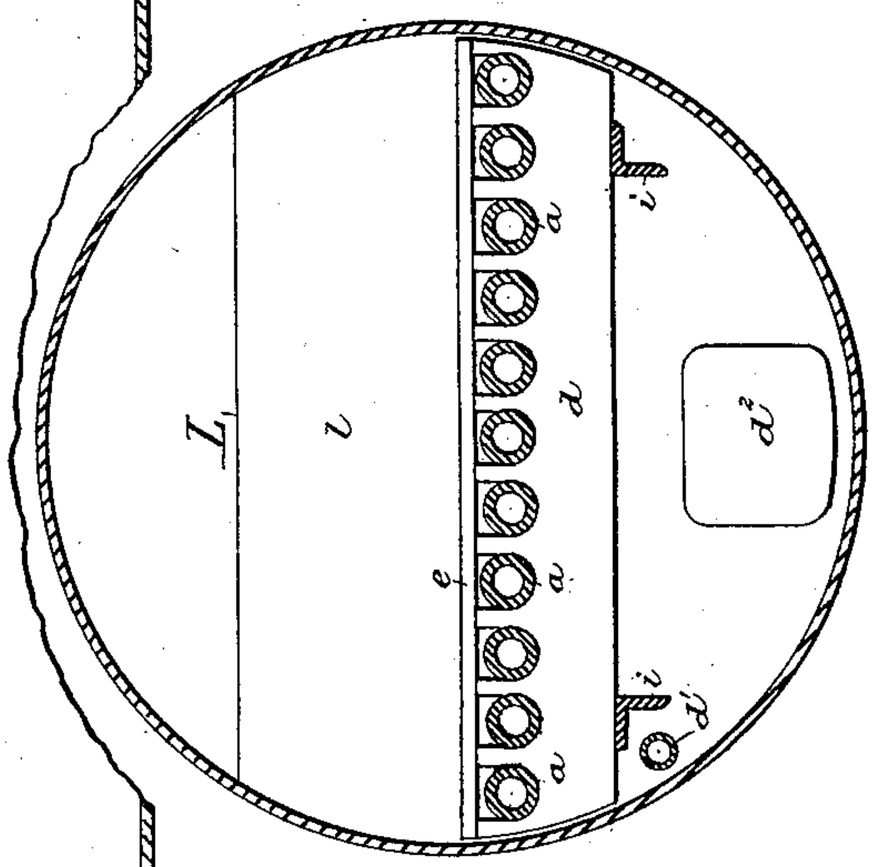

Fig. 5.

WITNESSES:

E. B. Bolton

Frank Moulin

INVENTOR:

Edward Boutcher

By his Attorney,

Henry Connett

UNITED STATES PATENT OFFICE.

EDWARD BOUTCHER, OF LONDON, ENGLAND.

FURNACE-GRATE.

SPECIFICATION forming part of Letters Patent No. 366,450, dated July 12, 1887.

Application filed September 9, 1886. Serial No. 213,082. (No model.)

To all whom it may concern:

Be it known that I, EDWARD BOUTCHER, of London, England, have invented certain Improvements in Steam-Boiler and other Furnaces, of which the following is a specification.

My invention relates to that class of furnaces employing rocking grate-bars constructed hollow for the passage of water through them.

In carrying out my invention I make the grate-bars of cast-iron and tubular and open at both ends. Each bar is provided with teeth or lateral projections which, when the bars lie side by side, interlock—that is to say, the teeth on one bar take between the teeth on the bar or bars next adjacent. These teeth are formed integrally with the bar and make up the grate-surface, and they have preferably a triangular form, so that either of the three faces of the bar may be turned uppermost to form said grate-surface by rotating the bar on its axis. These bars extend from front to rear in the furnace and stand inclined from front to rear. The front ends of the grate-bars rest in a notched bearing-bar, in which they may be rocked, and this bar is, by preference in the form of a trough. The rear ends of the bars also rest in a notched bearing-bar in the form of a trough or collector. Pipes are provided to supply water to the bars at their front ends, and this water flows by gravity through the bars to the collector at their rear ends, whence it is carried off by a pipe. The water that may overflow into the trough at the front ends of the bars is also led off by a pipe. The interiors of the hollow bars and the troughs or collectors are always open to the atmosphere, and no steam-pressure can be generated therein. The water from the grate, heated in keeping down their temperature, is conveyed away to be ultimately pumped into the boiler. Thus the bars serve the purpose of a feed-water heater. I may force steam or air through the bars, and I sometimes form holes in them at proper points, so that some of the steam or air passing through them, or some of the steam generated from the water flowing through them, may find its way into the furnace.

The grate-bars are rocked by suitable mechanism, that will be hereinafter described.

In some cases the collector at the rear or inner ends of the grate-bars is constructed to form a bridge or "bridge-wall," and the said bridge is open at its top like a trough. This construction permits steam and vapor rising from the water in said trough to escape into the furnace at the crown of the bridge, where the heat is intense, and thus promote combustion of the uncombined furnace-gases.

My invention will be better understood by reference to the accompanying drawings, wherein—

Figure 1 is a longitudinal section of a furnace provided with my improvements. Fig. 2 is a transverse section of same. Fig. 3 is a sectional plan of same. These views represent the furnace as applied to an externally-fired boiler. Fig. 4 is a longitudinal section, and Fig. 5 is a transverse section illustrating the application of my invention to a Cornish or other internally-fired boiler.

a a are the hollow or tubular grate-bars, which may be cylindrical or of any form. Each bar has cast on it a number of projections or teeth, *a' a'*, preferably in the form of equilateral triangles, as seen in Fig. 2, with the axis of the bar coincident with the center of the triangle and the surface of the bar tangent to the faces of said triangles. When the bars lie side by side, the teeth on one bar engage the spaces between the teeth on the bars next adjacent, as best seen in Fig. 3.

b is the main supply-pipe for supplying the hollow bars *a a* with water. This pipe extends transversely across the front of the furnace and has small branch pipes *b' b'* projecting laterally from it and into the open ends of bars *a a*, respectively.

c is the front bearing-bar, which is notched to form bearings for the front ends of the grate-bars *a a*. This bearing-bar is preferably provided with or formed in one with a trough, *c'*, for holding water, and in the present case this trough has a pipe, c^2, for carrying away surplus water therefrom.

d is the back bearing-bar, which is also notched to provide bearings for the rear or inner ends of the grate-bars, and is in the form of a trough or collector for receiving the water that has flowed through the hollow bars *a a*. The collector *d* is provided with an overflow pipe, *d'*, to carry away the water therefrom. It will be observed that the water is allowed to stand in the troughs *c'* and *d* up to a predetermined level, and when it rises above this

level it overflows, respectively, into pipes c^2 and d'. When pipe c^2 is employed, it is, by preference, coupled or joined to pipe d', as shown in Fig. 1. I usually arrange the trough d under a projecting part, l, of the bridge-wall or bridge L of the furnace, and provide it with a cover-plate, e, to support this projecting part l of the bridge.

In Figs. 4 and 5, where I have shown my improvement applied to a Cornish boiler, I have also shown the trough or collector d as provided with an open-topped upward projection, k, which, with the projecting part or facing l of refractory material, forms the bridge or bridge-wall L. In this construction the collector $d\,k$ extends down to the bottom plate of the boiler-tube and forms the back wall of the ash-box below the grate, and this lower part is provided with a door, d^2, to provide access for cleaning.

The means for rocking the grate-bars a will now be described.

$f\,f'$ are bars provided with notches or projections to engage with the pendent parts of the projections a' on the bars a, for the purpose of moving or rocking the latter. The bars $f\,f'$ are maintained in supports f^4, and have studs or pins $f^2\,f^3$ to engage with holes or recesses in a lever, g, which is pivoted on a stud, h', on a bracket, h. A horizontal vibrating movement given to lever g, either by hand or by suitable mechanism, imparts a corresponding rocking movement to the grate-bars $a\,a$.

$i\,i$, in Figs. 4 and 5, are bars or rods connecting the front and back bearing-bars, c d, so that when required the whole grate and its supports can be withdrawn from the furnace together.

I am aware that it is not new to provide rocking grate-bars with intersecting or interlocking teeth or projections. This feature I do not claim, broadly, nor do I claim, broadly, a tubular grate-bar filled with water under boiler-pressure, as this is not new. In such grates, however, there is great danger from explosion and great difficulty in providing steam-tight joints, owing to the expansion and contraction of the bars and the great internal pressure. This difficulty is increased with rocking bars. In my grate, as before stated, there is no appreciable internal pressure, as the interiors of the bars are open to the atmosphere.

What I claim is—

1. The combination of the tubular inclined grate-bars $a\,a$, open at their ends and mounted in rocking bearings, the notched bearing-bar c under their front ends, the notched trough or collector d under their rear ends, a pipe to supply water to the said bars at their front ends, and a pipe, d', to carry off the overflow-water from the collector d, said grate-bars and collector being open to the atmosphere, substantially as set forth.

2. The combination, with tubular grate-bars, of notched bearing-bars upon which the ends of said bars loosely rest at their front and back, respectively, the said bearing-bars being in the form of troughs open to the atmosphere and provided with overflow-pipes, substantially as set forth.

3. The combination of the loosely-mounted tubular grate-bars, a notched bearing-bar under the front end of said bars, a notched bearing-bar, d, under the back end of said bars, in the form of an open trough or collector having an open upward extension, k, forming a part of the bridge or bridge-wall of the furnace, and an overflow-pipe, d', for conveying away the surplus water from said collector d, substantially as set forth.

4. The combination, with the tubular open-ended inclined grate-bars $a\,a$, of the notched supports for said bars, the supply-pipe b, the lateral branch pipes $b'\,b'$, extending from pipe b into the open front ends of said bars a, the open trough d at the back ends of said bars, and the pipe d', leading from said trough d, all arranged substantially as set forth.

5. The combination of the grate-bars $a\,a$, having projections or teeth a', the notched bars $f\,f'$, engaging with said teeth a', the studs or pins $f^2\,f^3$ on said bars $f\,f'$, respectively, and a pivoted lever, g, with which said studs or pins are engaged, whereby a rocking movement is imparted to said grate-bars by vibrating said lever g.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

EDWARD BOUTCHER.

Witnesses:
GEORGE C. BACON,
EDWARD HENRY BOUTCHER.