(No Model.) 2 Sheets—Sheet 1.

J. W. BRIGHTMAN.

FURNACE.

No. 318,690. Patented May 26, 1885.

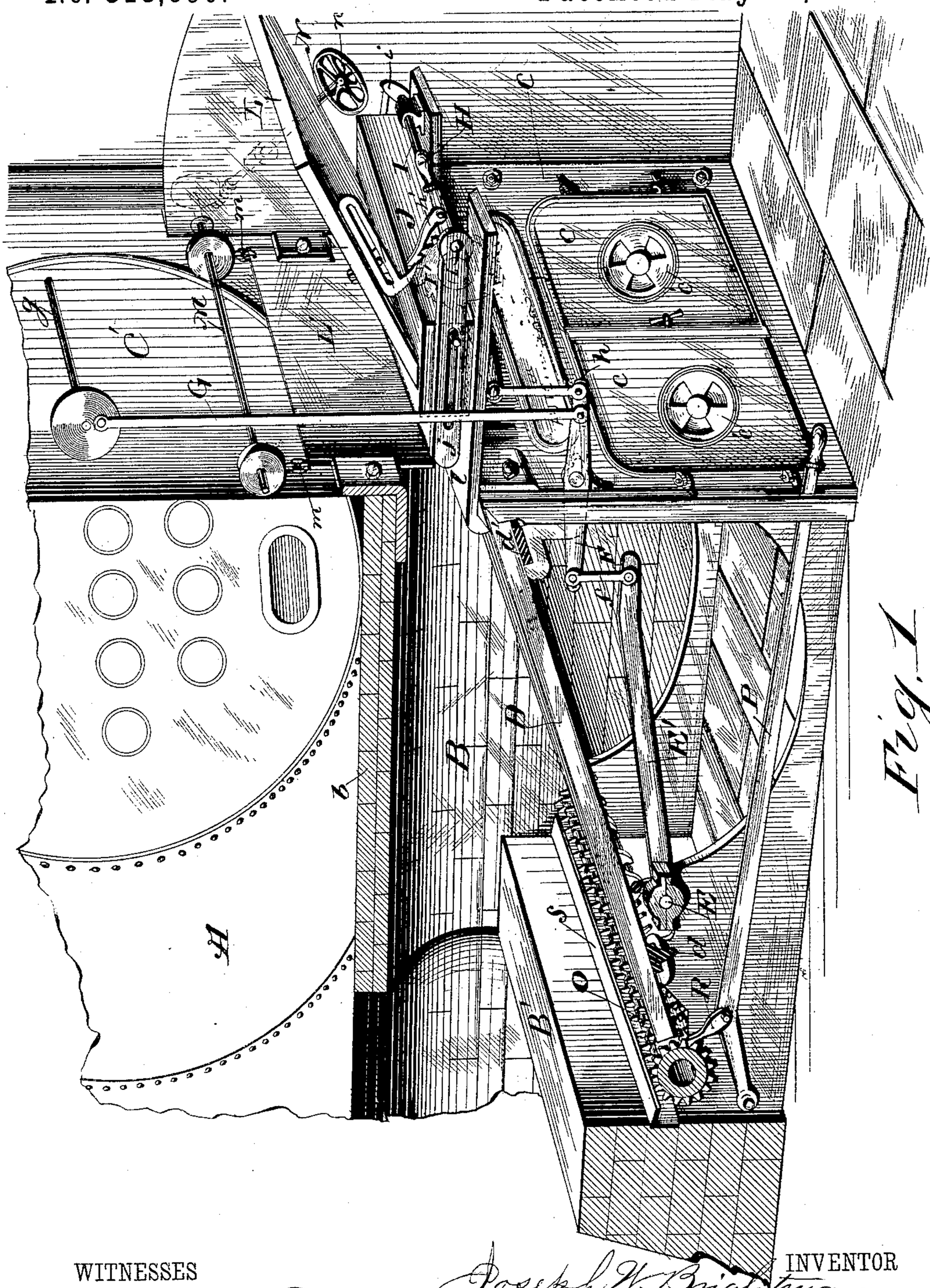

Fig. 1.

WITNESSES

Wm. H. Monroe

Geo. W. Ewing

INVENTOR

Joseph W. Brightman

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Leggett and Leggett. ATTORNEYS

(No Model.) 2 Sheets—Sheet 2.

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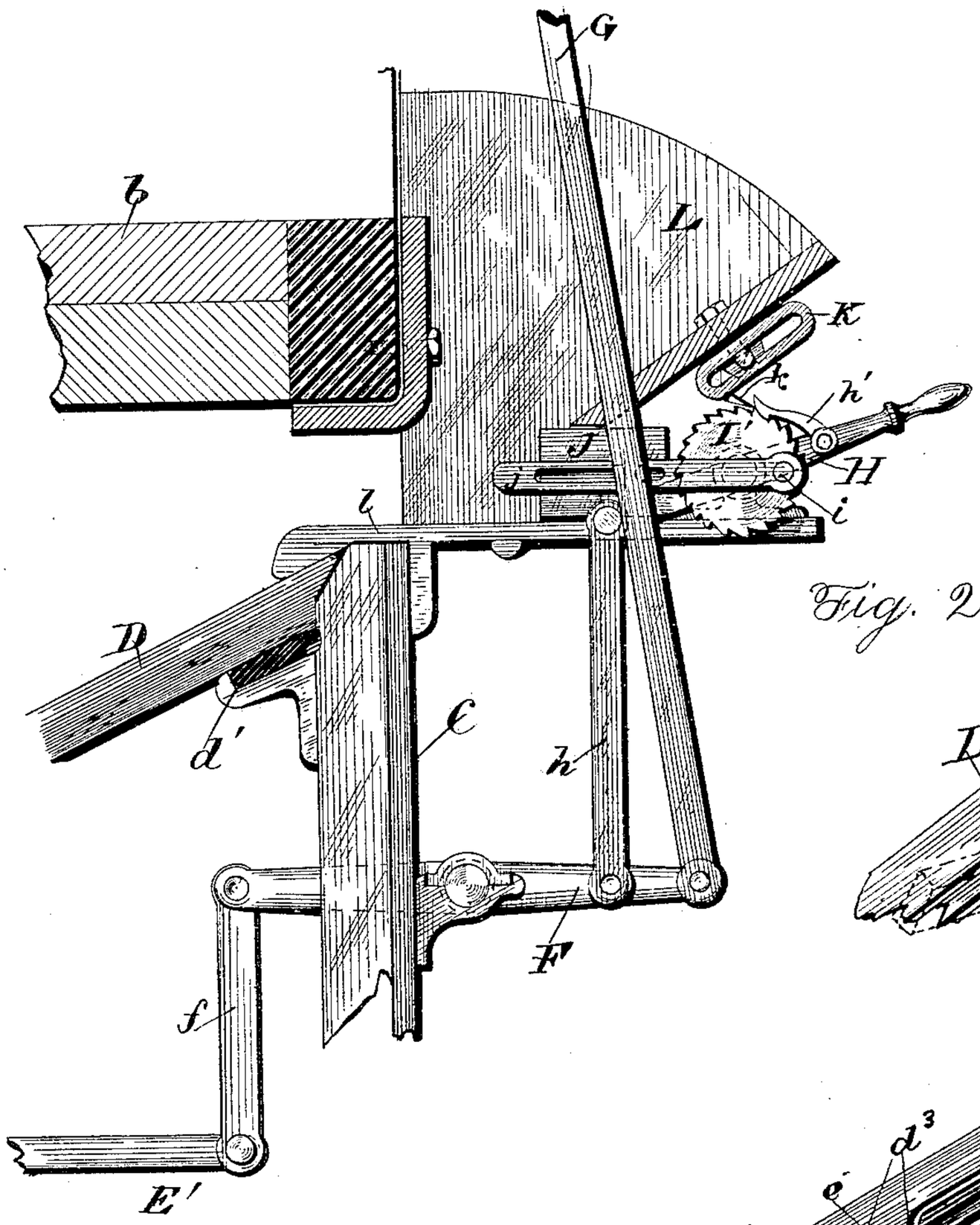

Fig. 2.

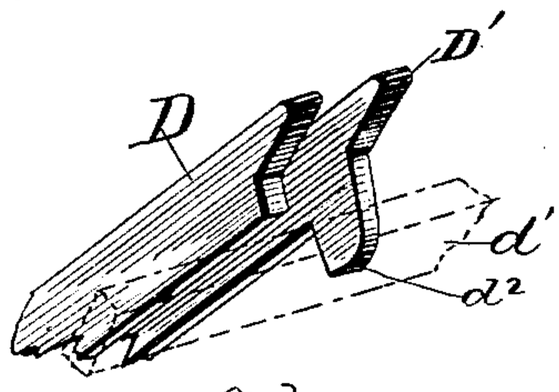

Fig. 4.

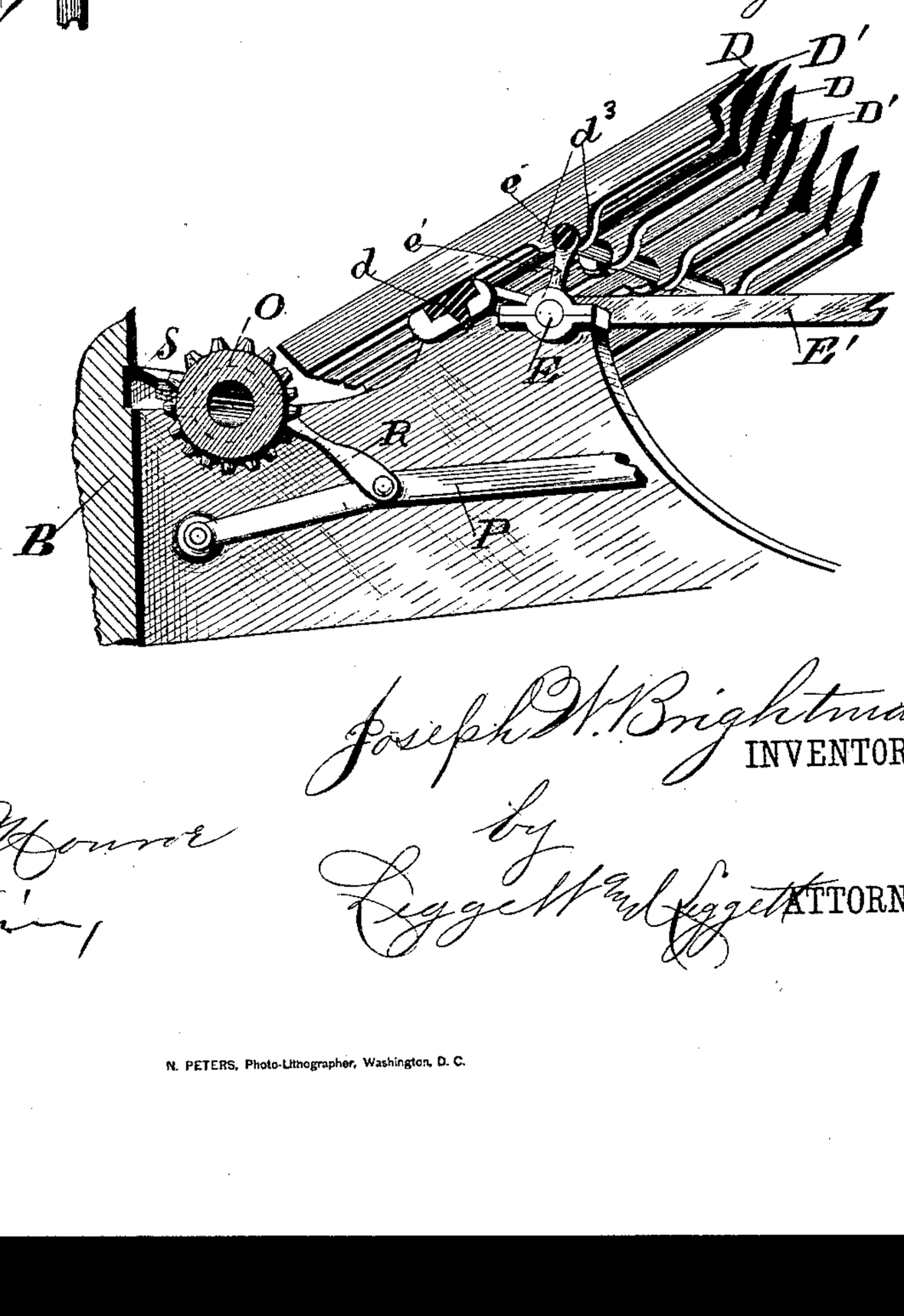

Fig. 3.

WITNESSES

Wm. H. Monroe

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Joseph W. Brightman,
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UNITED STATES PATENT OFFICE.

JOSEPH W. BRIGHTMAN, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO N. W. TAYLOR AND FRANK E. BRIGHTMAN, BOTH OF SAME PLACE.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 318,690, dated May 26, 1885.

Application filed December 26, 1883. Renewed January 21, 1885. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH W. BRIGHTMAN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in furnaces, more especially adapted to the use of steam-generators.

The object of my invention is to construct a furnace with an automatic feed, that will cause a constant and regular discharge of coals into the furnace.

A further object is so to construct the grates and other parts of the mechanism that the coals on entering the furnace will first be coked and afterward passed on and added to the body of the fire, and that the gases generated in the coking process will pass over the fire and encounter such a degree of heat that they will be consumed, so that no smoke will escape.

A further object is to concentrate the body of the fire at the back part of the furnace, and thereby produce such an intense heat as will insure the burning of the aforesaid gases as they pass, as they necessarily must, this part of the furnace.

A further object is the employment of mechanism by means of which the fire may be kept free from ashes and clinkers without the opening of furnace-doors or otherwise retarding the combustion in the furnace.

A further object is to simplify the construction and lessen the initial cost of "smoke-consuming furnaces," so-called.

With these objects in view my invention consists in certain features of construction and in combination of parts hereinafter described, and pointed out in the claims.

The smoke that passes in dense volumes from chimneys when bituminous coal is used in the furnaces is not only objectionable to the community at large, but is a serious loss to coal-consumers, in that a large per cent. of the fuel is thus passed off unconsumed and wasted. It is doubtful if smoke can be burned in an ordinary furnace by reason of the great degree of heat required. The gases that produce the smoke may be burned by a degree of heat that is practicable to maintain in such furnaces. For this purpose the heat at first should not be diffused over too great a surface, but should rather be concentrated and intensified. To accomplish this I use inclined grates, the back ends of which are the lowest, so that the body of coal across the back end of the furnace is much deeper, and the heat at this part much greater than if the coals were spread evenly over the entire grate-surface. If large quantities of coal are thrown into the furnace at one time, so much gas will be generated that it is impossible to consume it all. I have therefore invented an automatic feeding device that will discharge the coal into the furnace with a constant and even feed. The coal as it first enters the furnace is spread in a thin layer over the upper or front end of the grates and in a condition most favorable for coking. The feeding of the coal thus provided for, the next important step is to have a steady fire that will always give the required amount of heat. For this purpose I have first a reciprocating end motion given to alternate grates, by means of which the coal, after coking, is passed on and fed evenly onto the body of the fire at the back end of the furnace. By the same mechanism the lower end of the reciprocating grates are raised and lowered with each movement of the grates forward or back, by means of which the clinkers are prevented from adhering to the grates, and also the fire is kept free from ashes. A clinker-breaker is provided that is operated by a lever extending forward of the furnace-front, so that in the management of the fire no furnace-doors are opened or anything done to retard the combustion or make it irregular.

In the accompanying drawings, Figure 1 is a view in perspective of my improved furnace and attachments. Fig. 2 is an elevation in detail of a portion of the actuating mechanism. Fig. 3 is a view in perspective of a portion of the grates and clinker-breaker and the devices for operating them. Fig. 4 is a view in perspective of the upper end of the two kinds of grates, and in dotted lines a portion of a supporting-bar.

A represents a steam-boiler; B, the furnace;

C, the furnace-front, provided above with the door C′, for access to the end of the boiler, and below with the doors *c*, in front of the ash-pit, and provided with dampers *c′* for regulating the draft.

B′ is the bridge-wall, and *b* an arch spanning the furnace and extending from the furnace-front back about the length of the furnace. This arch is designed to confine and reflect back and concentrate the heat in the furnace, although it is probable that in many cases this arch might be dispensed with.

D and D′ are grates, that are supported by the cross-bars *d* and *d′*. The grates D and D′ alternate, as shown in Fig. 3, and the latter are provided with lugs *d²*, (shown in Fig. 4,) that hook over the upper edge of the supporting-bar *d′*, and hold these grates from sliding down endwise. The grates D have lugs at *d³* toward the lower end, (shown in Fig. 3,) that embrace the rod *e*, attached by the arms *e′* to the rock-shaft E, by means of which the grates D are reciprocated endwise up and down the incline, and are also raised a short distance in the middle of the throw by the said rod *e*.

Instead of the rod *e* and the arms *e′*, a rib of suitable shape might be cast on the rock-shaft, that would answer the same purposes.

The rock-shaft is actuated by the lever E′, attached thereto, that is operated by the connecting-rod *f*, that is connected with the rocking lever F. This lever is pivoted so near the furnace-front that a short slot only is necessary in which to operate the said lever.

The lever F is operated by the connecting-rod G, that in turn is actuated by a crank on the end of the shaft *g*, as shown in Fig. 1. Power may be applied to this shaft in any manner most convenient. The connecting-rod *h* couples the rocking levers F and H together, so that the latter is actuated by the former.

The lever H is fulcrumed on the shaft I, and terminates at the front end in a hand-lever, and is provided on this side of the fulcrum with the hoop-pawl *h′*, that engages the ratchet-wheel I′, that is attached to the shaft I. Each end of this shaft is provided with a crank, *i*, to the wrists of which are attached, respectively, the connecting-rods *j*, that move the block or coal-pusher J laterally. This block feeds or pushes the coal from the hopper above into the furnace, and moving slowly and but a short distance, and preferably with an intermittent rather than a continuous motion, the said cranks *i* have a much greater throw than would otherwise be necessary, and the connecting-rods *j* are slotted, as shown, so that they only engage the pins extending from the block J through the said slots at the extremes of their throw.

The motion of the lever H is sufficient to turn the ratchet-wheel, by means of the pawl, three notches at each throw; but when a slower feed is required the gage K, to which is attached the incline *k*, is set so that the said incline receives the pawl as it is thrust forward, and prevents its engaging the ratchet until returning on the backward motion, and may thus be made to turn the ratchet either one or two notches instead of three, as may be required.

The gage K has a long slot, through which passes the bolt by which it is secured, as shown in Figs. 1 and 2.

L is the hopper in which the coals are placed, the back part of which is formed by the vertically-sliding plate L′, and the bottom by the plate *l*, on which the block J slides. The plate L′ is secured in ways or grooves at the ends, as shown in Fig. 1, and is supported from the shaft M by the chains *m*. On the farther end of the shaft is a worm-gear, (shown only in dotted lines,) and that engages a worm on the one end of the shaft N. The front end of this shaft is provided with the hand-wheel *n*, by means of which the plate L′ may be raised or lowered at pleasure, thereby regulating the opening through which the coals are fed into the furnace. When the plate is raised to its full height, free access is had to the furnace for kindling the fire or other purposes, and by suddenly raising the plate a large quantity of coals may be discharged into the furnace, as is sometimes necessary in banking the fires.

One of the pins in the rod *h* should be so arranged that it can easily be removed, so that in starting the fire, or at other times if necessary, the lever H may be operated by hand.

The clinker-breaker O is a hollow cylinder extending across the furnace, as shown in Fig. 1, and journaled at each end, and has numerous hollow conical projections on the periphery, the holes in which are in open relation with the chamber in the cylinder, and by means of which air is freely admitted to this part of the furnace when the depth of coals is the greatest and the fire the hottest, and by means of which, also, the said cylinder and its projections are prevented from becoming overheated and burned.

The hand-lever P is fulcrumed at the back end, and extends forward and through a slot in the furnace-front, and is provided with the pawl R, that engages either a ratchet attached to the said cylinder or the said conical projections, and by means of which the said cylinder may be revolved by operating the said lever P.

A plate, S, is secured just back of the cylinder and out of reach of the said conical projections, and between these parts, (the plate and the projections,) when the cylinder is revolved, the clinkers are broken and discharged into the ash-pit below.

I do not wish to be understood as limiting myself to the construction shown, as many changes might be made in the mechanism and still accomplish the same object and be within the spirit of my invention. For instance, the clinker-breaker might be made of staves and fastened together, and instead of the conical

projections, ribs, corrugations, grooves, or depressions might be made to accomplish the same purpose.

What I claim is—

1. In a furnace, the combination, with a series of inclined movable grate-bars, a hopper, and a coal-pusher situated within the hopper, of devices, substantially as described, for moving the grate-bars and operating the coal-pusher.

2. In a furnace, the combination, with a series of inclined movable grate-bars, a hopper, a coal-pusher located within the hopper, and the vertically-sliding plate L′, of the devices, substantially as described, for simultaneously operating the grate-bars and coal-pusher.

3. In a furnace, the combination, with a series of inclined grate-bars and a bridge-wall situated at the lower end of said bars, of a revolving clinker-breaker, situated between the bridge-wall and grate-bars, and devices for operating the breaker, substantially as set forth.

4. In a furnace, the combination, with an inclined grate, a bridge-wall situated at the lower end of the grate, and devices for automatically feeding fuel to the furnace, of a hollow cylindrical clinker-breaker situated between the grate and bridge-wall and provided with air-escape orifices through which air is fed to the burning fuel.

5. In a furnace, a hollow cylindrical clinker-breaker extending crosswise of the furnace and near the back end thereof, and provided with hollow conical projections, the holes of which are in open relation with the chamber in the cylindrical part of the clinker-breaker, substantially as set forth.

6. The combination of clinker-breaker O, the plate S, the lever P, and the pawl R, substantially as set forth.

7. The block J, in combination with the slotted rods *j*, embracing pins or projections extending from the block, and actuating-cranks *i*, by means of which an intermittent reciprocating motion is given to the said block, substantially as set forth.

8. The slotted gage K, provided with the incline *k*, in combination with the pawl *h*′ and the ratchet-wheel I′, substantially as set forth.

In testimony whereof I sign this specification, in the presence of two witnesses, this 7th day of December, 1883.

JOSEPH W. BRIGHTMAN.

Witnesses:

C. H. DORER,

ALBERT E. LYNCH.