No. 635,318. Patented Oct. 24, 1899.

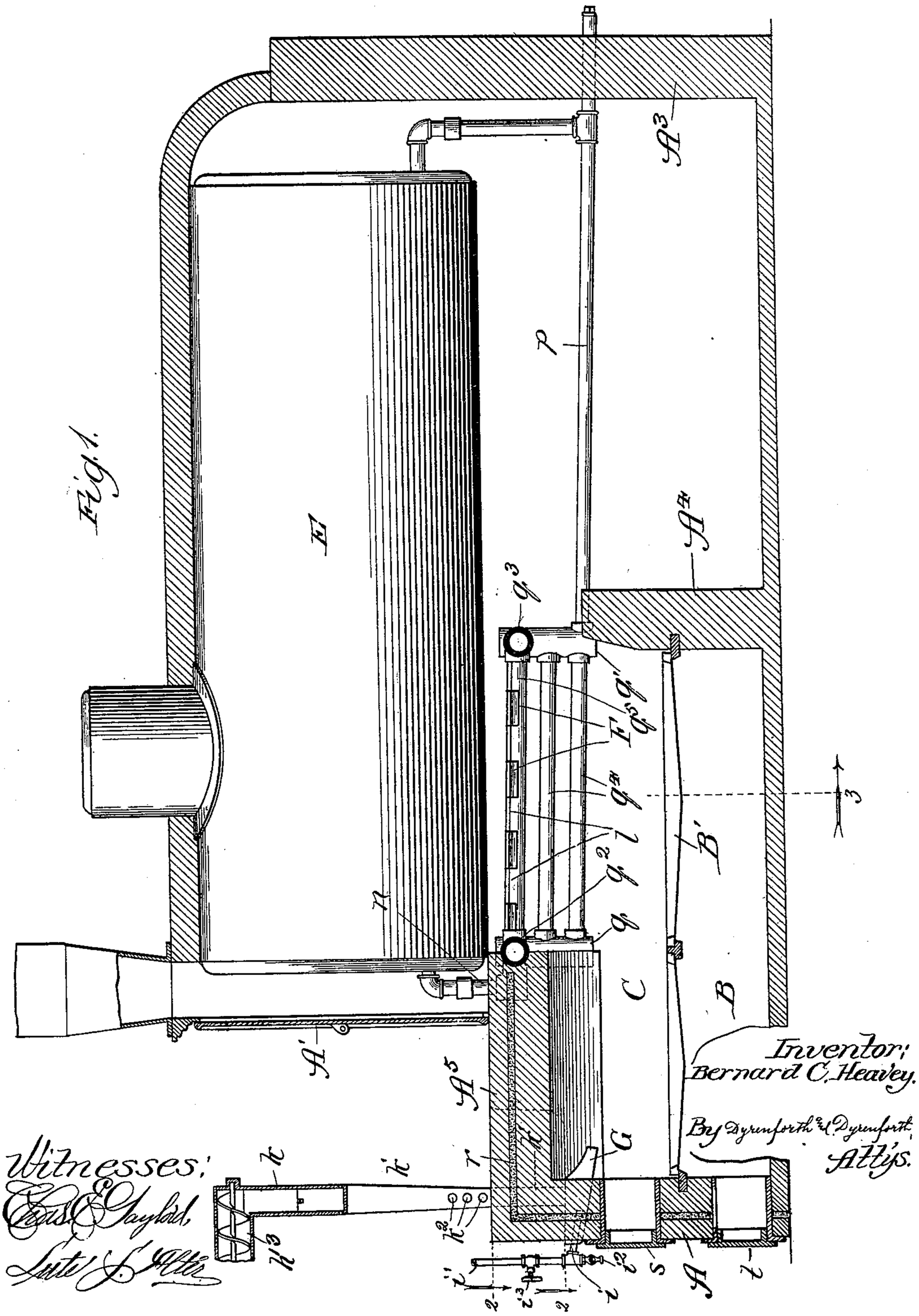
B. C. HEAVEY.

FURNACE.

(Application filed Apr. 12, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



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3 Sheets—Sheet 2.

Fig. 2.

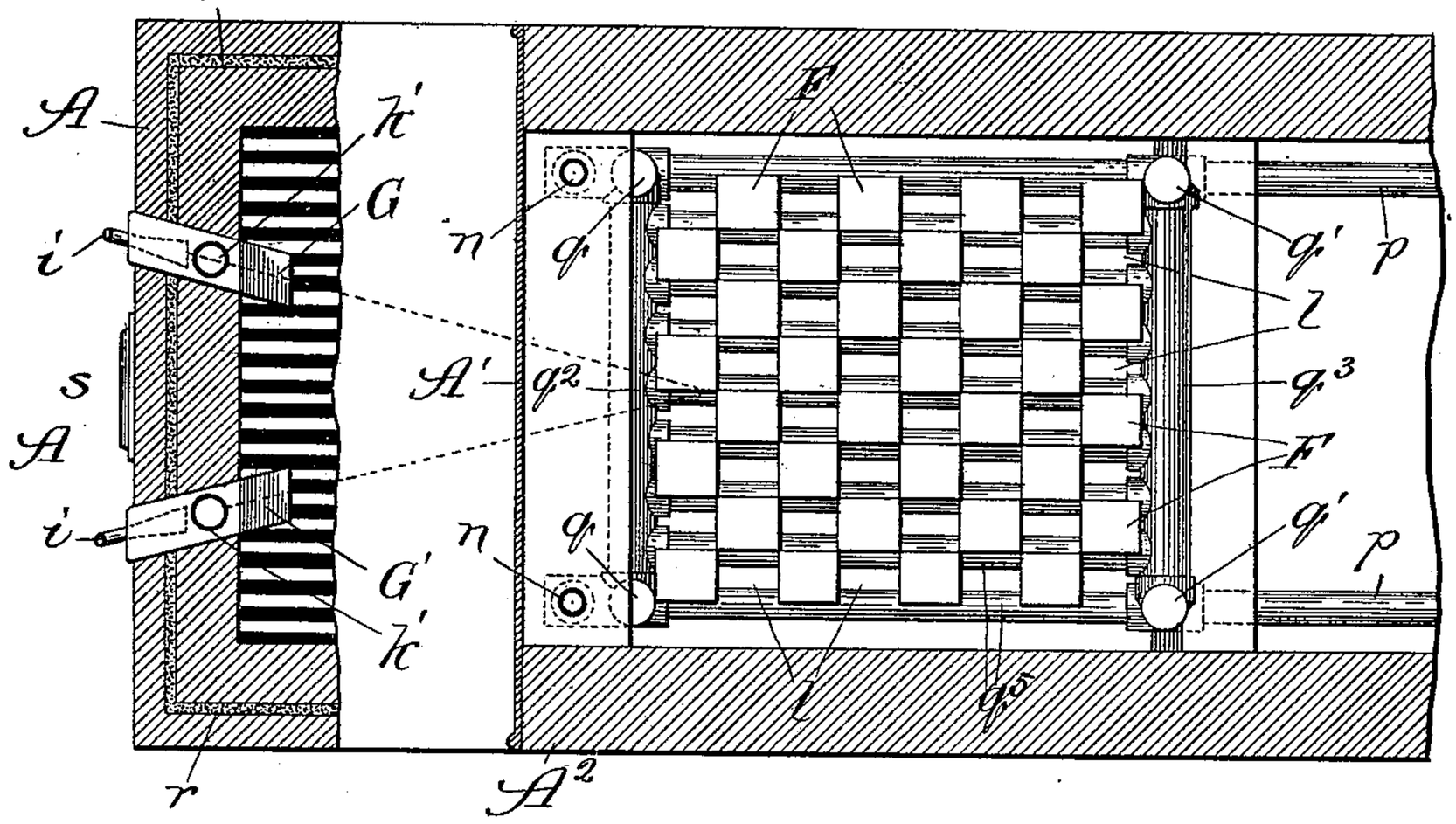
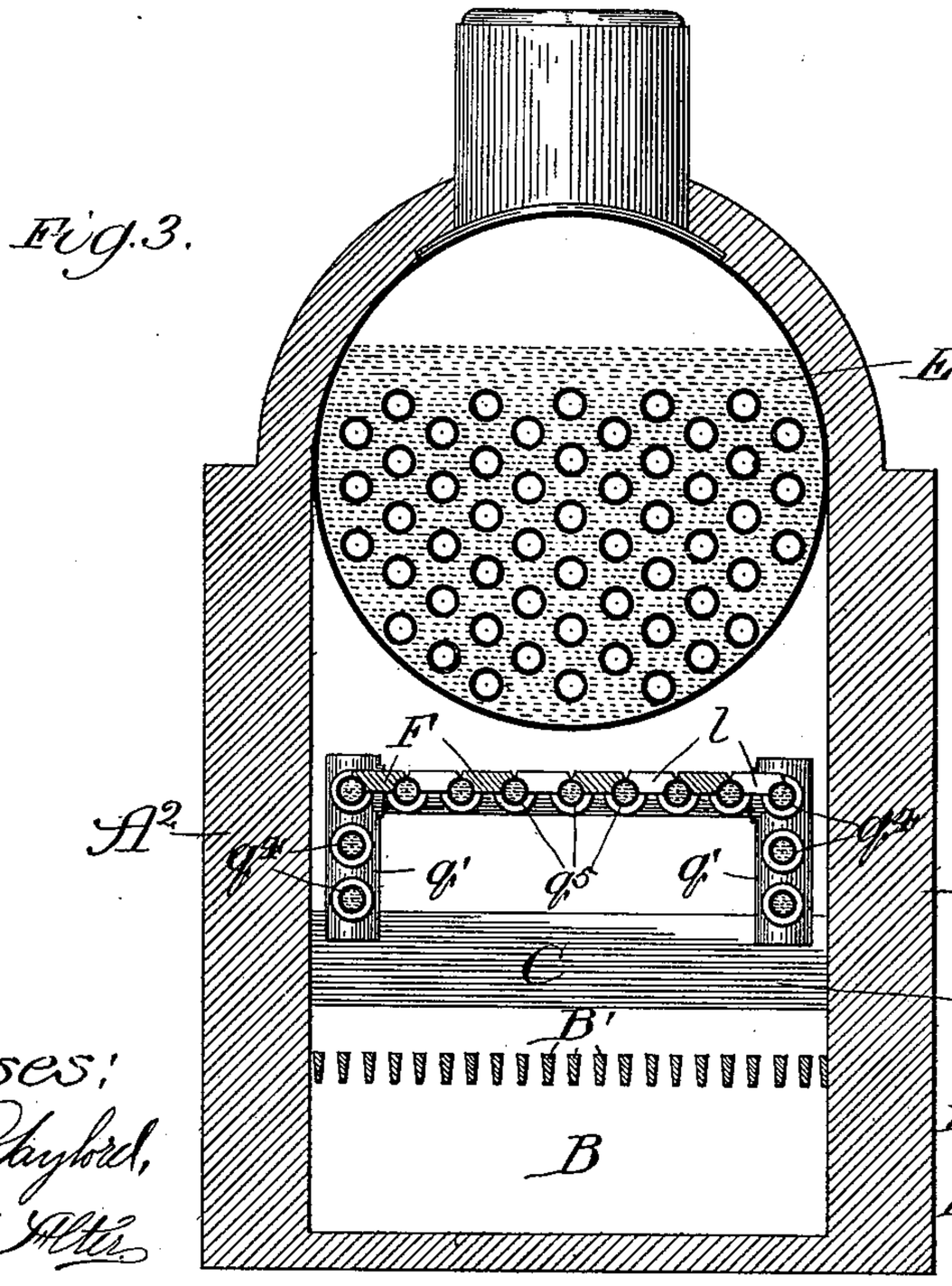


Fig. 3.



Witnesses:
Chas. E. Gaylord,
Luter & Luter

Inventor:
Bernard C. Heavey.
By Dyrenforth & Dyrenforth.
Attys.

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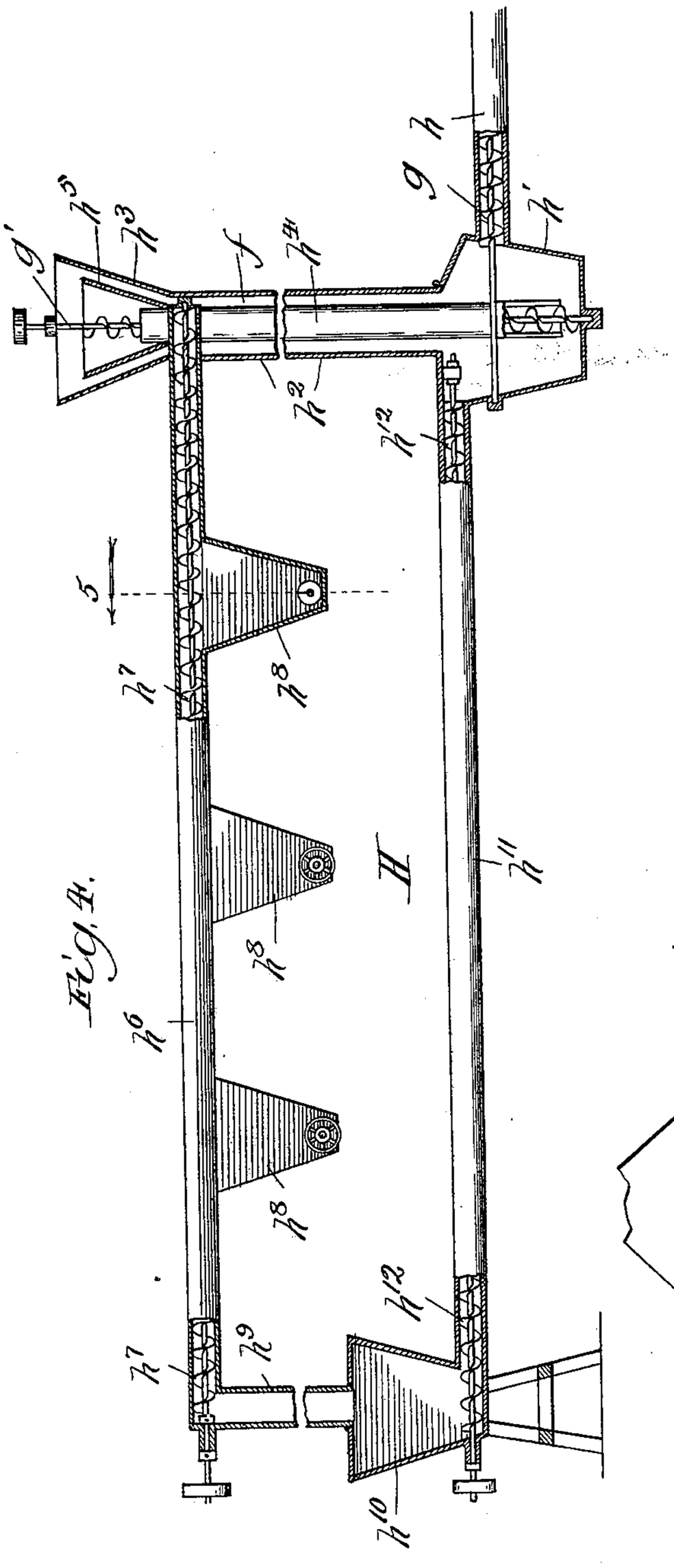

Fig. 4.

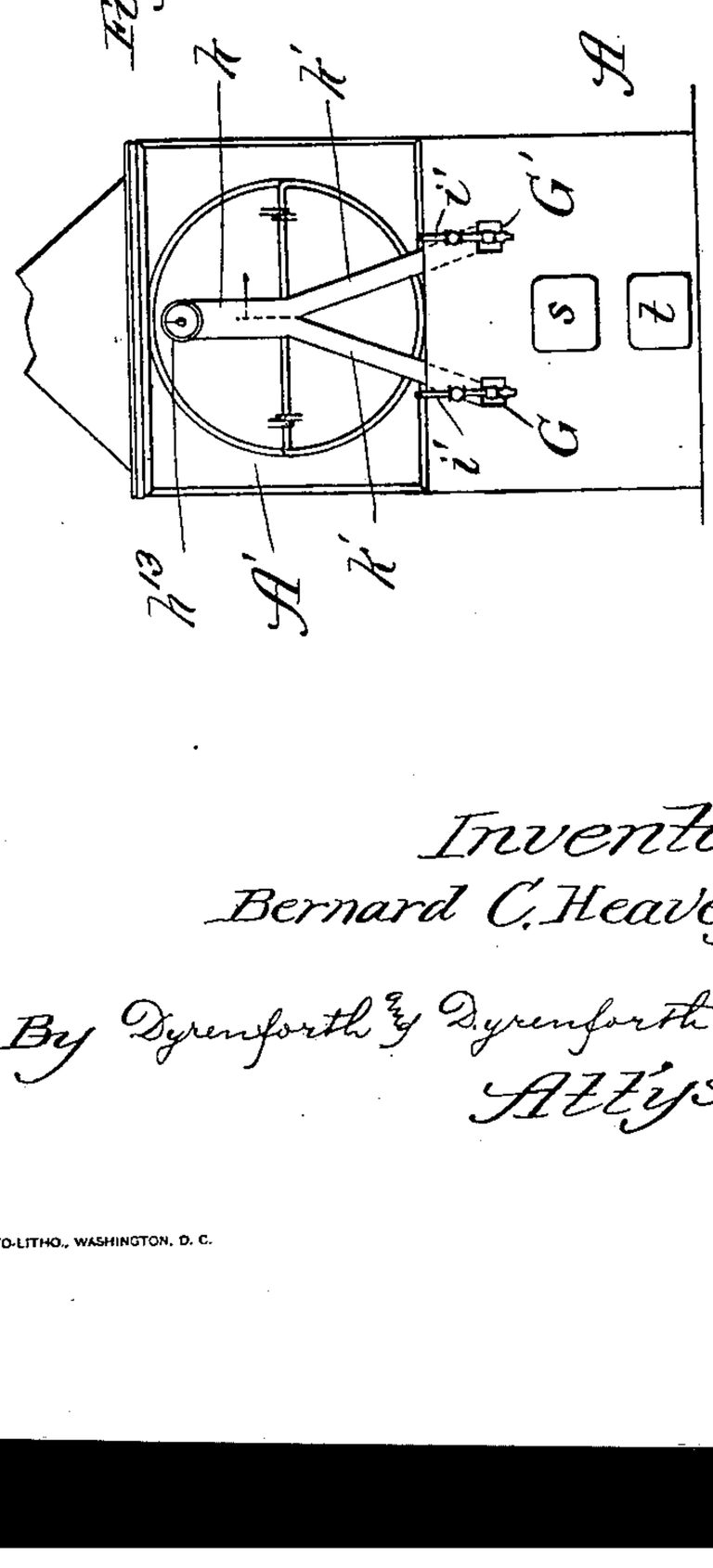

Fig. 5.

Witnesses:
Chas. E. Gaylord.
Lute L. Miller

Inventor:
Bernard C. Heavey
By Dyrenforth & Dyrenforth,
Attys

UNITED STATES PATENT OFFICE.

BERNARD C. HEAVEY, OF CHICAGO, ILLINOIS, ASSIGNOR OF FORTY-NINE ONE-HUNDREDTHS TO SAMUEL T. WHITE AND JOHN FLAHERTY, OF SAME PLACE; MARIA HEAVEY ADMINISTRATRIX OF SAID BERNARD C. HEAVEY, DECEASED.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 635,318, dated October 24, 1899.

Application filed April 12, 1897. Serial No. 631,845. (No model.)

To all whom it may concern:

Be it known that I, BERNARD C. HEAVEY, 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 Furnaces, of which the following is a specification.

My invention relates to improvements in furnaces generally, but more especially in furnaces intended to burn fuel-dust.

My object is, first, to provide certain improvements in the mechanism for automatically feeding fuel-dust to the fire-chamber, and, second, to provide certain improvements in the construction of the fire-chamber of a boiler-furnace, all to the end of economizing in fuel consumption and in the cost of steam production.

Referring to the drawings, Figure 1 is a vertical longitudinal section through a boiler-furnace constructed with my improvements; Fig. 2, a broken sectional plan view, the section being taken on irregular line 2 2 of Fig. 1; Fig. 3, a vertical cross-section taken on line 3 of Fig. 1; Fig. 4, a broken view, partly in section and partly in elevation, of an automatic fuel-dust feeder constructed for a battery of three furnaces; and Fig. 5, a broken elevation of the front end of the furnace on a reduced scale.

My present invention is similar in several of its main features to the furnace described in my application, Serial No. 607,916, filed in the United States Patent Office October 5, 1896.

A is the front wall of the fire-chamber, having a door t leading to the ash-pit B and a door s leading to the fire-chamber C.

A′ is the front of the boiler-chamber.

A^2 A^2 are the side walls of the furnace, A^3 the rear wall thereof, and A^4 the bridge-wall.

A horizontally-disposed grate B′ separates the fire-chamber and ash-pit. The fire-chamber projects forward from the front wall A′ of the boiler-chamber and is provided with a top A^5. This top covers the forward half, more or less, of the fire-chamber, and it, the front A, and the side walls A^2 are constructed of suitable brick. The front A, top A^5, and the side walls for a distance back about equal to the length of the top are provided with an embedded casing r of non-heat-conducting material, such as asbestos or other suitable substance. At the upper side of the fire-chamber are forward vertical manifolds q on opposite sides of the chamber C at the inner end of the top A^5 and corresponding manifolds q' extending upward from the bridge-wall. Extending between the upper end portions of the manifolds q is a cross pipe or conduit q^2, and extending between the upper end portions of the manifolds q' is a cross pipe or conduit q^3. Side pipes p^4 extend between manifolds q q' on the same side, and a series of upper parallel circulating-pipes q^5 extend between the pipes q^2 q^3. The manifolds and pipes constitute a frame D, forming a top for the fire-chamber spanning the grate B′ between the close top A^5 and bridge-wall. Communicating with the rear end of the boiler E and extending to the manifolds q' are circulating-pipes p, and extending from the manifolds q are circulating-pipes n, which communicate with the front end of the boiler. Fitting upon the circulating pipes or conduits q^5 are blocks F, of fire-clay or other refractory material, which are placed at intervals or spaced, as indicated in Fig. 2.

The frame D, with the spaced blocks supported thereby, forms a grated top for the rear end portion of the fire-chamber, having openings l left by the spaced blocks for the escape of products of combustion from the fire-chamber. The grated top tends to hold back the products of combustion in the fire-chamber, so that approximately perfect combustion will take place therein. Water from the boiler E passes downward from its rear end through the pipes p to the manifolds and circulating-pipes, forming the frame D, and reënters the boiler through the pipes n. The circulating-pipes q^4 q^5 are heated directly by the products of combustion. The blocks F when once heated tend to store the heat to prevent chilling of the hot products of combustion by the circulating-pipes. The blocks, furthermore, when once thoroughly heated, will form a hot, almost incandescent, bed below and close to the under side of the boiler.

My improved furnace, as before stated, is

intended for use more especially in burning fuel-dust and particularly the coal-dust which accumulates at the mines and has hitherto been considered more or less worthless for fuel.

Extending through the front wall A are preferably two converging and slightly-inclined chutes or deflectors G and G'. Above the said wall is a coal-dust-receiving tube or hopper k, (see Fig. 5,) from the lower end of which extend branch tubes k', which terminate in the furnace-wall above the deflectors G G'. In the sides of the branch tubes k' or tube k, or both, are air-inlet openings k^2. (See Fig. 1.) Extending through the front A into the spaces above the deflectors G G' and terminating at points more or less forward of the lower ends of the branch tubes k' are blast-pipes i, extending from a steam-pipe or steam-pipes i', communicating with the steam-supply, which may be the boiler E. The blast-pipes are provided with drip-cocks i^2, and interposed in each pipe i' is a shut-off valve i^3.

The chutes or deflectors G G' form flaring mixing-chambers and open into the fire-chamber, the feed-tubes k' entering the tops between the blast-pipes and fire-chamber. By preference the deflectors converge at an angle, the apex of which is a point about midway between the front and rear ends of the fire-chamber.

The automatic fuel-feeding mechanism H, which I prefer to employ and which is shown in Fig. 4, is in the main similar to that shown, described, and claimed in my aforesaid pending application, but is extended to obviate the necessity of any handling of the coal-dust after it has once been deposited into a supply-bin. A tube or conduit h extends from a storage-bin (not shown) to a supply-chamber h'. Extending upward from the top of the chamber h' is a pipe or chute h^2, terminating in a hopper-shaped compartment h^3. Centrally within the pipe h^2 is a tube h^4, extending from near the lower end of the chamber h' and provided at its upper end with a hopper-shaped receptacle h^5. In the tube h is a conveyer g, which may be a screw, as shown, and in the tube h^4 is a conveyer g', which extends from the bottom of the receptacle h' to a point above the tube h^4. The hopper h^5 terminates in a plane below the top of the hopper h^3, and the parts are so mounted with relation to each other that a space f exists around the hopper h^5 and tube h^4 in the hopper h^3 and tube h^2. Extending from the hopper h^5 horizontally across the front of the furnace or furnaces is a conveyer-tube h^6, containing a conveyer-screw h^7. In front of each furnace is a hopper or distributing-receptacle h^8 below an opening in the conveyer-tube h^6. At the end of the tube h^6 is a chute h^9, terminating at its lower end in a close receptacle or overflow-chamber h^{10}. A conveyer-tube h^{11} extends from the lower end of the receptacle h^{10} to the upper end of the chamber h'. In the tube h^{11} is a conveyer h^{12}. The construction shown in Fig. 4 is adapted to supply a battery of three furnaces, and the hoppers h^8 are each in front of a furnace, the lower end of the hopper being in horizontal line with the upper end portion of the respective feed-tube k of the furnace. Extending from the lower end of the respective hopper h^8 to the respective feed-tube k is a conveyer-tube h^{13}, provided with a conveyer-screw. Each of the conveyer-screws mentioned is upon a shaft provided with a pulley, the pulleys being belted to a suitable driving power, which will turn the screws at the desired speed.

In practice coal-dust is withdrawn from the storage-bin by means of the conveyer-screw g through the tube h to the chamber or receptacle h'. From the receptacle h' it is raised by means of the screw g' to the hopper h^5. Any overflow from the hopper h^5 will descend through the space f to the chamber h'. The fuel is withdrawn from the hopper h^5 by the screw h^7 and the hoppers h^8 thus kept supplied. When the said hoppers are full, the surplus fuel will be carried to the chute h^9 and descend to the chamber h^{10}, from which it will be withdrawn by the screw h^{12} through the tube h^{11} back to the chamber h'. The conveyer-screws in the tubes h^{13} carry the coal-dust from the hoppers h^8 to the feed-tubes k.

In operation the fire is started upon the grate B' and fed with fuel through the door s until the fire-chamber is thoroughly heated and an incandescent bed of fuel covers the grate. The conveyer-screws are then set in operation, and steam is turned in through the blast-pipes. The coal-dust, which descends through the feed-tube k and branch tubes k', falls into the mixing-chambers G G' and is sprayed backward into the fire-chamber by the steam-blasts.

In feeding coal-dust to a furnace it is desirable that the amount fed shall be properly proportioned so that it will enter the chamber as fast as, but no faster than, it can be consumed. If it is not fed fast enough, the desired heat cannot be maintained, and if fed too fast perfect combustion will not take place, and more or less unconsumed fuel will be carried by the draft over the bridge-wall. To produce the best results, the fuel must be prevented from caking or entering the furnace in lumps. The conveyer-screws have a tendency to grind the coal-dust and keep it from caking, though if fed directly by a screw into the furnace the coal-dust would be more or less packed and prevent even distribution. In my present construction the steam-blasts in the chambers afforded by the deflectors tend to suck the coal-dust through the tubes k', at the same time drawing in sufficient air through the openings k^2 to support initial combustion. The forward part of the fire-chamber being more or less close affords a heat-storage chamber, its heat-storage properties

being enhanced by the non-heat-conducting casing *r*. In practice the heat at the forward end of the furnace becomes so intense that the fuel ignites almost immediately upon entering the chamber, and the streams playing backward from the deflectors appear incandescent. Combustion of the fuel is increased by causing the incoming streams to meet at about the center of the furnace, where the particles of fuel strike against each other, intermix, and thus become thoroughly stirred. Air to support combustion also enters from the ash-pit through the grate-bars. With the construction described but little judgment is required on the part of an operator to maintain just the right supply of fuel to effect such perfect combustion that practically no unconsumed particles of fuel will escape over the bridge-wall. Thus, while employing fuel of the cheapest character, substantially all the heat-units are utilized and the furnace is practically smokeless.

While I prefer to employ two deflectors or mixing-chambers, disposed as described, because two streams striking together are of material advantage, I do not limit my construction to the use of two deflectors or mixing-chambers.

My improved furnace, constructed as described, is of the best form now known to me for producing the best results; but the construction may be variously modified in the matter of details without departing from the spirit of my invention as defined by the claims.

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

1. In a boiler-furnace, the combination of a fire-chamber provided along its forward portion with heat-storing sides and top, the top terminating beneath the forward end portion of the boiler, a bridge-wall at the rear end of the fire-chamber, water-circulating conduits extending from the rear end of said top to the bridge-wall, and spaced blocks resting upon the said conduits, substantially as and for the purpose set forth.

2. In a boiler-furnace, the combination of a fire-chamber provided along its forward portion with heat-storing sides and top, the top terminating beneath the forward end portion of the boiler, a bridge-wall at the rear end of the fire-chamber, a frame formed of manifolds and water-circulating pipes communicating with opposite ends of the boiler and extending from the rear end of the said top to the fire-wall, and spaced blocks of fire-clay, or the like, resting upon the said circulating-pipes, substantially as and for the purpose set forth.

3. A fuel-dust feeder for furnaces, comprising a supply-chamber h', an overflow-chamber h^{10}, a dust-conveyer extending from said supply-chamber to the overflow-chamber, one or more distributing-receptacles in the line of said conveyer, a dust-conveyer extending from the distributing-receptacle to the furnace, and an overflow-conveyer extending from the lower side of the overflow-chamber back to the said supply-chamber, substantially as and for the purpose set forth.

BERNARD C. HEAVEY.

In presence of—
J. H. LEE,
R. T. SPENCER.