

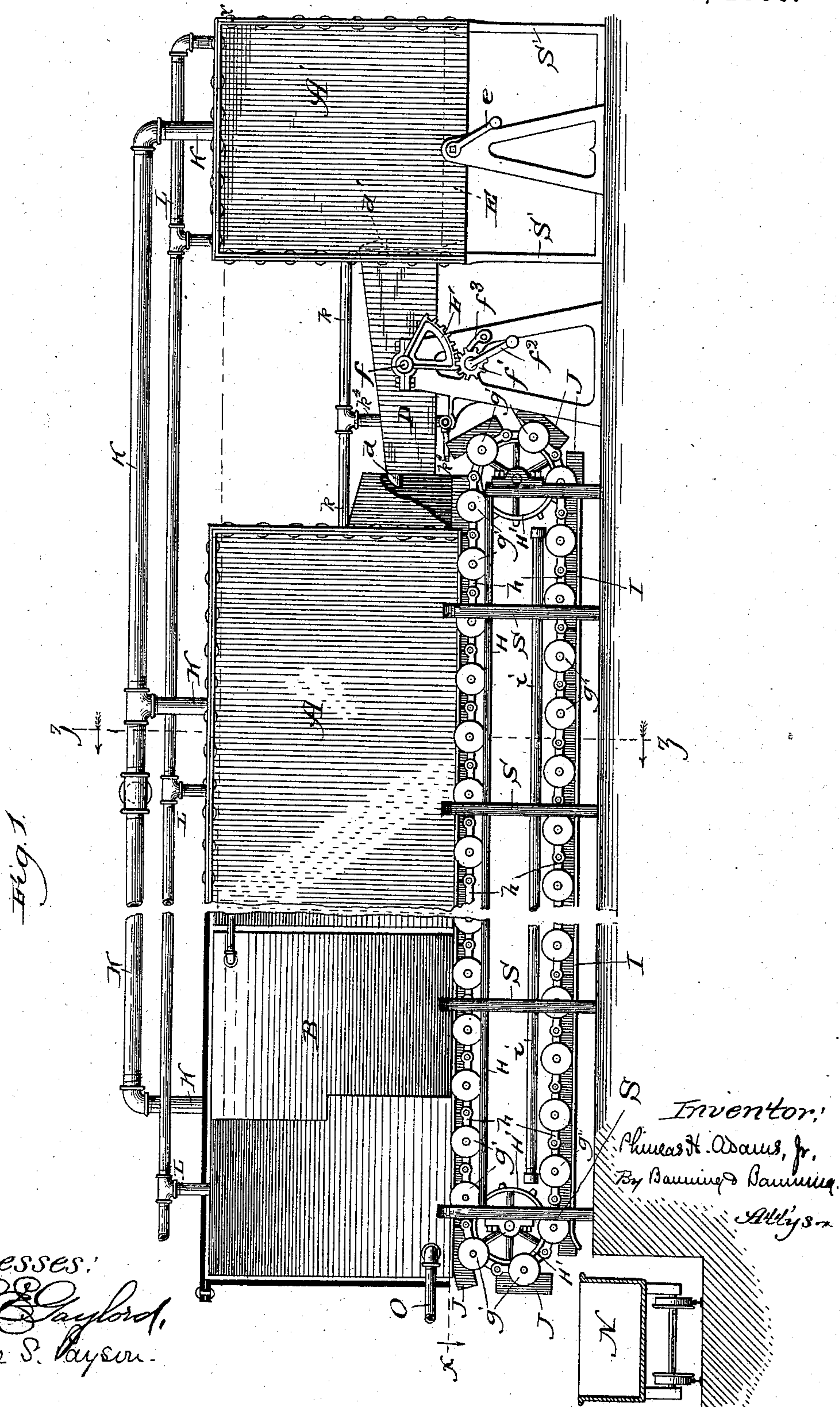
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4 Sheets—Sheet 1.

P. H. ADAMS, Jr.
SLAG FURNACE.

No. 379,437.

Patented Mar. 13, 1888.



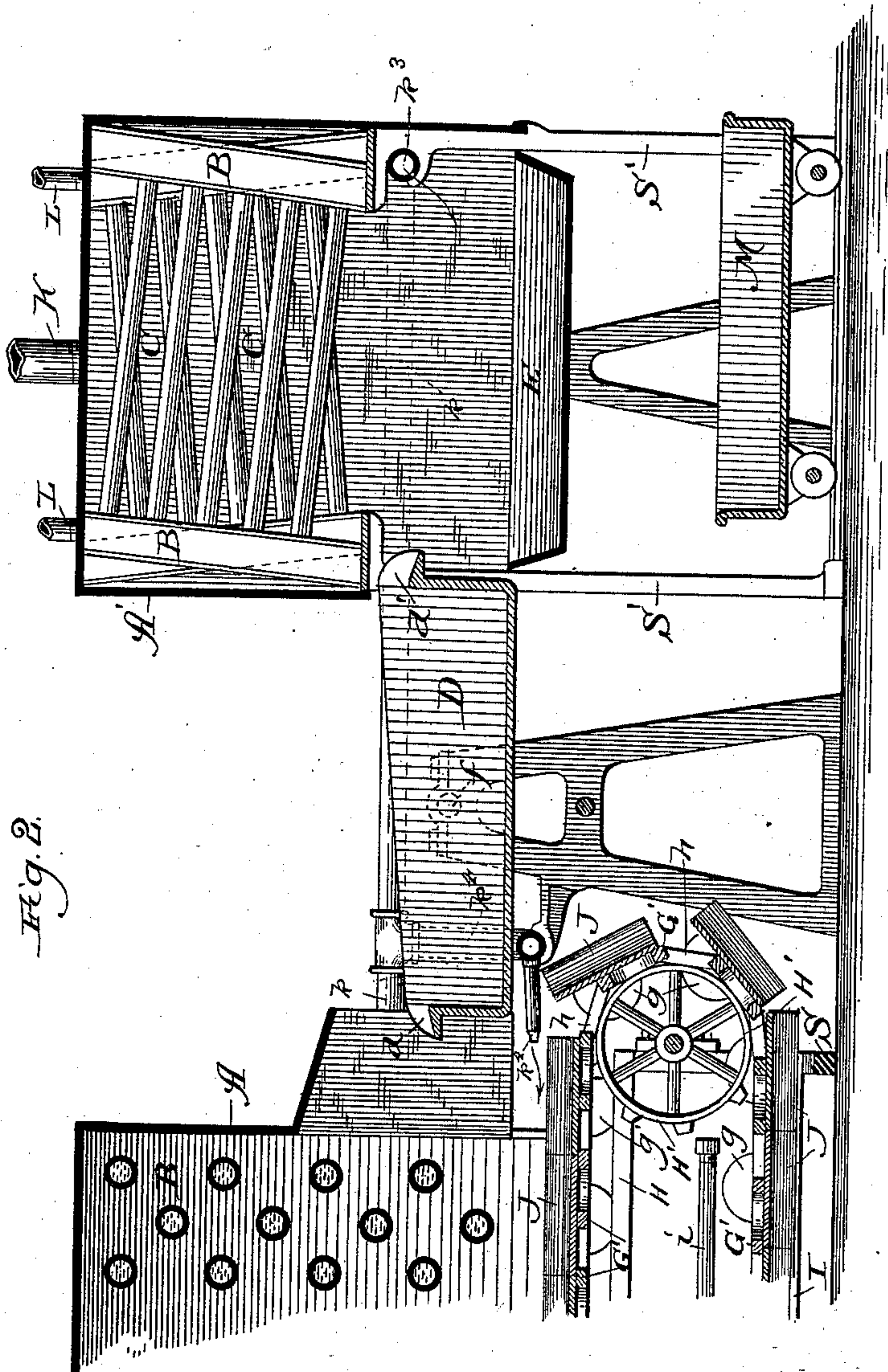
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No. 379,437.

Patented Mar. 13, 1888.



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By *Banning & Banning*
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(No Model.)

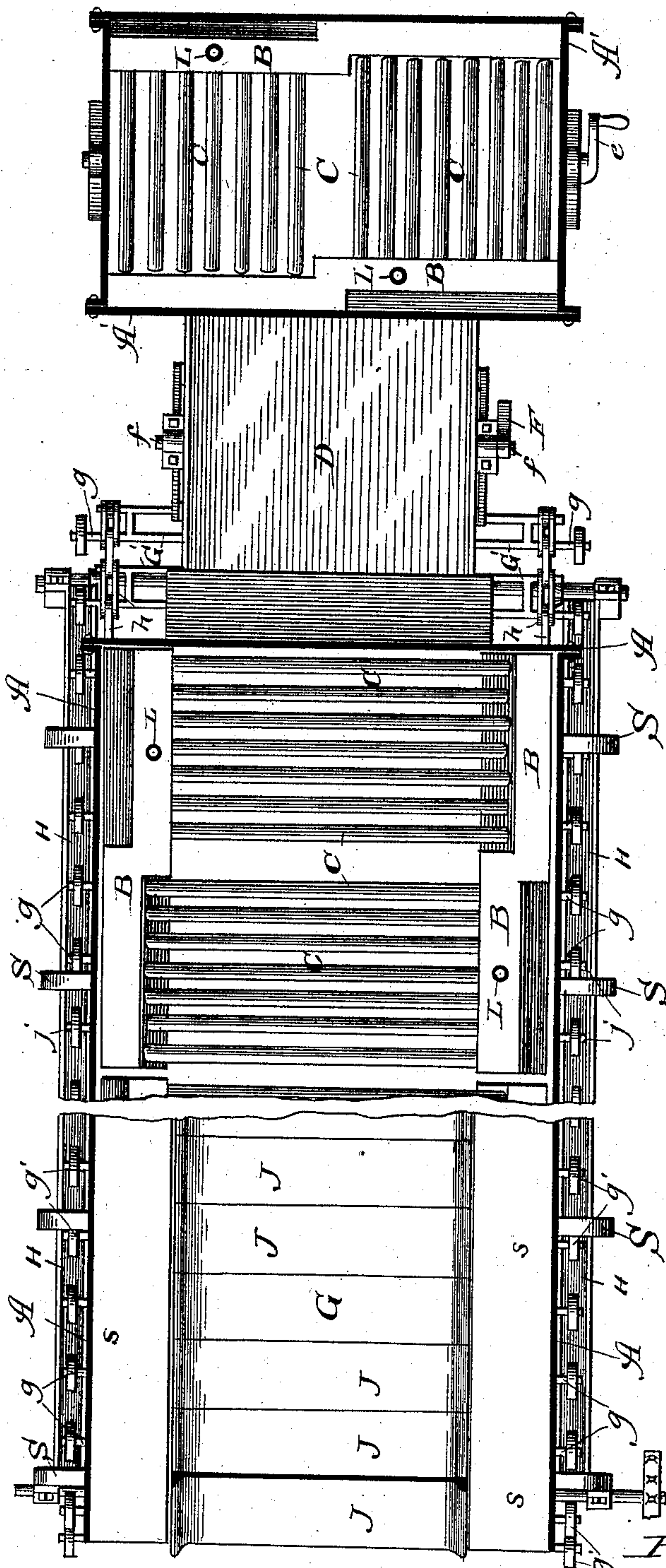
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Fig. 3.



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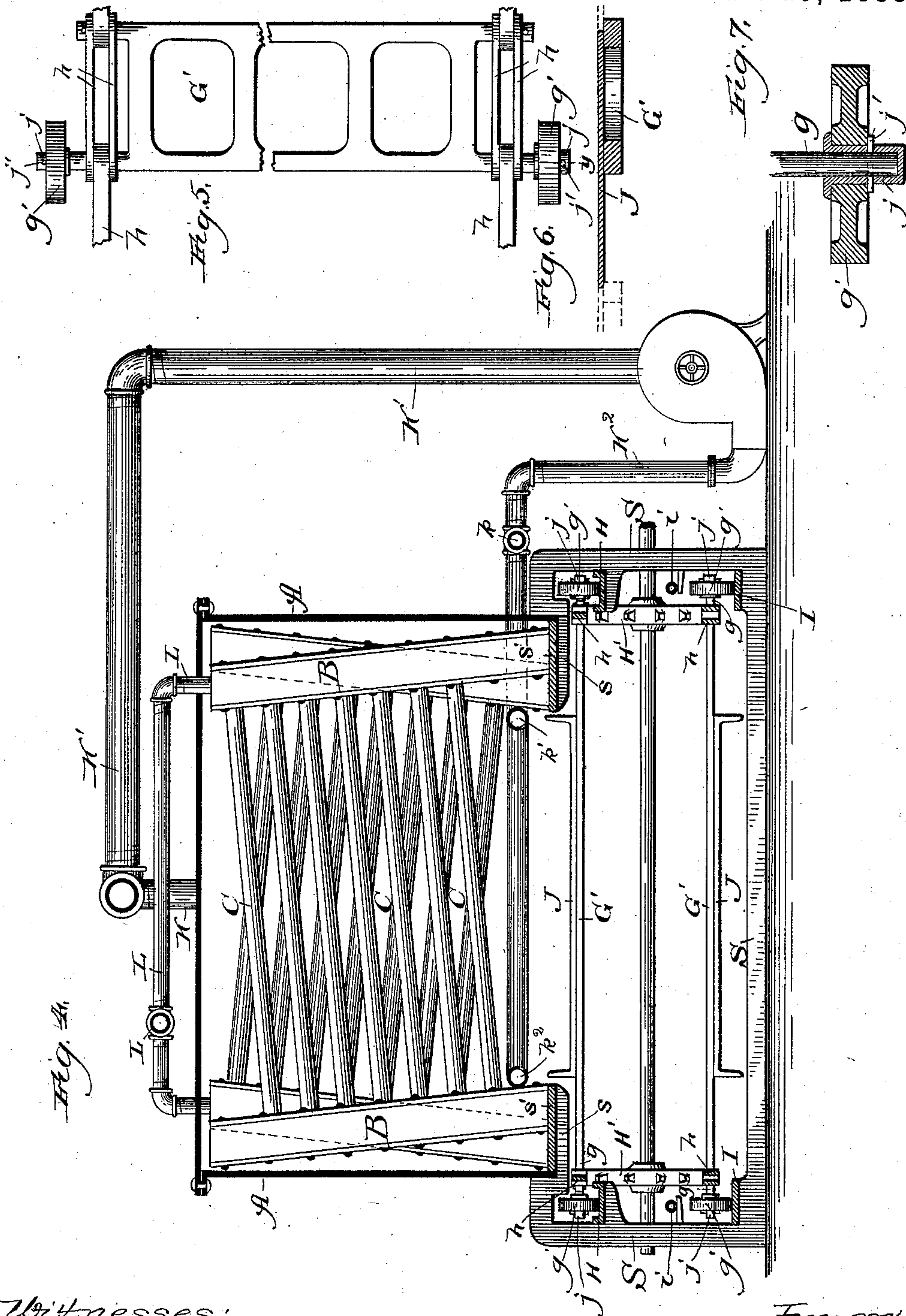
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Patented Mar. 13, 1888.



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UNITED STATES PATENT OFFICE.

PHINEAS H. ADAMS, JR., OF CHICAGO, ILLINOIS.

SLAG-FURNACE.

SPECIFICATION forming part of Letters Patent No. 379,437, dated March 13, 1888.

Application filed December 22, 1887. Serial No. 258,773. (No model.)

To all whom it may concern:

Be it known that I, PHINEAS H. ADAMS, Jr., a citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in Slag-Furnaces for Generating Steam, of which the following is a specification.

In the drawings, Figure 1 is a side elevation of my improved slag-conveyer and steam-generating furnace, showing the apron for carrying the slag, the covering in which the boiler is located, and the boiler-heads where the covering is removed for a part of the distance at the left hand of the figure. Fig. 2 is a longitudinal vertical central section taken through Fig. 3, showing the boiler at the right hand in elevation. Fig. 3 is a plan view taken in the line $x x$ of Fig. 1. Fig. 4 is a vertical transverse section taken in the line $z z$ of Fig. 1, showing the boiler in elevation. Fig. 5 is a plan view of one of the apron-frames. Fig. 6 is a transverse section of the same with the apron plates or pan in place; and Fig. 7 is a plan view of a portion of the apron-axle and apron-wheel, showing the connection of the two.

In the drawings, A represents the case in which the slag-boiler is located and by which it is inclosed; A', the inclosing-case of the matte-boiler; B, the boiler-heads; C, the boiler-heating tubes; D, the receiver into which the slag is emptied; d , the spout by which the slag passes onto the slag-conveying apron; d' , the spout by which the matte of the slag is emptied into a pan under the matte-boiler; E, such pan; e , the crank for tilting such pan; F, a segment rigidly attached to trunnions on the receiver D to enable the receiver to be tipped; f , such trunnions; f' , a gear for rotating the segment and tipping the receiver; f^2 , the crank by which such rotation is effected; f^3 , the pawl for holding the gear in any desired position; G, the slag-conveying apron; G', the frames on which the plates of such apron are located; g , the apron-axes on which the apron-wheels are mounted; g' , the apron-wheels at the ends of the apron-axes; H, a trough-shaped track or bed on which the apron-wheels roll as the slag is carried forward; H', sprocket-wheels moving the slag-conveying apron; h , links for connecting the apron-frames together; I, the track or bed on which the apron-wheels

move after passing under the sprocket-wheels; i , a perforated water-pipe keeping such bed and wheels moist and cool; J, the pans composing the slag-conveying apron; j , the thimble connecting the apron-axle with the apron-wheels, and on which the wheels revolve; K, air-pipes for taking air out of the boiler-cases; K', a common pipe to convey the air brought by the pipe K from the boiler-case to the fan-blower; K², the pipe leading from the blower; k , a branch leading from pipe K² along the outside of the boiler-cases; k' and k^2 , perforated branches entering at the end of case A and passing along between the boiler-heads and above the slag-conveying apron to permit the air to escape onto the slag through perforations; k^3 , the delivery end of the branch k , leading a current of air onto the pan beneath the matte-boiler; k^4 , still another branch delivering a current of air onto the slag as it falls onto the traveling apron; L, steam-pipes conveying the steam from the boiler-heads to the place of use; M, a car for receiving the matte when dumped from the pan E; N, a car for receiving the slag when it is dumped from the slag-conveying apron; O, a boiler feed-pipe for supplying the boiler with water; S, the frame on which the boilers are mounted, and in which the conveying-apron, sprocket-wheels, and other parts are located; S', the frame for the matte-boiler; s , the overhanging portion of the frame or structure, and s' the plates to close the space between the apron and bottom of the boiler-heads.

In making my improved slag-conveyer and steam-generating furnace I preferably make a boiler consisting of hollow boiler-heads with a series of heating-tubes passing back and forth between them. In the drawings I have shown boiler-heads as containing alternating inclined surfaces; but as to this feature I make no claim. I preferably mount these steam-boilers close to each other, but with sufficient space intervening to permit the location and operation of the parts hereinafter described. As a means of supporting these boilers, I prefer to employ a supporting frame or structure that will raise them enough to afford a considerable space beneath. I prefer, also, that the supporting frame or structure on which the boilers are to be located shall overhang, so to speak, at the top, for reasons hereinafter de-

scribed. As most nearly embodying my idea of a suitable supporting frame or structure, I have shown, particularly in Fig. 4, one made with a bottom connecting the parts, with sides rising from the bottom and turning in at the top to afford a proper support for the boiler. This supporting frame or structure may be in short pieces or sections and need not be the length of the boiler. More strictly speaking, perhaps, they can be termed "standards," placed at certain intervals apart. To connect them together when thus made and to prevent the heat from the slag escaping and the cold air from entering between the slag-conveying apron and the bottom of the boiler-heads, a plate, *s*, should extend from one end of the boiler to the other, and preferably resting upon the overhanging flanges of the frame. This plate is shown in plan in Fig. 3 and in section in Fig. 4, and will be readily understood by an inspection of the drawings.

Beneath the slag-boiler inclosed in the case A, I arrange near each end sprocket-wheels *H'*, mounted on a proper shaft revolving in suitable bearings and rotated by any convenient motive power. I make a slag-conveying apron, *G*, consisting of a number of pans or plates, *J*, resting on apron-frames *G'*. One of these apron-frames is particularly shown in Fig. 5 of the drawings, and consists of a frame on which a pan or plate may be riveted or otherwise fastened, and it is provided with extensions or apron-axles *g*, on which the apron-wheels are mounted. The different frames are connected together by links *h*, which will enable them to turn while passing around the sprocket-wheels. The double links, as shown in Fig. 5, afford means for engagement with the teeth of the sprocket-wheels, so that the apron can be moved by their rotation. Surrounding the end of the apron-axles *g*, I preferably employ thimbles *j*, so held by pins *j'* as to remain in a fixed position on the axle. The axle-wheels rotate on these thimbles, so that as they become worn they may be removed and new ones substituted in their places. The arrangement of these parts will be readily understood from an inspection of Fig. 7.

To afford a track or bed for the wheels *g'* to rotate on as the apron *G*, with its frames *G'*, is moved forward, I preferably arrange brackets on the sections or standards of the supporting frame or structure and locate on these brackets trough-shaped beds *H*. These brackets will be beneath the overhanging portions of the supporting-frame and will bring the apron-wheels out some distance from the sides of the apron. In this way they will be located away from the intense heat of the slag and in great measure protected from its effects. To permit this, I make the top of the supporting-frame overhanging, as above set forth; but the wheels will be measurably protected, and perhaps sufficiently, if they are brought out beyond the sides of the slag-conveying apron by the projection of the apron-axles, even though the supporting frame or structure be

not overhanging and no such brackets be provided. To still further protect the wheels, I make the trough-shaped beds or tracks preferably so that they can contain water in which the apron-wheels may travel, in order that they may not in any case become overheated. As the apron-wheels pass around the sprocket-wheels, they come onto the beds *I* upon the lower part of the standards or sections of the supporting-frame. To assist in cooling them as they pass back, I prefer to arrange a perforated water-pipe, *i*, which runs along just above the wheels and permits water to drop through the perforations on them. The arrangement of the sprocket-wheels, the slag-conveying apron, the beds *H*, the apron-wheels *g'*, the perforated pipe *i*, and the beds *I* will be apparent from an examination of Fig. 1, where a side view is presented, and Fig. 4, where a sectional end view is presented.

Between the slag and the matte boilers I prefer to locate a slag-receiver, *D*, into which the hot or molten slag from smelting-furnaces may be delivered. This receiver is of course to be supported on suitable frame-work and at the proper elevation to adapt it to the work intended. It is provided with a spout, *d*, overhanging the slag-conveying apron, so that the molten slag may flow out and fall upon the apron and be carried forward beneath the heating-tubes of the slag-boiler to convert the water contained in them into steam. The metal or matte which is contained in the slag will sink to the bottom of the receiver. I provide the receiver with another spout, *d'*, which extends into the case *A'*, inclosing the matte-boiler. I provide the receiver with trunnions *f*, rigidly attached to its sides and working in a suitable bearing in the supporting-frame. I rigidly attach to the ends of the trunnions which project beyond the bearings a toothed segment, *F*, which engages with the teeth of the gear *f'*, which in turn may be rotated by a crank, *f''*, and held in any desired position by a pawl, *f'''*. When a sufficient quantity of matte has collected in the bottom of the receiver, I tip the end of the receiver which contains the spout *d'* down by rotating the segment *F* through means of the gear and crank above described. In the bottom of the case inclosing the matte-boiler I arrange a pan, *E*, supported on trunnions, to which a crank, *e*, is rigidly connected. By means of this crank I am able to tip the pan *E* when the matte which has been dumped in from the receiver has sufficiently expended its heat as to be no longer useful.

Beneath the pan *E* a car, *M*, or other conveyer may be arranged, into which the cooled matte may be dumped to be carried away. The arrangement and operation of these parts will be apparent on an examination of Figs. 2 and 3 of the drawings, and I will only add that the matte-furnace may also be heated by the employment of slag instead of matte, if necessity or convenience requires. As the slag falls from the spout *d* on the conveying-apron, it is car-

ried forward beneath the heating or water tubes of the slag-boiler, so as to heat the water which they contain and convert it into steam. When they reach the end of the apron, as shown at the left hand of Fig. 1, the slag will be dumped into the car or conveyer N to be removed.

To assist the slag in throwing off and radiating its heat, I bring a current of air into contact with it as it falls upon the conveying-apron. To get the benefit of the air already heated, I have arranged a series of pipes, K, which lead preferably from the top of the cases containing the main and auxiliary boilers into a main pipe, K', which passes down to a fan-blower. (Shown in Fig. 4.) Leading from the fan-blower is a pipe, K², which has three branches, k, k', and k². The pipe k leads along the outside of the cases and enters the case containing the matte-furnace through an opening, k³, where a current of air is directed upon the matte discharged into the pan E. The branches k' and k² enter the case of the slag-boiler and pass from end to end above the slag-conveying apron and between the heads of the boiler. These pipes are provided with a number of perforations, so that the air escapes upon the heated slag as it passes along beneath the boiler. Still another branch, k⁴, leads from the pipe k and enters beneath the slag-receiver D, so as to direct a current of air against the slag as it falls from the spout d on the traveling apron. Both the slag and the matte are thoroughly exposed to the action of air, and by taking the air from the inclosing-cases, as above described, it is more or less heated when it comes into contact with the slag, though I do not confine myself to the use of heated air.

The steam generated by the heated slag and the matte is collected in a series of pipes, L, which lead from the heads of the boilers and carry the steam to some common pipe, whence it may be conveyed to an engine or other place of use.

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

1. In a slag-conveyer and steam-generating furnace, the combination of a boiler-supporting frame or structure provided with brackets on its inner sides, a boiler arranged thereon, beds or tracks supported on the brackets, and a slag-conveying apron provided with apron-wheels rolling on the beds or tracks, substantially as described.

2. In a slag-conveyer and steam-generating furnace, the combination of a boiler-supporting frame or structure overhanging at the top and provided with brackets on its inner sides, a boiler arranged thereon, beds or tracks supported on the brackets, and a conveying-apron provided with apron-wheels rolling on the beds or tracks, substantially as described.

3. In a slag-conveyer and steam-generating furnace, the combination of a boiler-supporting frame or structure, a boiler arranged thereon, and a slag-conveying apron provided with apron-wheels mounted on apron-axes projecting beyond the sides of the apron and rolling on beds or tracks, substantially as described.

4. In a slag-conveyer and steam-generating furnace, the combination of a boiler-supporting frame or structure, a boiler arranged thereon, a slag-conveying apron traveling beneath the water-heating tubes, and a plate to prevent the heat from the slag on the conveying-apron from escaping and cold air from entering between the apron and the boiler-heads, substantially as described.

5. In a slag-conveyer and steam-generating furnace, the combination of a boiler-supporting frame or structure, a boiler arranged thereon, a slag-conveying apron provided with apron-wheels, and trough-shaped beds or tracks adapted to contain water and in which the apron-wheels travel, whereby they are prevented from becoming overheated, substantially as described.

6. In a slag-conveyer and steam-generating furnace, the combination of a boiler-supporting frame or structure, a boiler arranged thereon, a slag-conveying apron provided with apron-wheels traveling on tracks or beds, and a perforated water-pipe arranged over the wheels and spraying water onto the same, substantially as described.

7. In a slag-conveyer and steam-generating furnace, a slag-conveying apron provided with apron-axes, sleeves or thimbles encircling the ends of the axes and fixed in their relation thereto, and apron-wheels mounted and revolving on the sleeves or thimbles, substantially as described.

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