

(No Model.)

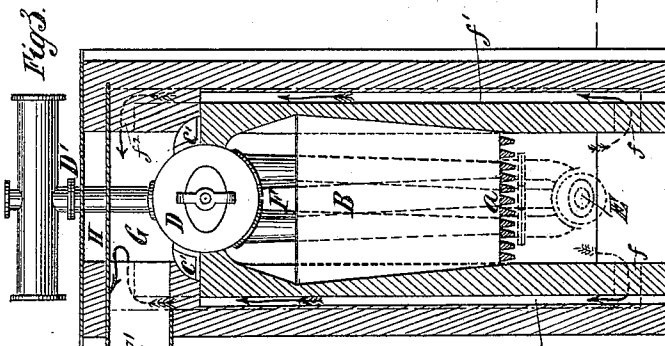
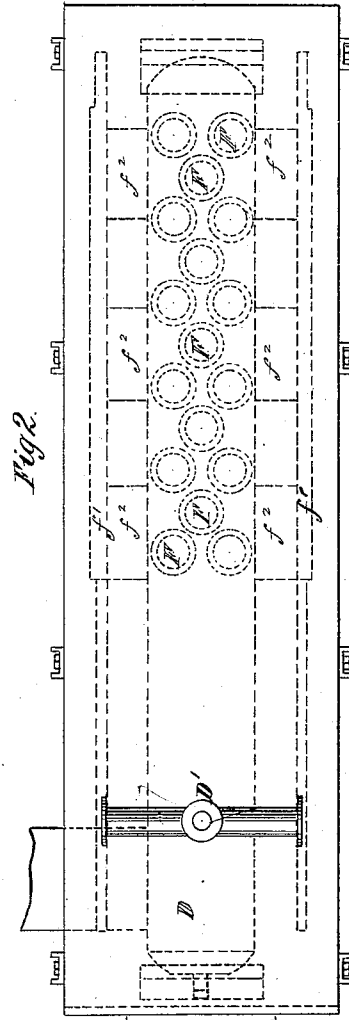
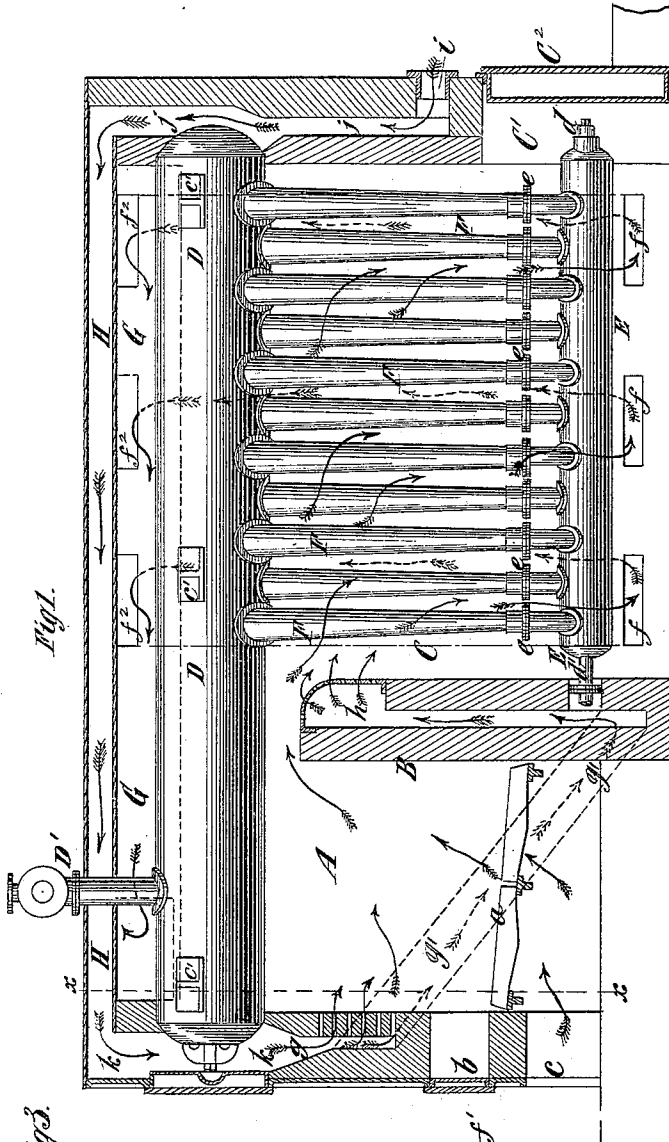
D. KELLY & W. H. HOFFMAN.

2 Sheets—Sheet 1.

STEAM GENERATOR.

No. 248,759.

Patented Oct. 25, 1881.



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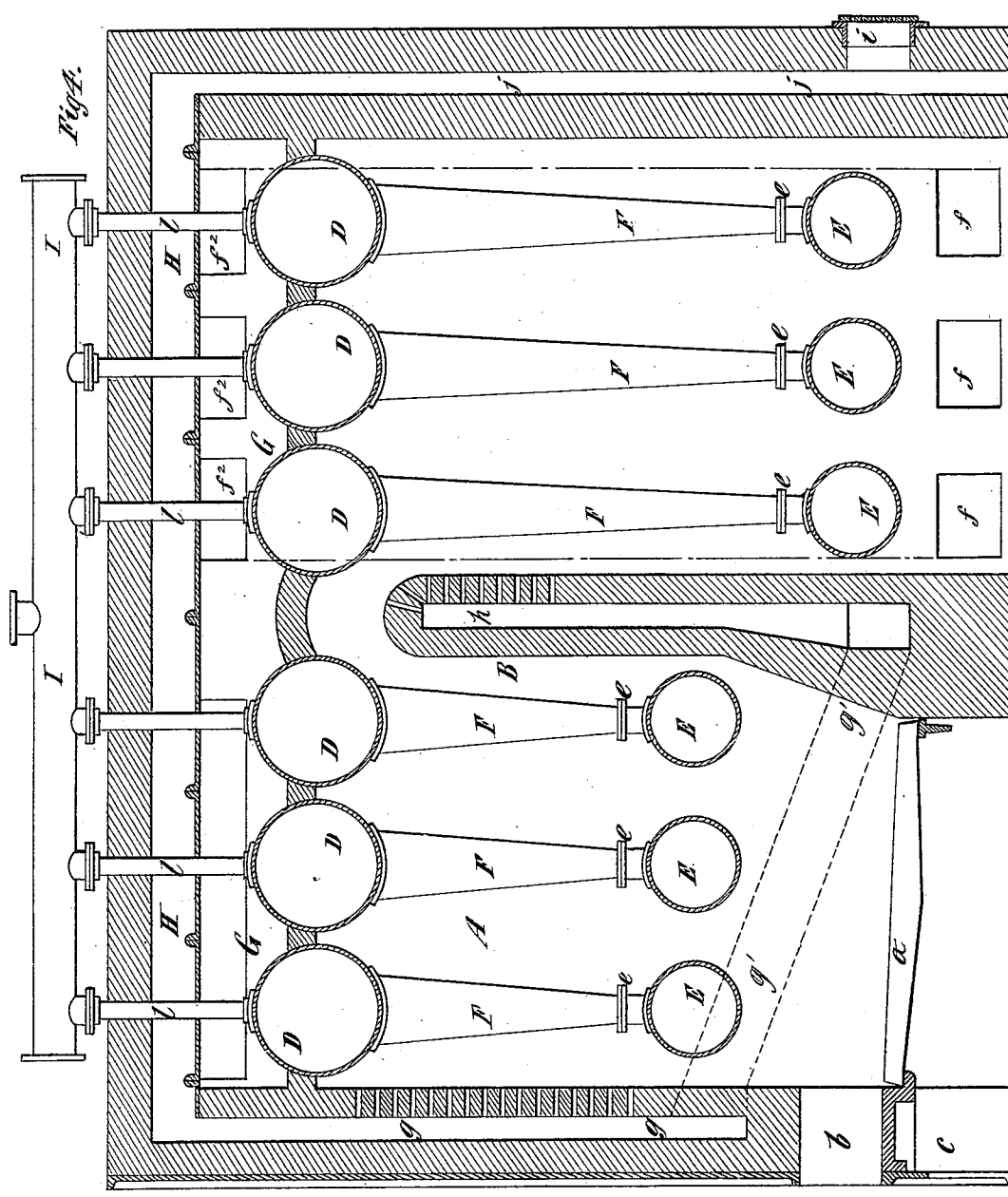
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# UNITED STATES PATENT OFFICE.

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## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 248,759, dated October 25, 1881.

Application filed June 28, 1881. (No model.)

*To all whom it may concern:*

Be it known that we, DANIEL KELLY, of the city and county of Philadelphia, in the State of Pennsylvania, and WILLIAM H. HOFFMAN, of Passaic, in the county of Passaic and State of New Jersey, have invented a certain new and useful Improvement in Steam-Generators, of which the following is a specification.

Our invention consists in the combination, with the furnace and combustion-chamber of a steam-generator, of air-chambers in the front of the furnace and in the bridge-wall, and a novel arrangement of flues, whereby air is heated by the waste products of combustion escaping from the generator and introduced into said air-chambers, from whence it passes into the furnace and combustion-chamber.

In the accompanying drawings, Figure 1 represents a longitudinal vertical section of a steam-generator embodying our invention. Fig. 2 represents a plan thereof. Fig. 3 represents a transverse vertical section thereof upon the dotted line *x x*, Fig. 1; and Fig. 4 represents a modified form of generator, also embodying our invention.

Similar letters of reference designate corresponding parts in all the figures.

Referring, first, to Figs. 1, 2, and 3, A designates the furnace of the generator, in which are the grate *a* and the usual fire and ash-pit doors, *b* and *c*.

B designates the bridge-wall, and C the combustion-chamber, into which the gaseous products of the fuel and the air pass over the bridge-wall.

D designates an upper drum for steam and water, arranged in the upper part of the generator, and supported at each end in the brick setting of the generator, and also by knee-pieces or lugs *c'* on its sides, which rest upon the brick-work, as seen in Fig. 3. The drum D is designed to be at all times partly filled with water, and D' designates a pipe through which steam may be taken therefrom for use. The said drum may be provided with a man-hole at each end to enable it to be entered for repair, if necessary.

In the lower part of the combustion-cham-

ber C, considerably below the drum D and parallel therewith, is a lower water and sediment or mud drum, E, which is shown as smaller than the drum D, and has connected to its ends pipes *d d'*, one of which may serve as a feed-pipe, while the other serves as a blow-off pipe.

F designates water-tubes, of which any number may be employed to give the power of boiler or generator required. These tubes are arranged in an upright position between the drums D and E, and they are connected at their upper ends with the drum D and at their lower ends with the mud-drum E.

The water-tubes F are made tapering from their upper ends downward, as clearly shown, and the area of communication between the tube and the drum is equal to the area of the large upper end of the tube, and hence steam generated at the internal surface of the tube has free opportunity of passage upward into the drum D, and through the water thence into the steam-space, without being opposed in its passage by the downward current of water which takes place in the center of the tubes.

In order to cause the heated gases and products of combustion passing through the combustion-chamber C to act more effectively upon the tubes, we arrange the tubes in staggered relation to each other, as best seen in Fig. 2—that is, the tubes are placed in three rows or lines longitudinally of the drums, and the tubes in the middle row or line are placed midway or opposite the spaces between the tubes in the side or outer rows or lines. This arrangement causes the gases and products of combustion to take a zigzag course in passing from front to rear of the combustion-chamber C, and to impinge more directly against the surfaces of the tubes.

In each tube F, near the connection with the mud-drum E, is a flange-joint, *e*, which is secured by means of bolts, and by breaking these joints the mud-drum E may be removed in case of necessity for repairs. By placing blank flanges over all the open ends of the tubes at the said flanged joints, the generator may be used even without the mud-drum, if

provision is made for feeding water into one of the tubes or into the drum D.

In the rear wall of the generator is an opening, C', closed by a door, C<sup>2</sup>, through which access may be had to the combustion-chamber C, and through which the drum E may be readily removed, if necessary.

We will now describe the flues for the passage of the products of combustion from the furnace and combustion-chamber, and for the supply of air to support combustion.

From the furnace A the smoke and partly-consumed gases, together with air, pass over the bridge-wall B into the combustion-chamber C, wherein the combustion is completed, and the products of combustion, after circulating through the combustion-chamber C and among the tubes F, finally escape through side openings, f, into flues f', which extend upward upon the opposite sides of the combustion-chamber, and may extend the whole length thereof. From the flues f' the products of combustion pass through openings f<sup>2</sup> into an escape-flue, G, which extends along the top of the drum, and from which they pass to the chimney under control of a damper, G'. (Shown in Fig. 3.) The passage of the waste products of combustion through the flues f' upon the sides of the combustion-chamber C prevents the radiation of effective heat outward from the highly-heated products of combustion in the combustion-chamber.

In the front wall of the furnace A is an air-chamber, g, from which air may enter the furnaces above the grate through numerous perforations or holes which widely distribute it, and in the bridge-wall B is a similar air-chamber, h h, from which air may be discharged into the combustion-chamber C through numerous holes or perforations, as best shown in Fig. 1. Cold air is taken in at an opening, i, in the back of the generator, and thence passes upward through a passage, j, to a flue, H, extending along the top of the generator, from rear to the front thereof. The flue H passes in close proximity to the flue G, and in this instance is immediately above the same, and is separated therefrom by a thin sheet-metal plate, so that the air passing through the flue H is considerably raised in temperature by heat radiated from the heated products of combustion passing through the flue G, and when it reaches the front end of the generator is heated to such a degree that it will promote

economical combustion if admitted to the furnace. From the front end of the flue H the heated air is admitted by a passage, k, to the air-chamber g in the front wall of the generator-furnace A, and a portion of the air passes through the holes or perforations in the said chamber, while the remainder passes through flues g' upon the sides of the furnace, as seen in dotted outline in Fig. 1, and thence to the chamber h in the bridge-wall, whence it issues from the perforations or holes in said chamber into the combustion-chamber C. By this arrangement of air-flues the air to support combustion is highly heated without extra expense, as the heat which is imparted to it would otherwise be wasted.

Of course, in starting the fires air may be admitted to the furnace entirely below the grate through the ash-pit door, and as much as may be necessary may be there admitted at all times during the working of the boiler.

In Fig. 4 we have represented a modified form of the generator, the construction of the several parts of which is like that previously described. In this case we have represented several of the upper drums, D, and a corresponding number of lower drums, E, extending across the furnace A and combustion-chamber C, and between the steam and water drums and their corresponding mud-drums are the downwardly-tapering water-tubes F. The several drums D are connected by branch pipes with a common steam-pipe, I, from which steam may be taken for use. In the front of the furnace and in the bridge-wall B are the air-chambers g and h, and the arrangement of the air-flues and their connecting passages and the escape-flue G and its communicating passages is the same as that previously described.

What we claim as our invention, and desire to secure by Letters Patent, is—

The combination of the furnace A and combustion-chamber C, the two heated air-chambers g h, connected by the side flues, g', the flues f' upon the sides of the combustion-chamber, and the smoke and air flues G H, extending along the top of the generator in close proximity, substantially as specified.

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