No. 632,720. Patented Sept. 12, 1899.

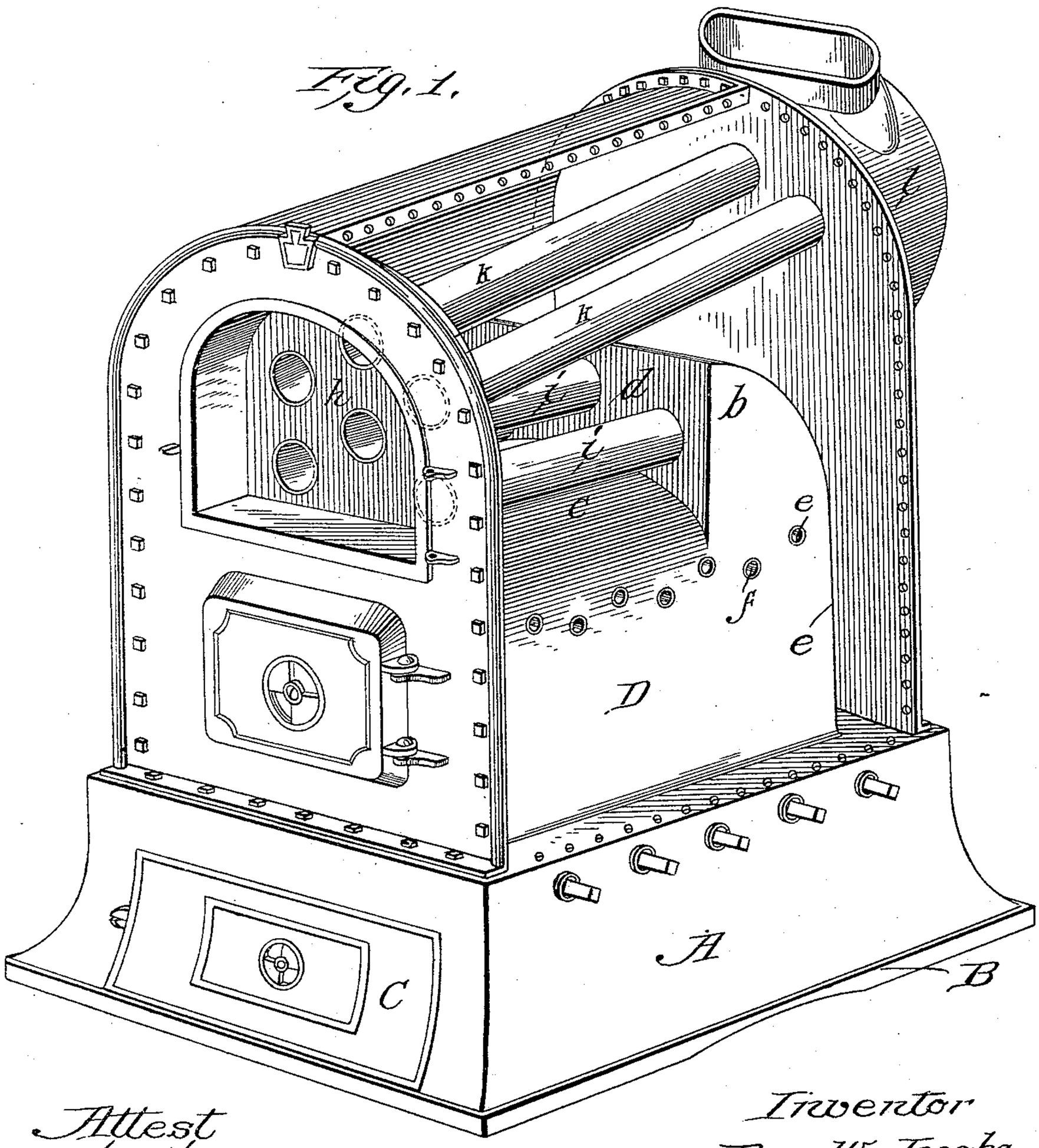
# R. W. JACOBS.

## BOILER.

(Application filed Oct. 22, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.




Attest,
F. L. Middleton
H. L. Mockbee

Inventor
Roy W. Jacobs
by Richards & Co
Attys.

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## BOILER.

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(No Model.) 3 Sheets—Sheet 2.

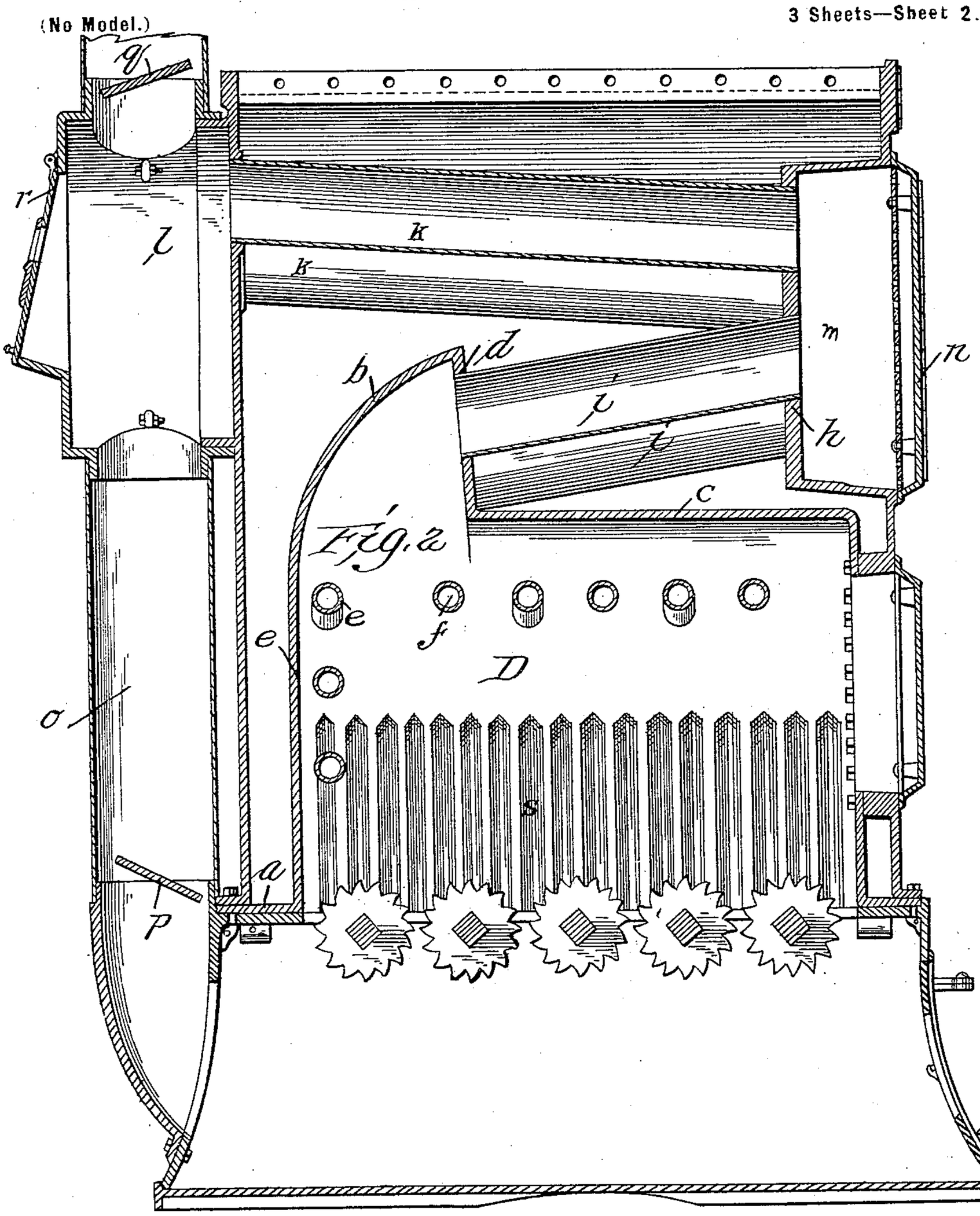


Fig. 2.

Attest
F. L. Middleton
H. L. Mockbee

Inventor
Roy W. Jacobs
by Richards & Co.
Attys.

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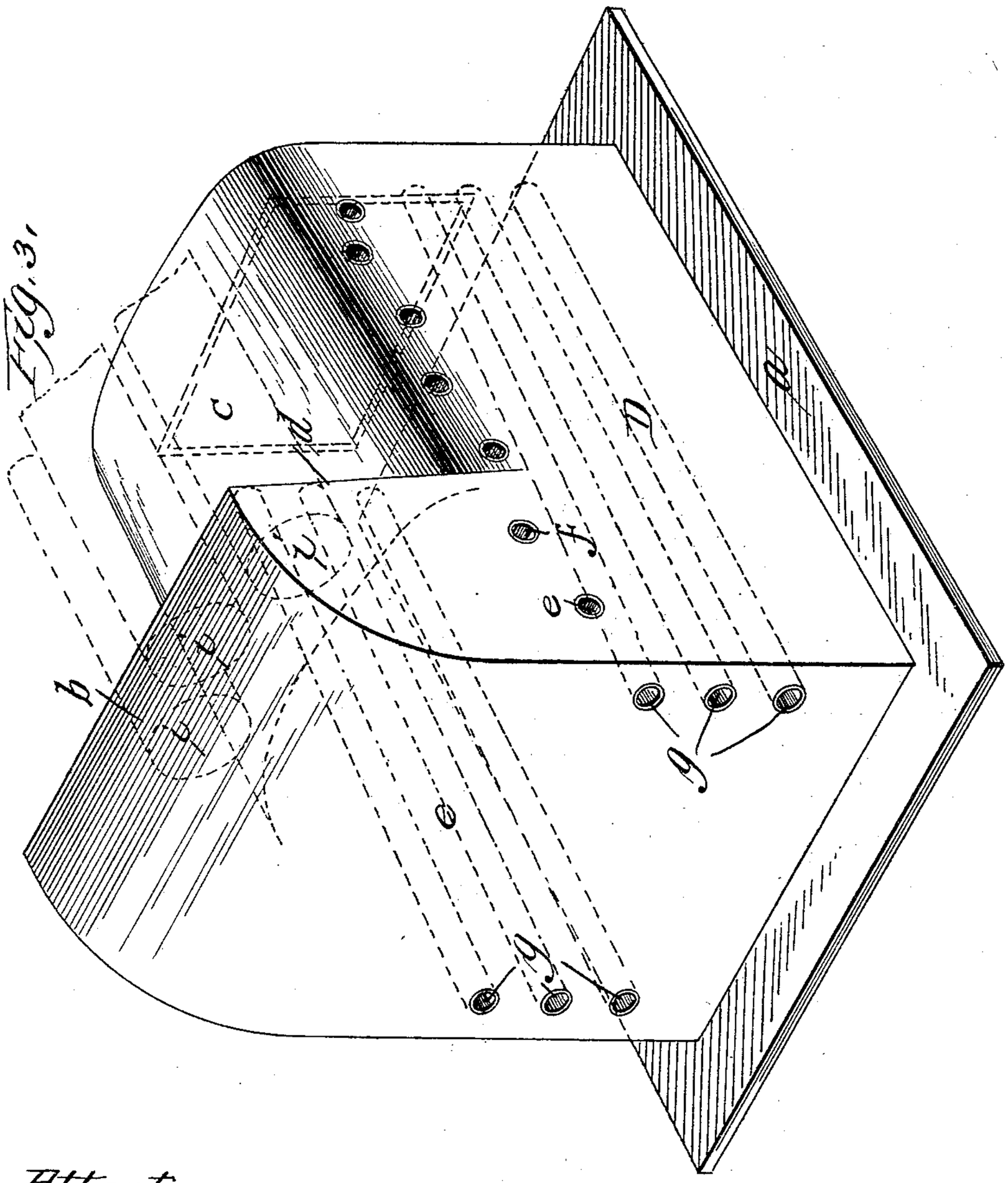
(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

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# UNITED STATES PATENT OFFICE.

ROY W. JACOBS, OF HUNTINGDON, PENNSYLVANIA.

## BOILER.

SPECIFICATION forming part of Letters Patent No. 632,720, dated September 12, 1899.

Application filed October 22, 1898. Serial No. 694,329. (No model.)

*To all whom it may concern:*

Be it known that I, ROY W. JACOBS, a citizen of the United States, residing at Huntingdon, in the State of Pennsylvania, have invented certain new and useful Improvements in Boilers, of which the following is a full, clear, and exact specification.

My invention relates to boilers of that class adapted for use for hot-water heating or for the generation of steam for steam-heating.

I have sought to provide a construction which shall be very compact, so as to economize space, which shall provide a fire-box in the midst of a water-chamber, so as to have the fire-box surrounded by the water, and to connect the columns of water on each side and at front and rear by tubes extending through the fire-box in two directions, to discharge the products of combustion circuitously from the fire-box to the stack through the water-chamber. I have also aimed to provide for the easy cleaning of the flues and generally to so arrange the parts in their relation to each other as to cheapen the manufacture, while at the same time making a durable boiler.

In the accompanying drawings, Figure 1 is a perspective view of my improved boiler, partially in section. Fig. 2 is a longitudinal section of the same. Fig. 3 is a perspective view of the fire-box with the outer shell removed.

In the drawings the base is shown at A and is preferably mounted upon a base-plate B, forming the bottom of the ash-pit. A door C gives access to the ash-pit. The fire-box is shown at D and is preferably in one piece, having an outwardly-extending base-flange *a*, serving to support the front and rear walls of the boiler and the intermediate casing extending between these walls. The shape of the fire-box is very clearly shown in Figs. 2 and 3. The forward part is provided with parallel side walls connected by a rounded top portion, while in the rear the side walls extend to a greater height, as shown at *b*, this extension rising above the rounded top *c* of the front portion and connecting with it by a vertical wall *d*. This rear extension curves from the top of the vertical wall *d* rearwardly to a vertical portion *e*, which terminates in the base-flange *a*. It will be observed that the fire-box is of less width and length than the inclosing walls of the boiler, and this space constitutes the water-chamber, which entirely surrounds the fire-box on all four sides, as well as covering the fire-box, as will be more fully described hereinafter. By thus providing practically a submerged fire-box radiation from the fire-box in every direction is absorbed by the water; but in order to absorb the heat more perfectly and more rapidly I connect the water-chamber on opposite sides of the fire-box by a series of copper tubes extending through the fire-box above the fire, and these tubes are arranged slightly inclined, the inclination of adjacent tubes being reversed, as shown at *e f*, so as to facilitate the flow of water through them and more readily set up a circulation. The columns of water at the front and rear are likewise connected by a series of tubes arranged at each side below the level of the cross-tubes, and I prefer to make these tubes (shown at *g*) inclined slightly from front to rear, the inclination of all the tubes being the same, preferably, as in this way circulation is provided from front to rear. It will be observed that with this construction a perfect circulation is provided and the movement of the water is continuous on all sides of and through the fire-box.

In the space between the top of the fire-box and the inclosing shell is located the main body of water, and I utilize and absorb the heat contained in the products of combustion by passing these products through smoke-tubes, forming a circuitous passage through the body of the water. These smoke-tubes I may arrange in any number according to the size of the furnace; but in the present case I have shown three tubes. I arrange these tubes in two sets, the first set extending from the vertical wall *d* of the fire-box extension to the rear wall *h* of a recess made in the front wall of the boiler, as shown in Figs. 1 and 2. The tubes *i* of the lower set are inclined upwardly from the wall *d* to the sheet *h*, and from this recess the second set of tubes *k* extend from the sheet *h* to the smoke-drum *l*, connected to the rear wall of the furnace, this drum being connected with the chimney. The second series of pipes are also inclined, and the effect is, by reason of the inclination of these pipes, to secure and provide a draft and to such an extent that the products of com-

bustion will pass from the lower to the upper set of tubes through the recess *m* without discharging into the room even when the door *n*, which ordinarily closes this recess, stands open. It will be understood that both the upper and lower sets of the combustion-tubes are submerged by the main body of water, and thus every possible amount of heat is extracted from the products of combustion passing through the pipes.

The lower set of combustion-tubes are readily cleaned by opening the door *n*, and by forcing the soot and accumulation rearwardly and from the rear ends of the tubes this drops upon the grate-bars.

The smoke-drum *l* is connected to the ash-pit through a pipe *o*, so that the accumulation from the tubes *k* drops through this pipe to the ash-pit. A valve *p* is provided at the lower end of this pipe, so as to control the draft from the ash-pit, and a valve or damper *q* is provided at the exit from the smoke-drum. A valve-door *r* closes the rear of the smoke-drum, and the arrangement is such that this opening is in direct line with the openings of the smoke-tubes, and the draft can be quickly checked by opening the door *r*, which admits cold air directly into the open ends of the tubes *k*.

As shown in Fig. 2, I prefer to corrugate the lower walls of the fire-box, as shown at *s*, and this not only strengthens the box, but forms a series of channels or grooves along which the fine ashes will be guided to the ash-pit.

I prefer to use with my improved boiler a particular form of grate, which I have shown in this case; but this has been made the subject of a separate application, and need not therefore be particularly described herein.

I claim—

1. A boiler comprising a shell or casing, a fire-box within, having a water-space at each side, a series of cross-tubes between the side walls of the fire-box, a series of tubes extending from front to rear thereof, a water-space above the fire-box and a circuitous smoke-discharge passing through the water-space, substantially as described.

2. A boiler comprising a shell or casing, a fire-box within, having a water-space at each side, a series of cross-tubes between the walls of the fire-box, a series of tubes extending from front to rear thereof, a water-space above the fire-box and a double series of smoke-tubes between the fire-box and chimney, said tubes being reversely inclined, substantially as described.

3. A boiler comprising a shell or casing, a fire-box within, having a water-space at each side, a series of cross-tubes between the walls of the fire-box, a series of tubes extending from front to rear thereof, a water-space above the fire-box, a flue-space in the front of the boiler, smoke-tubes inclined from the fire-box to the flue-space and a second set of smoke-tubes inclined upwardly from the flue-space to the chimney, substantially as described.

4. A boiler comprising a shell or casing, a fire-box, a water-space surrounding the fire-box, a series of tubes extending through the upper part of the fire-box between the side walls and a series of longitudinally-extending tubes, substantially as described.

5. A boiler comprising a shell or casing, a fire-box within the same, a water-space surrounding the fire-box, and a series of tubes extending through the upper part of the fire-box and reversely arranged connecting the water-spaces at each side, substantially as described.

6. The boiler comprising an outer casing, a fire-box within the same, a water-space on each side, a series of tubes passing through the upper part of the fire-box and connecting the water-spaces on each side, reversely-arranged smoke-tubes extending through a water-space and a flue-space connecting the smoke-tubes, substantially as described.

7. A boiler comprising a shell or casing, a fire-box, an ash-pit and a flue-space, smoke-tubes extending from the fire-box to the flue-space and from the flue-space to the smoke-drum, and a soot-pipe from the smoke-drum to the ash-pit, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ROY W. JACOBS.

Witnesses:
E. E. GODARD,
GEO. G. STEEL.