(No Model.)

3 Sheets—Sheet 1.

V. P. ORLOFF.

STEAM BOILER.

No. 332,357. Patented Dec. 15, 1885.

Fig 5

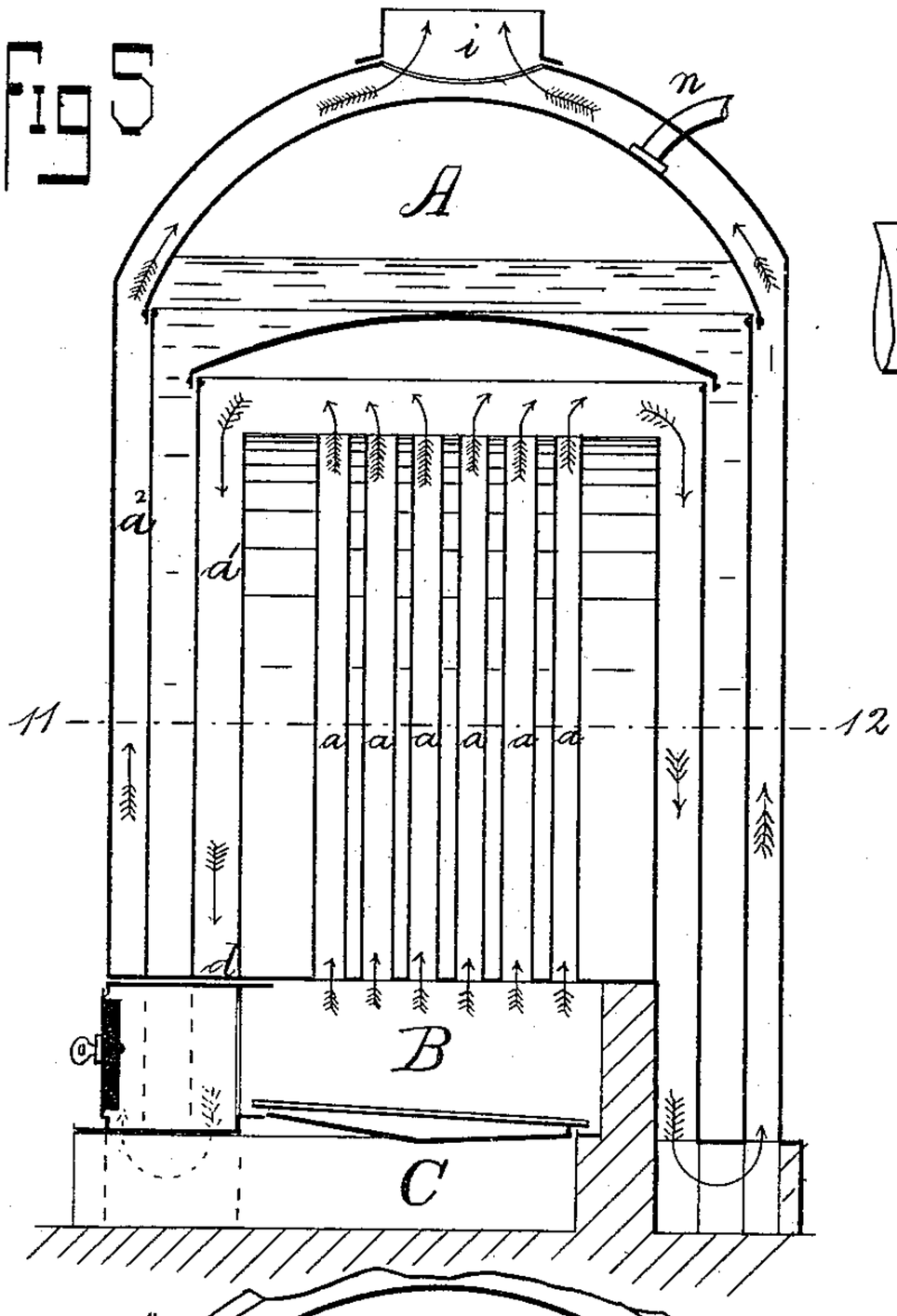


Fig 1

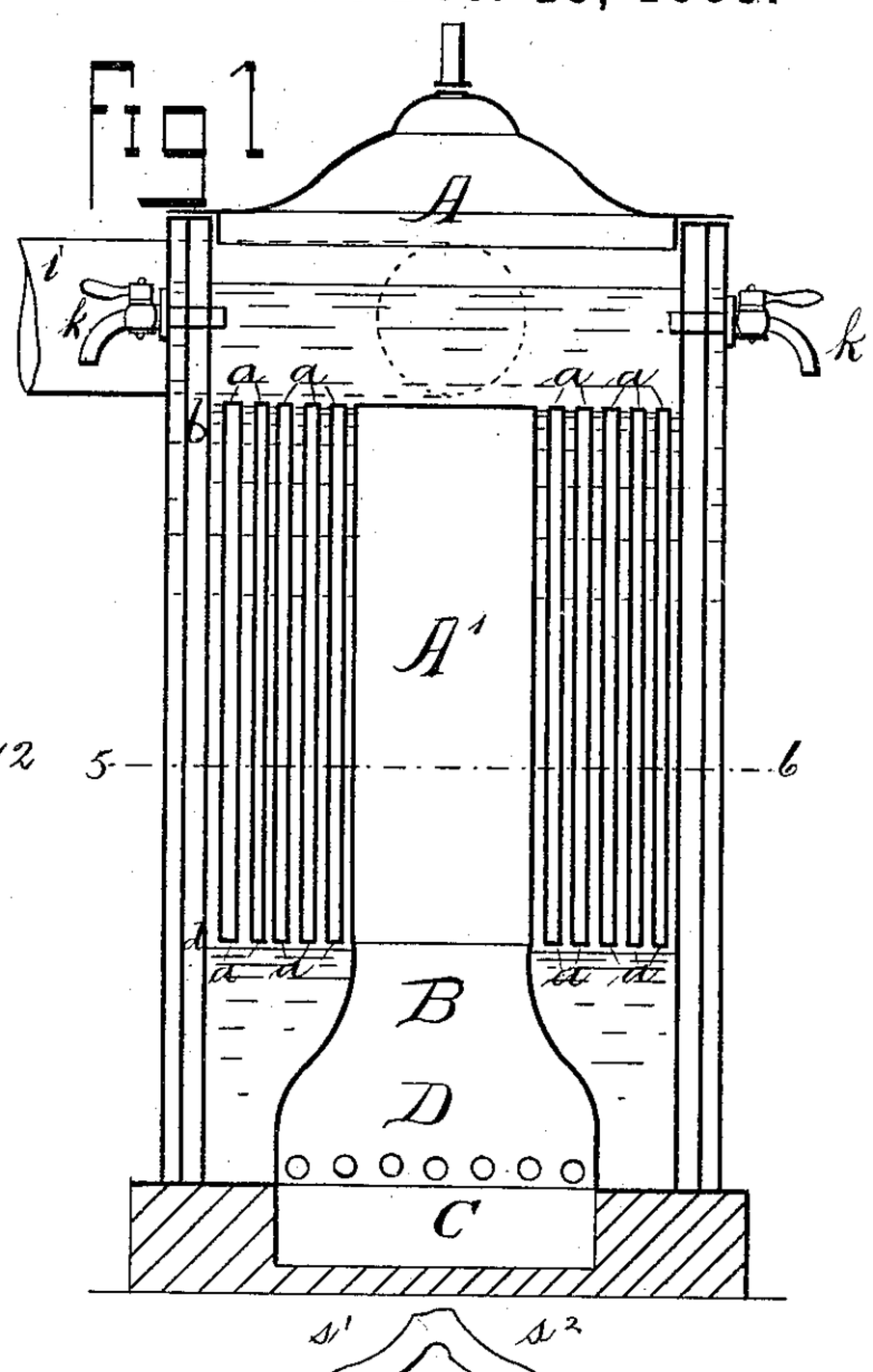


Fig 6

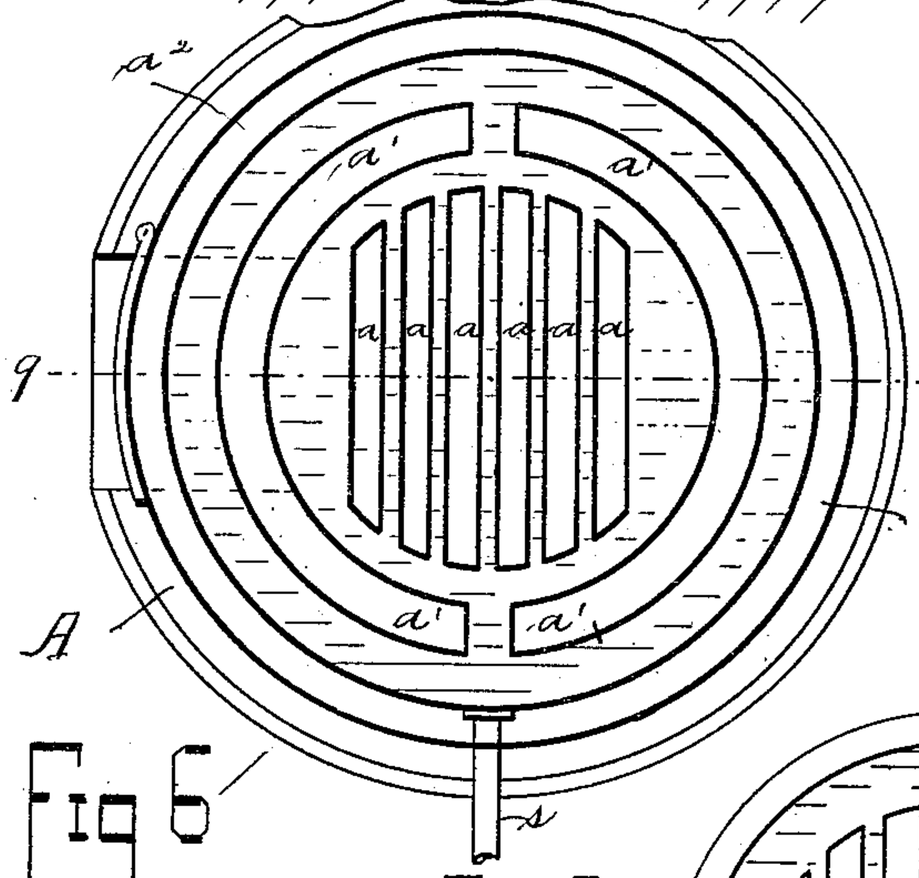


Fig 3

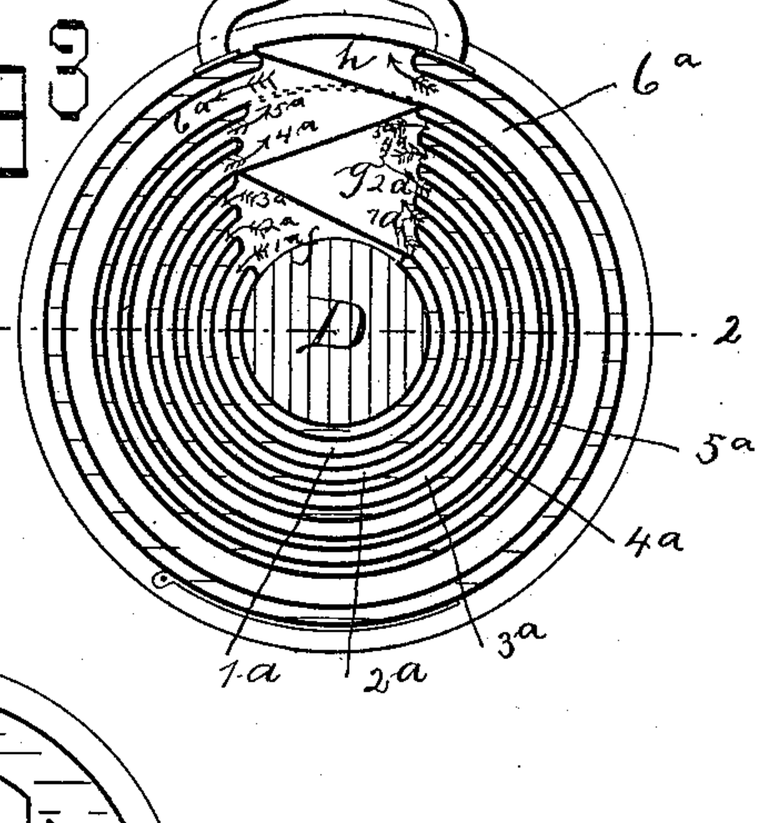
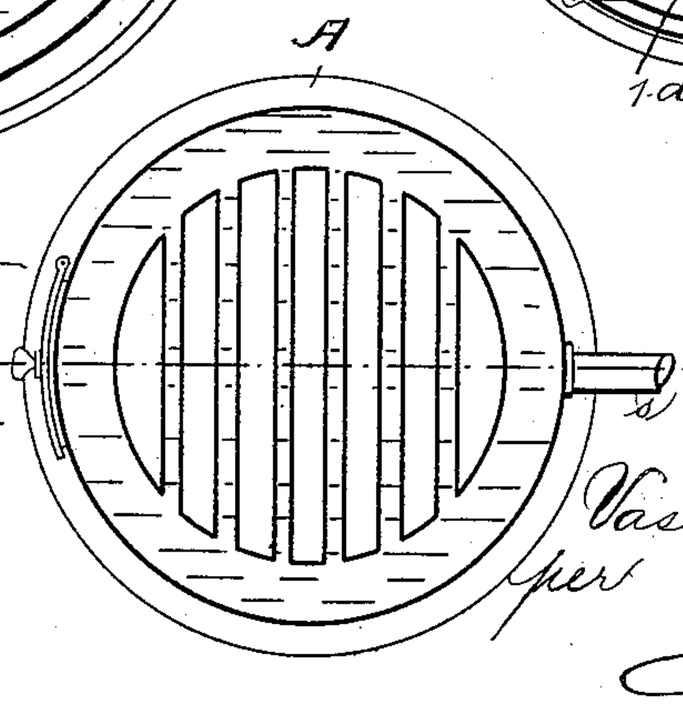


Fig 8



Attest:-
W. G. Boulter.
P. M. Knobloch.

Inventor:-
Vassili P. Orloff.
per Henry Orth
his atty

(No Model.)

3 Sheets—Sheet 2.

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STEAM BOILER.

No. 332,357. Patented Dec. 15, 1885.

Fig 2

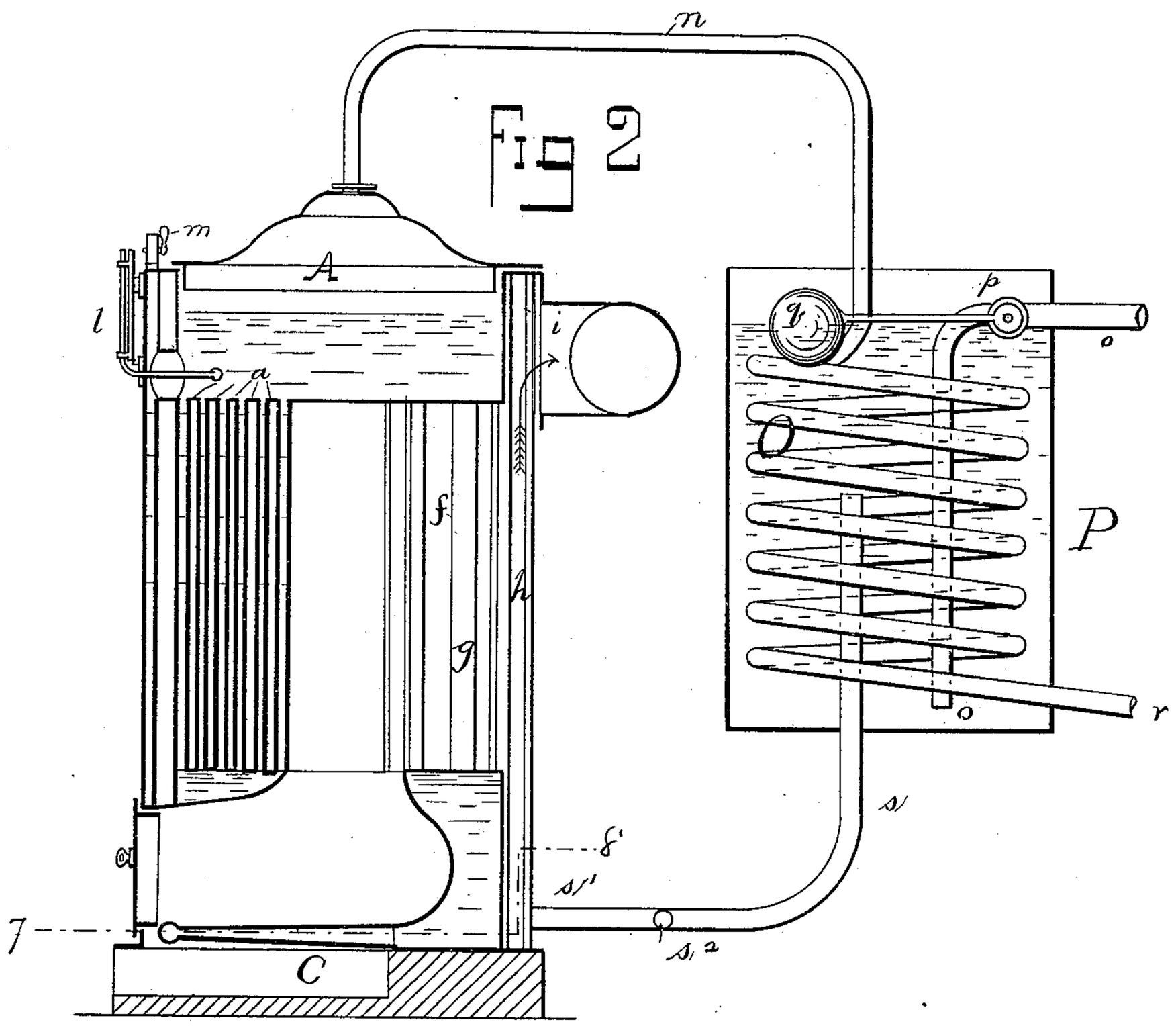
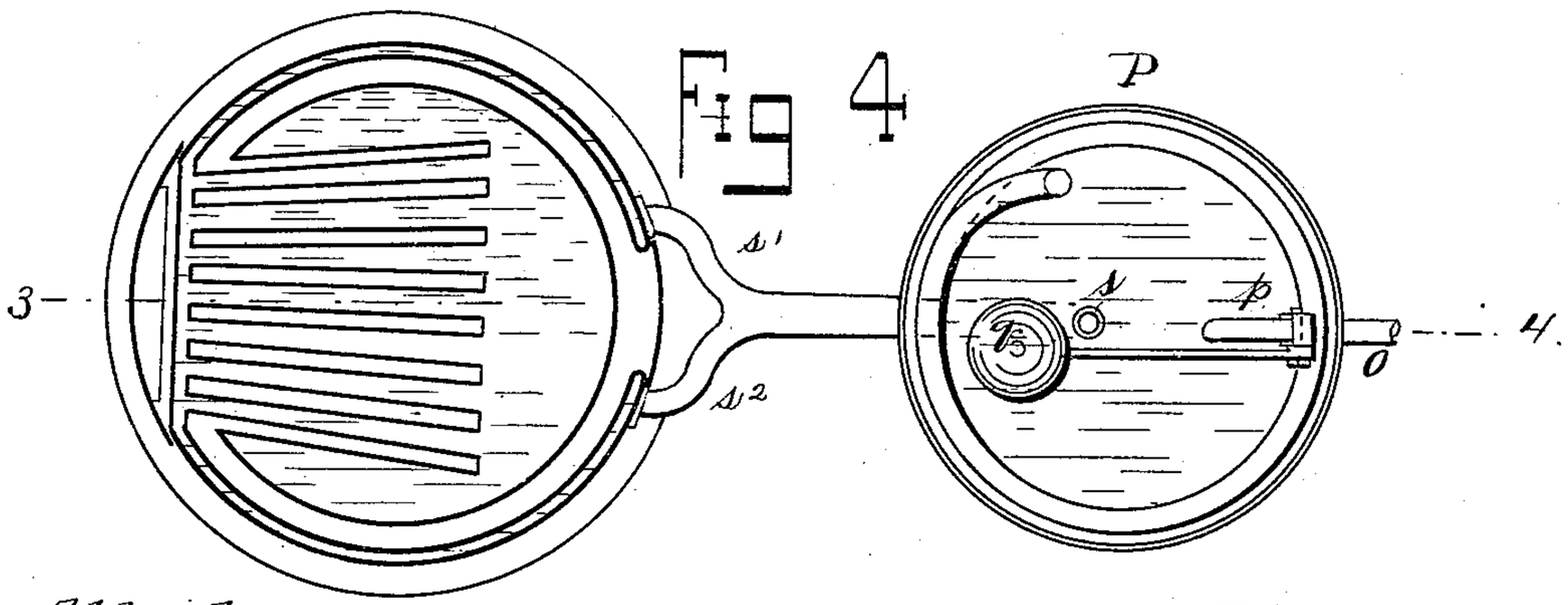


Fig 4



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(No Model.)

3 Sheets—Sheet 3.

V. P. ORLOFF.

STEAM BOILER.

No. 332,357. Patented Dec. 15, 1885.

Fig 9

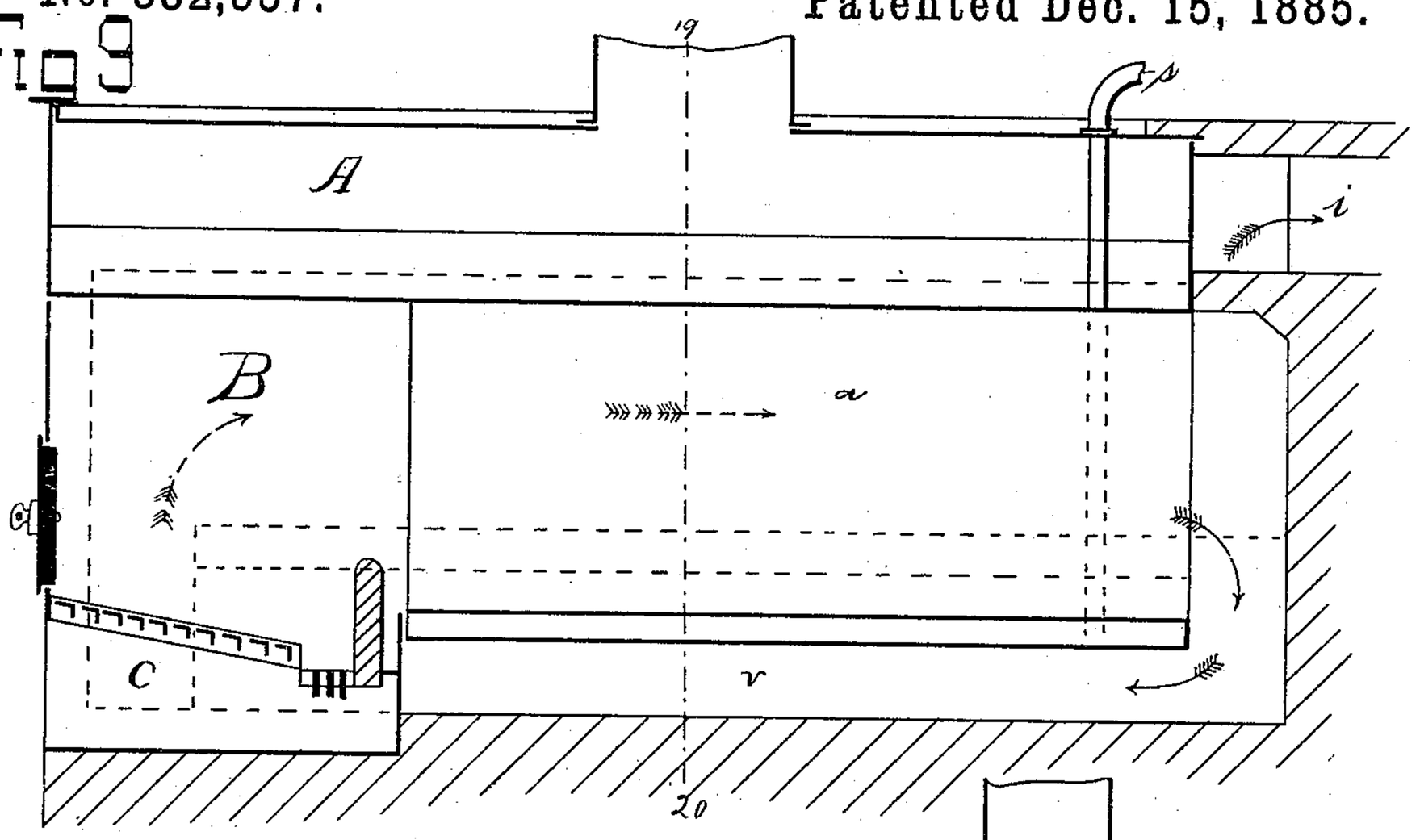


Fig 10

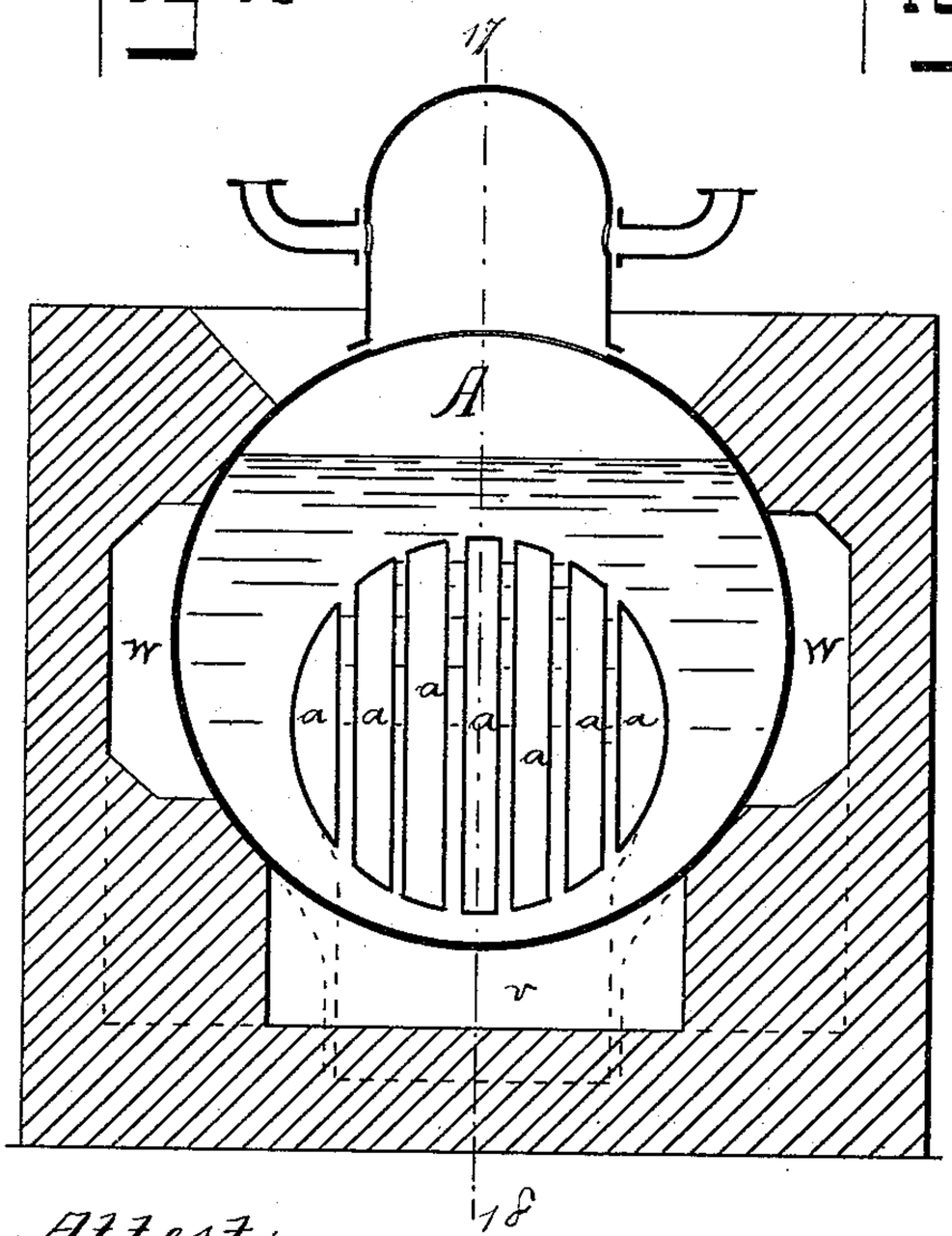
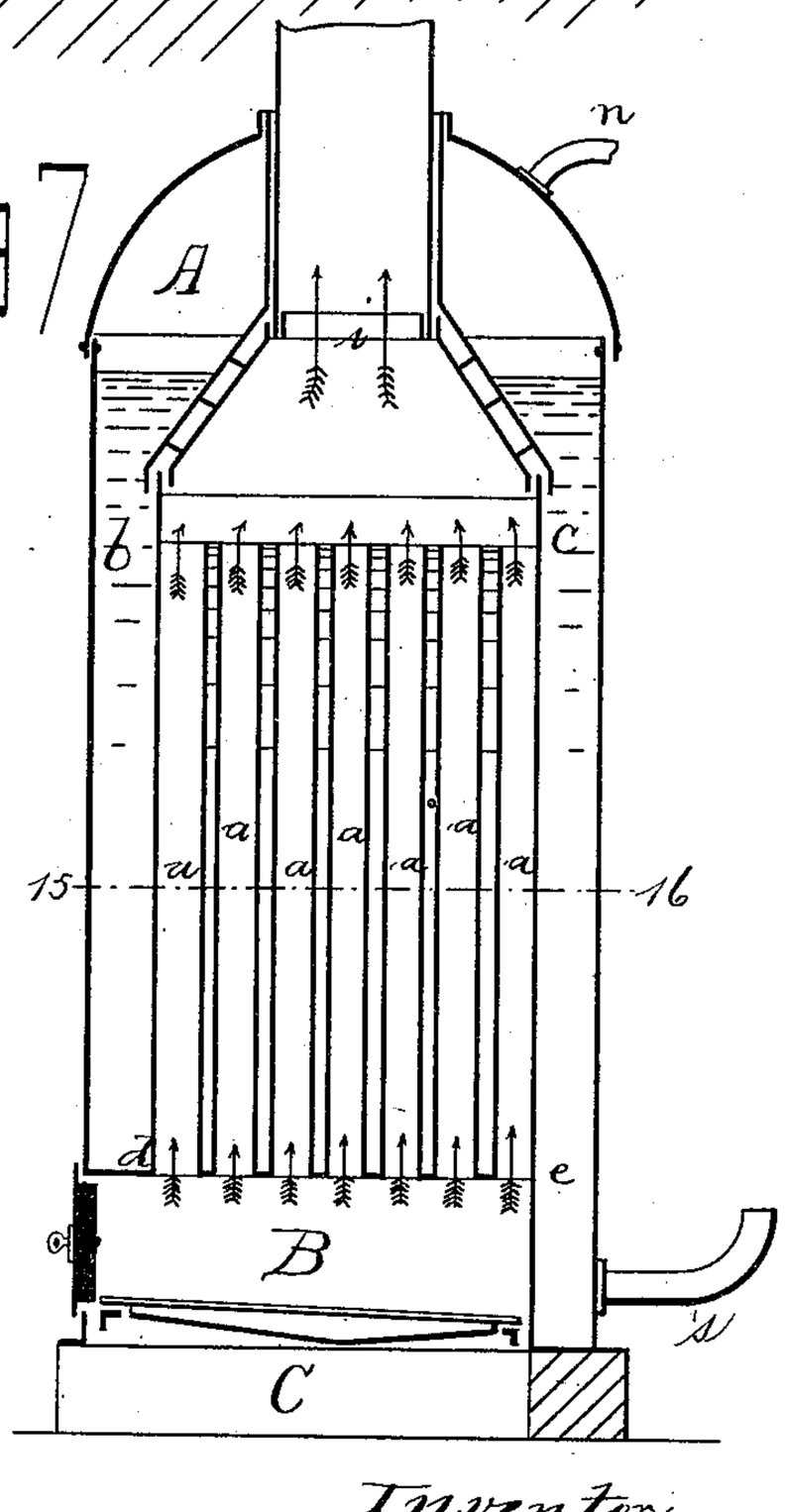


Fig 7



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Attest:
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P. M. Knobloch.

Inventor:
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per Henry Orth
his attiy.

UNITED STATES PATENT OFFICE.

VASSILI P. ORLOFF, OF MOSCOW, RUSSIA.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 332,357, dated December 15, 1885.

Application filed June 19, 1885. Serial No. 169,249. (No model.)

To all whom it may concern:

Be it known that I, VASSILI P. ORLOFF, a subject of the Czar of Russia, residing at Moscow, Russia, have invented certain new and useful Improvements in Hot-Water and Steam Boilers; 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The object of this invention is to increase the heating-surfaces of boilers for heating water or generating steam; and it consists, essentially, in substituting for the usual cylindrical flues or tubes a series of heating flues or passages, either of annular or rectilinear shape in cross-section, formed by a series of partitions arranged in the water-space of the heater or generator.

The invention further consists in the arrangement of the heating-chambers relatively to the source of heat and the escape duct or chimney to more effectually utilize the heat in heating water or in generating steam, substantially as hereinafter fully described and shown in the accompanying drawings, in which—

Figures 1 and 2 are vertical transverse sections of a water-heater, taken, respectively, on lines 1 2 and 3 4 of Figs. 3 and 4, which latter figures are horizontal sections taken on lines 5 6 and 7 8 of Figs. 1 and 2, the condenser in Fig. 4 being shown in plan view. Figs. 5 and 7 are vertical transverse sections of a vertical steam-boiler, taken, respectively, on lines 9 10 13 14 of Figs. 6 and 8, the latter two figures being horizontal sections taken, respectively, on lines 11 12 15 16 of Figs. 5 and 7. Fig. 9 is a vertical longitudinal section of a horizontal steam-boiler on line 17 18 of Fig. 10. Fig. 10 is a vertical transverse section thereof taken on line 19 20 of Fig. 9.

I have hereinbefore stated that instead of constructing the heater or boiler with fire-tubes for the circulation of the heat and products of combustion, I provide a series of heating flues or passages formed by properly partitioning the water-space. These flues may be arranged in various ways without departing from the nature of my invention. For instance, in the vertical boiler shown in Figs. 5, 6, 7, and 8, and the horizontal boiler shown in Figs. 9 and 10, I have shown these heating-flues extending vertically through the water-space; but it is obvious that, especially in the boiler shown in Figs. 9 and 10, they may be arranged in horizontal planes. In Figs. 1 and 3, on the other hand, I have shown the tubes arranged in the form of vertical cylindrical passages, and in Figs. 2 and 4 I have shown the flues as diverging from one side of the heater. I have given these examples of the different ways of arranging the flues to show that said arrangements may be varied in a great many ways without necessarily departing from the nature of my invention.

Figs. 1 to 4, inclusive, show a water-heater, A, in which the heating-surfaces are formed by a series of annular or cylindrical flues, *a*, arranged between the transverse partitions *b c* and *d e*, Fig. 1, around and concentric with a central draft-tube, A′, that communicates with the furnace B. As shown in Fig. 3, the double walls that form the heating-flues *a* do not extend entirely around the central flue, A′, of the heater, a space, A^2, being left, which is divided by partitions *f g h*, that extend alternately from the extremity or end of one of the flues *a* on one side to the extremity of another flue on the opposite side of the central flue, A^2. By means of this arrangement the heat and products of combustion passing into A′ from B are conducted, for instance, first through three of the chambers, as shown at 1^a 2^a 3^a, by partition *f*, thence into the chamber formed by partitions *f g*, thence through flues 4^a 5^a into the chamber formed by partitions *g h*, and through flues 6^a into the draft flue or chimney *i*. The heater is provided with a tubular grate, D, that communicates with the water-space of the said heater for obvious purposes.

C is the ash-pit, K K gage or draw-off cocks, and *n* the steam-escape pipe. The heater may be or is provided with the usual safety and other appliances, *l*. Fig. 2 indicates a thermometer, and *m* an air valve or cock. The steam generated in the heater may be al-

lowed to escape into the atmosphere through pipe *n;* but it is obvious that there would be a waste of heat, which I utilize in the heating of the feed-water by conducting the steam through a coil of pipe, O, arranged in a feed-tank, P. The steam passing through the coil is condensed by giving up its heat to the surrounding water, the products of condensation (distilled water) escaping from the coil at *r*. The feed-water is admitted to the feed-tank P through pipe *o*, that is provided with a valve or stop-cock, *p*, to the stem of which is connected a lever carrying a float, *q*, whereby said valve or cock is automatically controlled, as is well understood. The heated feed-water is admitted to the boiler by a pipe, *s*, that is bifurcated, as at $s' s^2$, to produce a more uniform circulation of the water in the heater.

In Figs. 5 and 6 I have shown the application of the heating-flues to a vertical steam boiler or generator, or said boiler may serve as a water-heater. The heat and products of combustion pass from the furnace B through the vertical flues *a*, thence downwardly through a flue, *a'*, and from the latter upwardly through a flue, a^2, formed by the outer shell of the boiler A and the water-space, and from thence said products of combustion pass to the chimney *i*. In these figures *n* also indicates the steam-pipe and *s* the feed-pipe.

The construction shown in Figs. 7 and 8 is materially simplified, the products of combustion passing directly from the chambers *a* to the chimney *i*, and *n* is the steam-pipe and *s* the feed-pipe.

In Figs. 9 and 10 I have shown a horizontal steam boiler or generator, in which *a* indicates the vertically arranged heating-flues through which the products of combustion from the furnace B pass to the end of the boiler, thence downward to and through a flue, *v*, and through vertical flues *w*, Fig. 10, to the chimney *i*. Said flues *v* and *w*, nearly surrounding the boiler, are formed in the masonry work, as shown, and it is obvious that, instead of arranging the flues *a* vertically, they may be arranged horizontally within the water-space. The number of these heating flues or passages for the heat and products of combustion, their relative arrangement, and dimensions may be varied and must depend in a measure upon the form of boiler employed and on the dimensions of the latter. These boilers are also provided with the usual safety and other appliances—such as try-cocks, pressure-indicator, level-indicator, safety-valve, blow-off cocks, and appliances for cleaning the flues and the boiler—which are too well known and I have deemed unnecessary to illustrate the same in the drawings. Finally, both the water heaters and boilers shown may be surrounded by or inclosed in the usual jackets of wood or other substance that is a non-conductor of heat, to prevent loss of heat by radiation.

What I claim is—

1. In a steam-boiler or water-heater, the combination, with the outer shell and the furnace located therein, of partitions arranged to subdivide the interior of the shell into a series of contracted or narrow continuous passages and form an axial draft-flue, A', for the circulation of the water and the products of combustion, the former enveloping or surrounding the latter and the furnace, said passages constituting independent circuits having their initials connected with the feed-water pipe and axial draft-flue, respectively, and their terminals with a discharge-pipe and chimney, respectively, substantially as and for the purpose specified,

2. In a steam-boiler or water-heater, the combination, with the outer shell, a furnace in the base of said shell, a feed-water heater connected with the steam-space of the shell, of partitions arranged to subdivide the interior of said shell into a series of contracted or narrow continuous passages and form an axial draft-flue, A', for the circulation of the water and products of combustion, the former enveloping or surrounding the latter and the furnace, said passages constituting independent circuits having their initials connected with the feed-water heater and the axial flue, respectively, and their terminals with a discharge-pipe and chimney, respectively, substantially as and for the purpose specified.

3. The combination, with the inclosing-shell of a boiler, the furnace, the chimney, and partitions arranged to form an axial flue and a series of continuous concentric passages for the circulation of the water and the products of combustion, the former enveloping or surrounding the latter, of the partitions *f g h*, said parts being arranged substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

VASSILI P. ORLOFF.

Witnesses:
FREDERICK KAUPE,
NICHOLAS TSCHEKALOFFE.