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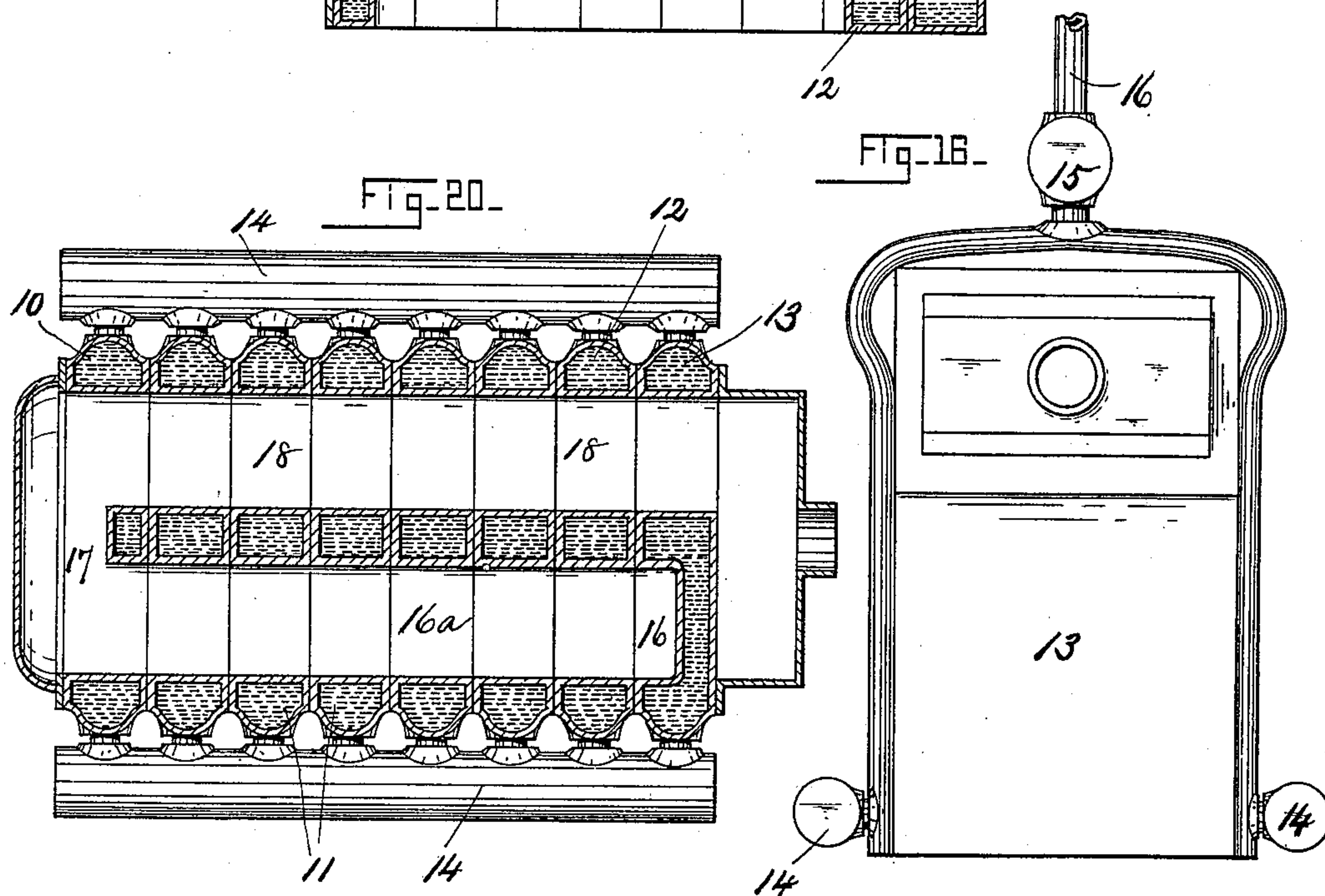
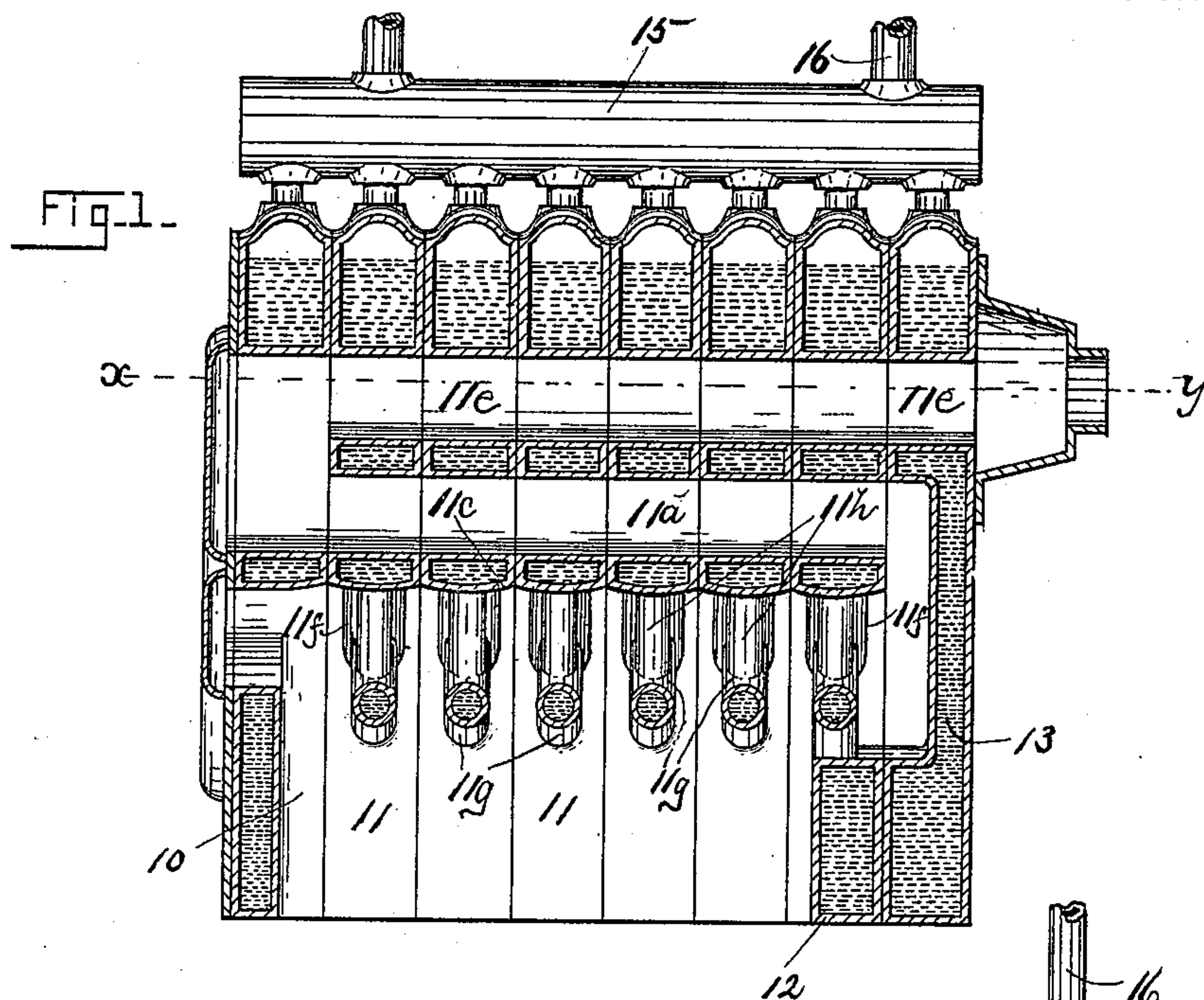
Patented Feb. 14, 1899.

W. C. HIGGINS.
STEAM GENERATOR AND HOT WATER HEATER.

(Application filed Mar. 28, 1898.)

(No Model.)

3 Sheets—Sheet 1.



WITNESSES

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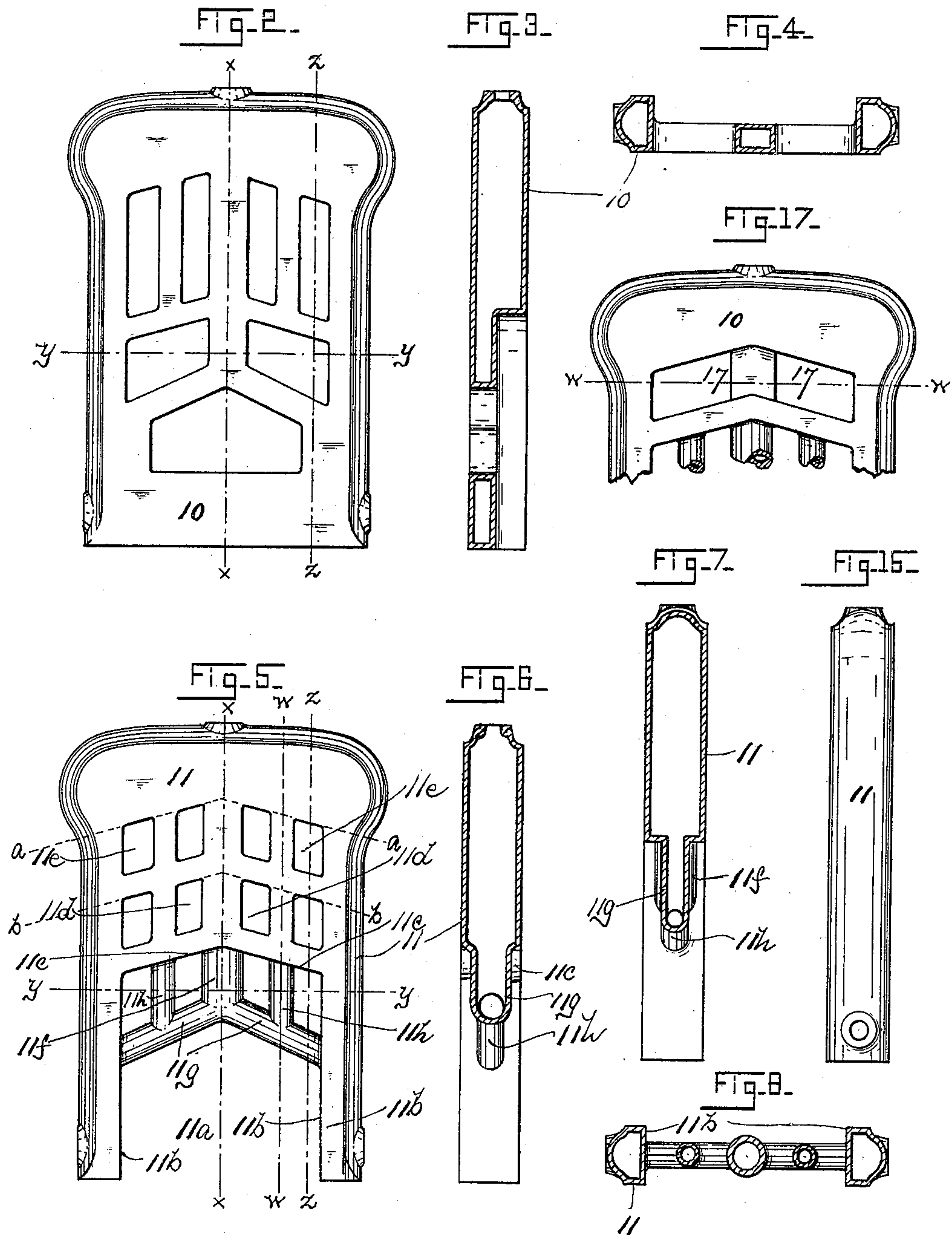
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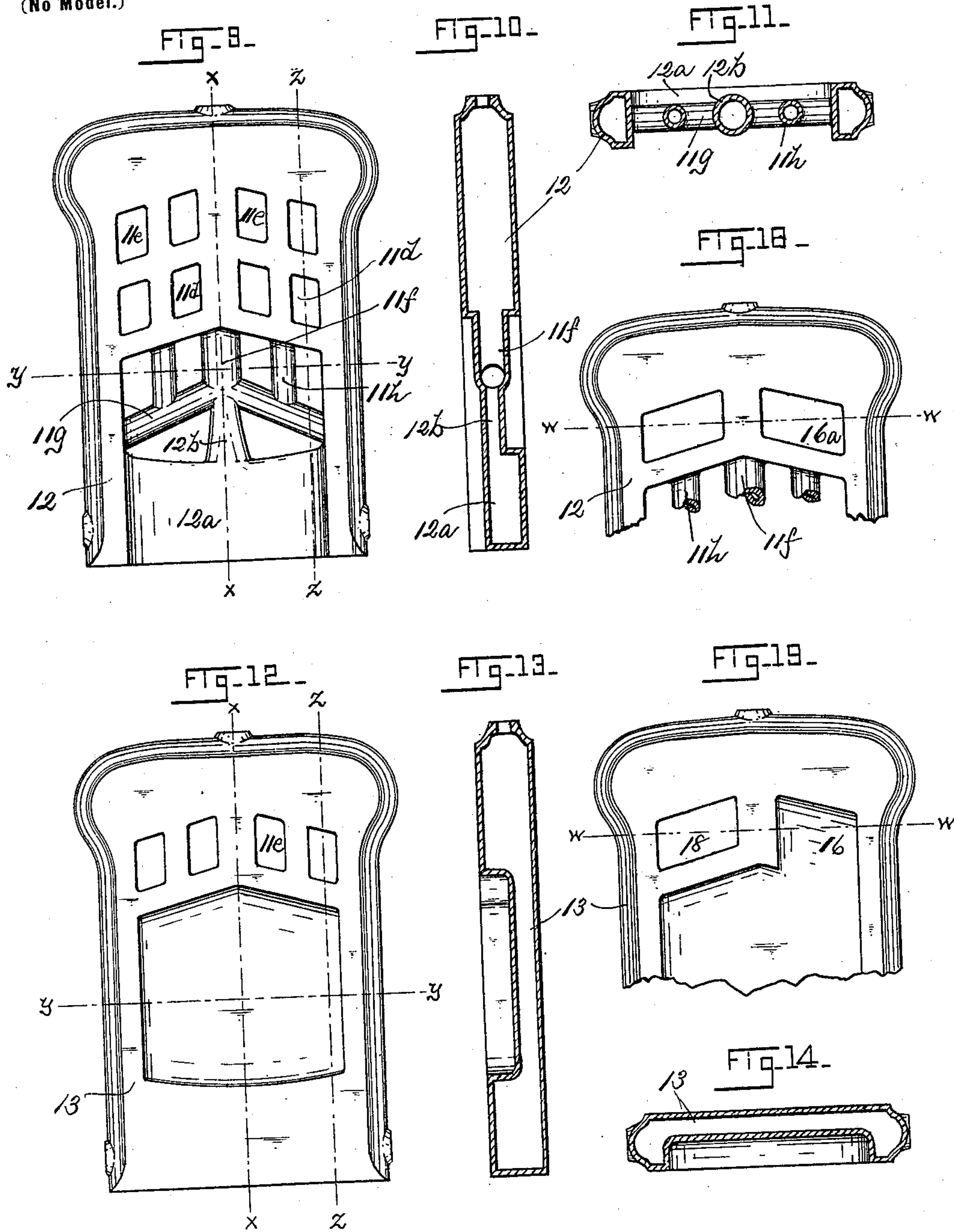
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UNITED STATES PATENT OFFICE.

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STEAM-GENERATOR AND HOT-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 619,412, dated February 14, 1899.

Application filed March 28, 1898. Serial No. 675,467. (No model.)

To all whom it may concern:

Be it known that I, WERTER C. HIGGINS, a citizen of the United States, residing at Norwich, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Steam-Generators and Hot-Water Heaters, which improvements are fully described in the following specification, reference being had to the accompanying sheets of drawings, in which—

Figure 1 is a longitudinal vertical sectional view of the several sections of a steam-generator embodying my present improvements, showing also the steam-dome mounted thereon. This view is taken on lines *z z* of Figs. 2, 5, 9, and 12 and is provided principally to illustrate the draft-flues. Fig. 2 is an elevation of the front section, Fig. 5 an elevation of one of the intermediate sections, Fig. 9 the bridge-wall section, and Fig. 12 a similar view of the rear section, of the generator of Fig. 1. Figs. 3 and 4 are cross-sectional views of Fig. 1 on lines *x* and *y*, respectively. Figs. 6, 7, and 8 are cross-sectional views of Fig. 5 on lines *x*, *w*, and *y*, respectively; and Fig. 15 is a side elevation of said Fig. 5. Figs. 10 and 11 are cross-sectional views of Fig. 9 on lines *x z*, respectively. Figs. 13 and 14 are cross-sectional views of Fig. 12, taken on lines *x z*, respectively. Fig. 16 is a rear elevation of the rear section of the generator of Fig. 1. In Figs. 17, 18, 19, and 20 I have illustrated a certain modification of my invention by means of which I am able to reduce the height of generators of this class. Of these views, Fig. 17 is an elevation of the upper part of the front section; Fig. 18, an elevation of the upper part of an "intermediate" section; Fig. 19, a similar view of the rear section; and Fig. 20 is a horizontal sectional view of a generator, taken at the plane indicated by lines *w w* of Figs. 17, 18, and 19.

This invention has for its particular object the improvement of the water-sections of steam-generators and hot-water heaters to the end that a more perfect and free circulation of water may be attained, and my said improvements are specially valuable when used in connection with generators of the type illustrated and described in United States Patent No. 468,423, which was issued to me Febru-

ary 9, 1892, although they may be used with advantage with other forms of so-called "sectional" heaters. It is very desirable, in fact necessary, in generators of this class that the water shall be so presented to the fire that the greatest possible influence of the caloric in the combustion-chamber may be quickly felt by said water, and also that the water when thus heated may find a ready and free exit upward and an unobstructed discharge into the boiler proper. Having served its purpose in said boiler, the water (somewhat reduced in temperature) passes downward at the sides of the sections into the space inclosing the fire-pot, where it is again influenced and its temperature raised by the intense heat from the combustion-chamber and again seeks to rise to the boiler proper. A constant circulation of the water is thus provided.

In the drawings annexed hereto the reference-figure 10 indicates the front section of a generator of my preferred construction. The reference-figures 11 indicate the intermediate sections, 12 the bridge-wall section, and 13 the rear section. These several sections are placed face to face and are joined in the manner described in my said earlier patent, No. 468,423, or in any other practical manner. Said sections are joined at their lower sides by a manifold connection 14, as shown in Fig. 20, and are also connected at their top portion by a steam-dome 15, from which steam is delivered through one or more pipes 16.

I will first describe in detail one of the intermediate sections 11, as they illustrate most forcibly one of the chief features of this present invention—to wit, the improved form of water-circulation whereby the heated waters are enabled to pass upward into the boiler proper without hindrance. Each intermediate section is open at its lower portion, as at 11^a, thus providing a fire-pot and combustion-chamber whose side walls 11^b extend downward and form "water-legs," by means of which the freely-circulating water may be brought under the influence of the fire in the said combustion-chamber. The upper wall 11^c of the chamber thus provided is inclined upward and toward the center of section 11, as best seen in Fig. 5, and that portion of said section above the combustion-chamber

is formed with draft-flue openings 11^d 11^e , arranged in two pairs at each side of the vertical center of section 11, one of said pairs 11^e being immediately above the other pair, as shown, and it should be noted that the walls defining these flue-openings incline upward toward the center of said section precisely as in the case of the wall 11^c over the combustion-chamber, which I have already referred to. By reference to Figs. 1, 6, and 7 it will be understood that water-space is provided around all of the described flues and that this water-space is connected with the hollow sides of the section, so that water in the sides may pass upward through said water-space whenever it becomes sufficiently heated to set it in circulation. When the several sections of the generator are assembled, as in Fig. 1, the flues of the several intermediate sections register, and thus two lower and two upper continuous passages are provided at each side of the center of the generator throughout the intermediate sections. Each of the intermediate sections has extending downward from the angle at the center of the wall 11^c a circular water-chamber 11^f , whose lower end is connected by pipes 11^g with the water-legs 11^b , the pipes 11^g being inclined or pitched toward the center of the generator substantially the same as the upper wall of the combustion-chamber and the water-spaces above and below the flue-openings 11^d 11^e , and directly in vertical alinement with the water-spaces between the pairs of flues at each side of the center of the generator I connect the pipes 11^g with vertical pipes 11^h . It should be particularly noted that the waterways provided for the upward flow of the heated water and for the downward flow of the slightly cooler water are positively vertical and that the connections or conduits between the extreme sides of the section and the several vertical ways are so inclined upward that the heated water will pass naturally from the sides toward the center of the generator and thence directly upward through the said vertical ways into the upper or boiler portion of the section.

Heretofore, so far as I am familiar with this class of generators, the generator-sections have not been formed with vertical ways that are continuous from the top of the combustion-chamber to the top or boiler portion of the sections; but such ways have been more or less indirect. Neither have all the lateral ways connecting the said vertical ways with the sides of the sections been inclined upward; but they, or some of them have been horizontal, and in all such constructions the indirect ways thus provided have resulted in hindering and checking the upward flow of the heated waters, and have thus made it impossible to attain the best results.

In my present improved construction I have provided a simple (because absolutely direct) system of waterways by means of

which the best possible circulation of water can be reached.

The principle embodied in the waterways of the described intermediate sections is also present in the front bridge-wall and rear sections, although the arrangement of the waterways varies somewhat in these several sections.

The bridge-wall section 12 is in the main like the intermediate section already described; but a hollow bridge-wall 12^a is provided that connects the opposing side walls of the combustion-chamber, and the central upper part of said bridge-wall is also connected with the water-column 11^f by a similar column 12^b , thus providing an unobstructed central vertical waterway leading from the hollow bridge-wall directly to the upper part or boiler-section of the generator-section 12.

It is frequently necessary to set up generators of this class in basements and the like low contracted places, and for use in such instances I may provide a slightly-modified form of my invention, as seen in Figs. 17, 18, 19, and 20, in which the generator-sections are much lower than those thus far described, although these modified sections embody all the newly-improved features of the sections first above described. In thus shortening the generator I have simply done away with that portion of the sections between the lines a b of Fig. 5—that is to say, I have cut out the upper flue-space 11^e and also the walls between the upper and lower flues and have then provided a novel arrangement of flues by means of which an equally efficient indirect draft is attained and by means of which the caloric products of combustion are brought into equally close relation to the various water chambers and passages of the boiler. In this modified form of generator the draft-flues are in the same horizontal plane instead of being arranged one above the other, as already described, the products of combustion being caused to pass upward from the rear of the combustion-chamber through an opening 16, provided in one-half only of the rear section 13, into a passage or flue 16^a , that extends to the front of the generator, and said products pass thence laterally through an opening 17 in the front section into a passage or flue 18, which extends through the several sections to the rear of the generator, whence said products are discharged into a suitable smoke pipe or stack.

It will now be understood that an indirect-draft flue is provided in a horizontal plane, the two parallel members or parts of which are separated by the hollow vertical portion, excepting at the front of the generator, where connection is made between said members by wholly or partly cutting away said vertical wall in the front section of the generator, the course of the smoke and other waste products being clearly indicated by the arrows in Fig. 20 of the drawings. In this shortened form of generator the unobstructed vertical water-

passages, which form a very important feature of my invention, are present, as in the preferred form of generator first described by me, and the vertical pipes 11^h, that connect the inclined pipes 11^g with the said vertical passages, are also provided.

In a generator of my newly-improved form the direct vertical water-passages, located, as they are, within or immediately over the fire-pot and combustion-chamber, make it possible to utilize to the fullest extent possible the heat from the fire and also permit the heated water to pass freely upward into the boiler or enlarged space in the upper part of each section and thence downward at the sides of the said sections as it (the water) becomes slightly lowered in temperature, the novel arrangement of parts being such as to induce and maintain a continuous and unobstructed circulation in given directions.

Having thus described my invention, I claim—

1. In combination in a section for generators of this class, an enlarged upper water-chamber, hollow side walls extending downward therefrom, horizontal passages connecting said hollow side walls, and direct vertical passages connecting the lowest horizontal passage with the said upper water-chamber and intersecting the other horizontal passages, substantially as specified.

2. A water-section for generators of the class referred to, consisting of hollow vertical side walls extending downward to form the walls of the combustion-chamber, inclined pipes located in, and leading to the center of, said combustion-chamber, and thence directly upward to the top of said section, and pipes 11^h connecting said inclined pipes with vertical passages located at each side of the said central passages.

3. The combination, in a generator of this class, of front and rear sections and a multiple of intermediate sections, each of said sections being formed with a water-chamber at

the top, hollow side walls extending downward therefrom at each side of the combustion-chamber, a horizontal water-passage connecting the said side walls immediately over the combustion-chamber, and vertical passages connecting said horizontal passage with the water-chamber at the top, substantially as specified.

4. In a generator of this class, front and rear sections and a multiple of intermediate sections, parallel flue-passages located in the same horizontal plane, a connecting-passage between said flues at the front of the generator, an exit from one of said flues at the rear, and an opening from the combustion-chamber into the rear portion of the other of said passages, substantially as specified.

5. A water-section for generators of the class referred to, provided with horizontal flue-openings which are arranged one above the other; water-passages between the flue-openings and extending from the bottom to the top of the boiler, the vertical pipes 11^f, 11^h, and the inclined pipes 11^g, connected at their outer ends to the water-legs; the three vertical pipes being in a line with the water-channels between the flue-openings, substantially as shown.

6. In a steam-generator, a section provided with flue-openings at its top arranged one over the other so as to form vertical water-passages between said flue-openings, the vertical pipes 11^f, 11^h, the inclined pipes 11^g, the vertical pipe 12^b, and the bridge-wall 12^a, suitable flue-spaces being made between the pipes, and the vertical pipes being placed in a direct vertical line with the water-channels formed between the flue-openings so that the heated water can rise from the bottom to the top of the boiler, substantially as set forth.

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Witnesses:

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