

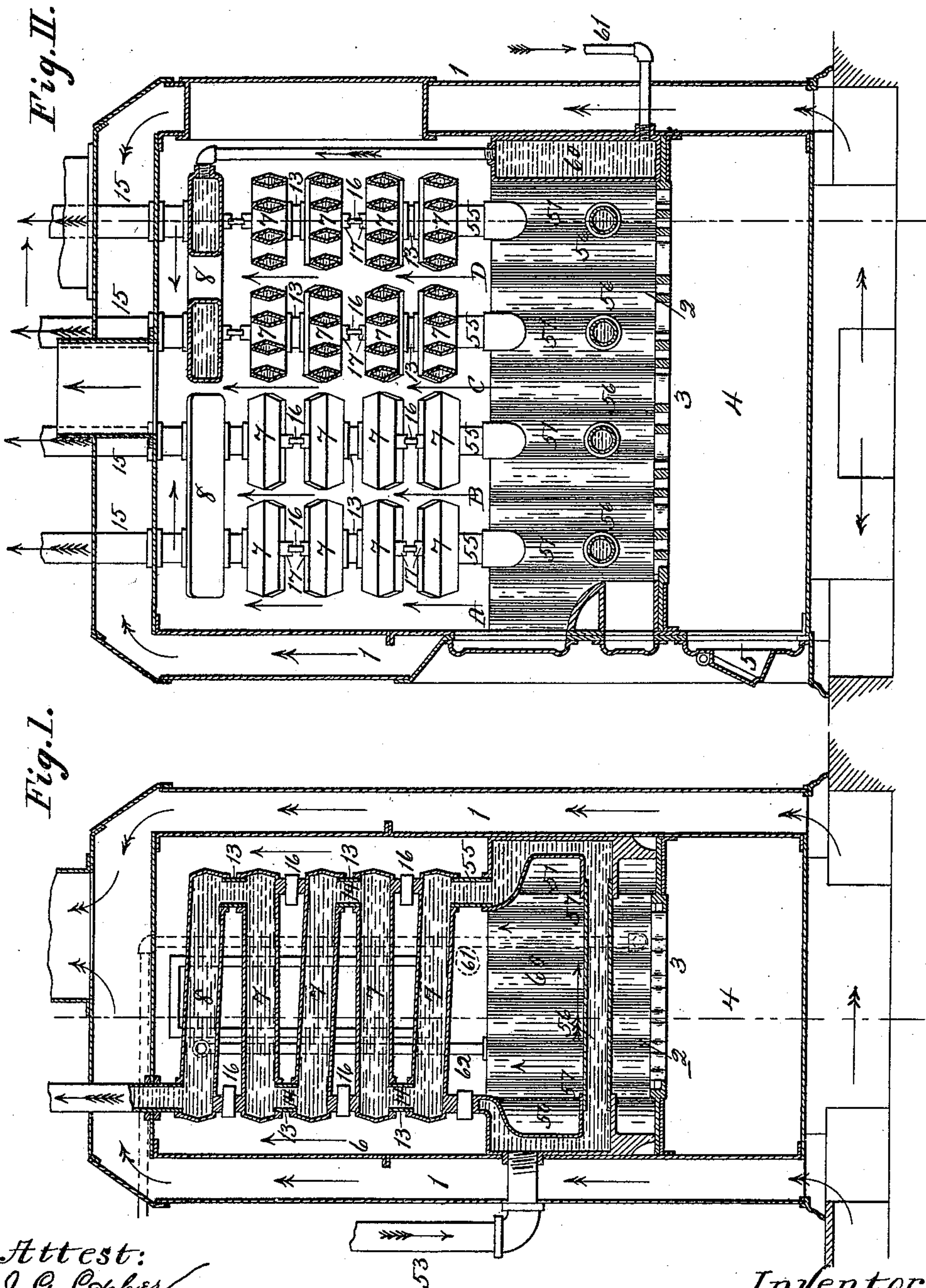
(No Model.)

2 Sheets—Sheet 1.

L. L. CULVER.  
WATER HEATER.

No. 438,531.

Patented Oct. 14, 1890.



Attest:  
J. G. Leppa  
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Inventor:  
Lucius L. Culver.  
By Knight & Pott's.

(No Model.)

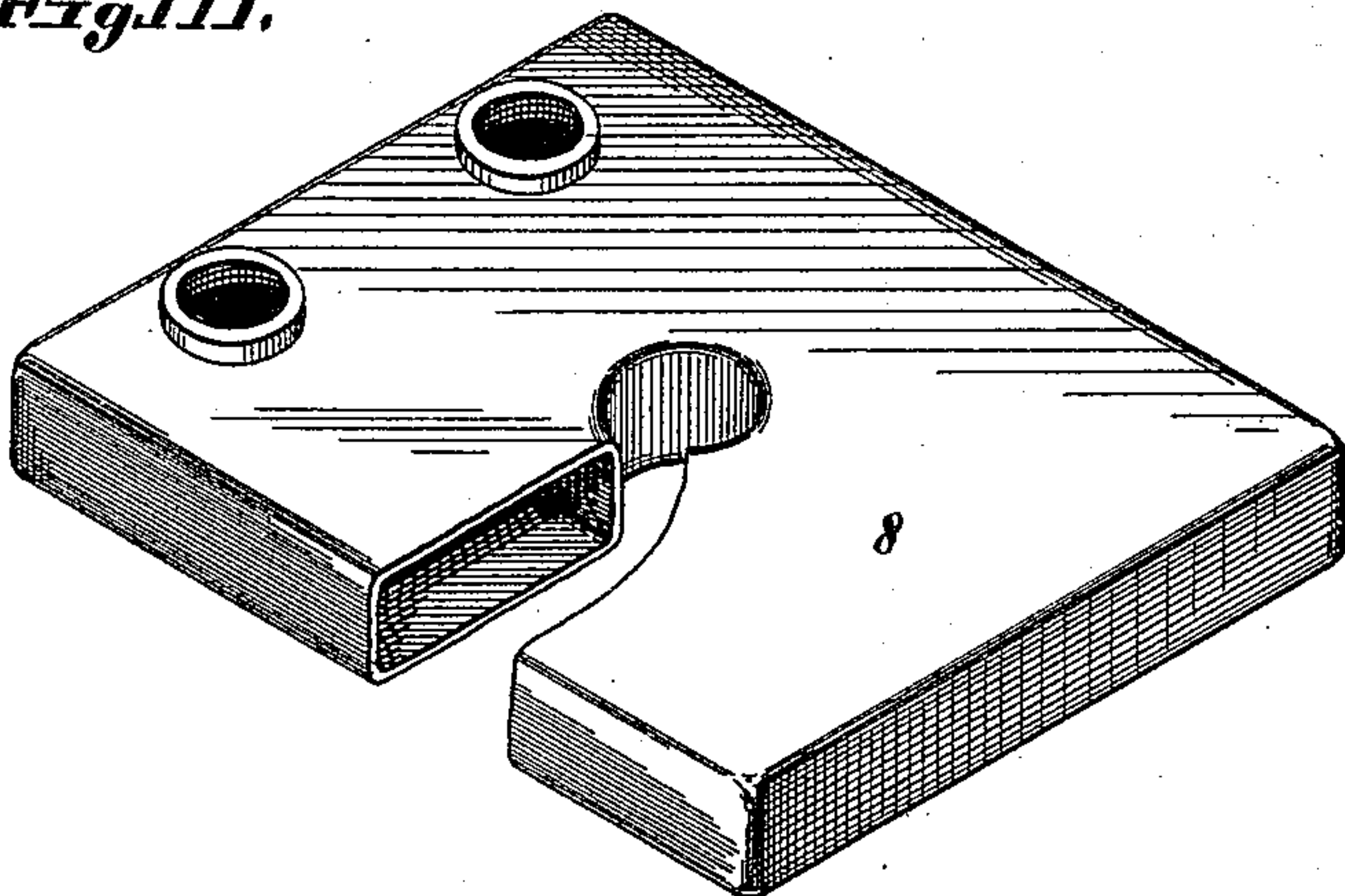
2 Sheets—Sheet 2.

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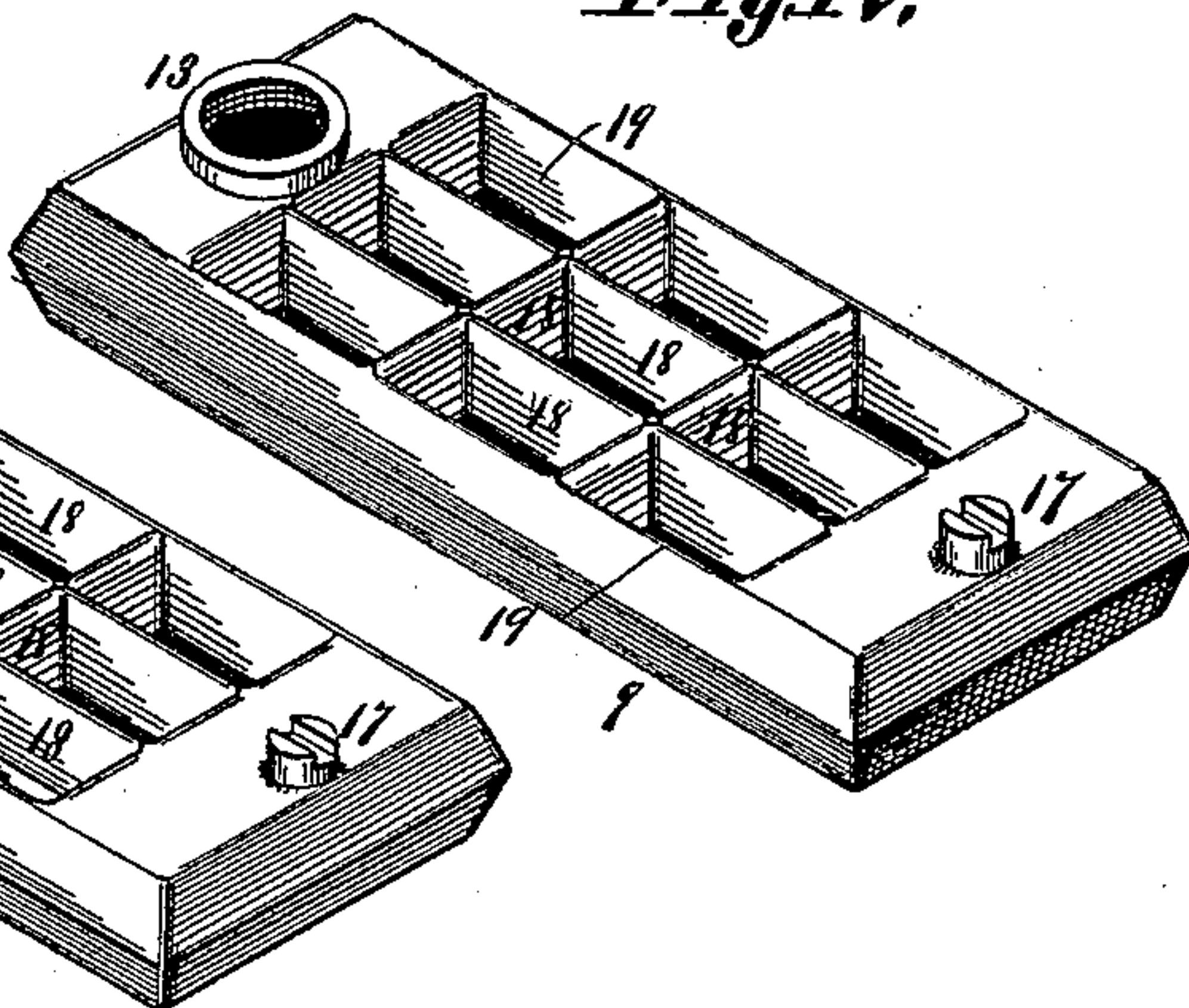
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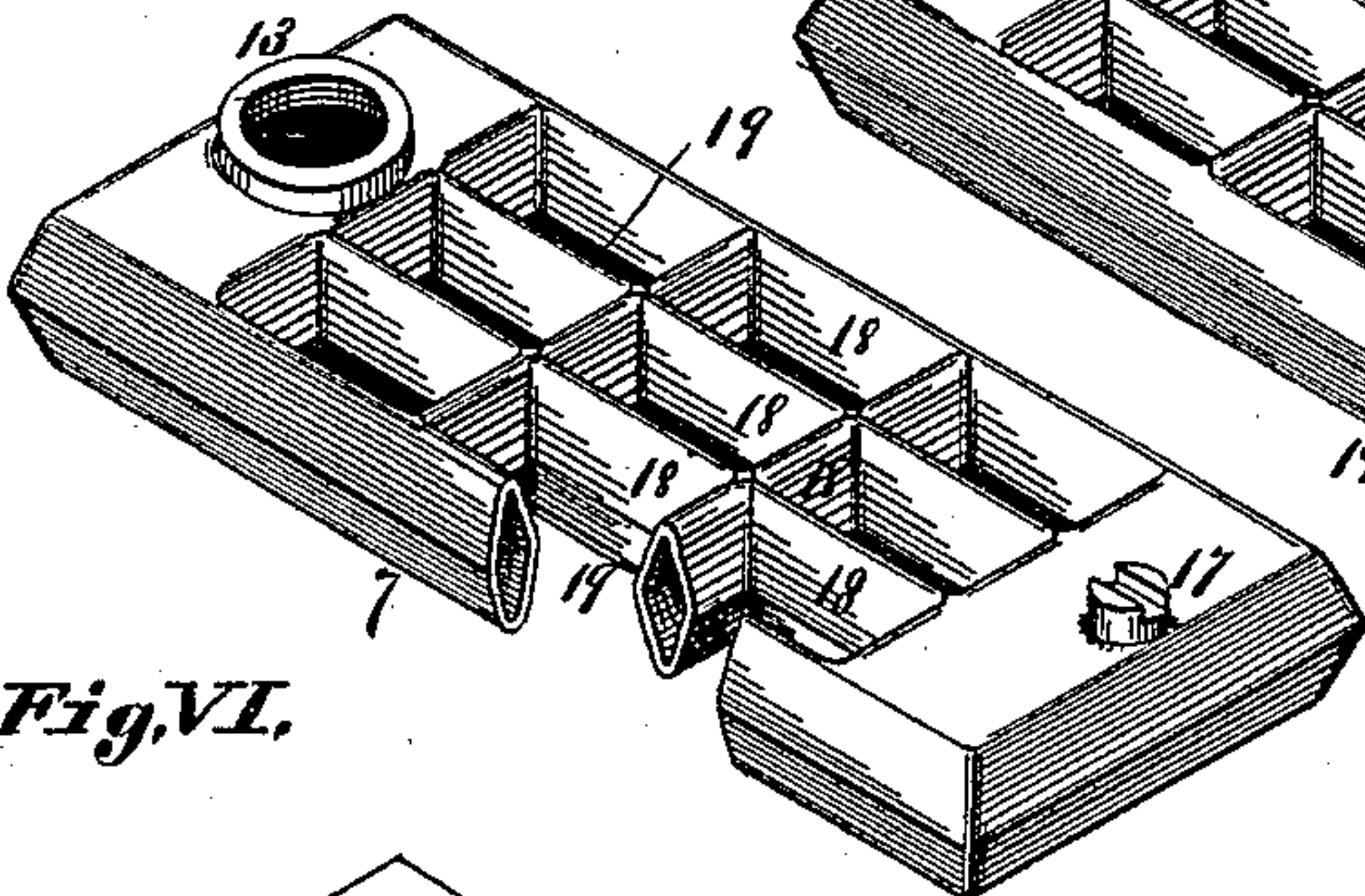
*Fig. III.*



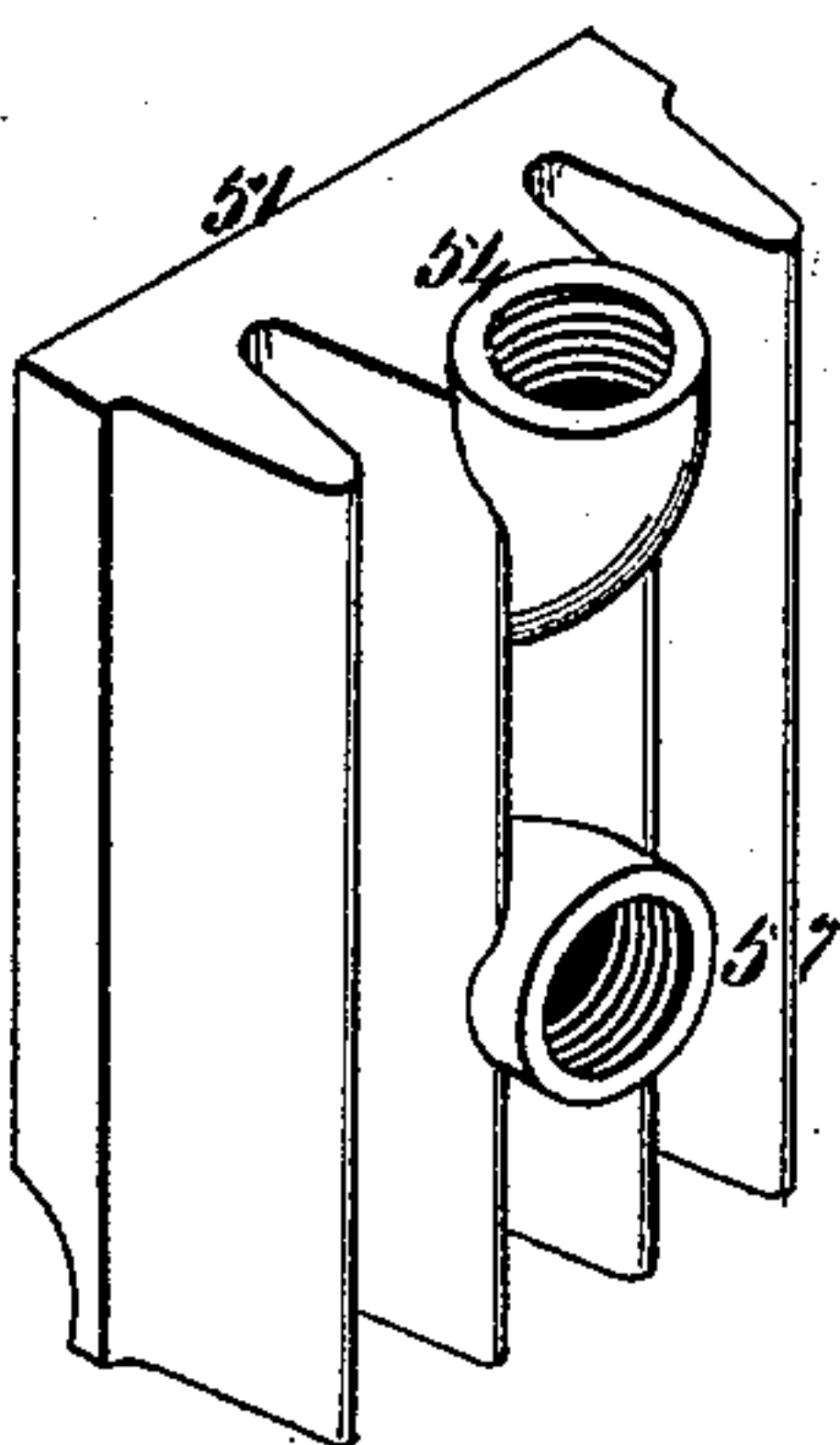
*Fig. IV.*



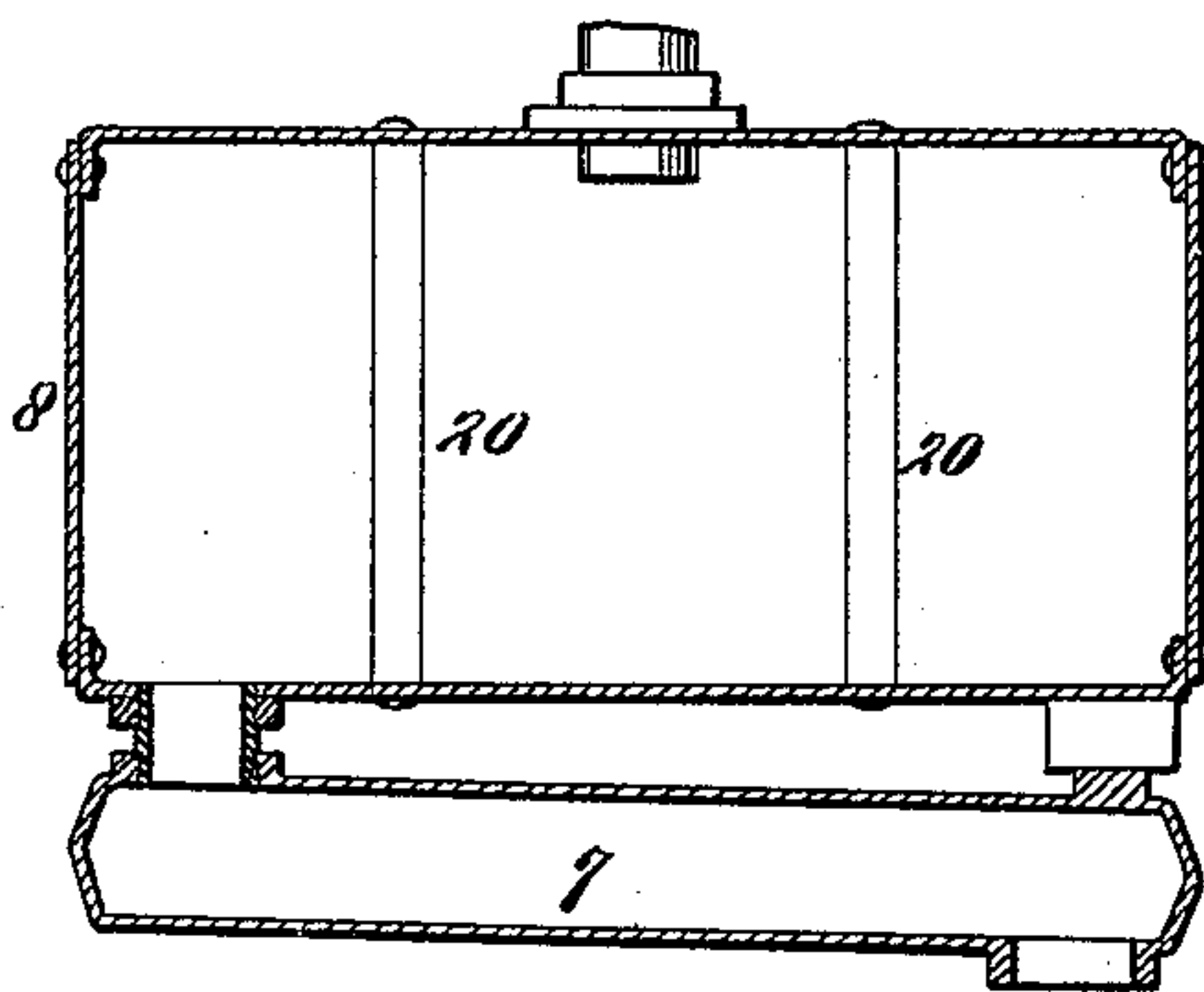
*Fig. V.*



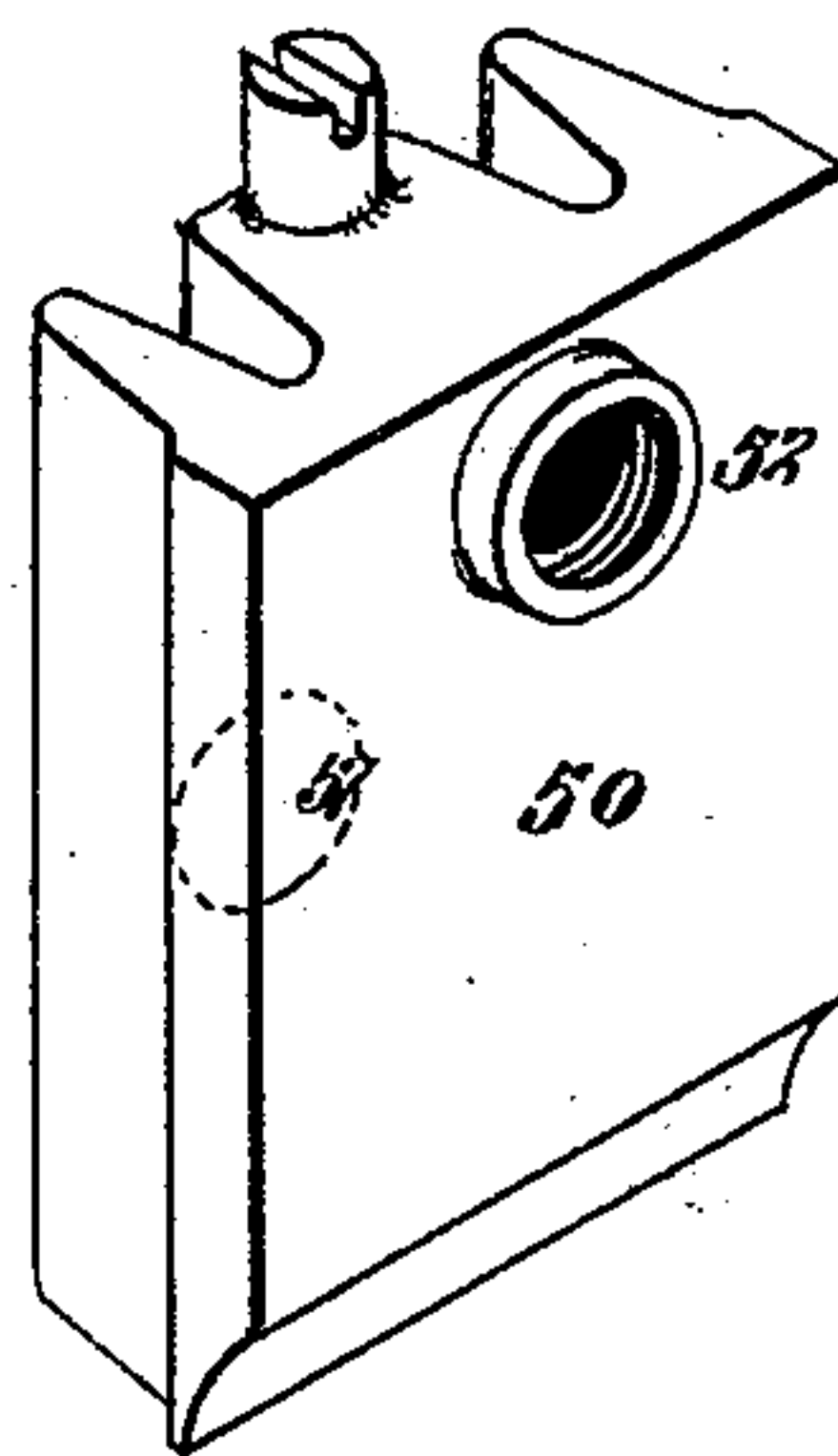
*Fig. VI.*



*Fig. VIII.*



*Fig. VII.*



Attest;  
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# UNITED STATES PATENT OFFICE.

LUCIUS L. CULVER, OF ST. LOUIS, MISSOURI.

## WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 438,531, dated October 14, 1890.

Application filed November 16, 1889. Serial No. 330,633. (No model.)

*To all whom it may concern:*

Be it known that I, LUCIUS L. CULVER, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Water-Heaters, &c., of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to an improved device for heating water, and which may also be used for generating steam, the object in view being to obtain the greatest possible amount of heating-surface and thus utilize heat to the best advantage; and my invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Figure I is a vertical transverse section of my improved heater, the section being taken on line I I, Fig. II. Fig. II is a vertical longitudinal section taken on line II II, Fig. I. Fig. III is a perspective view of the upper water-box. Fig. IV is a bottom perspective view of one of the water-sections. Fig. V is a top perspective view of one of the water-sections. Fig. VI is an inside perspective view of one of the discharge-sections of the fire-box lining. Fig. VII is an outside perspective view of one of the receiving-sections of the fire-box lining. Fig. VIII represents the upper box and one of the intermediate sections in the form in which they would be used where the device is employed for generating steam.

Referring to the drawings, 1 represents the walls of the furnace, 2 the fire-box, 3 the grate, 4 the ash-pit, and 5 the doors of the fire-box and ash-pit. The fire-box is lined with sections 50 51, (preferably corrugated, as shown in Figs. II, VI, and VII,) which form water-chambers. The width of these sections is, preferably, from A to B, from B to C, and from C to D, (see Fig. II,) and so on around the furnace. On one side of the furnace the sections 50 are provided with perforations 52 (see Fig. VII) to receive water-supply pipes 53, (see Fig. I,) and on the other side of the furnace the sections 51 are provided with perforations 54 to receive pipes 55, through which the water is discharged from the sections 51

into water-sections above. The water passes from the sections 50 to the sections 51 through pipes 56, which traverse the fire-box and which connect with the sections at 57. At the back of the fire-box is a section 60, provided with a supply-pipe 61, that may connect with the pipe 53, and this section is connected by a pipe 62 to the top box, hereinafter referred to.

Above the fire-box is a chamber 6, through which the heat and products of combustion pass from the fire-box to the chimney or uptake. Within this chamber are located water-sections 7 and an upper water-box 8. These sections are preferably arranged in vertical series, as shown in Fig. II, and are supported by the fire-box lining beneath them. There may be any desired number of sections in each series, and there may be any desired number of series. I have shown four series of four sections each. (See Fig. II.) The form of the sections is shown in Figs. IV and V. The lower section of each series is joined at one end to the section of the fire-box lining beneath it by means of one of the pipes 55, and the different pipes 55 thus join the sections of the fire-box lining to the sections 7 above. Each section 7 is connected at one end with the section 7 above it by means of a short pipe or coupling 13, (see Fig. I,) and the other end of each section 7 is connected to the section 7 above it by a similar connection 13, and so on, and the sections are connected at their alternate ends to the sections above them until the top box 8 is reached, and here a like connection is made between the two upper sections 7 of each two series with the box 8. To the opposite end of box 8, with which the sections 7 have communication, the hot-water pipes 15 are connected.

The water when it is heated passes through the sections 50, 51, and 7 into the boxes 8, where the water from the different sections commingles and passes through the pipes 15 at a uniform temperature—that is, if the water passing into the commingling-boxes 8 from one series of sections 7 is warmer than the water passing into the commingling-box from another series the two bodies of water are brought to an even temperature by commingling in the boxes 8 before passing to the pipes



15, which convey the water through the building to be heated.

The boxes 8 and sections 7 are supported at the ends not having the couplings 13 by means of keys 16, fitting in slotted projections or bosses 17 on the sections. (See Figs. IV and V.) The upper commingling-boxes 8 are made quite flat, as shown in Fig. III, so that these boxes present a large amount of heating-surface, and the sections 7 are also made quite flat and consist of a series of tubes 18, communicating together, and between which there are spaces 19, through which the heat and products of combustion pass on their way from the fire-box to the chimney or uptake. These tubes 18 are flat and preferably of diamond shape in transverse section, so that each section has a very large amount of heating-surface, and the heat in passing through the sections comes against the inclined lower surfaces of the tubes and is deflected in its upward passage, and thus the heat is utilized to the best possible advantage, and the upper edge of each tube coming to a point or fine edge avoids the possibility of ashes settling and remaining on the tubes, thus permitting the heat to come in contact with the metal of which the tubes are formed. By the use of this honey-comb arrangement of the sections and the shape of the tubes in transverse section a very large amount of heating-surface is presented, and the water contained in the sections is readily heated and by the use of the smallest amount of fuel. Each section has a portion at each end extending from side to side of the section, so that the water coming from the sections beneath and passing to the sections above may enter and escape freely from all of the different tubes 18.

When the device is used for generating steam, it is constructed substantially the same as I have described, except the top boxes 8 are made deeper than where water is simply to be heated, and may be provided with suitable stay or strengthening bolts 20. (See Fig. VI.)

By corrugating the inner walls of the lining of the fire-box a small water-surface and a large heating-surface are produced.

I claim as my invention—

1. In a water-heater, the combination of the superposed water-sections having the slotted lugs 17 and the keys 16, fitting in said slots, substantially as and for the purpose set forth.
2. In a water-heater, the combination of independent water-sections arranged around

and forming the wall of the fire-box, the diametric sections being connected together in pairs, independent series of water-sections connected with said pairs of fire-box sections, respectively, and commingling-boxes connecting a number of said series of sections together, substantially as and for the purpose set forth.

3. In a water-heater, the combination of the lower sections, a supply-pipe communicating with the lower section, a top box, and two or more intermediate and independent series of flat sections connected with said top box and each having a number of flat tubes, substantially as and for the purpose set forth.

4. In a water-heater, the combination of the independent lower sections, supply-pipes communicating with the lower sections, top commingling-boxes, and intermediate sections, each consisting of flat diamond-shaped tubes arranged with spaces between them, said intermediate heating-sections being superposed and arranged in independent series and communicating with the top boxes, substantially as and for the purpose set forth.

5. In a water-heater, the combination of the lower sections provided with supply-pipes, top boxes with which the hot-water pipes communicate, and intermediate sections consisting of a number of flat tubes arranged with spaces between them, slotted lugs on said sections, and keys fitting in said lugs, substantially as set forth.

6. In a water-heater, the combination of independent water-sections forming the lining of the fire-box, pipes connecting the diametrically-opposite sections together, and water-sections arranged in independent series over and communicating with each pair of the fire-box sections, substantially as and for the purpose set forth.

7. In a water-heater, the combination of independent water-sections forming the lining of the fire-box, pipes connecting the opposite sections together, water-sections arranged in independent series over and communicating with each pair of the fire-box sections, the top commingling-boxes connecting said series together, and pipes connecting the fire-box sections and the top commingling-boxes, all substantially as and for the purpose set forth.

LUCIUS L. CULVER.

In presence of—

GEO. H. KNIGHT,  
THOS. KNIGHT.