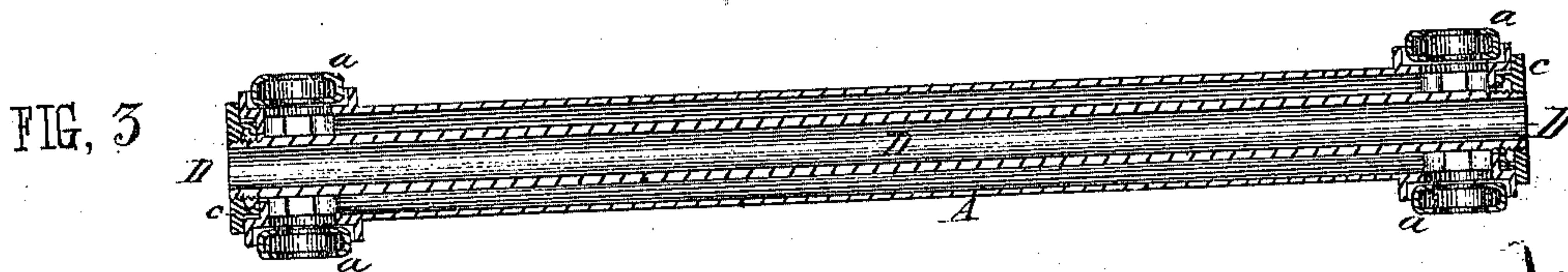
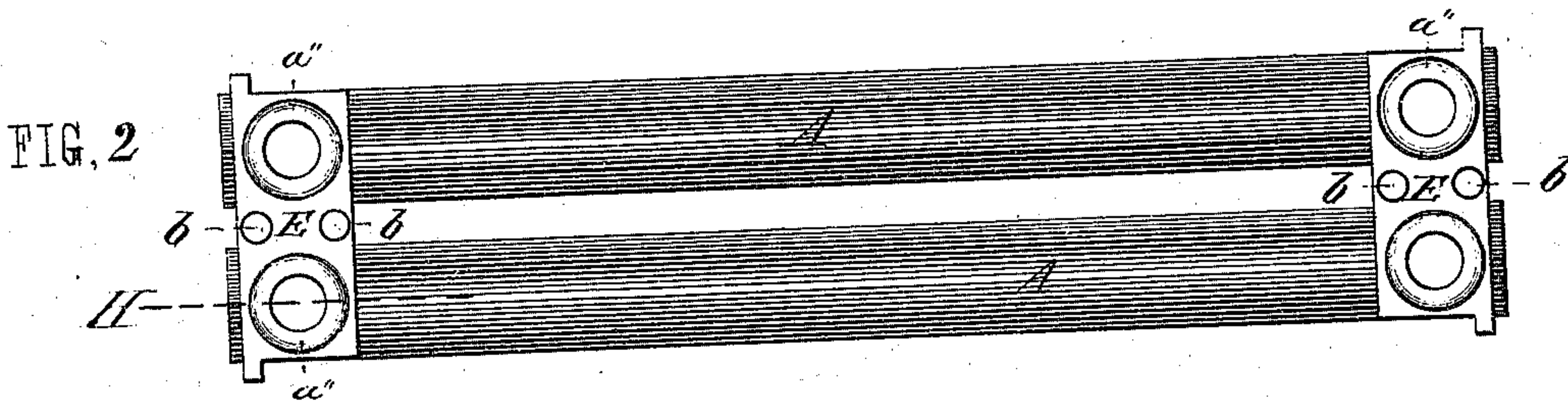
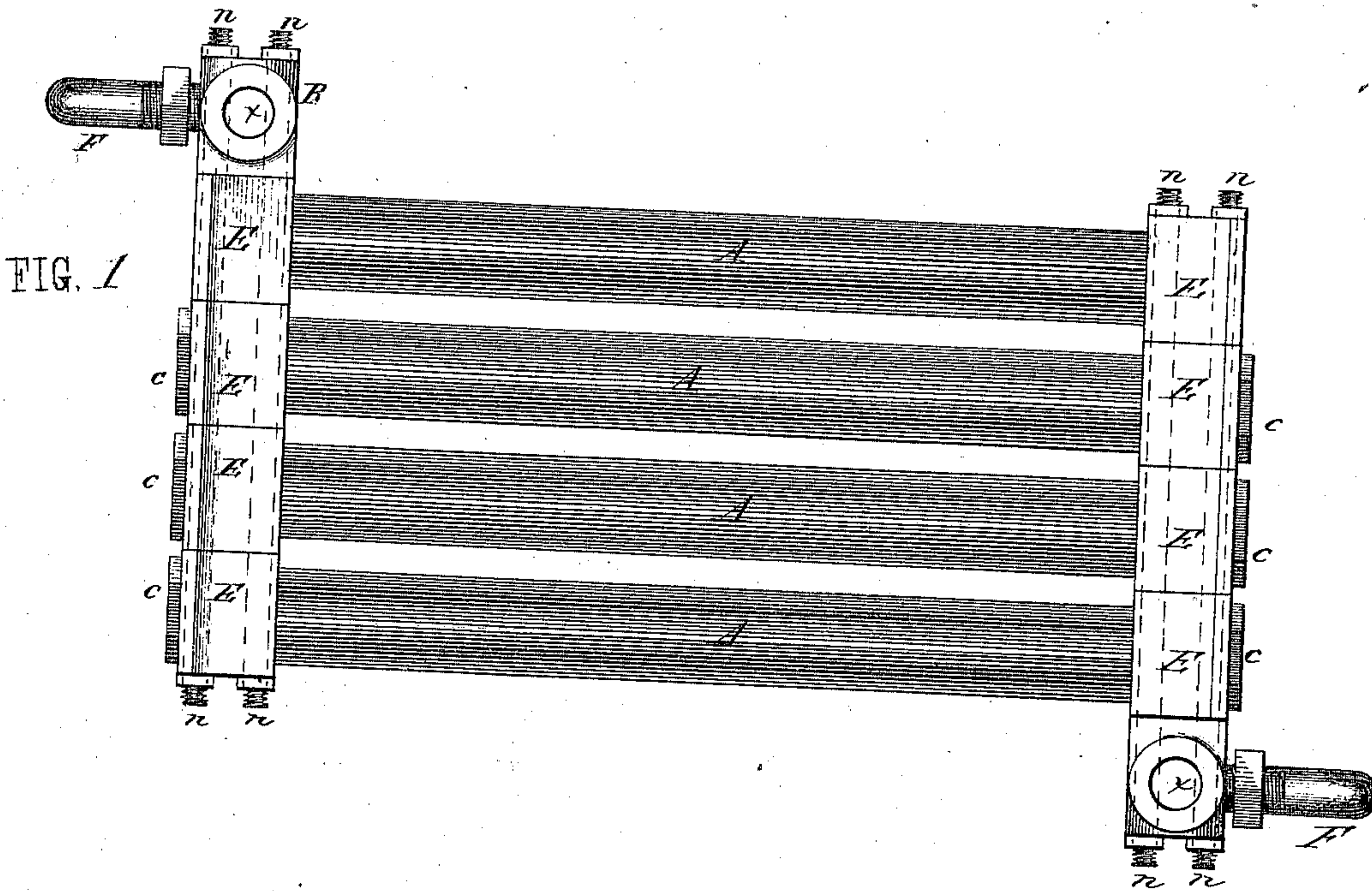


HENRY HOWARD.

Improvement in Steam Generators.

Patented March 26, 1872.

No. 124,898.



Witnesses,
 Clarence T. Buckland.
 Clarence E. Howard

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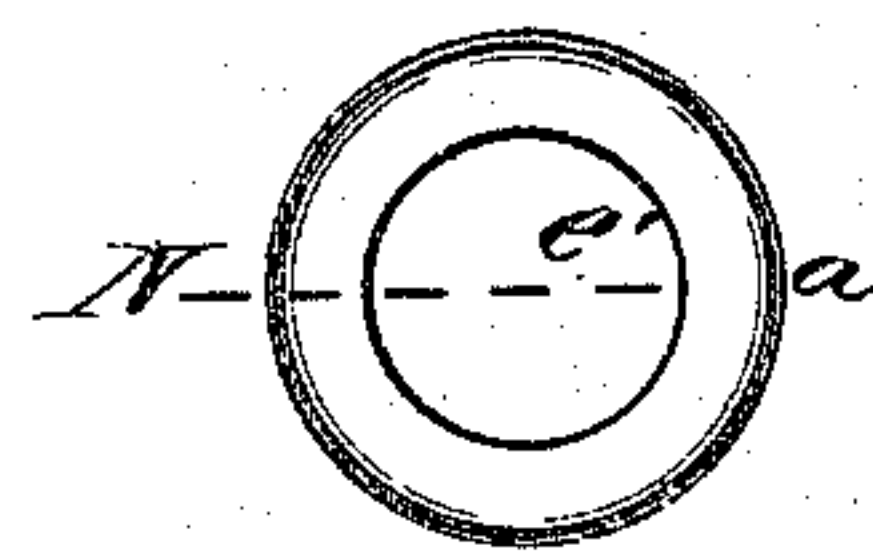
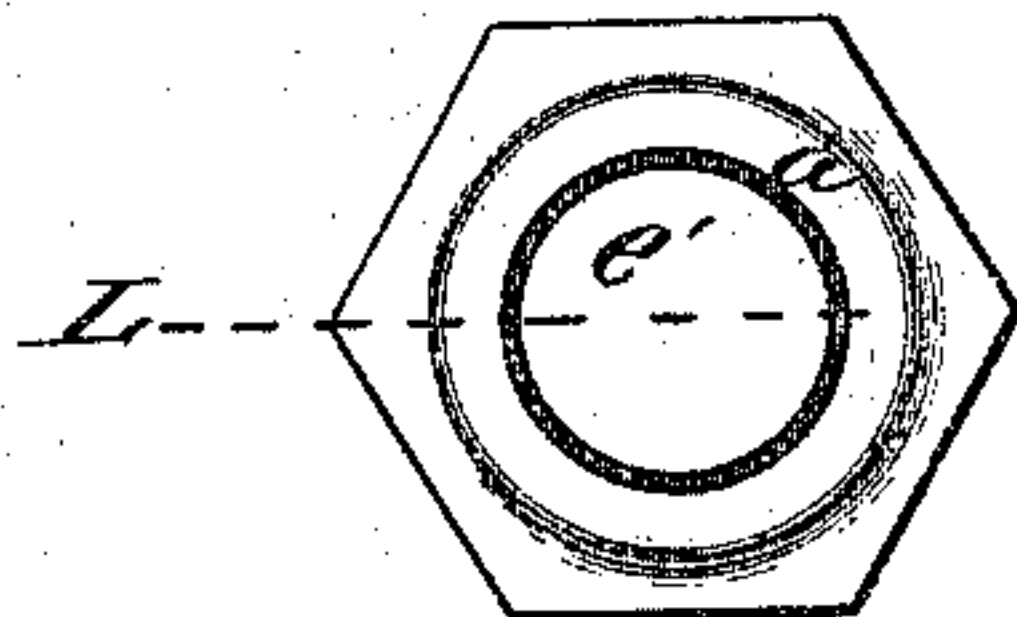
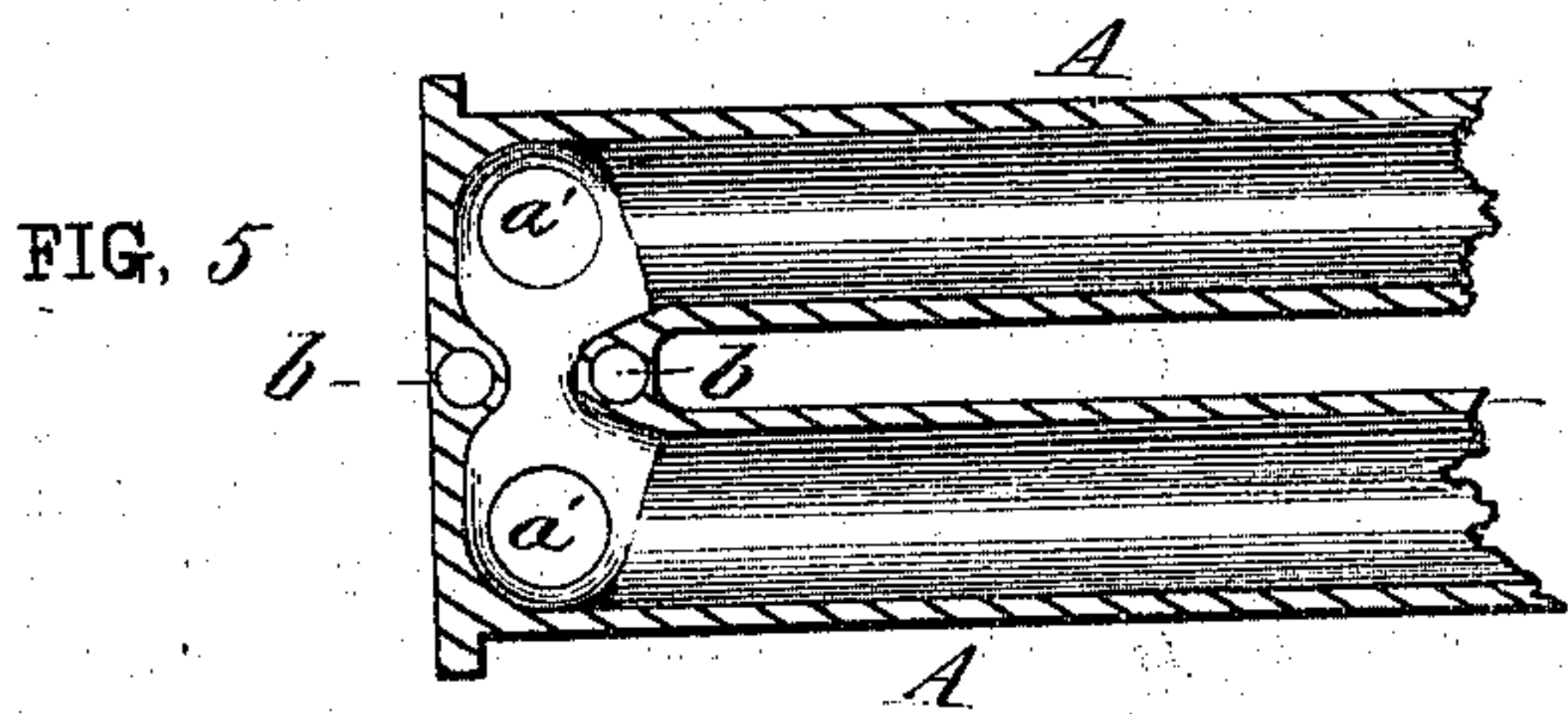
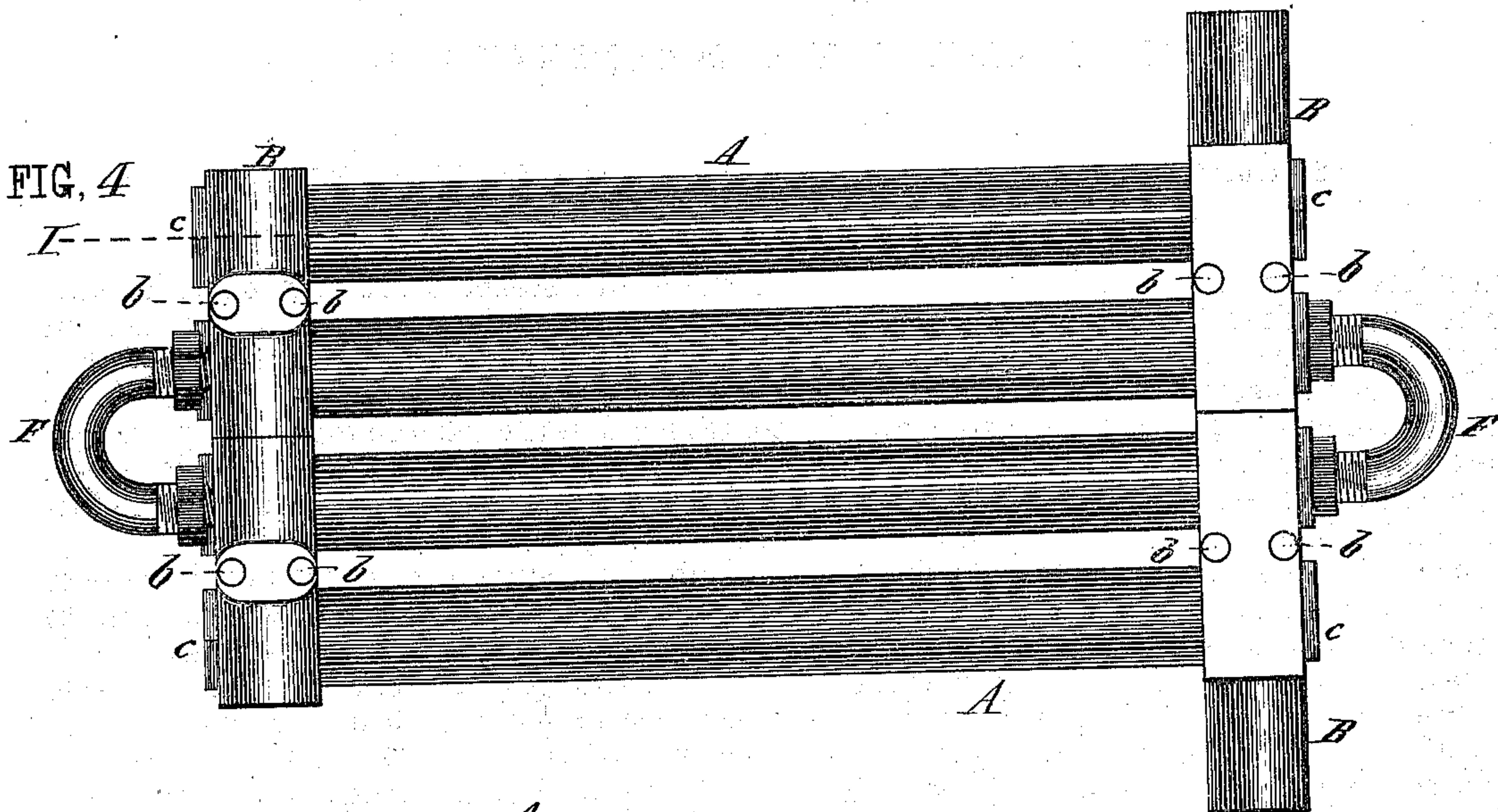


FIG. 6

FIG. 7

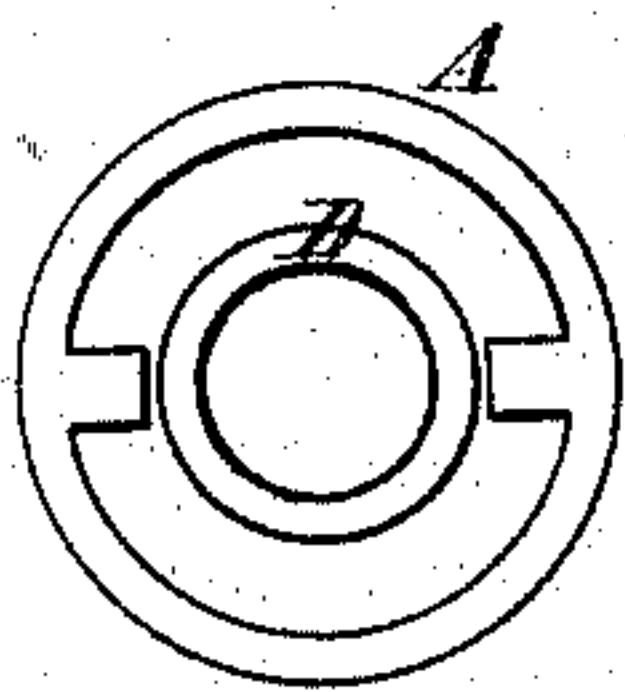


FIG. 8



FIG. 9



FIG. 10

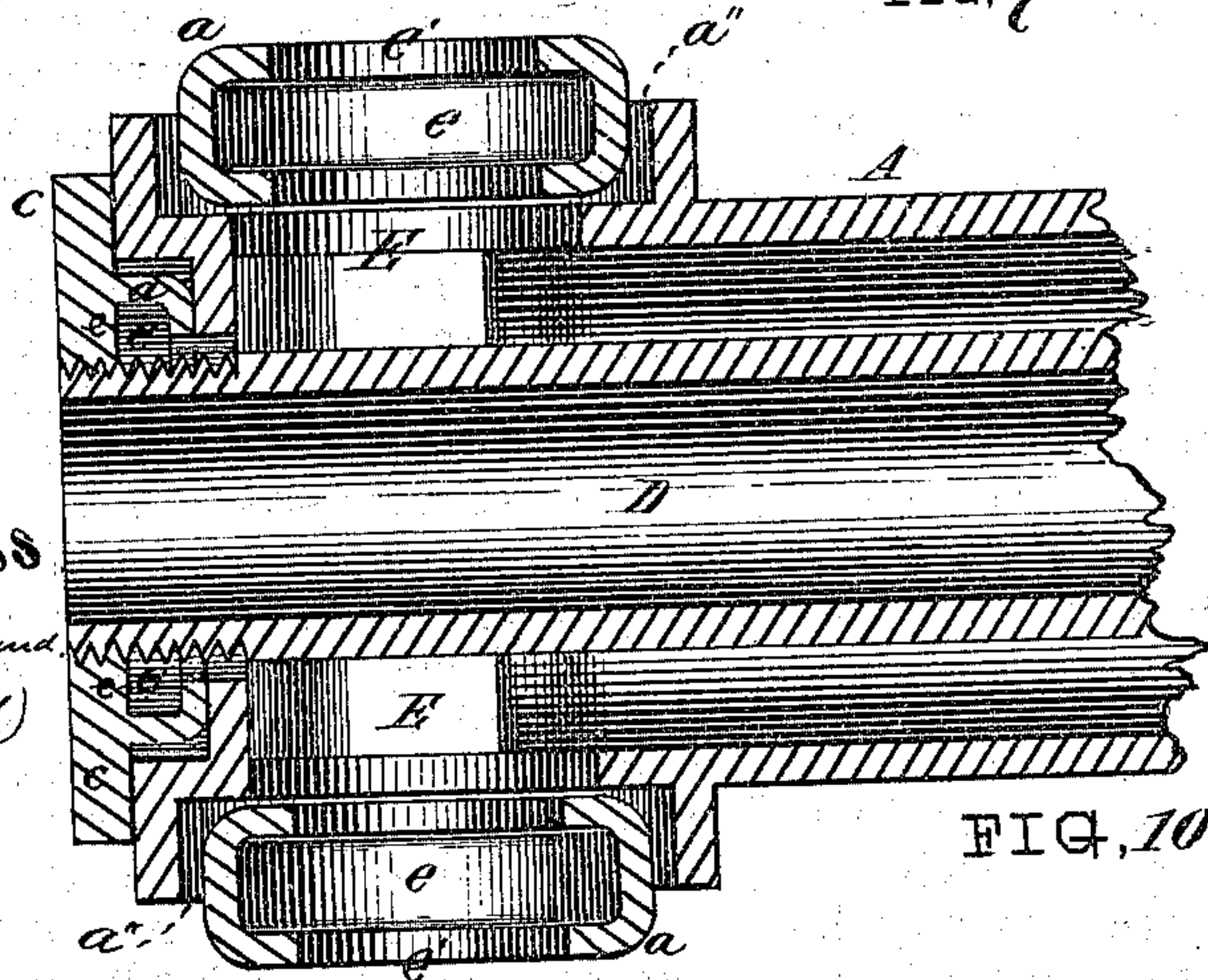


FIG. 11

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UNITED STATES PATENT OFFICE.

HENRY HOWARD, OF SPRINGFIELD, MASSACHUSETTS.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. 124,898, dated March 26, 1872.

To all whom it may concern:

Be it known that I, HENRY HOWARD, of Springfield, in the county of Hampden and State of Massachusetts, have invented a new and useful Improved Steam-Generator; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing making a part of this specification and to the letters of reference marked thereon, in which—

Figure 1 is a side elevation of my invention. Fig. 2 is a plan view of one section of the pipes. Fig. 3 is a vertical section of the same through line H of Fig. 2. Fig. 4 is a plan view, showing two sections and the method of joining the same together, or of making connections between two or more sections when it is desired to increase the power. Fig. 5 is a horizontal longitudinal section through line I of Fig. 4, showing the form of the head of a section of pipe. Fig. 6 is an inside plan view of one of the packing-nuts which secures the inner tube in place. Fig. 7 is a vertical section of the same through line L of Fig. 6. Fig. 8 is a plan view of the packing-ring. Fig. 9 is a section of the same through line N of Fig. 8. Fig. 10 is a vertical section through line H, in enlarged size, to show details of construction; and Fig. 11 is a vertical transverse section of one of the pipes, showing the application of a horizontal diaphragm to the inside of the large pipe.

My invention relates to a device for generating steam; and consists of a series of pipes cast together, preferably in sections of two each, and then secured together, one above another, with packing-rings between at the points of connection to make the joints secure and tight between every two sections; and each pipe has an inner pipe extending lengthwise through the same, and is made tight at the ends by a packing-nut having the same arrangement of packing-ring upon the inner face thereof, through one end of which the inner pipe passes, with a small space between said pipe and the inner opening of the packing-ring. These pipes, being cast in sections of two pipes each, are placed one section upon the other to any desired height, and they may also be placed side by side. When built up in this manner, and to make a proper connection between them when placed side by side for the circulation

of water and steam, a common bend is used, one end of which is connected to the head in one pile or section, and the other end to the head in the next pile or section; and the horizontal sections are secured together by vertical rods extending down through the sections, and nuts screwed upon the ends firmly to a bearing.

That others skilled in the art may be able to make and use my invention, I will proceed to describe its construction and operation.

In the drawing, A represents the outside pipes, cast in pairs, each pair being joined at each end by the head E. A hole is made in each head, said hole being located centrally opposite the end of each pipe A, with an annular recess around said hole in the outer face of the head for the reception of a packing, as hereinafter explained. *c* represents a nut having an interior thread made therein at *d*, and an annular projection, *a*, upon its inner face, with an orifice or opening, *e'*, a little larger in diameter than the outside diameter of the small pipe D, and said projection has an annular channel or groove, *e*, therein, as shown clearly in Fig. 7. This nut is turned upon the thread at one end of the small pipe D, and the other end of the pipe D is then inserted through the hole in the head E and passed entirely through the larger pipe A, just protruding through the opposite hole in the other head E, and another nut, *c*, is then turned onto the protruding end of said pipe, and both nuts are then turned on tightly against the heads, which brings the annular projection *a* up firmly to its bearing in bottom of the recess around the holes through which the small pipe protrudes at each end, so as to make a tight and close joint, as shown in Figs. 3 and 10. This furnishes a free passage for the free circulation of air from the outside through the interior pipe D, as both ends of the same are open, while there is a space between the interior and exterior pipes for the free circulation of water and steam, said spaces in each pipe communicating with each other through the head I, as shown clearly in Fig. 5. Vertical holes *b* are made through the heads E, the heads being formed upon the inside so that said holes are made through the solid metal, so that the rods which secure the sections together need not pass into the steam or water space. Annular recesses *a''* are made

in the upper and lower horizontal faces of each head E, and an annular packing-ring, *a*, having an annular groove or channel, *e*, therein, is placed in each of said recesses upon the upper face of each head E in each section, and the recesses are of such depth that when two sections are placed together said packing-rings shall have a good and firm bearing in each recess. These packing-rings being put in place in all the recesses in the upper face of a section, another section is placed on top of this last section with the upper part of each packing-ring projecting up into the recesses in the lower face of the upper section, and so on until all the sections shall be properly placed one above another, and when this is done the rods *n*, having a screw-thread upon each end, are placed through all the holes *b*, and nuts are turned thereon firmly to a bearing against the heads E, and this brings every packing-ring firmly and closely to the bottom of each recess before the horizontal faces of the heads E touch each other. There is then free and uninterrupted communication through all the series of pipes A and heads E, with a direct air-passage in each pipe A through the interior pipe D, open at each end. The lower head E at one end, and the upper head at the other end, may be somewhat elongated, as shown at B, with holes *x* therein, the lower one for the admission or circulation of water, and the upper one for passage or circulation of steam, and the elongations B furnish good support for the generator when set up in brick-work. When it is desired to furnish a generator with increased generating power, two or more of these vertical sections may be placed side by side, and the elongated parts B be dispensed with or not, as may be most convenient, as the steam will, of course, circulate in the head, the elongation serving mainly for support, and connection may be made between each vertical section by means of a common bend, F, one end of which is connected to one section and the other end to the next section by a common thimble-connection. If one section should then settle or become slightly displaced from any cause, such displacement would not be liable to disturb the next section. It would be better to set the generator, properly inclosed and supported by brick-work, at a slight inclination, say, an inch in height to a foot in length, in order to get the best circulation and a proper settling of any residuum which may be contained in the water, as such residuum would then naturally fall to the lower head B, and could easily be removed therefrom; and the arrangement of the pipes or flues D facilitates the cleaning of the pipes when required, as said pipes D may be easily removed by turning off one of the nuts *c* and drawing out said pipe. The annular projection *a* upon the nut *c* has sufficient elasticity to provide for the contraction and expansion

of the pipes, and as the orifice *e'* in said projection is somewhat larger than the outer diameter of the pipe D, and the steam or water can pass into the groove *e*, the pressure in the generator will have a tendency to press the outer annular flange of said projection, which forms the outside of the groove, more firmly to its seat in the bottom of the recess, and as the water or steam is always in the annular groove *e* in the packing-ring *a*, the tendency is, from the pressure in the generator, to press both flanges more firmly to the bottom of the recesses in which they are placed.

When properly set up in brick-work, with a space all around the pipes A up to the water-line, the fire from the fire-box at the forward end comes in contact with the exterior surface of all the pipes A up to the water-line, passes down and under the rear end of the generator, and passes through the pipes D, thereby heating said pipes and also the water in contact therewith, which fills the space between the pipes D and the interior surface of the larger pipes A, and a great amount of steam-generating or heating surface is thereby gained.

If it should be desirable, a horizontal diaphragm might be cast upon the inside of the pipe A, dividing the space between the pipe D and pipe A into two spaces—an upper and a lower space, as shown in Fig. 11. These sections might be formed by a series of single tubes, A, bolted together, with a tight packed joint between, and with the interior tube D secured in each, but I prefer to make them in sections of at least two pipes to one head at each end.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A steam-generator, made in sections of two or more pipes, A, cast together with a packing-head, E, said pipes having an interior air-passage, D, and secured together with a tight-packed joint at each point of connection, substantially as described.

2. I claim the pipe A, with a packing-head, E, at each end thereof, and having an interior tube, D, secured therein, substantially as described.

3. I claim, as a means of packing the joint or connection between two sections of the above-described generator, the annular metallic packing *a* having an annular groove or channel, *e*, therein, substantially as described.

4. I claim, as a means of securing the pipe D within the pipe A and of packing the joint at the point of connection, the nut *c* having the annular projection *a* with the annular groove or channel *e* therein, substantially as described.

HENRY HOWARD.

Witnesses:

T. A. CURTIS,

CLARENCE BUCKLAND.