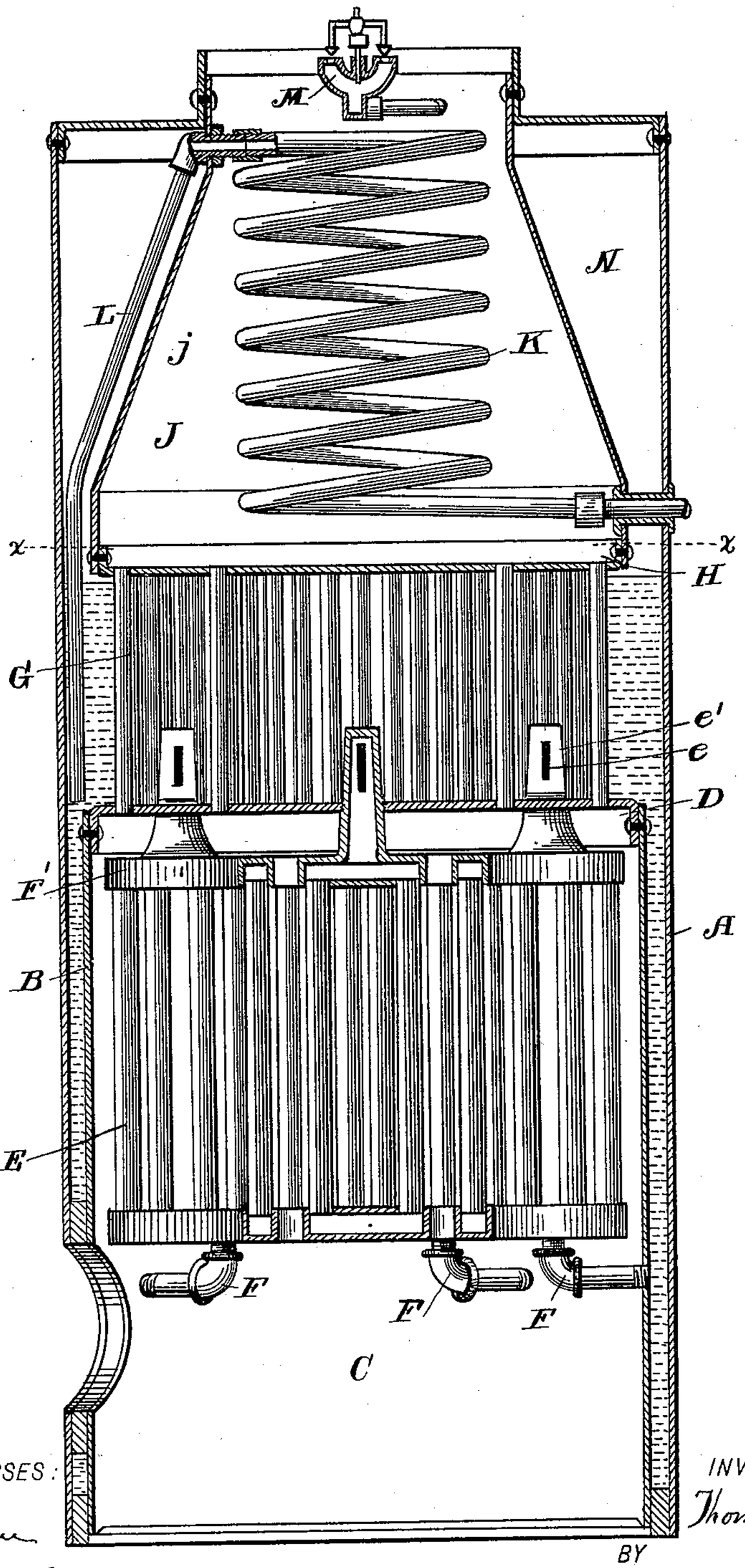
(No Model.) 2 Sheets—Sheet 1.

T. MANNING.

STEAM GENERATOR.

No. 594,641. Patented Nov. 30, 1897.

FIG. 1.



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(No Model.) 2 Sheets—Sheet 2.

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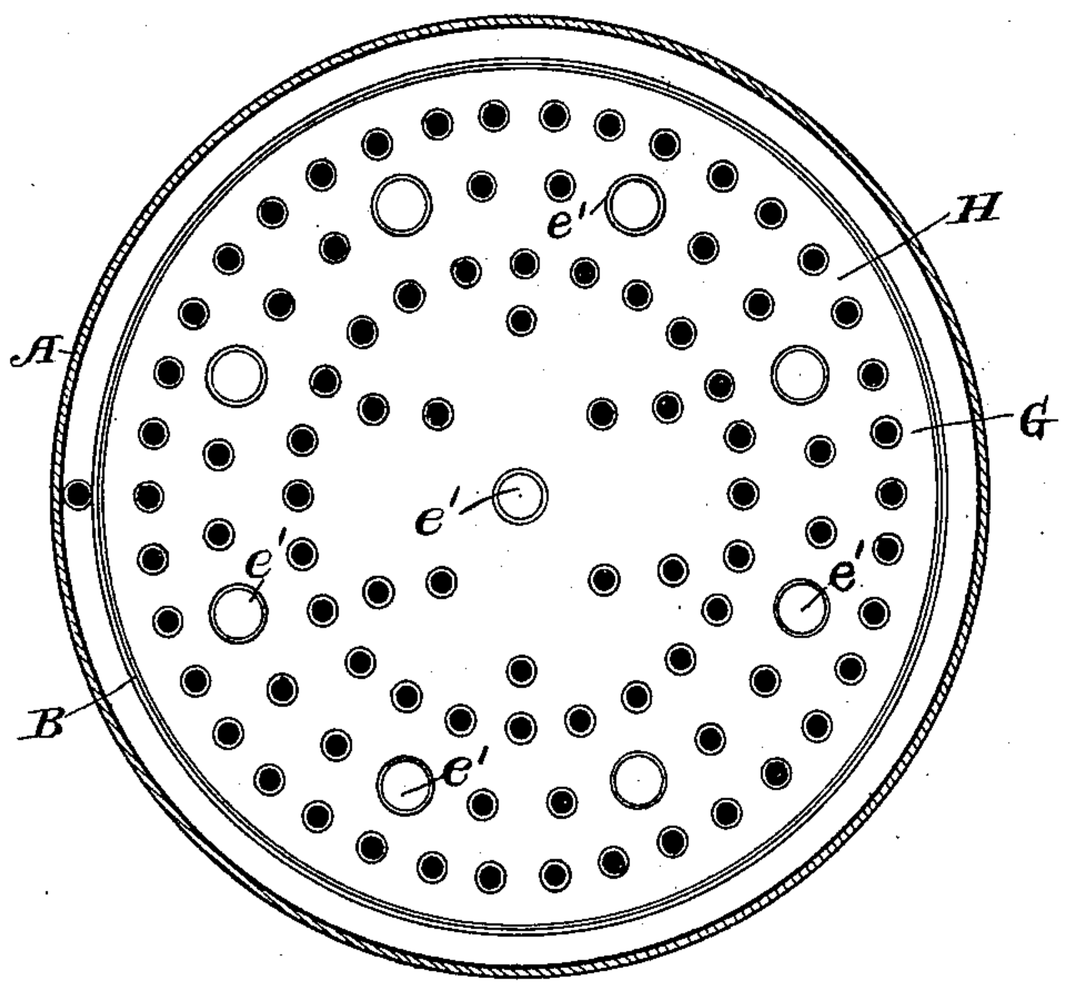
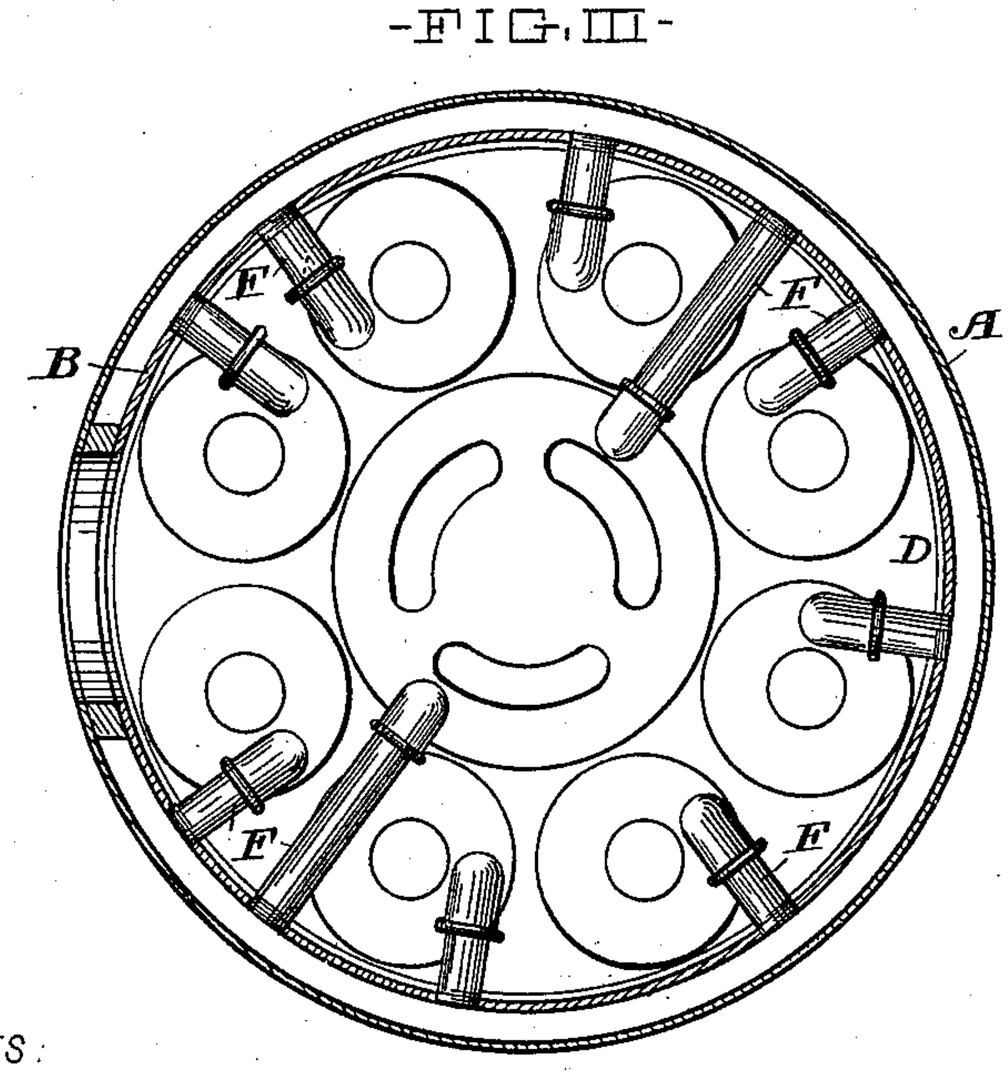
-FIG. II-



-FIG. III-



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UNITED STATES PATENT OFFICE.

THOMAS MANNING, OF CLEVELAND, OHIO.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 594,641, dated November 30, 1897.

Application filed April 26, 1897. Serial No. 633,862. (No model.)

To all whom it may concern:

Be it known that I, THOMAS MANNING, of Cleveland, Cuyahoga county, Ohio, have invented certain new and useful Improvements in Steam-Generators; 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 pertains to make and use the same.

My invention relates to steam-generators or upright boilers such as are generally used for generating steam for fire-engines, being adapted to make steam fast or quickly.

My invention consists in so constructing the said generator or boiler as that steam may be generated quickly upon the initial firing of the boiler and be maintained in a sufficient quantity to supply the engine of the pump; also, so constructing the boiler and locating the tubes as to avoid unequal expansion and consequent loosening of the joints between the tubes and the crown-sheet or head-sheet. This is accomplished by providing the boiler with drop-nests, which are formed by attaching or securing a number of tubes to circular heads, as shown in the drawings, the upper head of said nests being screwed into or secured to the crown-sheet of the furnace and projecting a short distance above the same and into a space formed between a series of flues located above said nests, the upper series of flues being submerged or below the normal water-level of the boiler. However, instead of the drop-nests I may, if desired, use drop-flues of the ordinary kind, such as are plugged at their lower end and provided with central circulating-tubes of the well-known kind.

In the drawings, Figure I is a view in vertical cross-section illustrating a steam-generator constructed according to my invention. Fig. II is a view in cross-section taken through line *x x*, Fig. I, showing the arrangement of flues which are located above the crown-sheet. Fig. III is a bottom plan view of the nests, showing their arrangement and the manner of connecting the same to the water-leg of the boiler.

A is the outer shell of the boiler; B, the inner shell, which is concentric with the outer shell, and forms, with said outer shell, a water space or leg which surrounds the furnace C.

D represents the crown-sheet of the furnace. Depending downward from this crown-sheet D are a series of tube-nests E E, which have their upper heads E′ screwed into the crown-sheet D. These upper heads E′ of the nests project upwardly, as at *e*, about three to four inches above the crown-sheet D, the upwardly-projecting portion *e* being provided with a series of openings *e′*, which communicate with the interior of the nests and allow of the passage of steam or hot water from them. The lower heads of the nests E E are connected to the water-leg of the boiler by means of pipes F F, and through these pipes F F the nests E obtain their supply of water, which circulates through said nests after the fire has been started in the furnace.

Located above the crown-sheet D of the furnace C and extending through said crown-sheet are a series of submerged tubes G G. The lower ends of the tubes G G may be rolled into the crown-sheet and the upper ends screwed into a sheet H, or both ends may be rolled into their respective sheets, as found convenient or necessary. The tubes G G communicate at their lower end with the furnace C and at their upper end with a stack J, and thus allow of the products of combustion passing through them and escaping through the stack. It will be noticed in Fig. I that the tubes G G are below the normal water-level of the boiler at all times, and hence no matter what the amount of heat they are subjected to they will expand and contract equally and so avoid the loosening of the joints. By submerging the tubes G G, or, in other words, keeping them below the normal water-level of the boiler, I am enabled to use copper tubing, which would be absolutely impracticable were the tubes G G extended above the water-level or only submerged in part, because where the flues G G are submerged in part only they not only become loose from unequal expansion and contraction, but on account of the softness of the material they would become burned out,

and hence necessitate constant renewing, even if they did last through one working of the engine, which is very improbable. It will also be noticed in the drawings that the tubes or flues G G being formed short a better draft is obtained for the fire in the furnace, and where a forced draft is used, as is common in this type of boiler, the exhaust from the engine will draw more quickly and strongly through the short tubing G G than it would were the tubing longer. This, in connection with the material of which the tubing is formed—namely, copper—enables me to obtain steam very quickly and also keep a constant supply in the boiler for working the engine at all times regardless of the quantity required for the engine or pump, it only being necessary, in order to generate more steam or generate it faster, to increase the draft of the fire.

K represents a water-heater for heating the feed-water which is supplied to the boiler. The water is fed to pipe *k*, thence into the upper part of the boiler and to the heater K, which is formed of spiral tubing, thus allowing the products of combustion in their heated condition to come in contact with all parts of the heater and warm the water or heat it before it is fed to the boiler proper. The upper end of the spiral or heater K is connected by means of a suitable coupling to a drop-pipe L, which extends down into the boiler proper and beneath the normal level of the water.

M represents the usual device for using the exhaust-steam for the purpose of producing the forced draft. This device, however, forms no part of my invention, and being of the usual construction needs no further description.

The preferred manner of arranging the nests in the furnace is illustrated in Fig. III of the drawings. The preferred manner of arranging the tubes G above the crown-sheet is illustrated in Fig. II. This arrangement, however, while the preferred one, is not material to my invention, inasmuch as it may be varied both to suit the size of the boiler and the style of the same.

The operation of my device is as follows: The feed-water is fed through pipe *k* into the water-heater K, thence from the top of the water-heater through pipe L into the boiler below the normal water-level, thence passing down the water-leg of the boiler through pipes F into the drop-nests, circulating through the same, and from thence passing out through orifices *e'* above the crown-sheet D between the tubes G G. During the passage of the water through the circuit, as just above described, it first comes in contact with heat in the stack J by passing through the heater K. Then, again, as it passes downward through the pipe L it is kept hot by making the pipe L to lie in close contact with a shell *j* of the stack J. As the water passes downward into the water-leg it is again heated by the inner wall of the furnace C, and from thence passes into the tubes or nests E, which are depending in the furnace. In this part of the apparatus steam is soon generated, and the boiling water passing outward through orifices *e'* comes in contact with the flues G G, where it is again heated, and from thence passes in the form of steam into the space N, the steam in the space N being kept hot by means of the walls or shell *j* of the stack J. From this space N it is fed to the pump or engine. It will thus be seen that from the very initial feeding of the water to the boiler it is kept constantly in a heated condition and steam is hence very quickly generated.

Although in describing the construction of the generator I have used the terms "drop-tube" and "drop-nests," I do not wish to be understood as limiting my invention to this exact construction, inasmuch as the lower or circulating tubes may be of the spiral or other construction adapted to be suspended from the crown-sheet and depending into the furnace.

What I claim is—

1. In a steam-generator of the drop-nest or drop-tube variety, the combination with said drop-tubes or drop-nests located in the furnace and having their upper portions extending above the crown-sheet of the same, of submerged flues carrying off the products of combustion from the furnace, substantially as and for the purpose shown and described.

2. In a steam-generator of the character described, the combination with the drop nests or tubes located in the furnace of said generator, said tubes having their upper ends extending above the crown-sheet of the furnace and in open communication with the water-space, of submerged tubes communicating with the furnace at their lower end and secured to the crown-sheet, and at their upper end communicating with the stack, whereby products of combustion pass through said tubes and heat the water surrounding them, substantially as and for the purpose shown and described.

3. In a steam-generator of the type described, the combination with the inner and outer shell forming the water-leg of said generator, of drop tubes or nests communicating with said water-leg, said tubes or nests being provided with apertures at their upper end, said apertures located above the crown-sheet of the furnace and a series or number of flues surrounding the upper ends of the nests, said tubes being entirely submerged or beneath the normal level of the water in the boiler, substantially as described.

4. In a boiler of the type described, the combination with the drop tubes or nests and flues located above said drop tubes or nests, of a water-heater located in the stack of the boiler substantially as described, said water-heater provided with a drop-pipe for feeding

the water to the boiler proper, substantially as shown and described.

5. In a steam-generator of the type described, the combination with the drop-nests E E secured to the crown-sheet of the furnace, of submerged pipes or flues G G, water-heater K and drop-pipe L, all operating substantially as shown and described.

In testimony whereof I sign this specification, in the presence of two witnesses, this 10th day of April, 1897.

THOMAS MANNING.

Witnesses:
JOHN R. MANNING,
GEORGE R. SAVAGE.