

(No Model.)

2 Sheets—Sheet 1.

D. ALMY.
STEAM GENERATOR.

No. 434,226.

Patented Aug. 12, 1890.

Fig. 1.

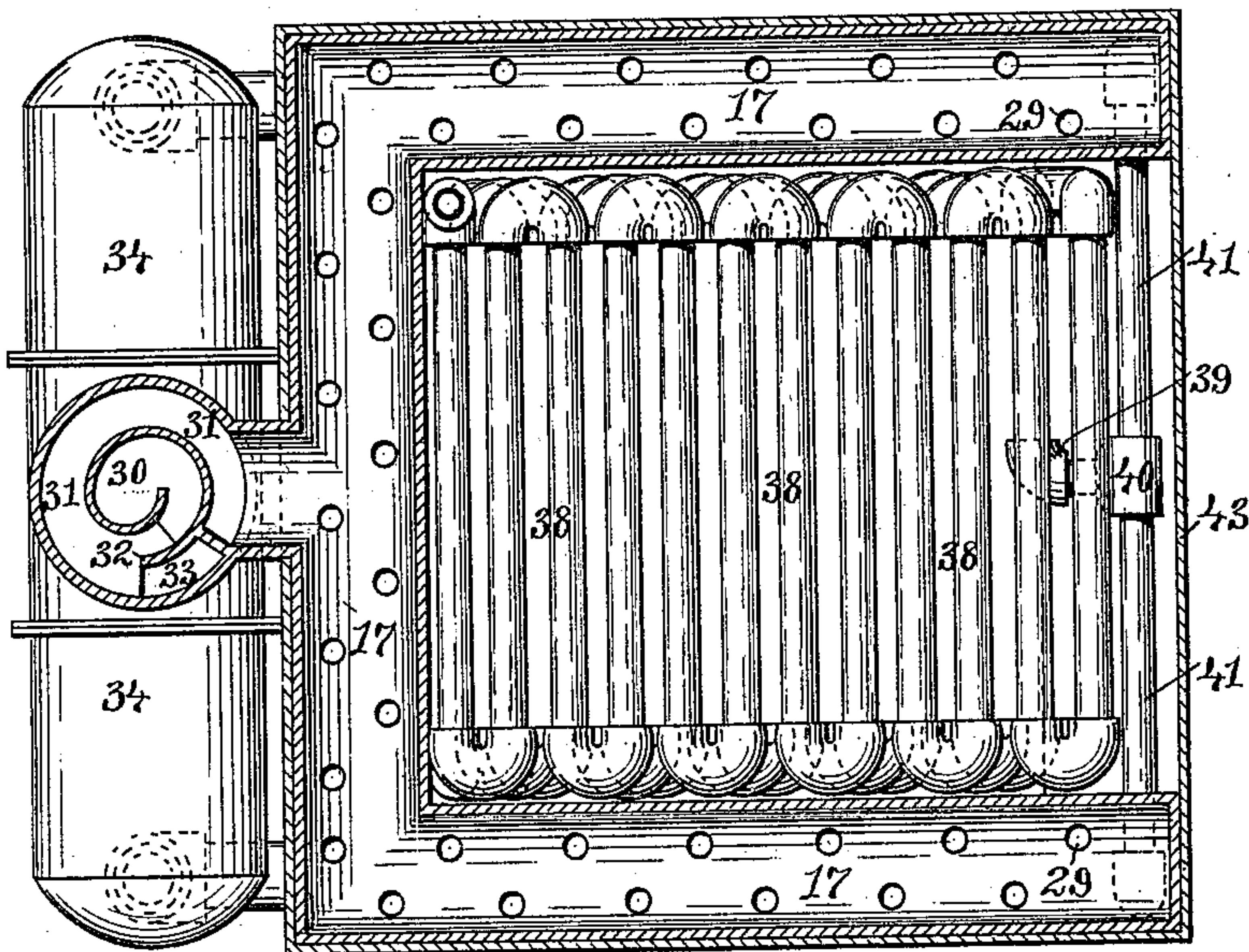
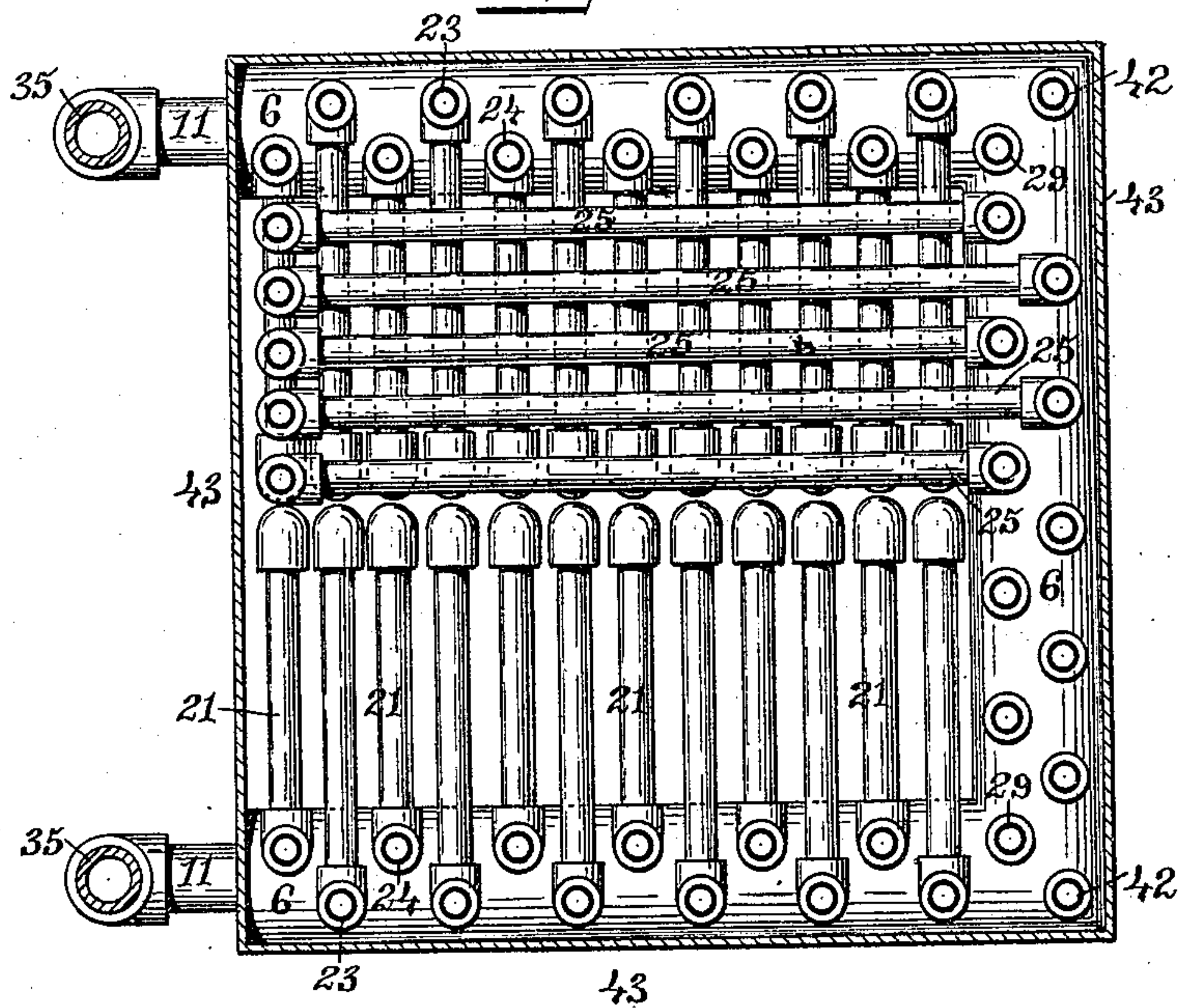


Fig. 2.



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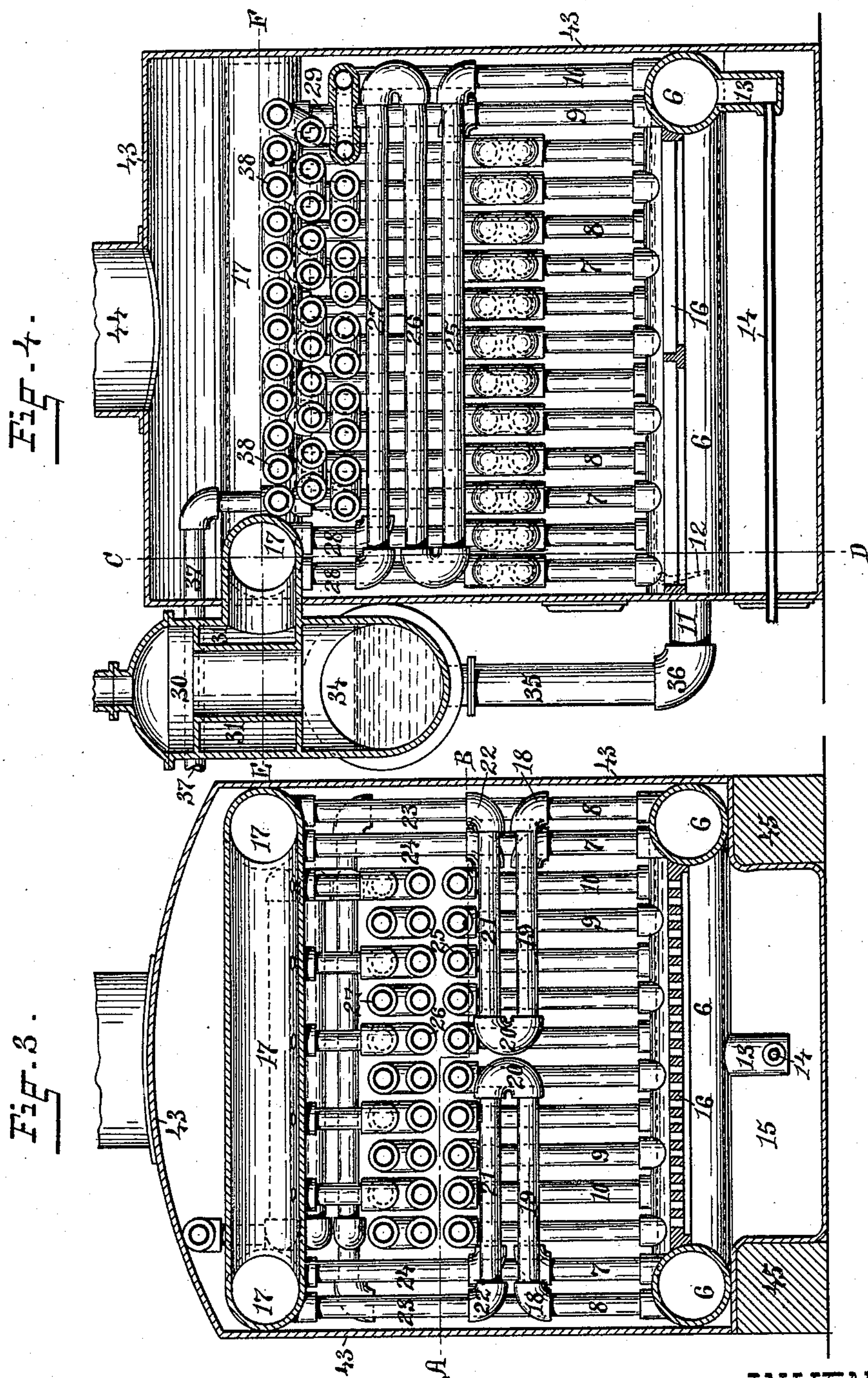
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INVENTOR:

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UNITED STATES PATENT OFFICE.

DARWIN ALMY, OF BRISTOL, RHODE ISLAND.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 434,226, dated August 12, 1890.

Application filed June 15, 1889. Serial No. 314,494. (No model.)

To all whom it may concern:

Be it known that I, DARWIN ALMY, of Bristol, in the county of Bristol and State of Rhode Island, have invented a new and useful Improvement in Steam-Generators; and I hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention has reference to improvements in the class of steam-generators known as "pipe-boilers," in which pipe-coils are connected with the water at or below the furnace and with the steam above the furnace, so that a large area of heating-surface is exposed to the heat of the furnace and a steam-generator having great steam-producing capacity and occupying a small space is produced.

The object of this invention is to so construct a steam-generator that the pipes or tubes exposed to the most intense action of the heat of the fire shall have a rapid circulation of the water through such pipes or tubes; that in the pipes or tubes not exposed to the most intense heat the circulation of the water shall be less rapid; that the steam and water shall be effectually separated, the feed-water thoroughly heated by the waste products of combustion, and the sediments collected in a pocket or pockets below the fire, from which the same may be blown off from time to time.

To this end the invention consists in the peculiar and novel construction of the side pipes by which they are made to extend over the fire in a loop and are connected with the steam and water space in the boiler, thus allowing freedom for the expansion or contraction of the pipes.

The invention further consists in the novel arrangement of the end pipes by which they are made to extend forward and backward over the loops of the side pipes and are connected with the front of the steam-chamber; also, in the novel arrangement of the coils of pipe for heating the feed-water placed above the steam-generating pipes, so as to absorb the heat from the waste products of combustion and connected with the water-space of the generator.

It further consists in the novel construction

of the steam and water separator and the novel use of a check-valve, as will be more fully set forth hereinafter.

In steam-generators constructed of pipes or tubes placed in groups, so as to secure a very large heating-surface in a small space, the excessive heat acting on the pipes directly exposed to the furnace frequently causes such rapid generation of steam as to force the water into opposite directions. The pipes thus exposed become highly heated, and they expand and cause the breaking of the joints, pipes, or fittings. To avoid this, I place a check-valve into the water-chamber and construct all parts of the generator so as to permit all parts to expand and contract without straining the joints or fittings.

Figure 1 is a horizontal sectional plan view on the line EF on Fig. 4. Fig. 2 is a horizontal sectional plan view on the line AB of Fig. 3. Fig. 3 is a vertical sectional view on the line CD of Fig. 4, and Fig. 4 is a vertical sectional view longitudinal through the center of the generator.

Similar numbers of reference indicate corresponding parts in all the drawings.

The number 6 indicates a manifold water-chamber inclosing three sides of the furnace—namely, the two sides and the rear of the furnace. The manifold 6 is provided with two rows of nipples spaced alternately, as is clearly shown in the drawings. The vertical side pipes 7 and 8 are secured to the nipples of the manifold 6; and form the sides of the furnace, the pipes 7 being nearer the fire, and the pipes 8 are placed between the pipes 7, on the outside nipples of the manifold. The pipes 9 and 10, forming the end of the furnace, are also secured to the manifold by the nipples, the pipes 9 being secured in the row of nipples near the fire end, the pipes 10 to the row of nipples placed between the pipes 9 on the outer side of the manifold.

Each of the two front ends of the manifold 6 is provided with the inlet 11, the inner end of which is provided with the hinged gate 12, forming a check-valve. The rear portion of the manifold 6 is provided with the sediment-collector, consisting of the pendent chamber 13, with which the blow-off pipe 14 is connected. The U-shaped manifold 6 rests on the supports 45, protected on the top and in-

ner side by any suitable non-conducting material covered by sheet metal, so as to form the ash-pit 15. The grate 16, filling the rectangular space between the sides of the manifold 6, separates the ash-pit from the furnace.

The number 17 indicates the manifold steam-chamber, which, like the manifold 6, forms three sides of an oblong or square. It is placed above the steam-generating pipes in a position the reverse of the position of the manifold 6. The part connecting the two sides is placed in front, and the ends or the open part of the U are placed in the rear. The nipples, which in the manifold 6 project upward, in the manifold 17 project downward.

The side pipes 7 and 8, extending upward from the manifold 6 to a height that will be sufficient to form a combustion chamber or furnace, enter the elbows 18, from which the horizontal pipes 19 project over the furnace. The bends 20 connect the horizontal pipes 19 with the horizontal pipes 21, which by means of the elbows 22 are connected with the vertical pipes 23 or 24, which pipes are connected by means of screw-threads or in any other suitable manner with the manifold 17, forming the steam-chamber of the generator. The water, therefore, in these side pipes 7 and 8, when the generator is in operation, rises through the pipes 7 and 8, passes over the furnace nearly to the center through the pipes 19, through the bends 20 and the horizontal pipes 21, and then into the pipes 23 or 24, where the steam enters the steam-space in the manifold 17, as is clearly shown in Fig. 3.

The rear pipes 9 and 10 extend upward to a point above the loops formed by the pipes 19 and 21, where they enter elbow-fittings, from which the pipes 25 extend forward across the loops of the side pipes, entering at the forward end bent fittings from which the pipes 26 extend to the rear end of the generator, where the pipes are connected by the usual bent fittings with the forward-extending pipes 27, the forward ends of which are provided with the usual elbow-fittings and connected with the manifold 17 by means of the short nipples 28, as is clearly shown in Fig. 4. The water in the pipes 25, 26, and 27 is not exposed to so intense a heat as the water in the loops formed by the pipes 19 and 21, but is exposed to the heated gases for a longer time. The pipes 29, in the inner corners of the manifold 6, form a straight column connecting with the last inner opening in the ends of the arms of the manifold 17, forming a rigid support for the same.

The steam from the manifold 17 enters the steam-dome 30 through the spiral passage 31, giving to the passing steam a whirling motion by which the water carried over by the steam is separated therefrom. This separation is greatly facilitated by extending the partition 32 so as to form two passages—one leading to the center of the steam-dome 30,

open above and below to allow the steam to escape freely, and the other to the opening 33, by which the water is discharged. The steam-dome 30 rises above the horizontal cylinder 34, extending across the width of the steam-generator. This cylinder 34 is of considerable diameter, so as to hold a considerable quantity of water and expose a considerable surface of the water, thus allowing the steam contained in the water to rise freely without lifting the water. The horizontal cylinder 34 is connected with both ends of the manifold 6 by the pipes 35, elbow-fittings 36, and the inlet-nipples 11.

The feed-water is supplied to the generator by means of a pump or injector through the pipe 37, connecting with the continuous pipe-coil, consisting of three rows of pipes so connected by bent fittings that the feed-water has to traverse all the pipes in the three coils until it reaches the elbow-fitting 39, connected with the T-shaped fitting 40, from which the two pipes 41 extend to the opposite sides of the generator, where, by means of the usual elbow-fittings, they are connected with pipes 42, secured in the outer corners of the manifold 6. The whole generator is inclosed in a suitable casing, preferably consisting of non-conducting material, or a poor conductor of heat protected by a sheet-metal casing. The generator may be set in brick-work in the usual manner.

To enable others to more fully understand the construction, its object, and the practical use of my improved steam-generator, I will now describe the operation of the same.

The steam-generator being filled with water to the water-line, as shown in the horizontal cylinder 34 in Fig. 4, and the fire burning with natural or forced draft on the grate 16, the direct radiated heat of the fire is exerted on the vertical pipes 7, 8, 9, and 10 and the horizontal pipes 19, the heated gases pass around the pipes 21, and as the pipes 25, 26, and 27 extend at right angles across the spaces between the pipes 21 and 22, as is clearly shown in Fig. 2, the heated gases are broken up and envelop the pipes 25, 26, and 27 successively, thus retarding the exit of the heated gases. As a very large amount of heating-surface is crowded into a small space, the gases are now reduced in temperature, so that they would have but little beneficial effect on additional steam-generating surfaces; but to utilize the gases more fully the feed-water is now exposed in the pipes 38 to the action of the heated gases before the same escape by the chimney 44, and to this comparatively cold feed-water the escaping gases surrender the heat yet contained in the same to a greater or less extent according to the fierceness or slowness of the draft.

The operation of the water and the steam in the interior of the generator is a continuous circulation through all parts of the generator excepting the feed-water heater. In this class of steam-generators the water-sup-

ply should be continuous. The pump or injector should force into the generator just the quantity of water required to continuously supply the desired quantity of steam.

5 This feed-water passing through the coil of pipes 38 exposed to the escaping gases becomes heated and enters the manifold through the pipes 42 at the rear corners of the manifold 6. The water rises over the heated surface

10 of the side and rear pipes and through the horizontal looped pipes. The water and steam enter the manifold 17, where, owing to the larger area, the flow of the combined water and steam is less rapid, a partial separation

15 of the steam and water takes place, and the partially separated steam and water pass from the manifold 17 into the steam-dome through the spiral passage, where, by the swirling motion induced by the circular road or channel

20 of the passage the water is thrown against the outer surface, is separated from the steam by the projecting partition 32, the steam enters the steam-dome, and the water passes through the opening 33 into the horizontal

25 cylinder 34. As the center of the spiral passage is open above and below, some of the water carried by the steam enters the steam-space in the cylinder 34 and the steam-dome with the steam, but separates freely owing to the

30 large steam-space in the cylinder 34 and the steam-dome 30, so that nothing but dry steam is drawn from the upper outlet of the steam-dome. As in this class of steam-generators the water is always raised with the steam. The

35 circulation must be complete. The horizontal cylinder 34 is therefore connected with the manifold 6 by large pipes, so that the water can flow freely downward to supply the water raised with the steam. To prevent

40 the reversing of the direction of the circulation and injury to the generator, the check valves or gates 12 are hung in front of the inlets 11. Sediment collects in such a generator only in the quietest corners of the

45 same. It is obvious that the least circulation of the water is in the middle of the rear portion of the manifold 6, where the chamber 13 is placed. By blowing off the contents of this chamber from time to time, preferably at short

50 intervals, the generator will be kept clean and bright, even with muddy or salt water.

It is evident that tubes may be substituted in all or nearly all places for pipes, and that

55 for the purpose of this specification the term

"pipes" is the equivalent for the term "tubes."

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

1. In a steam-generator, the combination, 60 with the manifold 6 and manifold 17 and the side pipes formed in a loop extending over the furnace and connected with both manifolds, of the rear pipes 9, 10, 25, 26, and 27, connected with both manifolds, the steam- 65 dome 30, and the horizontal cylinder 34, connected with the manifold 6, as described.

2. In a steam-generator, the combination, with the manifold 6 and manifold 17, the side pipes formed in a loop extending over the 70 furnace and connected with both manifolds, the end pipes connected with the horizontal pipes 25, 26, and 27 and with the front of the manifold, the steam and water separator connected with the manifold 17 and the mani- 75 fold 6, of the feed-water heater, consisting of the pipes 38, connected together and with the rear end of the manifold 6, as described.

3. The combination, with the manifold 6 and manifold 17, of the pipes 7, 8, 19, 21, 23, and 80 24, constructed to form the sides of the furnace and extending over the same, the pipes 9, 10, 25, 26, and 27, connected with the rear water-space and with the front steam-space, the pipes 37, 38, 41, and 29, connected with 85 the water-space, and the steam-dome 30, provided with the spiral passage 31 and connected with the upper and lower manifolds, as described.

4. In a steam-generator, the combination, 90 with the water and steam chambers, of the pipes 7, 8, 19, 21, 23, and 24, the pipes 9, 10, 25, 26, and 27, the pipes 37, 38, 41, and 29, the steam-dome 30, the horizontal cylinder 34, and connections 35, 36, and 11, as described. 95

5. The combination of the manifold 6, the manifold 17, the side pipes extending over the furnace in a loop, the rear pipes connected with the pipes 25, 26, and 27 and with the front of the manifold 17, the steam-dome 30, 100 the horizontal cylinder 34, connected with the manifold 6, and the sediment-chamber 13, provided with the blow-off pipe 14, as described.

In witness whereof I have hereunto set my hand.

DARWIN ALMY.

Witnesses:

J. A. MILLER, Jr.,

M. F. BLIGH.