

No. 778,767.

PATENTED DEC. 27, 1904.

J. C. WOOD.
STEAM GENERATOR.
APPLICATION FILED JAN. 20, 1904.

2 SHEETS—SHEET 1.

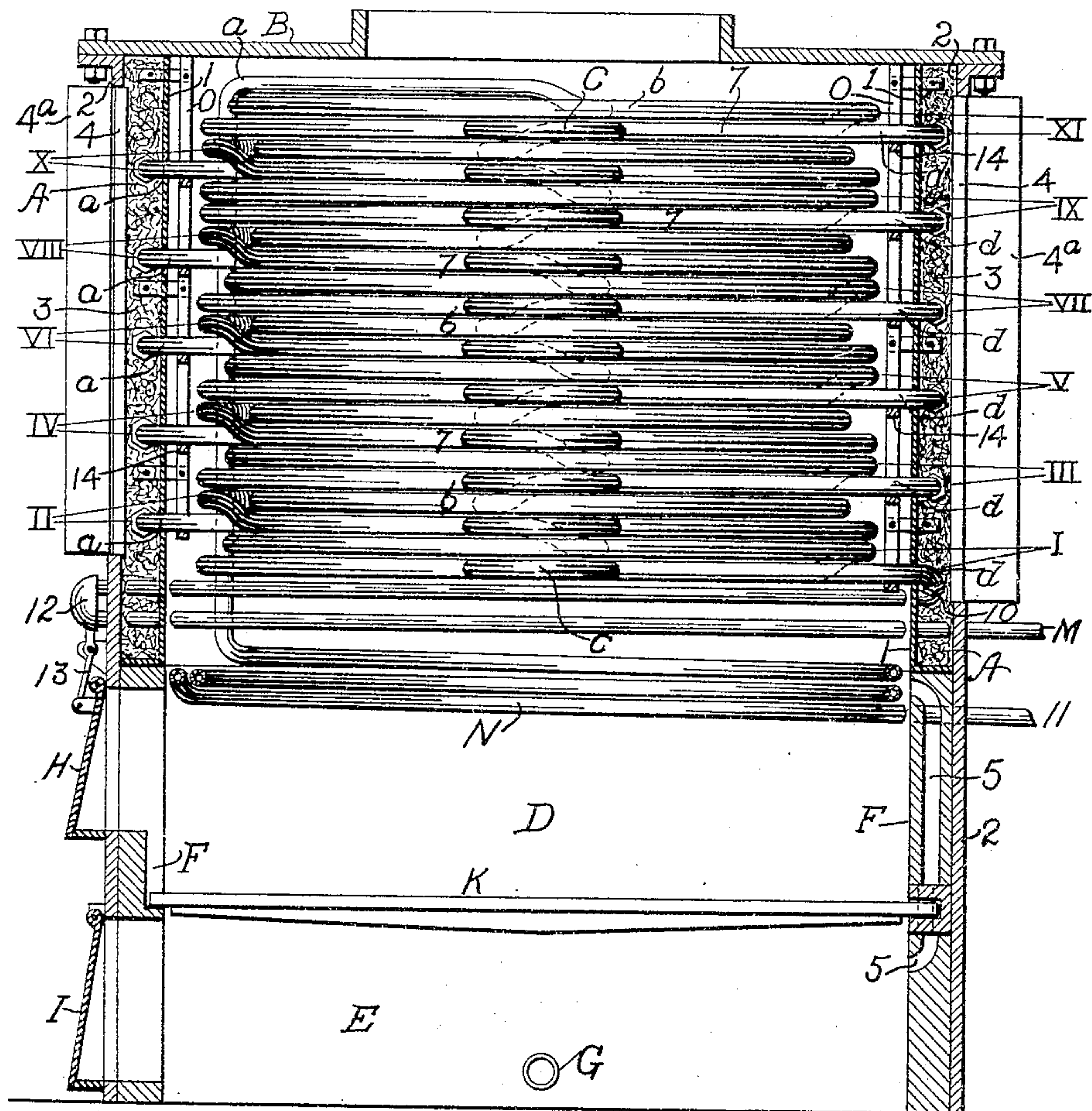


Fig. I

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2 SHEETS—SHEET 2.

Fig. 2.

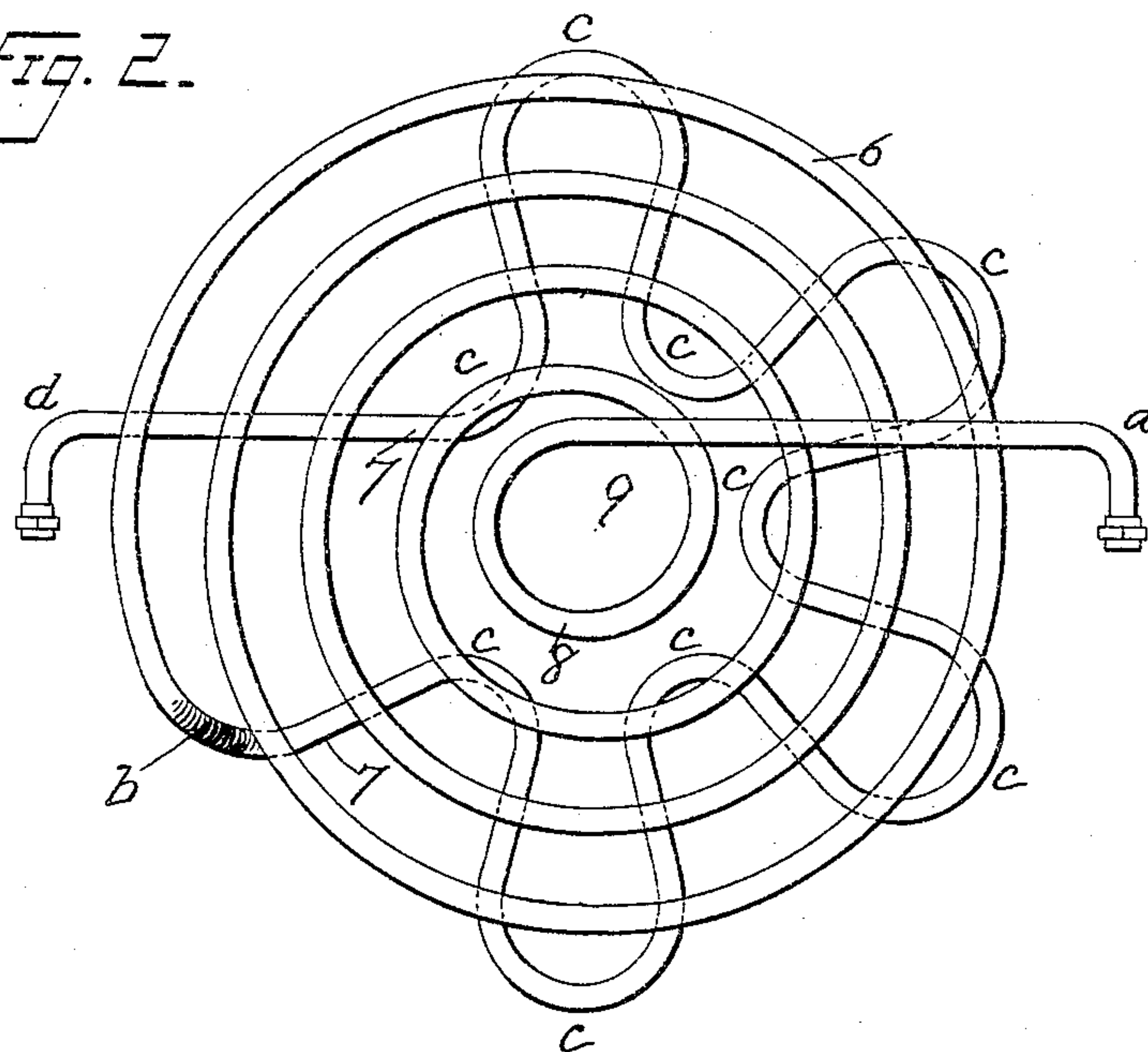
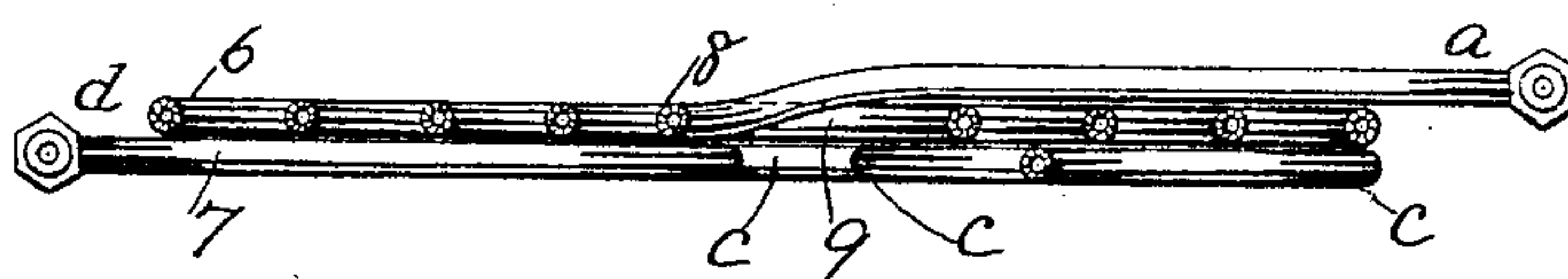


Fig. 3.



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STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 778,767, dated December 27, 1904.

Application filed January 20, 1904. Serial No. 189,819.

To all whom it may concern:

Be it known that I, JOSEPH C. WOOD, a citizen of the United States, residing at New York, (Brooklyn,) in the county of Kings and State of New York, 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 appertains to make and use the same.

My invention relates to water-tube steam-generators.

The object of the invention is, first, to insure the utilization of the heat from the fire-chamber of the generator to the greatest possible extent for the rapid and continuous production of steam in the generator by arranging the water-tubes so that they will intercept and break up the body of heated air arising from the fire-chamber, and thereby prevent the hot air from escaping in unbroken currents without first striking the water-tubes and parting more or less completely with its heat; second, to effect the thorough absorption of the heat by the water circulating through the tubes by causing the heated air to impinge directly upon the entire surface of the water-tubes at or about right angles to their length; third, to prevent the burning out of the spacing and supporting devices between the units of which the generator is composed; fourth, to construct the generator so that the steam will be conveyed from the tubes most distant from the fireback to the fire-chamber for superheating; fifth, to regulate the draft of the heating apparatus by the expansion and contraction of the water-supply pipe and the tubing connected therewith that forms part of one of the units of which the generator is composed.

In the accompanying drawings, Figure 1 represents a sectional side elevation of my improved steam-generator; Fig. 2, a horizontal plan of one of the units of which the boiler is composed, showing also the method of coiling the tubing to form the unit. Fig. 3 represents a transverse section of the unit shown by Fig. 2, taken through the center thereof.

Referring to the drawings, A designates the

shell of the generator, which is formed by an inner steel casing 1, an outer heavier steel casing 2, and between these a filling 3 of asbestos.

B is the top of the generator, which is fastened to the shell by bolting the same to a flange on the outer casing 2. This top has a draft-opening at the center. The exterior casing 2 is also provided with vertical openings 4 4 on opposite sides, closed by suitable doors 4^a 4^a, hinged or fastened by turn-buttons to the outer casing. These doors give access to the couplings between the ends of the tubes of adjoining units and the feed-water pipe, these couplings being located in the space between the two walls of the shell to protect them from the heat. The outer casing is extended downward to inclose the fire-chamber D and the ash-pit E. The walls of the fire-chamber are formed of fire-brick F, and in the walls there is a vertical air space or flue 5, that extends from the ash-pit to the top of the fire-chamber and around the fire-chamber. This air-space is provided to convey air supplied by a blower (not shown) to a nozzle G, that enters the ash-pit at any convenient and suitable point. The fire-chamber and ash-pit are also provided with feed and air doors H I and grate-bars K.

It will be understood from the foregoing that the fire-chamber of this generator is designed for the use of coal as a fuel; but this is not necessary to the operation of the generator, and liquid or gaseous fuels may be used by changing the fire-chamber to adapt it to the use of these fuels and providing suitable mechanism for supplying the same.

The generator may consist of one unit or a number of units coupled together and forming a continuous water-tube boiler. Each unit is composed of a spiral or helical coil 6 and a fluted coil 7, (see Figs. 2 and 3,) preferably made from tubing—that is, a section of a single tube. The generator is made up of any number of these units placed one above the other with the fluted coil of one unit joined or coupled to the spiral coil of the next unit above it. The ends of the tubing of each unit are carried out through the inner walls of the generator radially in planes parallel to

the planes of the coils, and the end of the spiral coil is coupled to the end of the fluted coil next above it between the inner and outer walls of the shell of the generator, and the series of units form a continuous water-tube system. The coils composing a unit are formed in the following manner: Tubing of the proper length to form the spiral and fluted coils and the coupling ends of both coils has the first or center coil 8 formed in it at such distance from the end *a* that the latter will project out of and above the proposed spiral coil. This first coil is made large enough to leave an opening 9 in the center. The tubing is then coiled spirally around the first coil and continuous therewith until the required diameter is reached, thus completing the spiral coil 6. At a point about diametrically opposite the end *a* the tubing is bent downward, as at *b*, to bring it into a plane below the spiral coil, and from this point it is formed into the fluted coil 7 by carrying it around once and forming the flutes *c* under the spiral coil. When this fluted coil is completed, the end *d* of the coil is at the side of the spiral coil at or near bend *b*, and from this point the tubing is bent out abruptly, so that its end *d* will project outside the spiral coil from the side opposite the end *a*. The fluted coil is designed to be in contact with the under side of the spiral coil, and the flutes *c* *c*, &c., are of such length that they lie between the opening 9 and the exterior line of the spiral coil. By forming the two coils in the manner described from tubing each unit is formed into a continuous water-tube without joints. The units thus formed are put together in the following manner: They are arranged so that the connections between alternate units are made on opposite sides of the generator. Thus the unit I has the end *d* of the fluted coil joined to the water-feed pipe M at 10 between the walls of the shell A, while the end *a* of the spiral coil is carried through the inner wall of the shell on the opposite side into the asbestos-filled space and there joined or connected to the end of the fluted coil of unit II. The end *d* of the fluted coil of unit II is carried through the inner wall on the opposite side and there connected with the end *a* of the spiral coil of the unit III. The remainder of the units IV to XI, inclusive, are connected in the same manner. By this arrangement the water entering the lower fluted coil is compelled to traverse the entire length of the coil from right to left, or vice versa, and from the outside toward the center. Then it passes up into the spiral coil and circulates through the same from the center outward and then passes again to the fluted coil of the next unit. In each unit, therefore, the water traverses the width of the generator twice, during which it is exposed to the heat ascending from below. The coils, it will be observed, are all at right angles to the direction of the

heat-currents—that is, the heat ascends vertically, while the coils are horizontal. Hence the water flows through them in horizontal planes at right angles to the ascending heat-currents and is thus exposed to the direct action of the heat. Both sets of coils in all of the elements cross the ascending heat-currents, which are thus intercepted by each coil and deflected sidewise against adjoining coils. This construction also gives a very extensive surface to the generator, every part of which is exposed to the heat. The fluted coils, besides adding their length to the evaporating-surface, serve also as supports for the spiral coils. As they underlie each spiral coil radially and in turn have their ends supported, as hereinafter described, the spiral coil of each unit is supported at a number of points, and when heated the coils are not liable to sag. These supporting-grids are important in this construction of the generator, and by making them of water-tubes instead of solid metal they are protected against destruction by the heat and increase materially the heating-surface of the generator. The end *a* of the spiral coil of the unit farthest from the fire is carried out horizontally to the space between the coils and the inner wall of the generator, thence down to the fire-chamber in the top or crown portion, where it connects with a superheating-coil N, that encircles the dome of fire-chamber, and finally emerges from the fire-chamber at 11, where it connects with the steam-pipe. By this arrangement the steam is superheated before it reaches the engine. The U bend or coupling 12 in the water-feed pipe outside the walls of the fire-chamber is connected by a rock-lever 13 with the feed-door H. The object of this construction is to control automatically the admission of air over the top of the fire, and this is accomplished by the opening and closing of the door by the expansion and contraction of the feed-water pipe actuating the rock-lever. In this manner a perfect regulation of the heat is secured.

O represents standards placed within the inner casings of the shell on opposite sides, so that the connected ends *a* *d* of adjoining units are passed around the standards and rest upon cross-bars 14, attached to the standards. By this means the units are connected with and supported in the shell of the generator.

The water supply or feed pipe may connect outside of the shell directly with the end *d* of the fluted coil of the first unit, and in that case the rocking lever 13 would be connected with the coupling between the said water-supply pipe and the end of the fluted coil. Furthermore, the end of the topmost spiral coil may be carried directly through the shell and connected with the steam-pipe leading to the engine, if desired, instead of being connected with a superheating-coil N. If but one unit is used in the generator, the end of the

helical coil in that unit will connect with the steam-pipe and the end of the fluted coil with the water supply or feed pipe.

The generator may include any number of the units, the number depending upon the horse-power the generator is required to have.

The construction of the shell of the generator herein described while deemed to be the best for the purpose is not essential to the operativeness of the water-tube system, and it may be changed without affecting the principle of the invention.

I claim—

1. In steam-generators a unitary coil consisting of a spiral coil and a fluted coil made from tubing and arranged in parallel planes the ends of the spiral and fluted coils being extended radially outward beyond the spiral coil, substantially as specified.

2. In steam-generators a unitary coil consisting of a spiral coil and a fluted coil made from tubing and arranged in parallel planes the ends of the spiral and fluted coils being extended radially outward from the respective coils at opposite sides of the spiral coil, substantially as specified.

3. In steam-generators the combination of a suitable casing and a series of unitary coils each unit consisting of a spiral coil and a fluted coil formed from tubing the two coils arranged in parallel planes the ends of the spiral coil and fluted coil of each unit being extended radially outward parallel to the planes of the spiral and fluted coils and connected respectively with the ends of the fluted and spiral coils of adjoining units, substantially as specified.

4. In steam-generators the combination of a suitable casing and a series of water-tube units each unit consisting of a spiral coil and a fluted coil formed from tubing the two coils arranged in parallel planes the ends of the spiral coils and fluted coils being extended radially outward from the coils at opposite sides thereof and through the walls of the casing and the ends of the spiral coils coupled to the ends of the fluted coils of adjoining units to form the generator, substantially as specified.

5. In steam-generators the combination of a casing and a series of water-tube units each unit consisting of a spiral coil and a fluted coil formed from tubing the two coils arranged in parallel planes with the fluted coils underneath the spiral coils the ends of the spiral coils and fluted coils being extended radially outward through the walls of the casing and the end of the spiral coil of each unit coupled to the end of the fluted coil of the adjoining unit, substantially as specified.

6. In steam-generators the combination of a casing and standards provided with cross-pieces inside the walls of the casing and a series of water-tube units each consisting of a spiral coil and a fluted coil formed from tubing the

two coils arranged in parallel planes with the fluted coils underneath and supporting the spiral coils, the ends of the spiral coils and fluted coils being extended radially outward at opposite sides of the standards over the cross-pieces and through the inner walls of the casing, and the end of the spiral coil of each unit coupled to the end of the fluted coil of the adjoining unit below, between the inner and outer walls of the casing, substantially as specified.

7. In steam-generators a water-tube unit made from tubing which at a greater or less distance from one end is formed into a center coil so as to leave an opening therein thence coiled spirally until the proper diameter is reached thence at a point opposite the end of the spiral coil is bent down below the plane of the spiral coil and formed into a fluted coil under the spiral coil, the ends of the spiral and fluted coils being extended outward radially and terminating on opposite sides of the coils, substantially as specified.

8. In steam-generators the combination with a shell consisting of inner and outer walls and an intermediate non-heat-conducting filling, of a series of connected water-tube units each comprising a spiral coil and a fluted coil the fluted coils and spiral coils of adjoining units connected together by a suitable coupling between the inner and outer walls of the shell of the generator, substantially as specified.

9. In steam-generators the combination with a shell consisting of inner and outer walls and an intermediate non-heat-conducting filling of a series of connected water-tube units each of which comprises a spiral coil and a fluted coil the end of the spiral coil of the topmost unit being carried outward from the center to the wall of the casing and connected mediately or immediately with the steam-pipe leading to the boiler, substantially as specified.

10. In steam-generators the combination with a shell consisting of inner and outer walls and an intermediate non-heat-conducting filling of a series of connected water-tube units each of which comprises a spiral coil and a fluted coil the end of the spiral coil of the topmost unit farthest from the fire being carried outward from the center to the inner wall of the casing thence downward between the water-tube units and the walls of the casing to the fire-chamber and connected with a superheating-coil in the crown of the fire-chamber the end of which is connected with the steam-pipe leading to the boiler, substantially as specified.

In testimony that I claim the invention above set forth I have affixed my signature in presence of two witnesses.

JOSEPH C. WOOD.

Witnesses:

WILTON C. DONN,
ARTHUR LOWE.