(No Model.) 3 Sheets—Sheet 1.

L. DE NAEYER.

WATER TUBE STEAM GENERATOR.

No. 601,790. Patented Apr. 5, 1898.

Fig. 1.

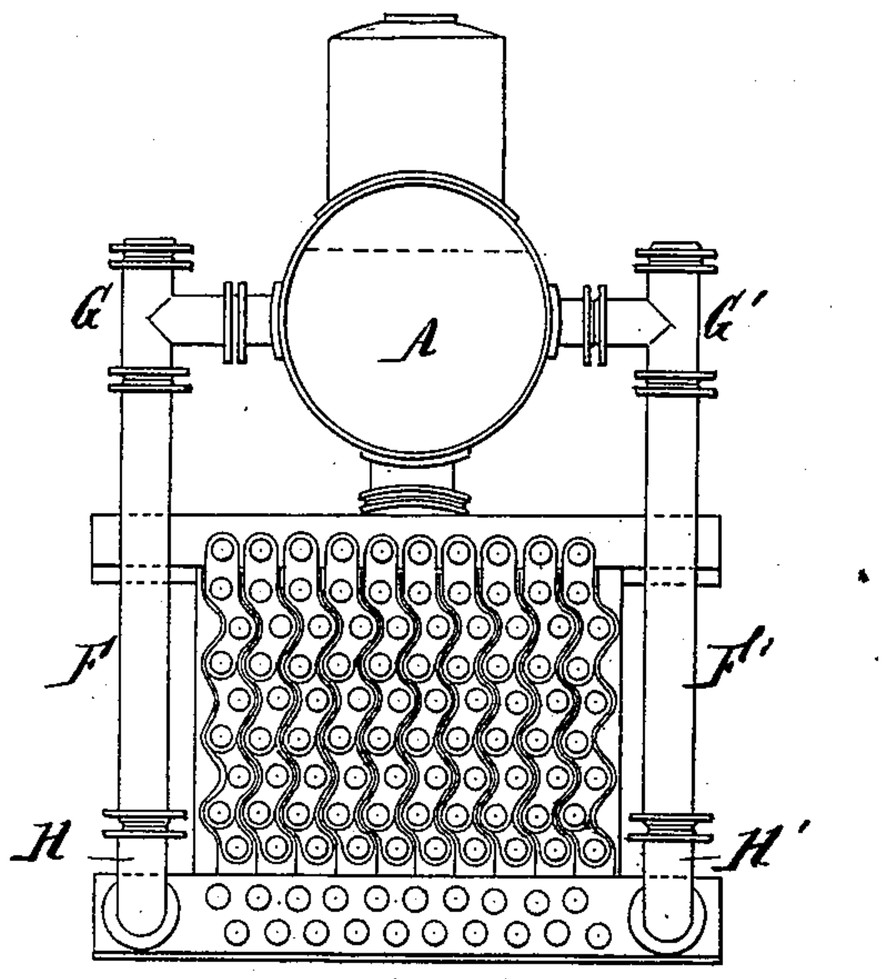
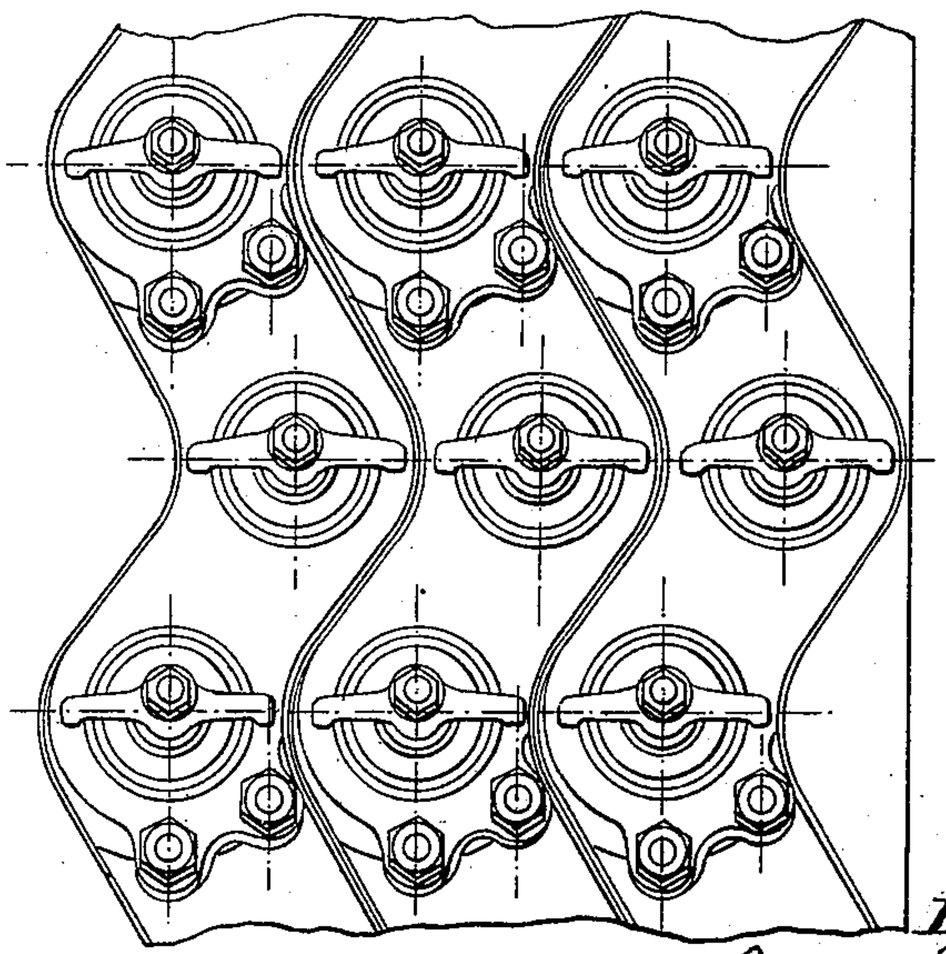


Fig. 4.



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By Richards & R
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(No Model.) 3 Sheets—Sheet 2.

L. DE NAEYER.

WATER TUBE STEAM GENERATOR.

No. 601,790. Patented Apr. 5, 1898.

Fig. 2.

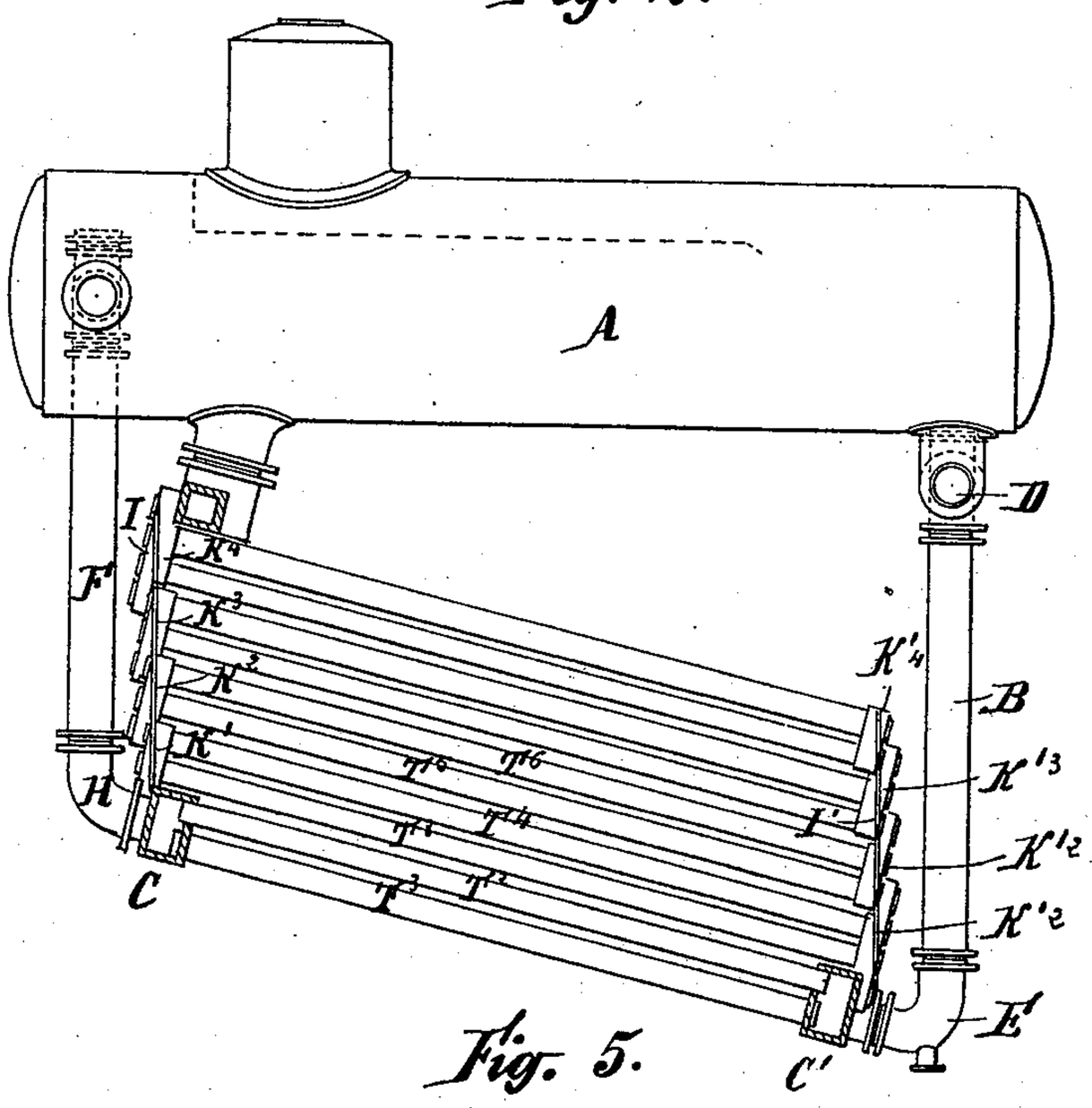
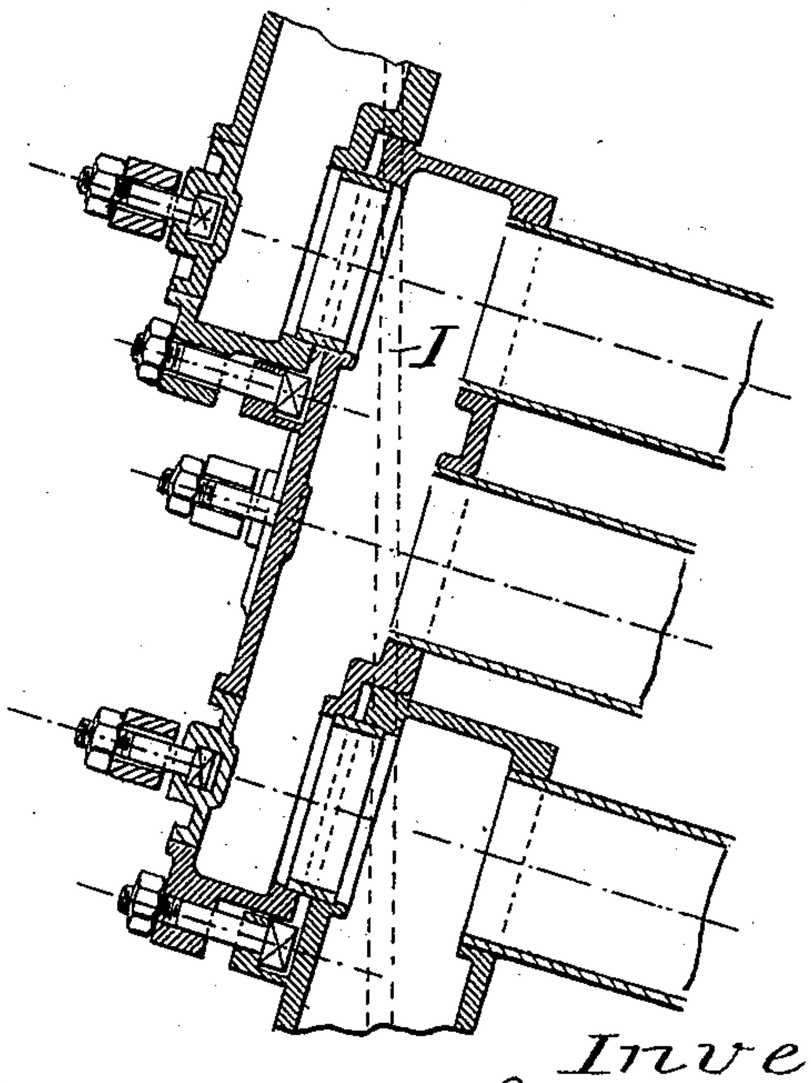


Fig. 5.



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(No Model.)

3 Sheets—Sheet 3.

L. DE NAEYER.

WATER TUBE STEAM GENERATOR.

No. 601,790. Patented Apr. 5, 1898.

Fig. 3.

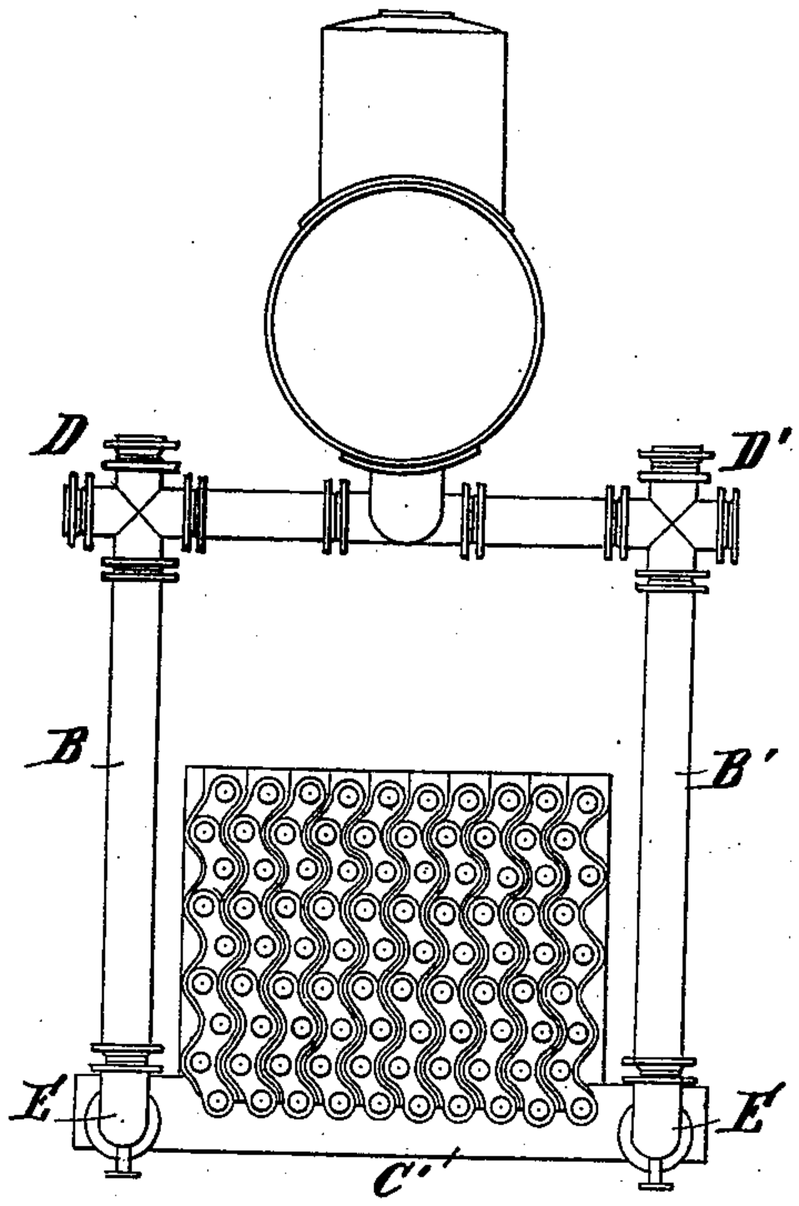
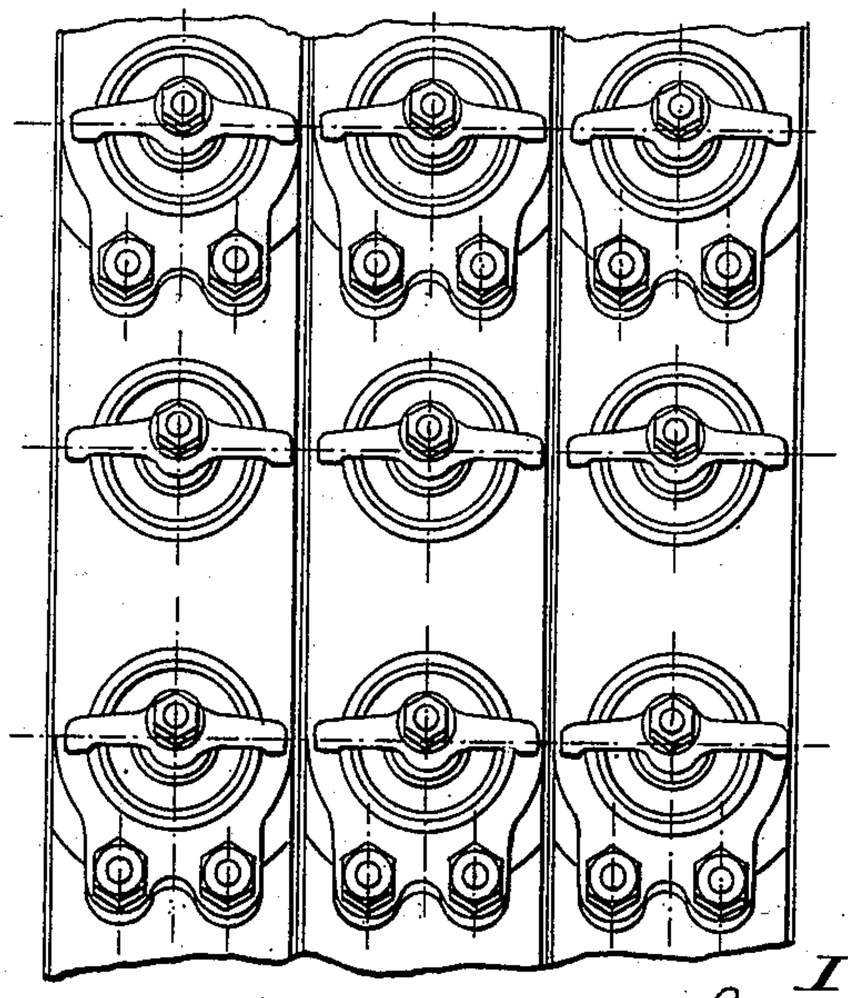


Fig. 6



Witnesses:
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UNITED STATES PATENT OFFICE

LOUIS DE NAEYER, OF WILLEBROEK, BELGIUM.

WATER-TUBE STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 601,790, dated April 5, 1898.

Application filed March 31, 1897. Serial No. 630,178. (No model.) Patented in Belgium December 28, 1896, No. 125,379; in France February 13, 1897, No. 234,043; in Italy February 14, 1897, No. 86/210; in England February 26, 1897, No. 5,218; in Germany March 2, 1897, No. 95,533; in Spain March 6, 1897, No. 20,501, and in Austria March 8, 1897, No. 47/3,238.

To all whom it may concern:

Be it known that I, LOUIS DE NAEYER, a subject of the King of Belgium, residing at Willebroek, in the Kingdom of Belgium, have invented certain new and useful Improvements in Water-Tube Steam-Generators, of which the following is a specification.

The invention has been patented in Belgium, No. 125,379, dated December 28, 1896; in England, provisional protection, February 26, 1897, No. 5,218; in France, No. 234,043, dated February 13, 1897; in Italy, No. 86/210, dated February 14, 1897; in Spain, No. 20,501, dated March 6, 1897; in Austria, No. 47/3,238, dated March 8, 1897, and in Germany, No. 95,533, dated March 2, 1897.

This invention relates to water-tube steam-generators; and it consists of an improved construction thereof with the object of obtaining greater simplicity with increased evaporation and efficiency. My experience has proved that the quantity of steam produced by the water-tubes that lie immediately over the furnace of a generator generate at least half of the total quantity of steam produced by the whole of even a well-arranged interconnected tube group, and the aim of my invention is to utilize this fact fully and to discharge such steam direct into the steam collector or receiver independently of that generated by the rest of the water-tube system employed. According to my invention, therefore, I arrange the lowest tubes to discharge direct into the receiver and the rest or upper tubes of the system to discharge thereinto independently of the first or lowest tubes; and my invention consists in the arrangement and combination of parts whereby I effect this purpose.

I will now fully explain same in reference to the accompanying drawings, in which—

Figure 1 is a front end elevation; Fig. 2, a side elevation, partly in section; and Fig. 3, a rear end elevation of a steam-generator without the furnace and usual accessories, illustrating my invention. Fig. 4 is an enlarged part front elevation of sinuously-arranged tube-boxes and covers. Fig. 5 is a sectional elevation of same. Fig. 6 is an elevation showing a vertical arrangement of tube-end boxes.

My improved generator is composed of two practically independent tubulous groups T and T^0 and one upper steam and water drum A. The lower one T of these tubulous groups is placed immediately over the fire-grate and is composed of two or more superposed rows of parallel tubes T' T^2, slightly inclined to the horizontal and fixed at their ends into similar transverse junction boxes or collectors C C', made of cast or wrought iron or steel. These have closed ends, which are fitted with mud-holes in the usual way, and the whole is suitably supported by or suspended, as shown at I I', by rods from the furnace-frame or superposed part T^0. The front transverse collector C communicates at each of its ends by bends H and H', pipes F F', and branches G G' with the upper steam-collector A at or about water-level therein, and the rear transverse collector C' communicates by bends E E', pipes B B', and branches D D' with the base of the same collector A at D^2. The said steam-collector A is suitably protected from the direct impact of flames by baffle or iron plates, as usual. The other or upper tubulous part T^0 consists of a similar group of tubes of any desired number placed above the first group T, and it is composed of a superposed series of tubulous elements. Four are shown in the drawings, and since each element is the same I will describe one of them. It is made up, preferably, of two superposed inclined water-tubes T^3 T^4, fixed at their ends into sectional junction-boxes K' K^5, each having three openings t' t^2 t^3 in their inner faces, two of which, t' t^2, serve to receive the ends of the said two water-tubes T^3 T^4, and the third, t^3, serves to receive a short connecting-tube M, Fig. 5, or suitable coupler for joining it to the next lower similar box, upon which it rests. These end boxes K' K^2 K^3 K^4 are preferably arranged and connected at each end to the tubes one above the next in step-like form, as illustrated, and the tube ends therefore may come in sinuous lines, as in Figs. 1, 3, and 4, or in vertical lines, as in Fig. 6, according to the design of the boxes.

An access-hole and cover N is provided opposite to the end of each water-tube, and the whole is secured and held together by flanges or lugs *f f*, with bolts *f'* and nuts f^2, or by clamps or otherwise. This upper tube group T^0 is supported, therefore, by the transverse collectors C C' of the lower tube group T, and the uppermost end box K^4 at the front has an additional hole at t^4 in its upper inner end by which it is connected to a transverse collector L, similar to C C' above described, and which is independently connected to the base of the steam-drum A by the pipe connection L'. This practically independent system of tubes T T' T^2 and collectors C C', placed immediately over the fire, as first above described, is of itself an efficient generator of steam, and by joining, as above explained, these two lowest rows of tubes T' T^2 and collectors C C' directly and independently to the steam-collector A, I am able to directly discharge thereinto about half of the total steam product of the whole tube group T T^0. The upper tube group T^0, secondly described, serves to utilize and absorb heat which has escaped from the said lower group T. The rear tube-end boxes K^5 K^6 K^7 K^8 of the upper tube group are arranged in step-like form similarly to the front ones, and the lowest one K^5 is provided with a fourth opening t^5 at the lower part of its inner face, by which it is connected to the back of the lower transverse rear collector C' of the first tube group T, so as to afford free circulation of water through the whole system.

Though I have particularly described one way of forming, arranging, and connecting the tube-end junction-boxes of the upper tube group T^0, I do not confine myself to that above, since the said boxes may be otherwise formed and arranged so long as the system of boxes is in free and open communication with one another and with the steam-receiver. This combination will admit of forming a whole section of the tubulous elements following either sinuous or vertical lines, as shown and described.

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

1. A water-tube steam-generator consisting of one or two rows of inclined water-tubes placed immediately over the fire, joined at their ends into transverse collectors communicating at each end direct with an upper steam receiver and collector the front one at or about water-level, and the rear one at the base thereof, an upper group of inclined water-tubes interposed between said lower group and the steam-receiver consisting of separate elements each comprising two superposed water-tubes joined at their ends into vertically-arranged short sectional junction-boxes each connected to the one above and below it by open water-tube couplers, the upper front boxes all communicating with a transverse collector connected to the base of the steam-collector and the lowest rear boxes communicating by open water-tube couplers with the rear side of the rear transverse collector of the lower tube group, substantially as described for the purposes specified.

2. In a water-tube steam-generator the combination with the upper steam-receiver A of the lower tube group T, collectors C C' and independent pipe connections thereto, the upper tube group T^0 with sectional tube-end junction-boxes K' K^5, K^2, K^6, K^3, K^7, K^4, K^8 formed and arranged in sinuous lines, the front upper transverse collector L' being connected to the base of the steam-receiver A and the rear water connection to collector C' substantially as described.

3. In a water-tube steam-generator the combination with the upper steam-receiver A of the lower tube group T, collectors C C' and independent pipe connections thereto, the upper tube group T^0 with sectional tube-end junction-boxes K', K^5, K^2, K^6, K^3, K^7, K^4, K^8 in vertical lines with the front transverse collector L' connected to the base of the receiver A and rear water connection to collector C' substantially as described.

4. In a water-tube steam-generator the combination with the steam-receiver A, lower tube group T independently connected thereto, of the upper group of tubes T^0 comprising a superposed series of tubulous elements each element made up of two inclined superposed water-tubes fixed at their ends into sectional junction-boxes each box having three openings in its inner face, two for the tubes, and the third for a coupler joining it to the next lower similar box, three openings in front, one for the upper coupler, and two for access-holes and covers, said boxes being arranged in step-like form at each end and resting on each other substantially as described.

5. In a water-tube steam-generator the combination with the steam-receiver A, of the lower group of pipes T having an independent connection with the receiver at each end, the upper group of pipes parallel and coextensive with said lower group, an independent connection from the front of said upper group to the receiver, and a connection between the rear ends of the upper and lower group, substantially as described.

I testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LOUIS DE NAEYER.

Witnesses:
GEORGE BEDE,
GREGORY PHELAN.