(No Model.)

G. D. COOPER.

STEAM GENERATOR.

No. 407,395. Patented July 23, 1889.

Fig. 1

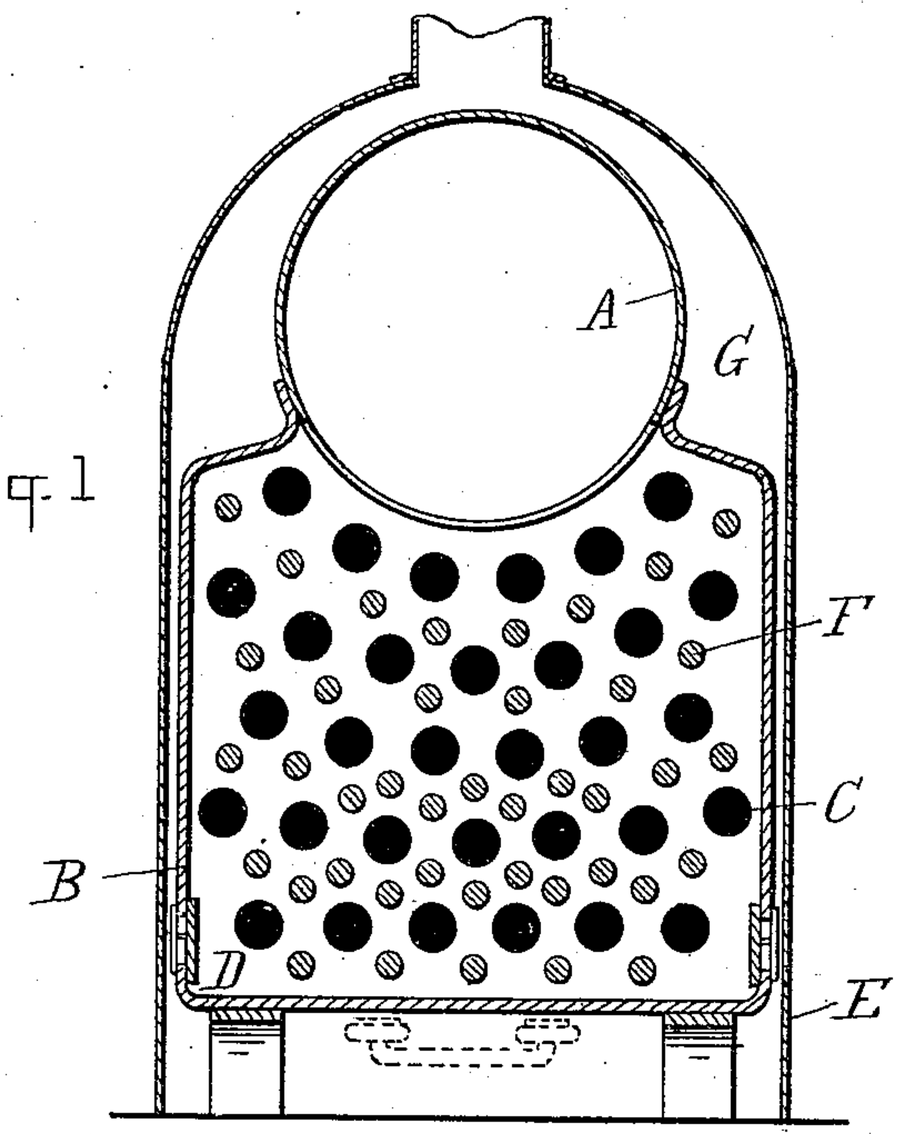
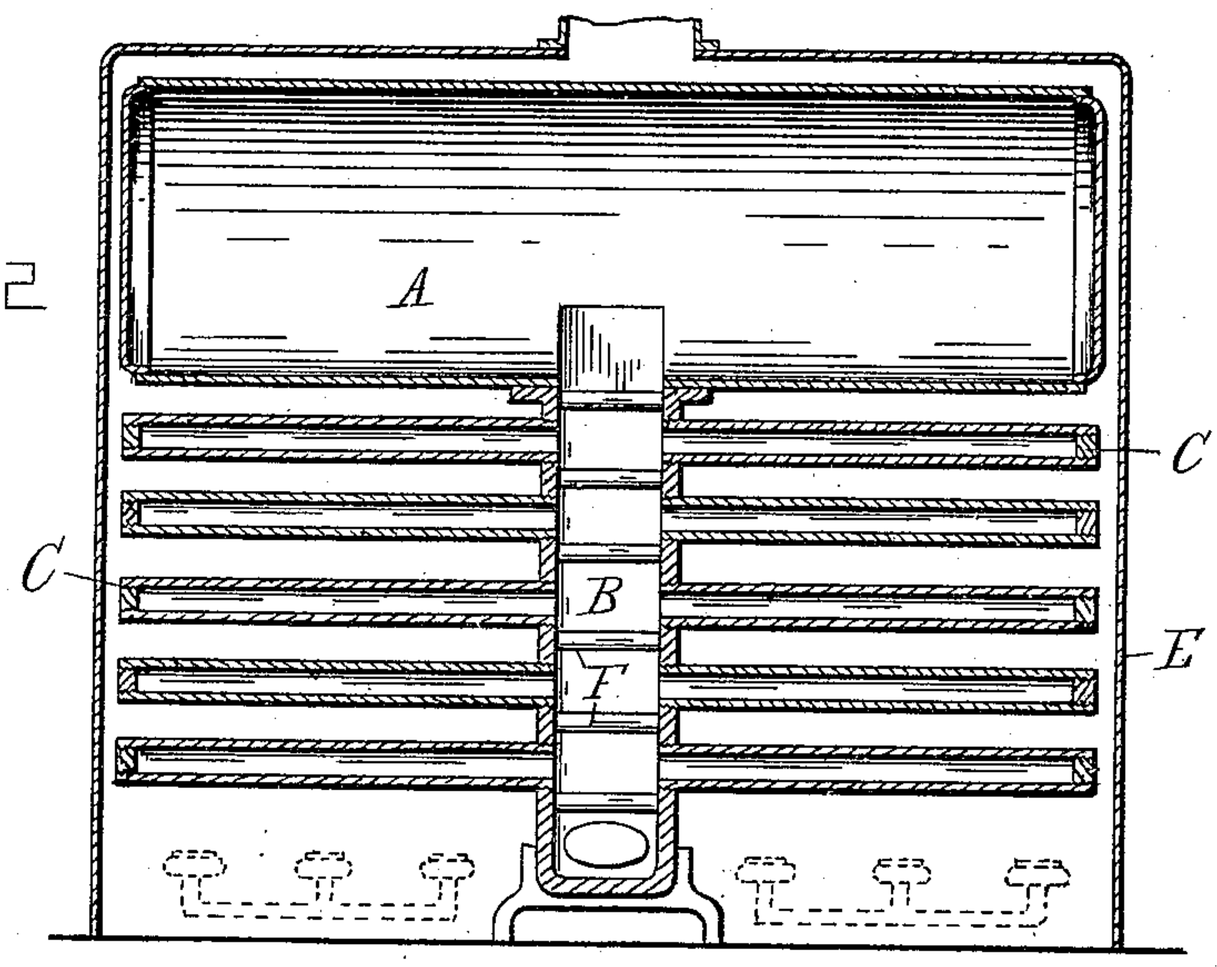


Fig. 2



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UNITED STATES PATENT OFFICE.

GEORGE D. COOPER, OF ST. JOHN'S, MICHIGAN, ASSIGNOR TO THE COOPER BOILER AND ENGINE COMPANY, OF SAME PLACE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 407,395, dated July 23, 1889.

Application filed February 2, 1889. Serial No. 298,423. (No model.)

To all whom it may concern:

Be it known that I, GEORGE D. COOPER, a citizen of the United States, residing at St. John's, in the county of Clinton and State of Michigan, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to new and useful improvements in steam-generators; and the invention consists in the arrangement and construction of different parts, whereby simplicity, safety, and great steaming qualities are obtained, all as more fully hereinafter described.

In the drawings which accompany this specification, Figure 1 is a cross-section of my improvement on line X X in Fig. 2. Fig. 2 is a vertical central longitudinal section of my improved steam-generator.

A is a horizontal drum, preferably of cylindrical shape, and constructed in any suitable manner, either of boiler-plate or cast-iron.

B is a vertical water-leg communicating with the drum at or near the longitudinal center thereof and is placed at right angles thereto. This water-leg preferably forms a rectangular box of cast-iron or boiler-plate and is of somewhat greater width than the diameter of the drum. This water-leg communicates upon its sides with a series of horizontal tubes C, which are closed at the outer ends and are opened at their inner ends, and which are secured into the leg in any suitable manner. The outer ends of these tubes are about in the same vertical plane as the ends of the steam-drum, and there are as many of them secured in the water-leg as can be conveniently secured therein, and so as to leave sufficient space between them for the circulation of the flame and the gases of combustion. This series of tubes, however, does not extend quite to the bottom of the water-leg, for the purpose of forming a mud drum or pot D at the bottom of the water-leg, into which the sediment is collected, and may be removed through suitable hand-holes formed in the opposite end of the water-leg.

The whole generator is inclosed within a combustion-chamber formed by an outer casing E, which approaches closely to the sides and ends of the generator and forms a chamber G around the sides and top of the drum, whereby the gases and flames are confined and directed through the interstices between the tubes in the chamber, which may be provided with an exit in the top of the casing.

As a source of heat for the generator, I use preferably liquid fuel or gas, which is burned by means of a series of burners adapted for the kind of fuel employed, and suitably distributed underneath the tubes in the space provided therefor. In case of smokeless combustion an exit pipe or flue to a chimney may be omitted.

In practice it will be seen that the tubes form a very large heating-surface in comparison with the amount of water in the generator, which is contained in the tubes and in the water-legs.

Steam can be raised in a very short time and the pressure is easily maintained with a small amount of fuel, and as a result of the construction the expansion or contraction of the iron can have no injurious effect on the generator, as the tubes are free to expand or contract, and therefore it is most durable.

The large steam-space in the drum prevents foaming or priming, and as the drum is inclosed inside of the jacket, so as to be entirely surrounded by the hot gases of combustion and exposed to the direct heat and flame, the steam becomes superheated and dry; hence a large amount of water, which is in other generators mechanically carried off with the steam, is retained in the boiler and saved with the heat.

I also claim increased safety for my generator, as the tubes are the best form to withstand the great steam-pressure, and the water-leg being of great depth may be firmly stayed from wall to wall by suitable stays or lugs F, spaced between the inner ends of the tubes, preferably cast integral with the water-leg.

As the circulation in the generator will take place in the water-leg, the sediment will be easily precipitated to the bottom, and can be withdrawn therefrom through the hand-holes placed therein.

I deem it important that the burners or source of heat be arranged beneath the tubes

and distributed upon each side of the water-leg, whereby I obtain the greatest benefit of the heat.

I deem it important that the tubes C extend the full length of the steam-drum, and that they be arranged parallel therewith and with each other at equal distances apart and preferably alternating, as shown in Fig. 1—that is, with the tubes in one row arranged opposite the spaces between the tubes in the next row, whereby the heat from the burners or other source of heat is evenly distributed over all of the tubes and up past the ends of the tubes and the ends of the drum and over the top of the latter. Where the tubes are arranged radially, as has been common, the spaces between the tubes vary, and the water, after receiving the greatest amount of heat at the point farthest from the central leg, has to pass inward to the said central leg through the cooler portion of the tubes, for near the central leg the tubes are so close together that there is little or no room for the heat to pass between them to heat the water therein.

What I claim as my invention is—

In a steam-generator, the combination, with the horizontal cylindrical steam-drum, of the vertical water-leg supporting said drum arranged at right angles thereto and communicating therewith, as shown, and of greater width than the diameter of the drum, the water-tubes closed at their outer ends and at their inner ends communicating with the water-leg, said tubes extending from the opposite sides of the water-leg parallel with each other and with the drum, the stays F, spaced between the inner ends of the tubes from wall to wall of the water-leg, and the outer casing E, inclosing the tubes and drum and forming a jacket around the drum and a combustion-chamber around the tubes, substantially as shown and described.

In testimony whereof I affix my signature, in presence of two witnesses, this 24th day of January, 1889.

GEORGE D. COOPER.

Witnesses:

JAMES WHITTEMORE,

ED. MCBREARTY.