P. FOUQUE & G. CHARPENTIER.

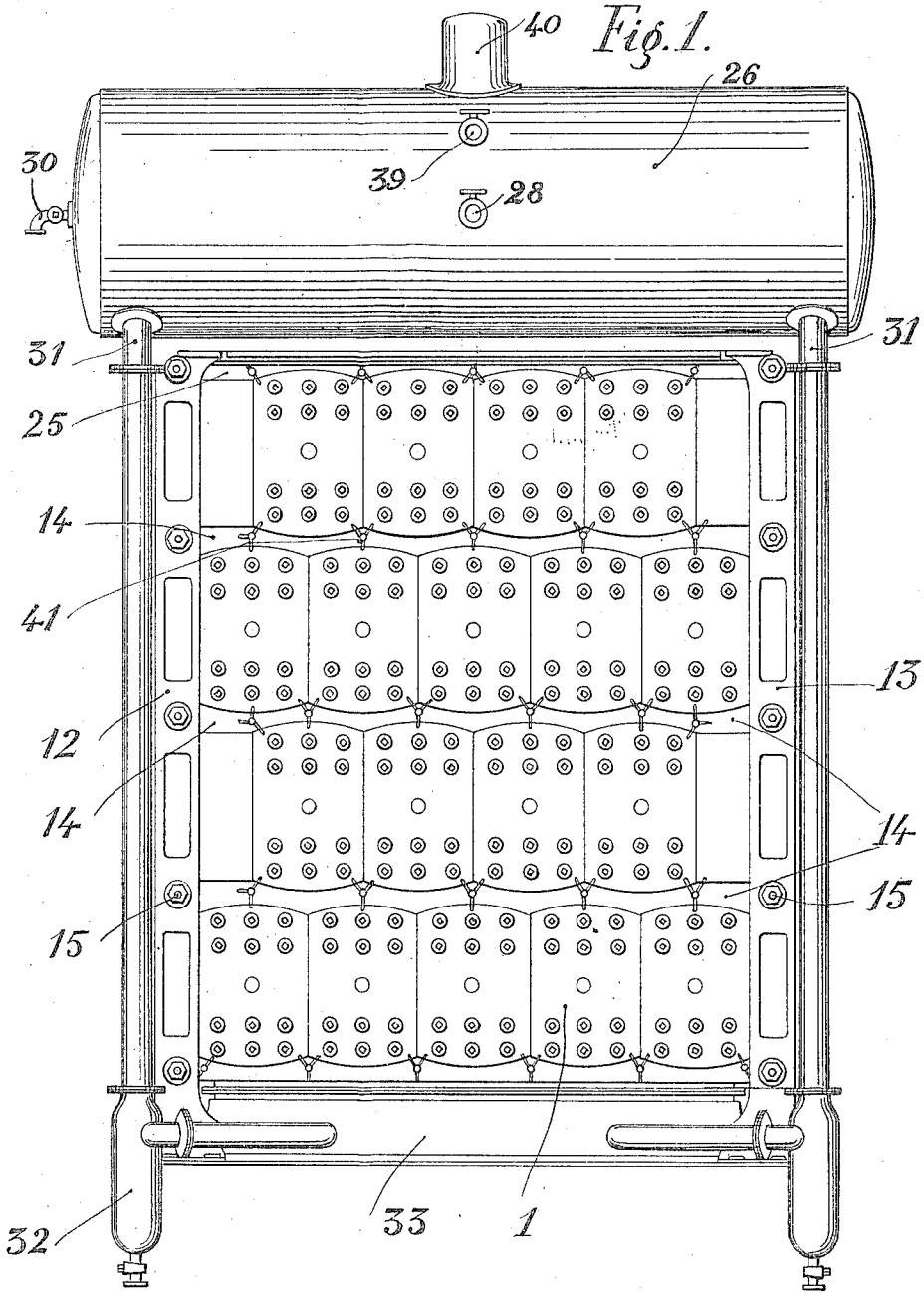
STEAM GENERATOR WITH FORCED CIRCULATION.

APPLICATION FILED JAN. 6, 1913.

1,082,312. Patented Dec. 23, 1913.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Willy Kurth

Ferd. Hüttiger

Inventors

Pierre Fouque and
Gilbert Charpentier
by Fenderson & Marsh
Attorneys

P. FOUQUE & G. CHARPENTIER.

STEAM GENERATOR WITH FORCED CIRCULATION.

APPLICATION FILED JAN. 6, 1913.

1,082,312. Patented Dec. 23, 1913.

3 SHEETS—SHEET 2.

Fig. 9

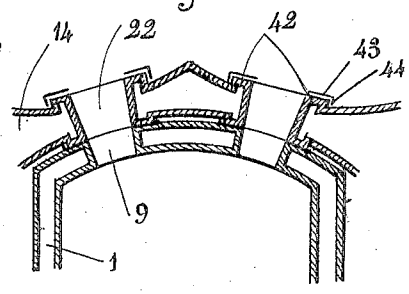


Fig. 10

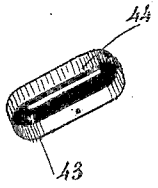


Fig. 2

Witnesses

Willy Mauk

Fred Haffner

Inventors

Pierre Fouque and
Gilbert Charpentier
by Fredrick Mauk
attorney

P. FOUQUE & G. CHARPENTIER.

STEAM GENERATOR WITH FORCED CIRCULATION.

APPLICATION FILED JAN. 6, 1913.

1,082,312. Patented Dec. 23, 1913.

3 SHEETS—SHEET 3.

Fig. 3

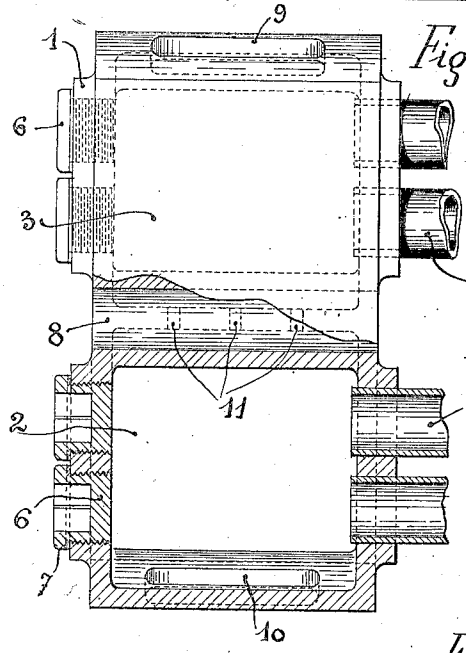


Fig. 4

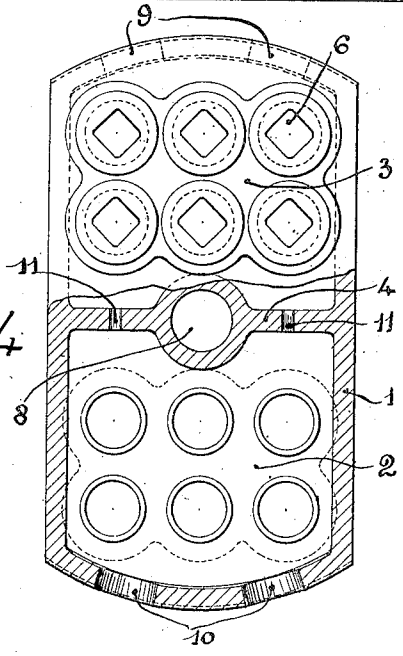


Fig. 5

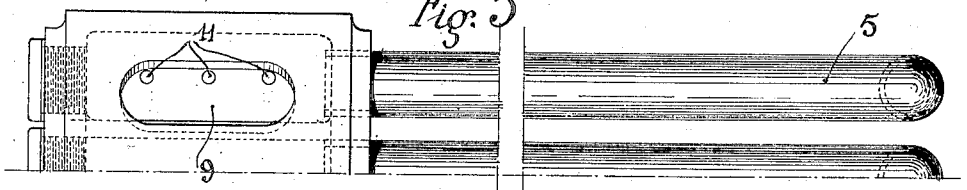
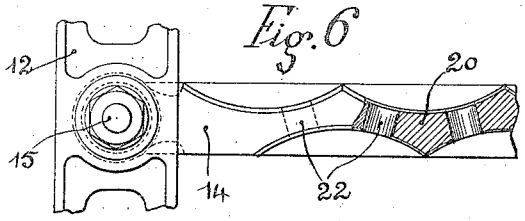


Fig. 6



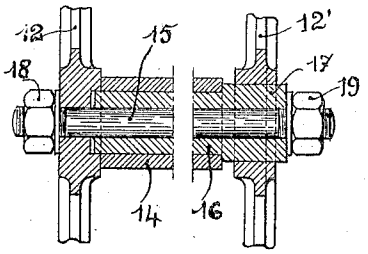
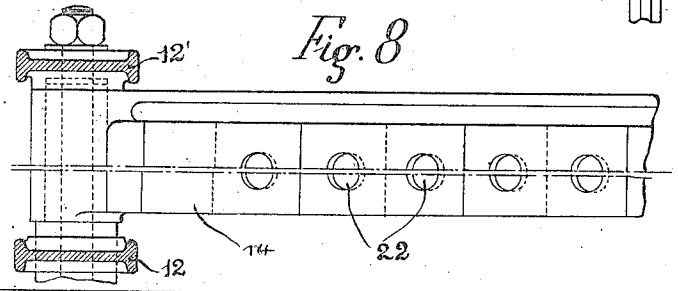


Fig. 7

Fig. 8



Witnesses

Willy Heath

Ferd. Hellmuth

Inventors

Pierre Fouque and

Gilbert Charpentier

by Fredk. Haas Heath

Attorneys

UNITED STATES PATENT OFFICE.

PIERRE FOUQUE AND GILBERT CHARPENTIER, OF LA-PLAINE-ST.-DENIS, FRANCE.

STEAM-GENERATOR WITH FORCED CIRCULATION.

1,082,312. Specification of Letters Patent. Patented Dec. 23, 1913.

Application filed January 6, 1913. Serial No. 740,467.

To all whom it may concern:

Be it known that we, PIERRE FOUQUE and GILBERT CHARPENTIER, both citizens of the Republic of France, residing at La-Plaine-St.-Denis, in the Republic of France, have invented certain new and useful Improvements in Steam-Generators with Forced Circulation, of which the following is a specification.

This invention relates to a steam generator of that type in which the water flows through tubes which communicate with one another and are arranged in a furnace. The water flows in at the lower part of the tubes, ascends in the same and passes successively through all the tubes to flow out as steam at the upper end of the circuit. This boiler is composed of separate elements which consist each of a chest divided into two compartments. The two ends of a certain number of U-shaped tubes terminate in the one and in the other compartment respectively. The chests are juxtaposed in horizontal rows and the several rows are separated by special cross-pieces which serve for establishing the communication between the several chests. The two compartments of each chest have perforations registering with holes of the two cross-pieces of the corresponding chest. The holes of the cross-pieces serve for connecting the juxtaposed upper and lower compartments of two adjacent chests in vertical direction. The cross-pieces have their ends mounted in special uprights constructed so that the cross-pieces can freely expand. The chests have conical upper and lower walls and flat side walls.

Concavities in the upper and lower surfaces of the cross-pieces serve for the reception of the conical walls of the chests. Each chest is inserted between the two cross-pieces which maintain the same and the joint between the chests and the cross-pieces is tightened by means of three-armed clamps bearing upon the cross-pieces and pushing the chests toward the bottom of the furnace. Each chest has a passage parallel with the tubes which does not communicate with the interior of the chest and permits of sweeping the corresponding tubes.

In the accompanying drawings a form of construction of the present invention is shown by way of example.

Figure 1 is a front elevation. Fig. 2 is a side elevation partly in section. Figs. 3 and 4 and 5 show an element of the boiler in side elevation, front elevation and in a plan view respectively. Figs. 6, 7 and 8 represent the connection of a cross piece with the uprights in front elevation, side elevation and plan view respectively. Figs. 9 and 10 illustrate the joint between a chest and a cross-piece.

Each element of the boiler essentially consists of a chest 1 divided into two compartments 2 and 3 by means of a partition 4. The U-shaped tubes 5, six for example, are dudgeoned in said chests with the one end in one compartment and with the other end in the other compartment. The front wall of the chest 1 has openings registering with openings of the rear wall which permit of dudgeoning the ends of the tubes 5 in the rear wall. These openings further permit of inspecting and cleaning the tubes 5. The openings are closed by screw stoppers 6 and washers 7. A passage 8 traversing the chest 1 from the front to the rear, without communicating with the inner space of the same, permits of using a jet of steam for sweeping the tubes 5. The lateral walls of the chest 1 are flat and the two walls of two adjacent chests which are in contact do not communicate the one with the other. The upper wall and the lower wall of the chest are inclined toward the rear and they are perforated by holes 9, 10 (for example two). The median partition 4 has holes 11 of small diameter serving to connect the two compartments. The boiler is supported by two double-uprights 12, 13.

Cross pieces 14 are fixed with their end upon the two uprights. Each cross piece 14 is traversed by a bolt 15 having a sleeve 16 with flange 17 which serves for rigidly connecting the cross piece with the front uprights 12 by the aid of two nuts 18, 19. The rear upright 12′ is freely mounted upon the flange 17 of the sleeve 16; it is connected with the front upright only by its ends. In the upper and lower surfaces of the cross piece 14 conical cavities 20, 21 are arranged which are inclined toward the rear in accordance with the upper and lower walls of the chest 1. These cavities are arranged so that the horizontal rows of chest 1 are staggered. The cross pieces 14 have holes 22 which connect the upper compartment of a lower chest with the two lower compartments of the two adjacent upper chests. Each hole 22 of a cross piece 14 (Fig. 9) registering with a hole 9 of the chest has a ring-

shaped projection 42 at the upper and lower end of the hole. Upon these projections 42 caps 43 with flanges 44 of red copper are arranged, said caps having openings corresponding with the holes 9 and 22. The joints between the cross piece 14 and the chest 1 are thus made perfectly tight. The U-shaped tubes 5 rest with the rear ends upon supports 23 fixed in the bottom of the furnace the fire-grate of which is arranged at 24. The two double uprights 12, 13 are connected at their upper ends by a cross piece 25 which connects the last row of chests with the receiver 26.

The steam gets into the receiver by means of an expansion tube 27. The feed water flows into the receiver through the valve 28, it traverses the purifier 29 which has a blow-off cock 30. From the receiver 26 the water gets into the return-tubes 31, hence to the vessel 32 and into the feeding collector 33 which occupies all the lower part of the front wall and communicates by convenient openings 34 with the lower cross piece and the lower row of chests 1. The vessel 32 has a deflecting partition 35 which facilitates the separation of the mud which is thus collected upon the bottom of the vessel under the partition 36. The blow-off cock 37 serves for the removal of the mud. The receiver 26 has an out-flow tap 38 and a steam valve 39 the end of which reaches into the steam dome 40. Three-armed iron bars 41 which are mounted each upon a threaded bolt screwed into the cross piece 14 bear with the ends of the three-arms upon the three adjacent chests, two upper and one lower and secure the same in position.

The water flows into the receiver 26, descends through the tube 31, deposits the mud and passes from the collector 33 into the lower row of chests 1. From there the water flows through the first series of tubes 5 into the upper compartments of these chests and so on, until it has circulated through all the tubes 5 which together form a serpentine. When the water arrives at the upper end of the boiler it has been completely vaporized and escapes through the expansion tube 27 as steam. The perforations 11 of the inner partitions 4 of the chests 1 prevent the formation of water pockets or steam pockets in these tubes as the bubbles which might be formed can ascend in successively traversing the different chests 1 to escape through the tube 27. The perforations are too small to permit of the water flowing up directly through the chests 1 without passing through the tubes 5.

Having thus described our invention what we claim is:—

A steam generator with forced circulation and composed of detachable separate elements comprising in combination: a certain number of chests, each forming one element, a partition in the chest dividing the same into two compartments and having a hole of small diameter, U-shaped tubes terminating with one end in one of said compartments and with the other end in the other compartment, an inclined perforated top wall of the chest and an inclined perforated bottom of the chest, cross pieces supporting said chests and having holes registering with the holes in the bottom and top plates of said chests, cavities in the upper and lower surfaces of said cross pieces corresponding with the inclined top and bottom plates of said chests, ring-shaped projections surrounding said holes of the cross pieces, perforated red copper caps upon said ring-shaped projections, and double uprights at the ends of the cross pieces supporting the same substantially as described and shown and for the purpose set forth.

In witness whereof we have hereunto set our hands in the presence of two witnesses.

PIERRE FOUQUE.
GILBERT CHARPENTIER.

Witnesses:
HANSON C. COXE,
A. DE CARZALADE.