(No Model.)

D. A. CASALONGA.

STEAM GENERATOR.

No. 605,997. Patented June 21, 1898.

Fig. 4.

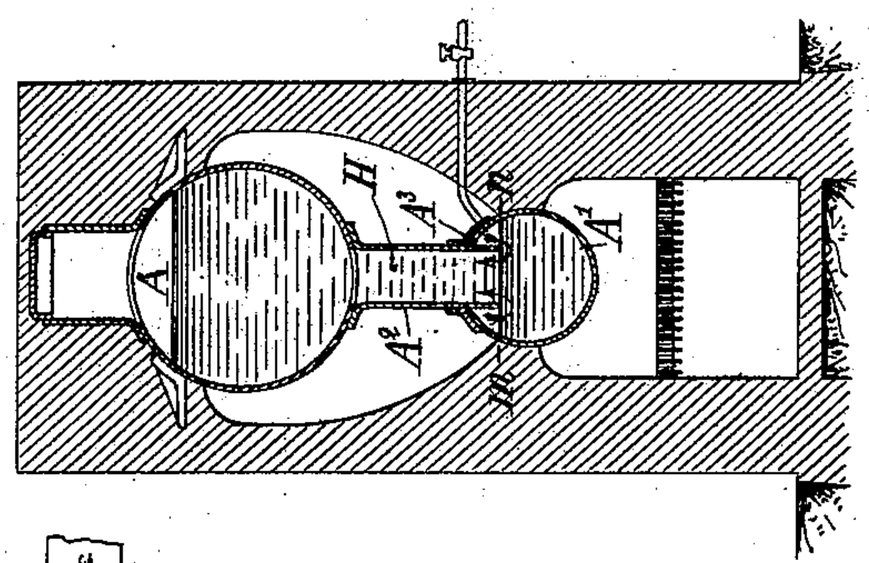


Fig. 2.

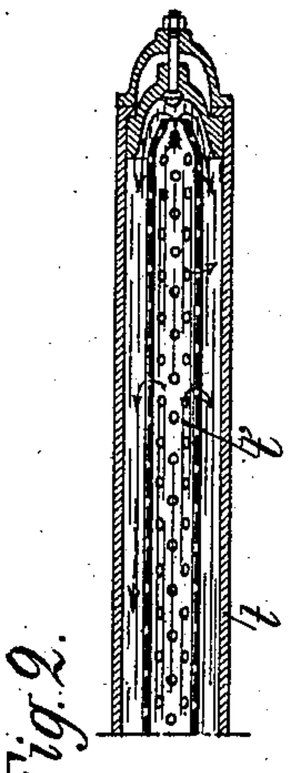


Fig. 3.

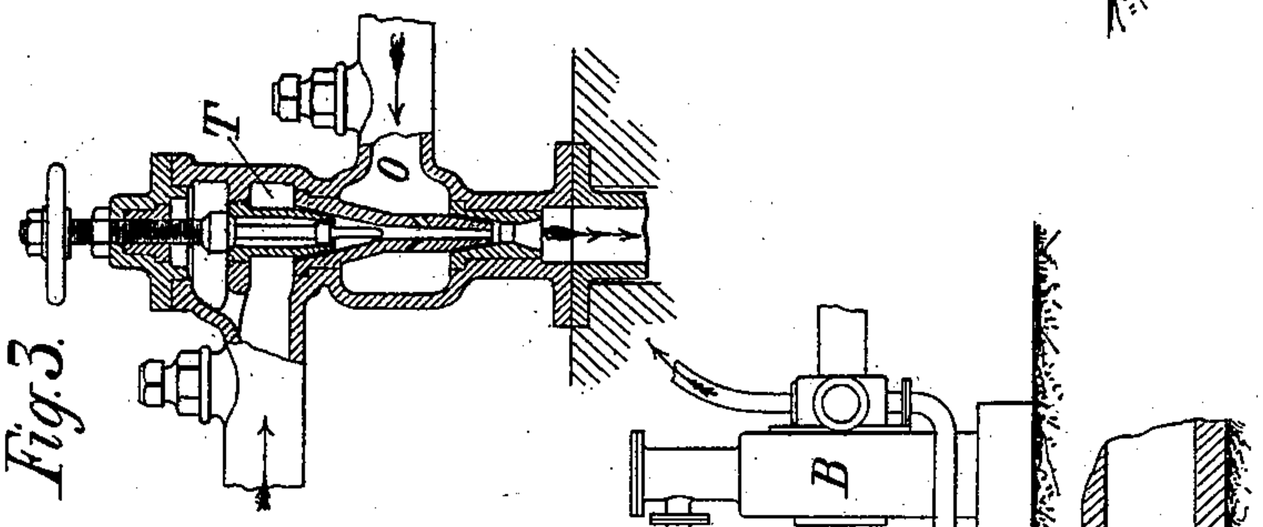
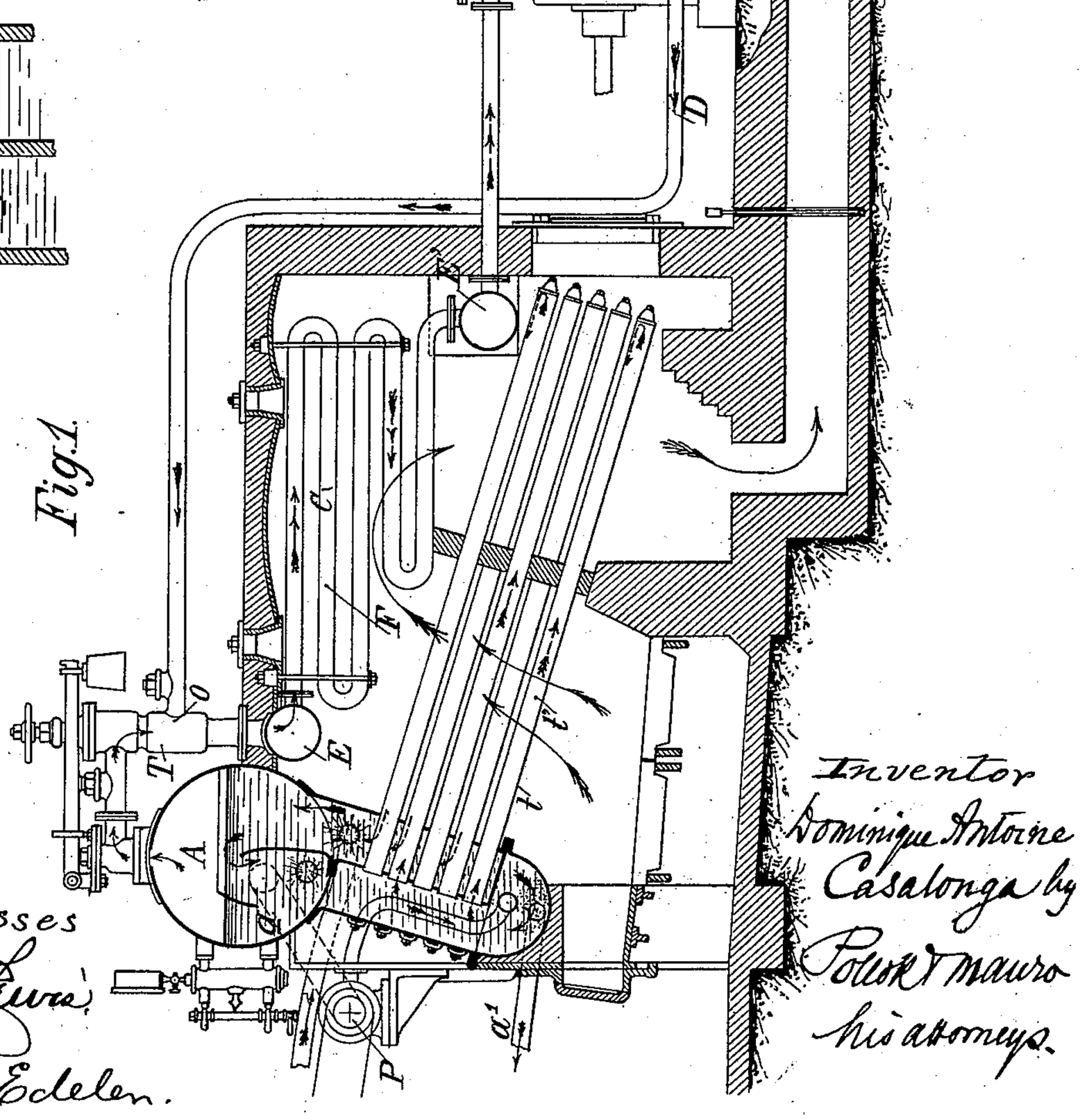


Fig. 1.



Witnesses
Geo. Geis.
H. R. Edelen.

Inventor
Dominique Antoine
Casalonga by
Foster & Mauro
his attorneys.

UNITED STATES PATENT OFFICE.

DOMINIQUE ANTOINE CASALONGA, OF PARIS, FRANCE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 605,997, dated June 21, 1898.

Application filed December 28, 1897. Serial No. 663,940. (No model.) Patented in England September 17, 1895, No. 17,276, and in France March 17, 1896, No. 254,832.

To all whom it may concern:

Be it known that I, DOMINIQUE ANTOINE CASALONGA, a resident of Paris, France, have invented new and useful Improvements in Means for Producing and Applying Steam, which are fully set forth in the following specification, and for which I have obtained patents in England, No. 17,276, dated September 17, 1895, and in France, No. 254,832, dated March 17, 1896.

This invention relates to improvements in means for producing and applying steam-power, and has for its object to increase the efficiency of steam-boilers and steam-engines while reducing their weight and dimensions.

The improvements consist in supplying an engine with superheated steam obtained by causing a jet of saturated live steam of high pressure to draw into a vessel situated between the superheater and the boiler a portion of the exhaust-steam of the engine, the engine being preferably of the kind whose receiving element consists of a turbine wheel adapted to revolve freely in its casing—such as, for instance, steam-turbines or a steam-turbine on Laval's system; where the receiving element does not rub against the walls of the casing; in producing and maintaining by means of a pump, preferably of the centrifugal type, a continuous mechanical circulation of the water in the boiler, which circulation aids that produced by the heat of the furnace, with the object of rendering the temperature uniform; of scouring energetically the heating-surfaces, and of increasing the steaming power and the safety of the steam-boiler.

These improvements are applicable to all types of steam-engines and steam-boilers, but more particularly to practically frictionless rotary engines and to tubulous boilers.

The superheater is arranged behind the boiler, so as not to be exposed to a too powerful action of the fire. It is connected to the boiler by means of the intermediate conduit, which contains and distributes the mixture at a mean pressure. The sectional area of the passage-way of the superheater increases toward the outlet, which latter should be exposed to the hottest gases, and for this reason should be capable of withstanding a high temperature and of being easily removed and replaced. The conditions of outflow of the superheated steam may be regulated by means of known devices for regulating the pressure and the temperature.

A portion of the exhaust of an engine is drawn off by a jet of live saturated steam of high pressure supplied by the boiler. The jet exerts its inducing action by means of an injector, that may be of known type, having one or more inducing-cones, and the mixture of live and exhaust steam passes into the intermediate reservoir or conduit, whence it is admitted to the superheater and caused to travel, as much as possible in the opposite direction to that of the hot gases, to the engine. The superheater may be composed of a number of separate removable and replaceable sections, each being provided with a removable end portion that is designed to be subjected to the most intense action of the hot gasses of combustion. As the steam travels toward the engine it expands and is superheated more and more.

The continuous mechanical circulation for the purpose of accelerating and intensifying the circulation in the boiler is not necessarily combined with the return of a portion of the exhaust-steam by means of live steam of high pressure; but it promotes the absorption of the heat of the furnace and of the hot gases by the circulating water. It maintains the surfaces clean by scouring them or causing the said water to impinge upon them. It increases the generation of steam and the safety of the apparatus, and it localizes in a quiet and not-much-heated part of the boiler the impurities held in suspension in the circulating current.

Figure 1 of the accompanying drawings shows in vertical section a general diagrammatic view of the general arrangement of the various parts of the apparatus. Fig. 2 shows, on a larger scale, a detail view of one of the heating and circulating tubes. Fig. 3 is a separate view, to a larger scale than Fig. 1, of an injector which may have several inducing-cones. Fig. 4 is a vertical sectional view of a modified construction of my boiler.

The operation of the apparatus is as follows: Of the high-pressure saturated steam supplied to the drum A of the boiler a portion is allowed to pass direct to the engine B through the superheater C at starting, as indicated by

the arrows in full lines. After the engine has thus been started a jet of high-pressure steam passing into an injector T draws in through an opening O a part of the exhaust-steam of the engine, this steam passing through the return-pipe D. The mixture of the live and exhaust steam enters at a mean but rather low pressure into an intermediate conduit E, whence it is admitted to the coils or passages of the superheater F and thence into the superheated collector E'. The steam, which is preferably caused to travel as much as possible in the contrary direction to the hot gases, becomes superheated and expands during its course and leaves the hottest part E' in order to be distributed under the best conditions to the receiver of the engine B. The peculiar cycle of the steam, which I call a "motive" cycle, having been established in this way, continues, and the boiler is supplied with a quantity of water corresponding to the exhaust-steam which is lost, but whose heat can be utilized to heat either the air passing under the grate or the feed-water, or both. While this motive cycle is taking place in a continuous manner, there may, as already stated, also be established a circulation of the water in the boiler by means of a centrifugal pump P, which draws water from a quiet chamber *a* of the boiler and delivers it into another chamber *a'*, which feeds the circulating and heating tubes *t t'*. Although these two chambers are quite separate and distinct, they, however, communicate freely through the central and always-open passage through the pump. The arrangement is such that if the mechanical circulation should become interrupted the physical or natural circulation would not be affected thereby.

When it is possible to insert a supplementary tube *t'* for circulating purpose centrally within each of the heating-tubes *t t t*, as shown in Fig. 2, it is preferable to close or to contract the extreme outlet end of the said supplementary tube and to pierce the thin wall thereof with numerous small holes, as shown, through which jets of water can escape at right angles to the heating-surface of the inclosing heating-tube *t*, the said jets serving to take up heat to a considerable degree from the outer tube.

The cycle constituted by the saturated live steam, the exhaust-steam, and the superheated mixture of live and exhaust steam is indicated by arrows drawn in full lines and furnished with single and with double barbs. The cycle formed in the interior of the boiler and passing through the circulating-pump P is indicated by dotted arrows having single barbs.

The pump P may be operated directly by steam taken from the boiler or from the superheater or even from the exhaust of the engine B, or it may be by means of gearing from the said engine. The taking up of a portion of the exhaust-steam might also be effected by means of expanded saturated steam instead of by live high-pressure steam; but the efficiency would be less, because the efficiency of the heat stored in superheated steam is about three times greater than that of the heat stored in saturated steam.

The circulation of the water can be effected, as shown in the modification illustrated in Fig. 4, by a jet of steam formed in a lower chamber A', communicating with the upper chamber or drum A of the boiler through an upright pipe A^2, through which the steam and water pass and whose wall is prolonged downward at A^3 in such a manner as to dip a little into the water of the lower chamber A' and to there produce a lower water-level *m n*. The steam formed in the lower chamber A' has a pressure higher than that of the steam generated in or admitted to the drum A by an amount corresponding to the head H of the water that bears upon the water in the lower chamber A'.

The circulation by means of a pump or jet of steam can be also effected in water-tube boilers of the Belleville type.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination with a boiler divided into two chambers, of concentrically-arranged heating and circulating tubes, the outer tubes communicating with one of the boiler-chambers, and the inner tubes communicating with the other boiler-chamber and being perforated whereby jets of water are projected at right angles against the heating-surfaces of the outer tubes, and a pump connected respectively with said chambers and through which they communicate and by which a mechanical circulation of the liquid from one chamber to the other and through the heating and circulating tubes is maintained, substantially as described.

2. The combination with a boiler divided into two independent chambers by an internal partition, of concentrically-arranged heating and circulating tubes projecting at one end into said boiler, the outer tubes communicating with one chamber, and the inner tubes communicating with the other chamber, said inner tubes being perforated so as to project jets of water at right angles against the inner surfaces of the outer heating-tubes, and a pump connected respectively with said chambers and through which they communicate and by which a mechanical circulation of the liquid from one chamber to the other and through the heating and circulating tubes is maintained, substantially as described.

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

DOMINIQUE ANTOINE CASALONGA.

Witnesses:
EDWARD P. MACLEAN,
EDWARD BEUGNIOT.