

L. SERPOLLET.

GENERATOR FOR THE VAPORIZATION OF LIQUIDS.

No. 480,286.

Patented Aug. 9, 1892.

FIG. 1

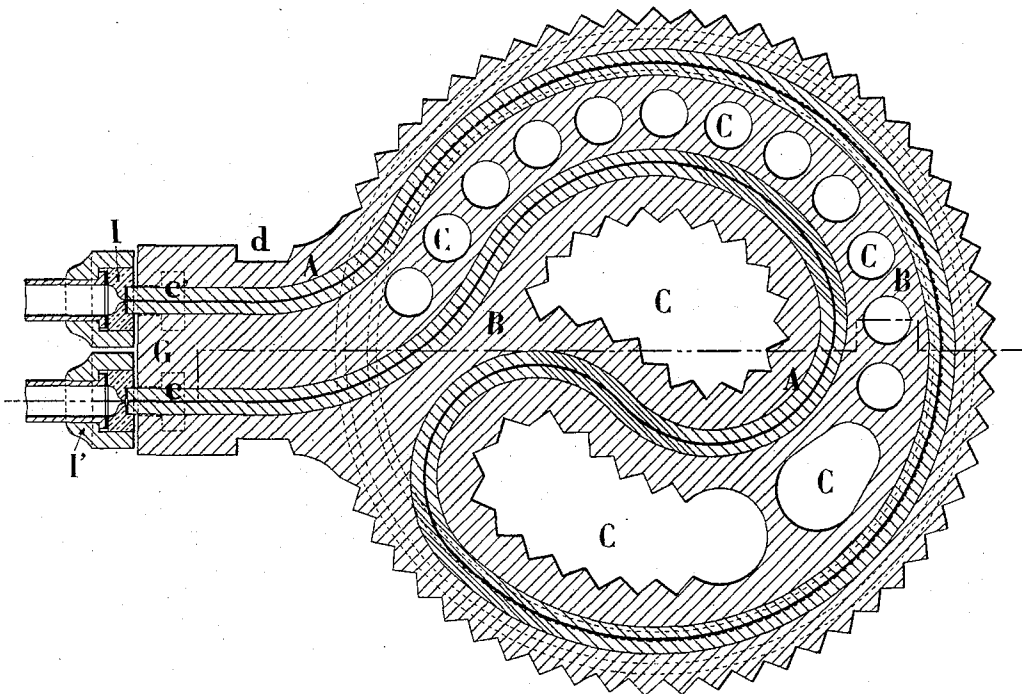
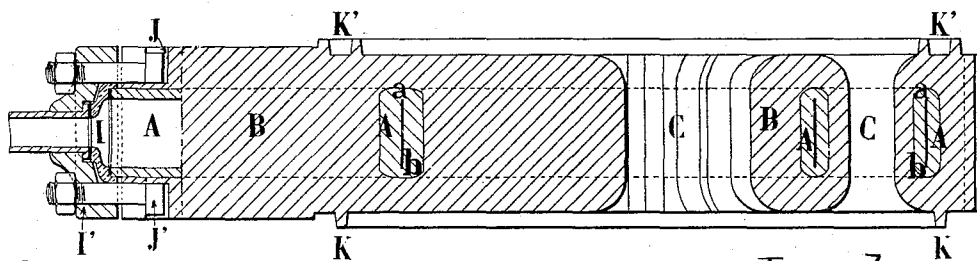


FIG. 2



Witnesses:  
*Lehtzale*  
 E. L. Richards

Inventor:  
 Leon Serpollet.  
 By *Richardson*  
 Attorneys.

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FIG. 3

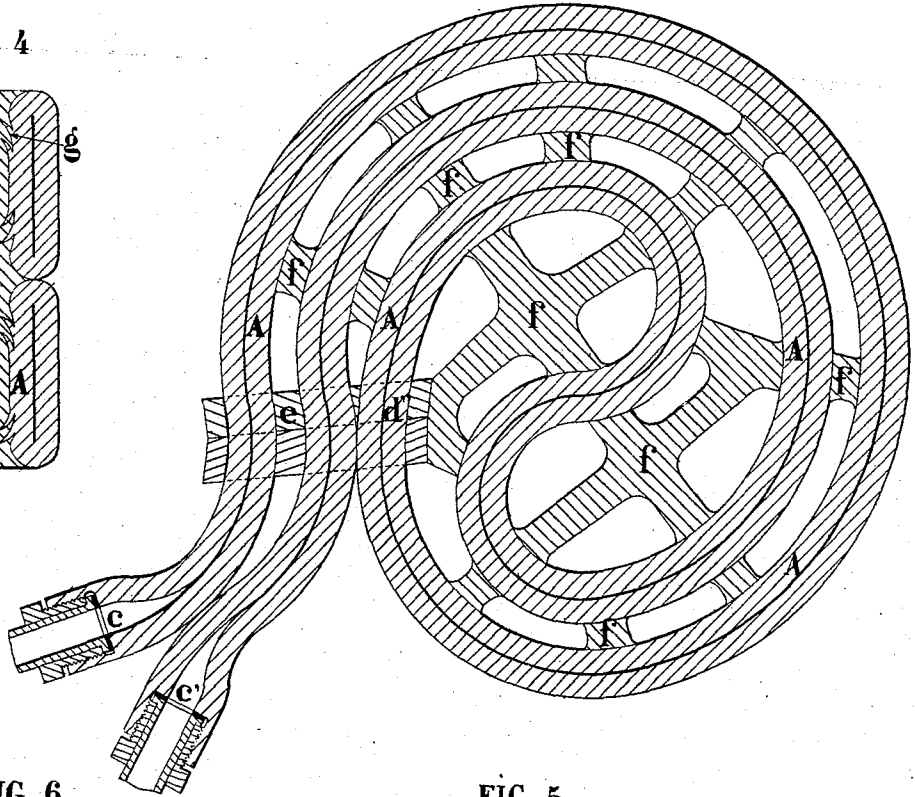


FIG. 4

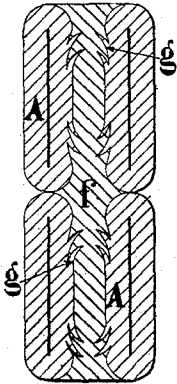
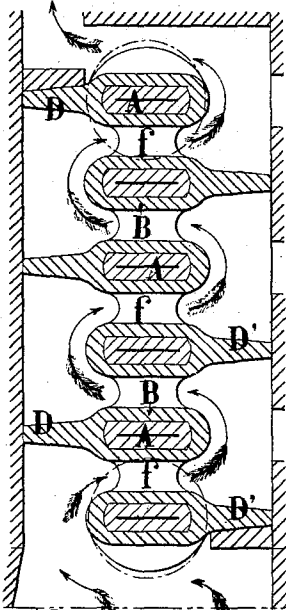
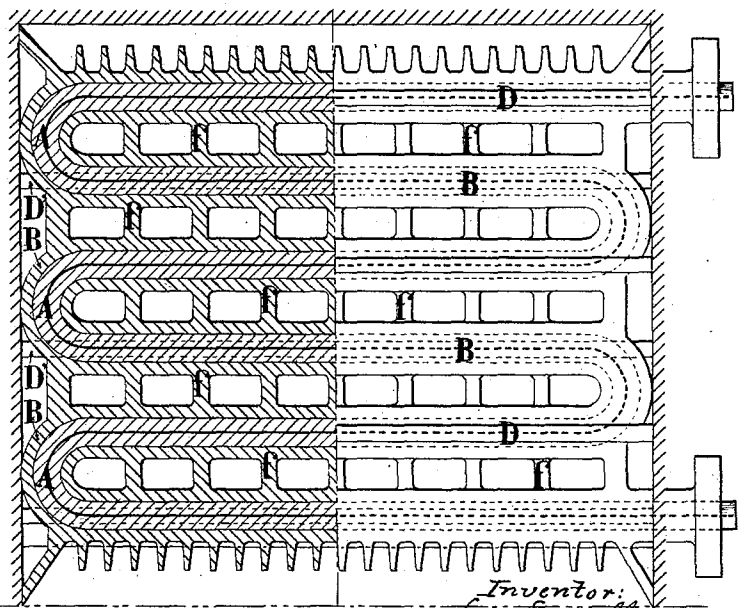


FIG. 6



Witnesses:  
*E. Richards*

FIG. 5



Inventor:  
*Leon Serpollet*  
 By *Richardson* attorney

# UNITED STATES PATENT OFFICE.

LEON SERPOLLET, OF PARIS, FRANCE, ASSIGNOR TO LA SOCIÉTÉ DES GÉNÉRATEURS À VAPORISATION INSTANTANÉE, (SYSTÈME SERPOLLET,) OF SAME PLACE.

## GENERATOR FOR THE VAPORIZATION OF LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 480,286, dated August 9, 1892.

Application filed November 20, 1890. Serial No. 372,093. (No model.)

*To all whom it may concern:*

Be it known that I, LEON SERPOLLET, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Generators for the Vaporization of Liquids, of which I declare the following to be a full, clear, and exact description.

In my improved generators the instantaneous vaporization of the injected liquids is effected in the flat capillary space *a b* of a lengthened metallic tube A, either curled, folded back and forth, or straight, the form being retained by its binding with hoops and bracings or by inclosing the spirals or tubes in a cast body of metal. I thus obtain vaporizing elements of determined forms more or less light and adequately protected against fire and the interior pressure. These elements can be superposed, inclosed, and joined together with ease. The manufacture is simple, the mounting and dismantling easy, and the interchangeability assured.

In the accompanying drawings, forming a part of this specification, Figure 1 is a horizontal section through one of the elements of my vaporizer. Fig. 2 is a vertical section of the same. Fig. 3 is a horizontal section showing another form of element. Fig. 4 is a section through the tubes and stay. Fig. 5 is a vertical section illustrating another arrangement of the tubes. Fig. 6 is a vertical section taken at right angles to that shown in Fig. 5.

Figs. 1 and 2 show in horizontal and vertical section a flat tube, whose circumvolutions or spirals are arranged in the same plane and whose ends *c c'* (the one by which the liquid to be vaporized is injected and the other by which the vapor formed flows out) are arranged quite near to one another and can be inclosed in the same joint or coupling.

The tube A is inclosed by casting in a block or mass B of metal, through which extend passages C C, varying in size and proximity to each other, for the combustion-gases, and whose sides, as also the circumference of the casting, may be smooth or provided with projections, as shown in Fig. 1. The vaporizer thus formed terminates in a cylindrical end

G, through the middle of which the two ends *c c'* of the vaporizing-tube pass, and which is provided with lateral groove *d*. At the end of this casting notches J J are formed to receive and hold the stem and heads of the bolts *J' J'*, whose nuts press the collar *I'*, which in turn presses a flexible washer and tapered cap I, seated on the ends *c* or *c'* of tube A. By means of this collar the conducting or connecting tubes T, X, or H are coupled to tube A, said tubes being provided with flanged ends bearing on a flexible washer, which presses on the inserted cap *I'*, thus forming a tight joint between said tubes and the end *c* or *c'* of tubes A. I obtain thereby a sure and easy double joint without projections to join the different elements. A single joint can be made on the two ends *c c'* when they are close together. The two ends *c c'*, instead of being cut off closely, Figs. 1 and 2, can also be widened apart and rounded off with a hammer, as seen in Fig. 3.

As it is necessary for the resistance of the tube A and the free transmission of heat that the tube be closely connected with its casing B, I take care to carefully scale it, or, if needs be, to tin it or to recover it with a readily-fusible metal before the fusion. The connection, however, is made when the casting metal is cast-iron or soft steel, which I have just mentioned, by reason of the high temperature at which this sort of metal melts, which causes a slight melting of the surface of the tube and in consequence a welding of the tube and its casing. This kind of metal, having more resistance than the ordinary casting, has, besides, the advantage of great malleability. It tends to the obtaining of vaporizers of a comparative lightness, when desired, and stands the changes of temperature of the furnace, which allows it to better protect the incased tube. Its use under these circumstances is of great service.

The cast-casing B permits of giving the vaporizing elements desired forms, which, obtained by molding, allow an easy mounting of the generators and the interchangeability of the cast-casings by series all on the first model. It also constitutes a powerful and economical heat-reservoir. Independently of the lateral

groove *d* and the notch *J* at the end *G*, I provide at the lower part of the casing or casting *B* a circular projection or rib *K*, and at the upper part a groove *K'* of the same diameter, in which the projection *K*, of a superposed element, is inserted and which may be filled with fine dry sand. This rib *K* and its corresponding groove *K'* can be utilized, whatever may be the form of the casing—round, square, or rectangular.

The casing of tube *A* of ordinary casting, but preferably of cast-iron or soft steel, may be of skeleton form; but in this case walls of the tube *A* must be made thicker. This form is seen in Fig. 3, where the ends *c c'* are connected together and to the adjacent spiral *d''* by a fret *e*, which can be scored or roughened a little on top and on bottom of the tube. The other tubes are similarly cross-barrred and tightened by wedges *f*, obtained by the flow of a stream of melted metal after the tube has been disposed in the sand. The metal can be made less thick on the lateral surfaces, (although the tube be submerged during the fusion,) which are cross-barrred by thin cross-bars *f f*, which are less high than the tube, as seen in Figs. 5 and 6. To prevent the displacing of these cross-bars when they press directly against the lateral surface of the tube, stop-teeth *g* are formed on the tube, whose points and edges melt during the casting of the cross-bars, and the metal of said bars will flow around the teeth on the sides of tube *A*. The teeth are arranged oppositely to resist opposite strains. By means of this fretting, cross-barring, and coating, which I apply to the elements of various forms, I obtain at my desire lighter or heavier vaporizers, and at the same time I assure the indispensable permanence of shape of the interior space *a b*.

The vaporizing-tubes, arranged in sinuous or snake-like folds, Figs. 5 and 6, can be arranged horizontally and in layers, as the vaporizing-tubes of the form, as Figs. 1, 2, 3, and 4; but to better realize the result or the essential principle, which consists in all vaporizing elements, of injecting the liquid by the hottest spiral, consequently by the cen-

tral or lower one, and to have the warm gases move in the same direction as the current of water and of steam. These kinds of tubes, whether single or in two parts, symmetrically joined or severally connected in series, are arranged to work vertically.

In addition stays *D D' D'* are cast with the upright parts of the casting *B* to give the ascending gases a zigzag movement. They are arranged one to the right of these upright parts and the other to the left of the neighboring parts, &c. These stays bear with their ends and laterally, whether they be formed rectangular, semi-elliptical, or semicircular, against the casing of the furnace, which itself can be rectangular, semi-elliptical, or semicircular, in such a manner that the gases which pass through the openings *C C* circulate from one side to the other of every branch of the tube and under the stays *D D'*, following the indication of the arrows, as seen in Fig. 6.

What I claim in the generators in which the instantaneous vaporization is effected in the flat capillary space *a b* is—

1. A generator-section consisting of a sinuous metal tube *A* and a surrounding casing of metal cast around the same, provided with a series of openings or spaces intermediate of the circuitous lines of sinuous tube *A*, substantially as described.

2. A generator-section consisting of a flattened tube *A*, having an elongated flattened interior passage and an inclosing casing of metal cast around the same, substantially as described.

3. A generator-section consisting of a sinuous tube *A*, a surrounding casing of metal cast around the same, and braces or supports interposed between the parts of the casing, substantially as described.

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

LEON SERPOLLET.

Witnesses:

G. DUPONT,  
R. J. PRESTON.