

D. RENSCHAW.  
Steam-Generator.

No. 162,497.

Patented April 27, 1875.

Fig. 1.

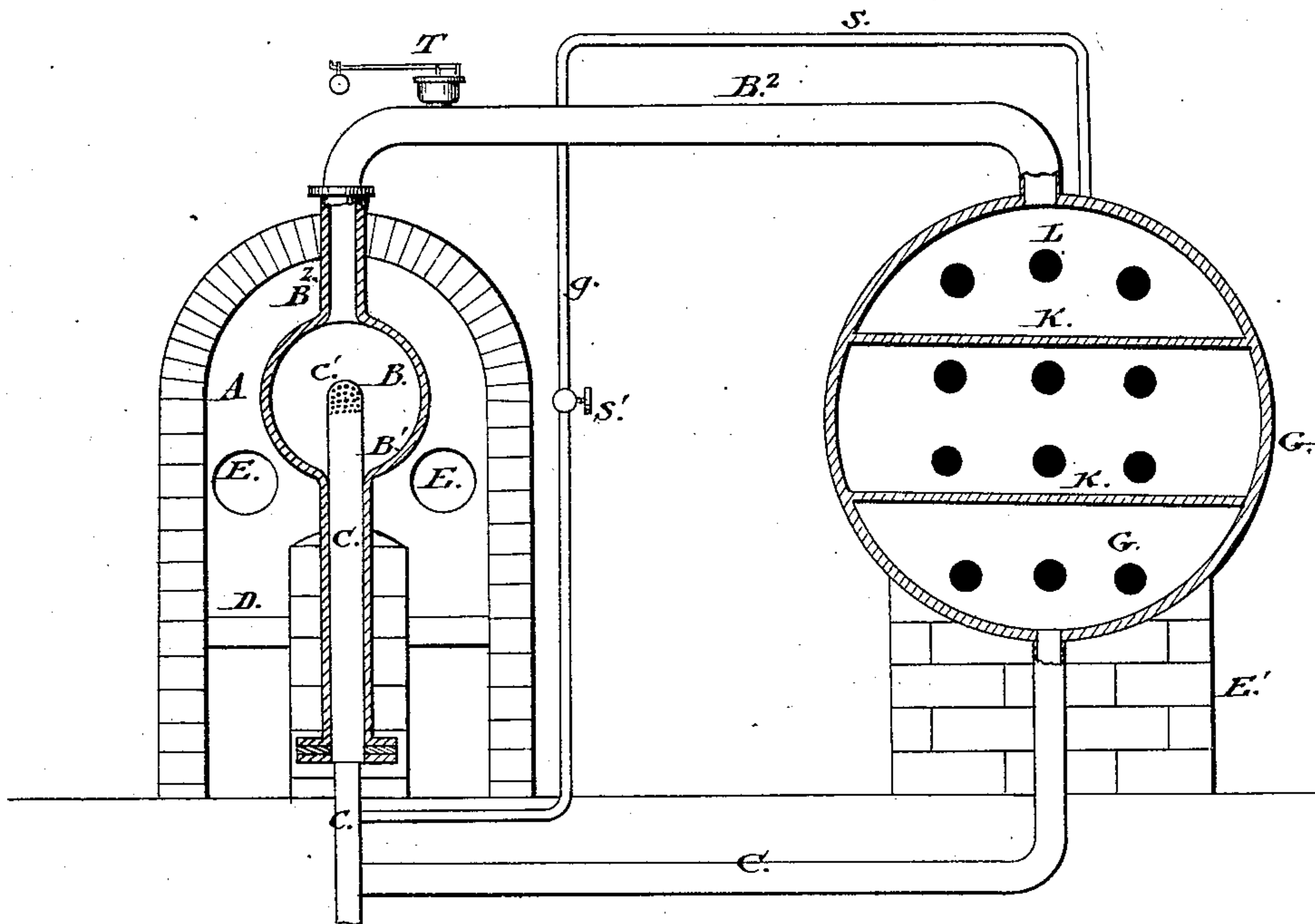
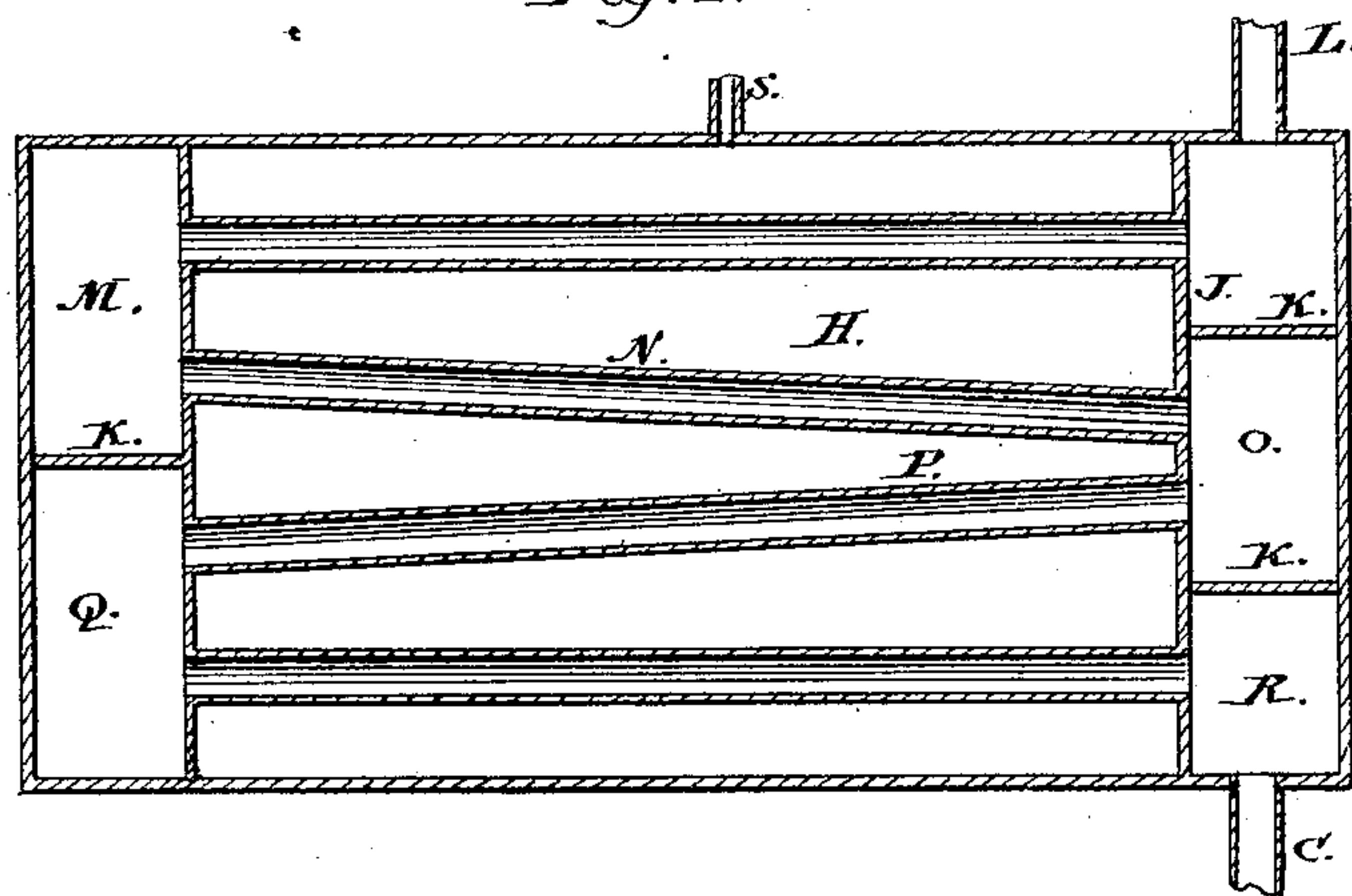


Fig. 2.



Witnesses:  
Edw. W. Doun  
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# UNITED STATES PATENT OFFICE.

DAVID RENSHAW, OF HINGHAM, MASSACHUSETTS.

## IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. **162,497**, dated April 27, 1875; application filed April 8, 1874.

*To all whom it may concern:*

Be it known that I, DAVID RENSHAW, of Hingham, in the county of Plymouth and State of Massachusetts, have invented a certain new and useful Improvement in Steam-Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a vertical sectional view of my invention applied to a sectional steam-generator. Fig. 2 is an elevation and partial section, showing my improvement applied to a tubular boiler.

My invention relates to that class of steam-generators or evaporators in which evaporation is effected by means of a system of submerged heating-pipes; and consists in connecting the submerged heating-pipes with a superheating apparatus, in such a way that a prescribed quantity of steam is kept in rapid and continuous circulation through the heating-pipes by being automatically injected into said pipes from the superheater at a very high temperature, and taken therefrom back into the superheater at a lower temperature after having given off its excess of heat to the liquid in which the pipes are immersed.

Heating or evaporating liquids by blowing steam through submerged pipes is not new; but my apparatus is the first in which both ends of a system of submerged pipes have been connected with a superheating apparatus so arranged as to inject high steam into one end of the system of pipes, and withdraw low steam from the other end, and reheat it and reinject it, and thus keep a prescribed quantity of steam in continuous circulation through a pipe or pipes submerged in the liquid to be evaporated.

The object of my invention is economy in the use of fuel. It may be advantageously applied to all processes involving the use of evaporating pans or vats, such as the processes of manufacturing salt, sugar, or soap, and also to boilers for generating steam for the purpose of supplying power.

In the latter connection I have exhibited it in the accompanying drawings, which embrace, Fig. 1, an end elevation, showing the superheater and a section of the generator through line *x x* on Fig. 2, and, Fig. 2, a longitudinal vertical section of the generator, showing the circulating-pipes and chambers. A represents a circular reverberatory furnace; B, a globe superheater therein, having inlet and outlet extensions *B<sup>1</sup> B<sup>2</sup>*. C is the introduction-pipe, terminating with a blank or closed end within the globe, but provided with a series of minute perforations, *c'*, for the passage of the steam. D is the grate. E E are flues for carrying off the waste gases and products of combustion. G is the generator, containing a body of water, H, in which several series of alternately-inclined pipes are immersed. The generator G is an iron cylinder, having chambers established at each end by the walls I and division-plates K, so that steam injected into the uppermost section of the chamber L flows through the upper tier of pipes to the section M at the opposite end of the cylinder, and from thence back through the next lower tier of pipes N to the section O, and from thence through the tier of pipes P to the lower section of the chamber in the opposite end Q, and backward again to the lowermost section R, from which it is discharged into the pipe C, by which it is reintroduced into the superheater. A pipe, S, leads from the top of the generator G to the pipe C, and is provided with a valve, *S'*, for the purpose of admitting steam from the cylinder G into the pipe C when a larger quantity of steam is required for superheating and circulation. The superheater is provided with an ordinary safety-valve, T.

In applying my invention to locomotive or tubular boilers, the flues may be connected by curved pipes or return-bands, so as to form a continuous conduit, through which the superheated steam will pass as it does through the several series of pipes which I have described.

The operation of my apparatus is intended to be such that superheated steam injected into the chamber L at a temperature of, say, 800° Fahrenheit returns through the pipe C to the superheater at a temperature of about



300° Fahrenheit, having parted with, say, 500° of heat to the liquid in which the inclined pipes are immersed.

The apparatus is started in operation by firing the furnace and introducing a quantity of water into the globe B, and the amount of steam requisite for the most efficient working of the superheater and circulating-pipes is thereafter regulated by the use of the inlet-pipe S, for supplying any deficiency of steam from the generator G, and by the use of the safety-valve attached to the superheater, by means of which any excess of steam may be blown off. The quantity of material present within the superheater and circulating-coil is an essential factor in determining the tension resulting from the application of any given degree of heat thereto.

I claim as my invention—

1. The combination of a vessel for containing a liquid which it is desired to evaporate with a system of submerged pipes, connected with a steam-superheating apparatus arranged in relation thereto, so as to establish and main-

tain a constant current of superheated steam from the superheater into one end of the system of pipes, while constantly withdrawing the cooler steam from the other end of the system of pipes, whereby a prescribed quantity of steam is maintained in continuous circulation, substantially as described, and for the purposes set forth.

2. The combination of a superheating apparatus, provided with a safety-valve and connected with the pipes N and P, and arranged in relation to a steam generator or boiler, substantially as shown and described, with the inlet-pipe *g* leading from the steam-space G to the pipe C, for the purpose of facilitating the regulation of the quantity of steam maintained in circulation, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand this 25th day of March, 1874.

DAVID RENSHAW.

Witnesses:

JAS. B. BELL,  
ALLAH W. WRIGHT.