

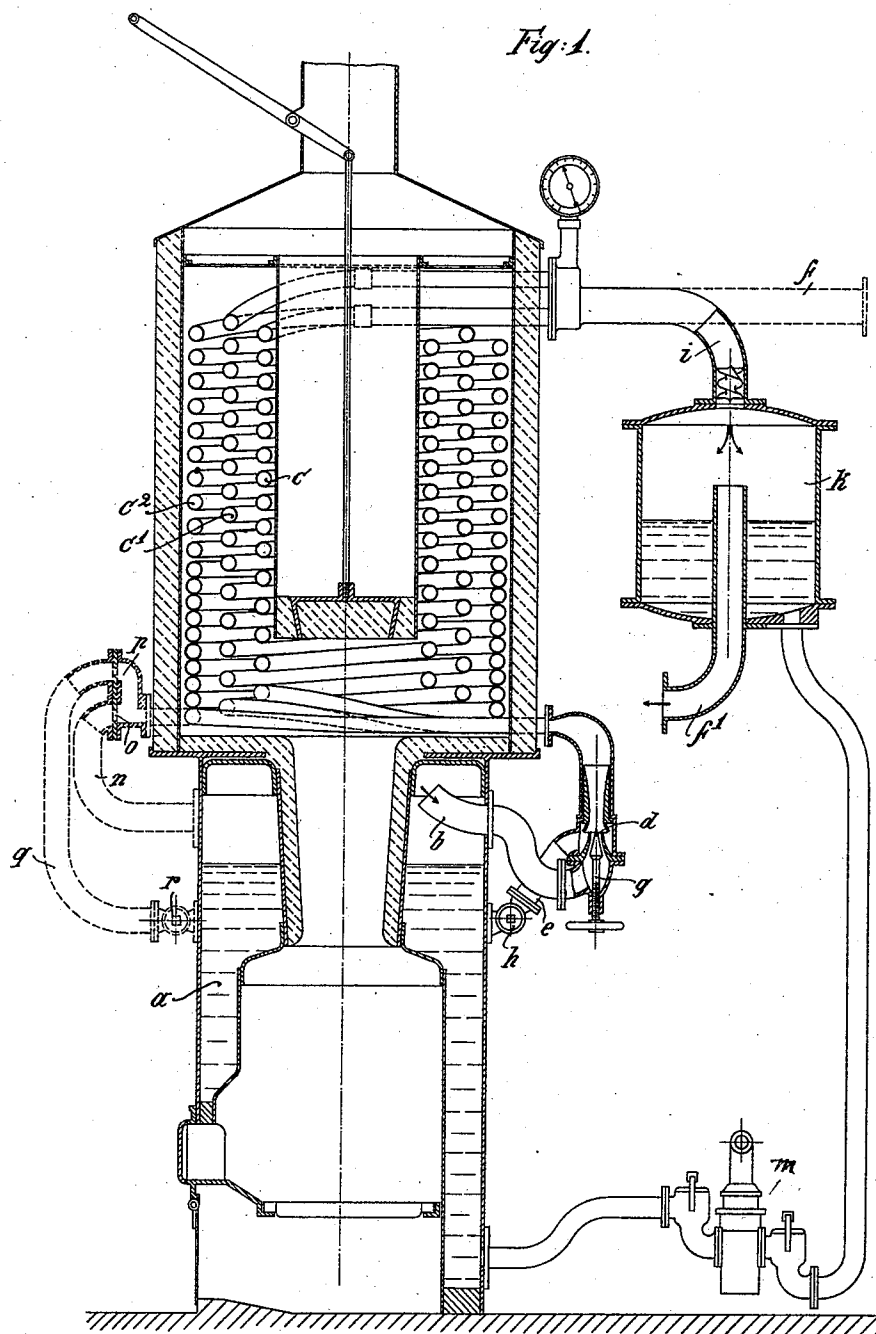
(No Model.)

2 Sheets—Sheet 1.

W. SCHMIDT.
GENERATION OF STEAM.

No. 529,754.

Patented Nov. 27, 1894.



Witnesses:
Carl Reiback
R. Herpich.

Inventor:
Wilhelm Schmidt
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Fig. 3.

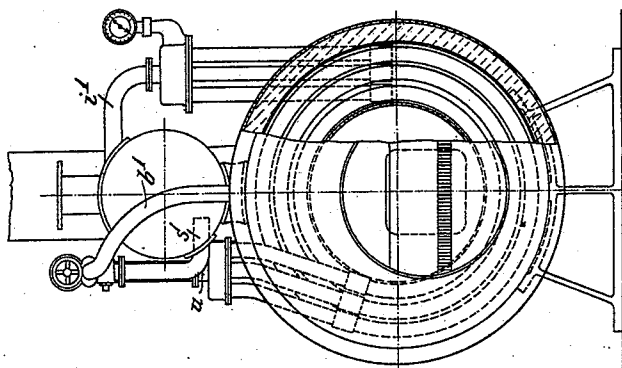
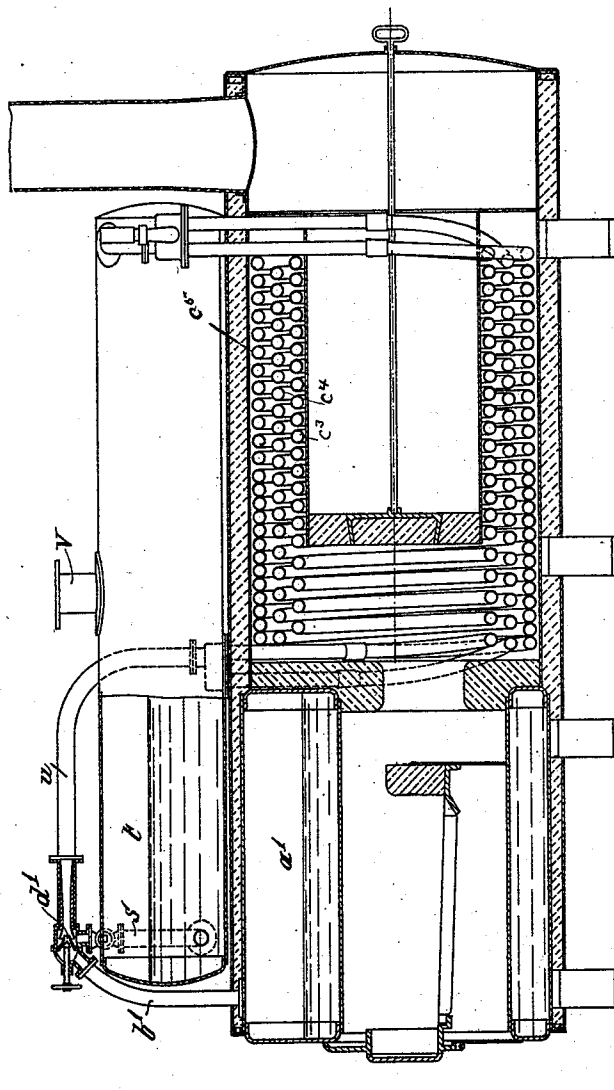


Fig. 2.



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UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF WILHELMSHÖHE, NEAR CASSEL, GERMANY.

GENERATION OF STEAM.

SPECIFICATION forming part of Letters Patent No. 529,754, dated November 27, 1894.

Application filed May 27, 1893. Serial No. 475,726. (No model.) Patented in Germany December 21, 1892, No. 73,396; in England January 16, 1893, No. 564; in Switzerland March 21, 1893, No. 6,791; in France March 24, 1893, No. 228,888; in Italy April 3, 1893, No. 33,825; in Belgium April 5, 1893, No. 104,181; in Sweden April 12, 1893, No. 5,155, and in Austria-Hungary June 17, 1893, No. 1,621 and No. 20,204.

To all whom it may concern:

Be it known that I, WILHELM SCHMIDT, a subject of the King of Prussia, German Emperor, and a resident of Wilhelmsöhe, near Cassel, in the Province of Hesse-Nassau, Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in the Generation of Steam, (for which I have obtained patents in the following countries: Germany, No. 73,396, dated December 21, 1892; Austria-Hungary, No. 1,621 and No. 20,204, dated June 17, 1893; Switzerland, No. 6,791, dated March 21, 1893; Sweden, No. 5,155, dated April 12, 1893; France, No. 228,888, dated March 24, 1893; Belgium, No. 104,181, dated April 5, 1893; Italy, No. 33,825, dated April 3, 1893, and Great Britain, No. 564, dated January 16, 1893,) of which the following is a specification.

The objects of my invention are, first, to reduce to a minimum the formation of boiler scale; secondly, effectively to cool the walls of a part of the boiler, and thirdly to permit constructing horizontal boilers with spiral tubes, which was not possible hitherto.

My improved method consists in generating a part of the steam in a first small boiler heated directly by a furnace, and in generating the other part of the steam by causing the steam evolved in the first boiler to enter a second boiler formed by tubes wound around in spiral, this first steam being also made to take up water on its way and to carry it along to the second boiler where this water is vaporized.

To carry my invention into effect, I make use of the steam generating apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a sectional elevation of this apparatus with an upright tubular boiler. Fig. 2 is a longitudinal sectional elevation of a similar apparatus with a horizontal tubular boiler, and Fig. 3 is an end elevation partly in section of the same.

Similar letters refer to similar parts throughout the different figures.

In carrying out my invention as illustrated by Fig. 1 I employ a small boiler *a* in which

the water to be vaporized is contained. The steam evolved in this boiler is conveyed to the spiral tubes *c c' c²* by the pipe *b*, and on its way to said tubes is made to pass through a nozzle *d*, and thus to drive water out of boiler *a*, said water flowing out through pipe *e*. In consequence thereof a mixture of steam and water will enter the spiral tubes *c c' c²*. If the amount of water carried away by the steam is such as may be brought to perfect vaporization by the steam at the temperature which the latter has required, the mixture of water and steam entering the spiral tubes will gradually be changed more and more into steam; so that the steam conveyed to the engine through the pipe *f* (shown in dotted lines) will be pure steam without any particles of water suspended therein.

The quantity of steam issuing from boiler *a* can be regulated by means of the screw *g* which is adapted to lessen or to increase the area of the nozzle *d*, through which steam may pass. Similarly the amount of water fed to the nozzle to be carried away by the steam may be varied by turning the cock *h*. Now it will be obvious that if only such a quantity of water is carried away by the steam as can be gradually vaporized by the steam in consequence of its high temperature, the volume of steam will be considerably larger than that of water and the spiral tubes *c c' c²* might be subjected to a too excessive heating as their walls are cooled almost only by the steam. In order to obviate this the steam may be caused to carry along with it a larger quantity of water than it is capable of vaporizing. In this case the construction of the apparatus must be somewhat altered in order to separate this additional water from the steam and to convey it back to the boiler *a*. For this purpose I do not lead the mixture of water and steam having passed through the spiral tubes *c c' c²* directly to the engine of the pipe *f*, but cause said mixture to travel through pipe *i* into a trap *k* which is constructed in usual manner and where the water collects at the bottom and is thus separated from the same. The latter leaves the trap by the tube *l* whence it is conveyed to the engine. The

water collecting in the trap k is pumped back through pipe l by means of the pump m . By this arrangement the walls of the spiral tubes c c' c^2 are effectively cooled by the water conveyed through the same together with the steam. I also insert into the tube f or i a metallic thermometer which allows to ascertain the temperature of the steam or the mixture of steam and water whereby the generation of steam may be readily passed, and if necessary the right temperature is obtained by turning the cock h or the screw g .

Experiments which I have made with highly heated steam have yielded the result, that even in superheated steam water may be contained in the form of suspended particles and I am enabled to ascertain the proportion of such suspended water by simply determining the temperature of the mixture as I have found, that to each temperature corresponds a definite proportion of suspended water.

I wish to point out that it is not necessary to provide a mechanical contrivance such as the nozzle or injector for carrying the water along by the steam, but this may also be effected by the simple means which are shown in dotted lines on the left of Fig. 1. The steam in this case leaves the boiler a by the pipe n at the upper end of which the diameter for the passage of steam is reduced. By this means I cause the steam yet to be contracted to a reduced cross-sectional area, so that the pressure of steam is greater before the reduced portion than after the same. In consequence thereof the pressure in the small chamber p will be smaller than in the boiler a and as the water in the boiler is subjected to a stronger pressure, it will be driven into the chamber p through the pipe q and the steam passing through the chamber p will carry this water farther through the spiral tubes. The amount of the water which is thus driven out of the boiler can be regulated by means of the cock r .

It will be readily understood that the formation of incrustations or boiler scale is practically impossible in the spiral tubes c c' c^2 as the proportion of non vaporized water carried along with the steam is quite small, and as the mixture of steam and water is propelled through the spiral tubes by the full pressure of steam in boiler a . Thus the compounds capable of forming incrustations will have no time to be deposited on the walls of the tubes.

If the fire in the furnace is extinguished, only pure steam unmixed with water will be conveyed through the spiral tubes as the nozzle d is placed above the level of water in boiler a . Thus it will be seen that each time the fire is extinguished, the spiral tubes c c' c^2 will be cleaned by pure steam. A formation of boiler scale cannot ensue even when the tubes get cool and cause the steam to be condensed as this condensation water is perfectly pure.

The formation of the boiler scale will only occur in the small boiler a but as this boiler is of small dimensions and of a simple con-

struction, its inner walls are easily accessible and may be readily cleaned from incrustations.

In Figs. 2 and 3 I have shown the application of my improved method to horizontal boilers. I have also shown in these figures that, even when the steam is caused to carry along with it more water than it can vaporize (which I prefer to do) a pump for driving the superfluous water back into the boiler is not necessary.

a' is the first boiler containing the water and the steam evolved from the same rises in the pipe b' to the nozzle d' of any injector. In this case the water carried away with the steam is not taken from the boiler a' but from a special water reservoir t by means of a tube s . The pressure in reservoir t must be somewhat less than that in boiler a' in order that the steam passing through a nozzle d' may be able to draw off water from reservoir t through pipes. This water gets mixed with the steam and the mixture is conveyed to the spiral tubes c^3 c^4 c^5 which in this case have been arranged in such manner that they form a cylinder, the axis of which lies horizontal. The mixture of water and steam which is heated in the spiral tubes by the furnace, enters the reservoir t by the pipe i' , and the water is separated in this reservoir from the steam which latter is conveyed to the engine through the socket v .

I wish especially to point out this peculiarity which constitutes a great advantage of my invention, viz., that the spiral tubes may be arranged so as to form a horizontal cylinder whereas hitherto such an arrangement could not be employed practically owing to the water collecting at the bottom of the spiral tubes and causing the same to be shaken during the passage of steam or even obstructing the same entirely. In my improved method these inconveniences can not occur as the proportion of water carried away with the steam is quite small and as this water moves along with considerable speed.

I do not confine myself to the exact form of construction as shown in the drawings but the same may be modified without departing from the nature of my invention. For instance I may employ other forms of tubes instead of spiral tubes and I may also substitute a tubular boiler for the first boiler a (Fig. 1) or a' (Fig. 2).

Having thus fully described the nature of my invention, what I desire to secure by Letters Patent of the United States is—

1. The method of generating steam, consisting in heating water, producing a continuous stream of the steam evolved, distributing within said stream as much water as the steam is capable of carrying with it without being condensed thereby, and evaporating said distributed water by exposing the mixture to furnace-gases, for the purpose as described.

2. The method of generating steam, consisting in heating water, producing a continu-

ous stream of the steam evolved, distributing within said stream by jets of the steam itself as much water as the steam is capable of carrying with it without being condensed thereby, and evaporating said distributed water by exposing the mixture to furnace gases, for the purpose as described.

3. The method of generating steam, consisting in heating water, producing a continuous stream of the steam evolved, distributing within said stream by jets of the steam itself as much of the heated water as the steam is capable of carrying with it without being condensed thereby, and evaporating said distributed water by exposing the mixture to furnace-gases, for the purpose as described.

4. The method of generating steam, con-

sisting in heating water, producing a continuous stream from the steam evolved, distributing within said stream by jets of the steam itself as much of the heated water as the steam is capable of carrying with it without being condensed thereby, and evaporating said distributed water by exposing the mixture to the same furnace-gases as used for heating the water, for the purpose as described.

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

WILHELM SCHMIDT.

Witnesses:

HERMANN GUTZ,
JULIUS FRANKE.