

(No Model.)

2 Sheets—Sheet 1.

W. SCHMIDT.
FEED WATER HEATER.

No. 572,573.

Patented Dec. 8, 1896.

Fig. 1.

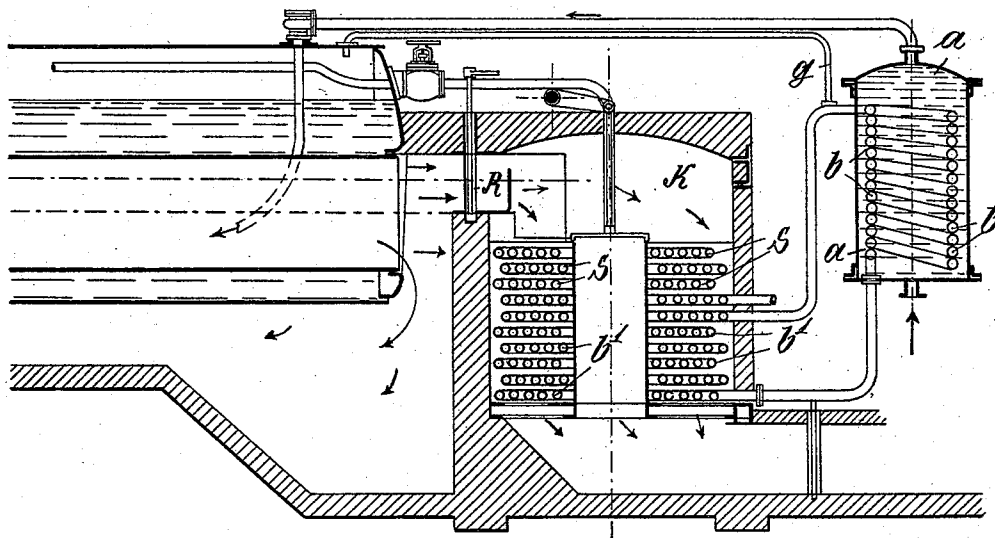
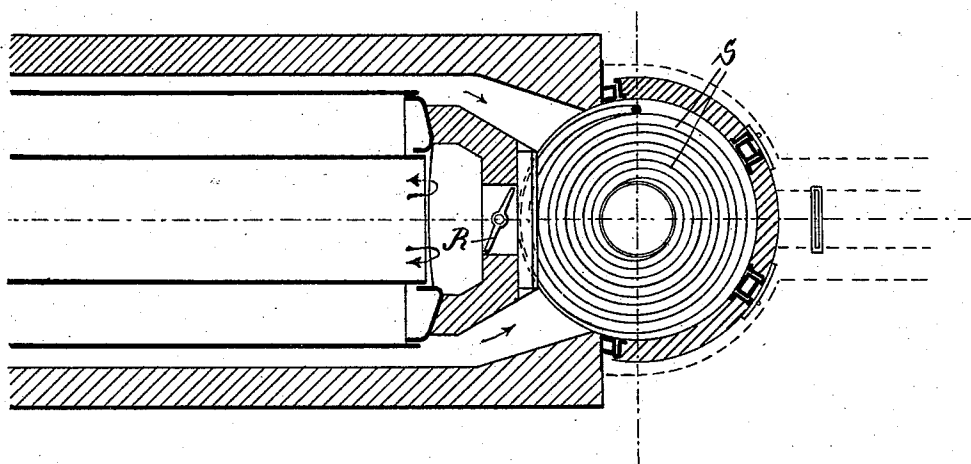


Fig. 3.



Witnesses.
Omit Hansen.
Charles Lohelt

Inventor
Wilhelm Schmidt
by
Kunze & Co.
Attorneys.

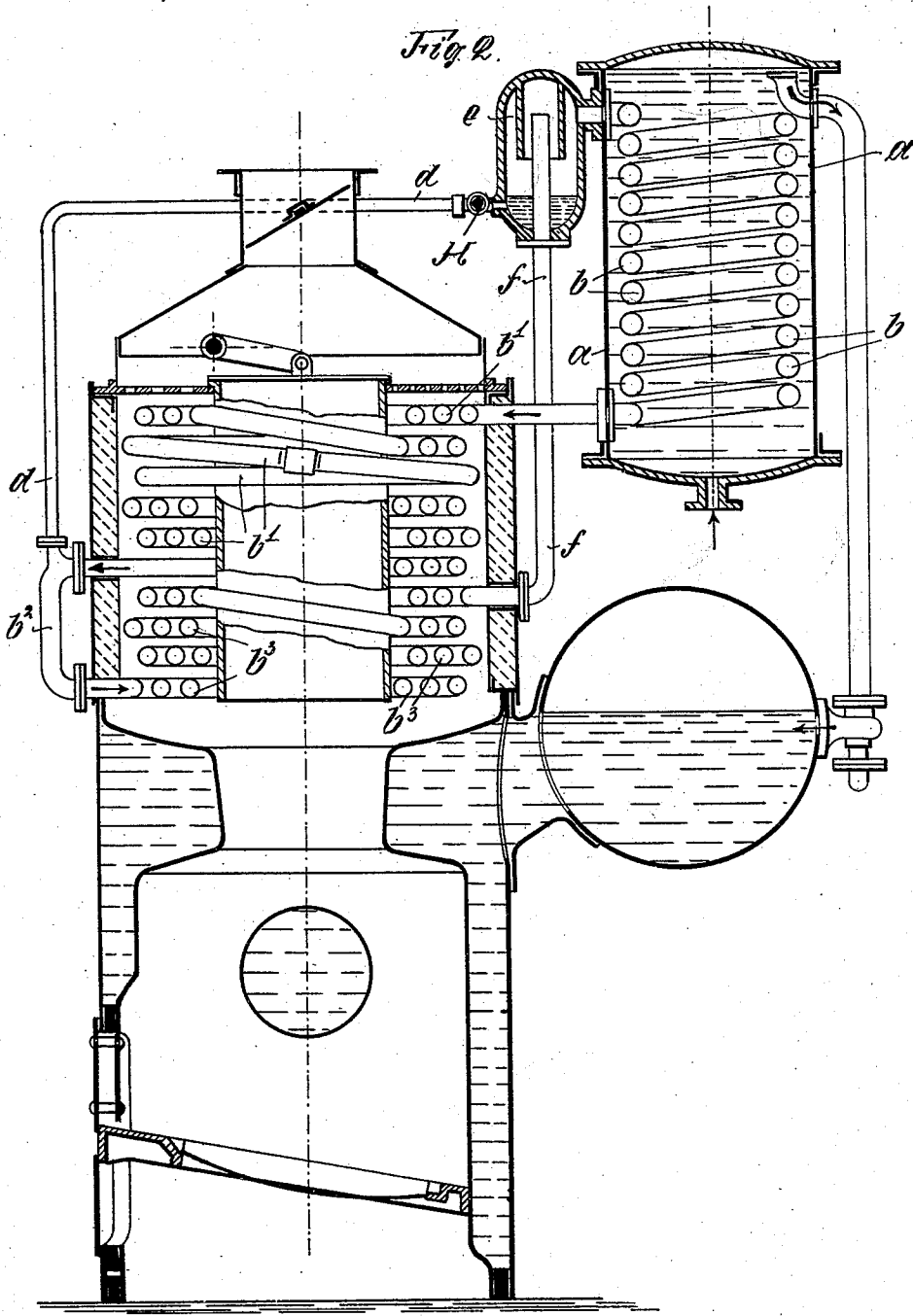
(No Model.)

2 Sheets—Sheet 2.

W. SCHMIDT.
FEED WATER HEATER.

No. 572,573.

Patented Dec. 8, 1896.



Witnesses.
Emil Kayser.
Hans Lochelt

Inventor
Wilhelm Schmidt.
by
Hans Schaefer
Attorney

UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF BALLENSTÄDT, GERMANY.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 572,573, dated December 8, 1896.

Application filed February 3, 1896. Serial No. 577,961. (No model.)

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 Ballenstädt-on-the-Harz, in the Duchy of Anhalt, in the German Empire, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is an exact specification.

It is known that to exhaust the waste gases of a steam-boiler furnace by letting them heat the feed-water large surfaces are requisite if that exhaust is to be a somewhat considerable one. Said large surfaces necessitate generally a great space, which is tolerably reduced only if the feed-water heater is formed by coiled pipes. There is, however, then created another drawback that consists in the clogging of said pipes by incrustated sediments. These latter, before causing the final clogging of the pipes, hinder them from properly transmitting the heat of the waste gases upon the feed-water, and the exhaust of said gases is therefore an unsatisfactory one.

The object of my invention is to overcome all the said drawbacks, and I attain that object in general by inclosing a certain quantity of pure water within a coil one part of which is acted on by the waste gases of a boiler-furnace, whereas the other part acts in its turn upon the feed-water. The end of said coil is connected with the commencement of the same, or vice versa, and the pure water that circulates quickly or is artificially caused quickly to circulate through and within the coil receives the heat of the waste gases and transmits it to the feed-water. The heat of the waste gases is thus taken up by a coil or coils; but there is no possibility of the latter getting clogged, as the water circulating within the coils has originally been introduced in a pure state and remains so.

In order to make my invention more clear, I refer to the accompanying drawings, in which similar letters denote similar parts throughout the different views, and in which—

Figure 1 is a vertical longitudinal section through the rear portion of a Cornwall boiler that is furnished with my novel arrangement. Fig. 2 shows said arrangement combined with an upright boiler of a particular construction, and Fig. 3 is a horizontal section taken on line 4 5 of Fig. 1.

The transmission of the heat upon the feed-water takes place within the feed-water heater *a*, Figs. 1 and 2, that contains the cylindrical coil *b*. The latter is filled with pure water, which flows, as a matter of course, in a downward direction, whereas the feed-water enters the vessel *a* at the bottom thereof and leaves it in a heated state at the top. It is obvious that by this means the feed-water is highly heated, whereas the pure water is correspondingly cooled. The latter, when leaving the coil *b*, passes into the coils *b'*, Figs. 1 and 2, that are arranged in the way of the fire-gases streaming forth from the furnace of the respective boiler. Said coils *b'* offer the last surfaces that can usefully consume the heat of the escaping fire-gases, and said heat is transmitted to the pure water that comes down from the cylindrical coil *b*, passes through the coils *b'*, and flows again up to said cylindrical coil *b*. The coils *b b'* form a continuous way and may practically be regarded as one serpent consisting of two parts. In either of said parts the direction of motion of the respective two media is one opposite to the other.

In the form of construction represented in Figs. 1 and 3 I have shown my novel arrangement combined with a flame-tube boiler that is furnished with a throttle-valve *R*, or other equivalent device, for regulating the temperature as well as quantity of the fire-gases flowing from the flame-tube into the vaulted chamber *K*. The latter forms a part of the conduit that leads the waste gases to the chimney. The heat of said gases is taken up in two stages, in that the said gases are first caused to wash a superheater *S*, that consists of coiled pipes and is arranged above the coils *b'* aforementioned. The size of said superheater is, as a matter of course, chosen so as to superheat the steam of the boiler up to the degree desired.

The coils *b'*, that contain the pure water for transmitting the remainder of the heat of the waste gases upon the feed-water within the vessel *a*, are thus washed by the waste gases only after these latter have acted upon the superheater *S*. Owing to the greatly-reduced temperature of said gases when arriving at the coils *b'* the water within the latter can never get exposed to a stronger pressure than

the boiler-water proper, and I am thus enabled to connect the coils b b' with the steam-space of the boiler by means of a pipe g . The purpose of this connection is to allow of the steam replacing that part of the pure water contained within said coils b b' that has got lost by leakage and the like. Other devices for filling, in such a case, the coils b b' may thus entirely be dispensed with.

Instead of letting the pure water when passing through the coils b' run fully in a direction opposite to that of the waste gases I may in some cases lead it partly in said latter direction and partly in a direction opposite to the former, or equal to that of the waste gases, respectively. Such a modification of the method is necessary in all boilers in which the waste gases flow in an upward direction, as is especially the case with upright boilers.

In the correspondingly-modified arrangement shown in Fig. 2 the pure water coming from the feed-water heater a passes through the coils b' in a downward direction, *i. e.*, opposite to the direction of the furnace-gases. The number and length of said coils is so chosen that the water cannot be turned into steam. The water is then led by the mediation of a pipe b^2 into the lowermost of a number of coils b^3 , arranged below the coils b' . Said coils b^3 are exposed to far hotter gases than the coils b' , and a part of the hot water flowing through the coils b^3 is therefore turned into steam. The mixture of hot water and steam flows finally upward through the pipe f . By these means I not only gain the difference in weight between the hot water and the cooled water as a motive power for causing the water to circulate through the coils, as in Figs. 1 and 3, but moreover I increase that effect by letting a part of the water be turned into steam, so as to obtain a still greater difference in weight, as in Fig. 2. The fast circulation of the water is very advantageous if the temperature of the waste gases is a somewhat high one.

The water and steam separate when escaping from the upper end of the pipe f . The water is collected by a vessel e and led off by a pipe d to the connecting-pipe b^2 aforementioned. The steam enters the cylindrical coil b within the feed-water heater a and condenses again to pure water while giving its heat off to the feed-water. Said water then passes into the coils b' and the circuit aforesaid commences anew. The fact that the speed of the water when flowing through the coils b' is considerably lower than when flowing through the coils b^3 affords two important advantages: first, by the slow speed of the water within the coils b' the heat of the waste gases is very thoroughly consumed; second, by the fast speed of the water within the coils b^3 the latter are very effectively prevented from being burned.

The water collected within the vessel e need not all be led off into the pipe b^2 or the coils b^3 , respectively, but the quantity of the water

led over into said parts b^2 or b^3 may be regulated according to the temperature of the fire-gases, preferably by a cock H or other equivalent means. Owing to the insertion of the vessel e between the coils b^3 and b the passage of the steam from the pipe f to the coil b occurs free of shocks. Said vessel may, if desired, be furnished with a gage-cock or gage-glass, as well as with a funnel or other device for filling fresh pure water into the apparatus if a part of the previous water has got lost by leakage or the like. Said cock and funnel or equivalent parts may, as a matter of course, be arranged also at other suitable parts of the apparatus.

Also in the modified construction shown in Fig. 2 the coils b' b^3 may be combined with a superheater. The latter may be arranged either below said coils (or, in other words, in front of the same with regard to the direction of the fire-gases, as in Fig. 1) or between the set of coils b' and the set of coils b^3 , but other arrangements may as well be chosen.

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

1. As a means for exhausting the waste gases of a boiler-furnace, the combination with a steam-boiler and furnace, of a hollow heating-body arranged within the way of the waste gases of said furnace, and of another hollow heating-body connected at both ends with said former body, arranged within a feed-water heater, and communicating with the steam-space of said boiler, said hollow heating-bodies containing pure water, for the purpose as described.

2. As a means for exhausting the waste gases of a boiler-furnace, the combination with a steam-boiler and furnace, of a set of coils arranged within the way of the waste gases of said furnace, and of another set of coils connected at its lower end with the lower end of said former set, and at its upper end with the upper end of the said former set as well as with the steam-space of said boiler; said sets of coils containing pure water, for the purpose as described.

3. As a means for exhausting the waste gases of a boiler-furnace, the combination with an upright steam-boiler and furnace, of a set of coils arranged above said boiler within the way of the waste gases of said furnace; another set of coils arranged above said former set, and connected at its lower end with the lower end of the said former set; a third set of coils arranged within a feed-water heater, and connected at its lower end with the upper end of said second set, and communicating at its upper end with the upper end of the first set by the mediation of a water-trap, said sets of coils containing pure water, for the purpose as described.

4. As a means for exhausting the waste gases of a boiler-furnace, the combination with an upright steam-boiler and furnace, of a set of coils arranged above said boiler within the way

of the waste gases of said furnace; another set of coils arranged above said former set, and connected at its lower end with the lower end of the said former set; a third set of coils
5 arranged within a feed-water heater, and connected at its lower end with the upper end of said second set, and communicating at its upper end with the upper end of the first set by the mediation of a water-trap; said sets of
10 coils containing pure water; the water-space of said trap being connected by a pipe with the first set of coils; a cock or valve inserted into said pipe, for the purpose as described.

5. As a means for exhausting the waste gases
15 of a boiler-furnace, the combination with a steam-boiler and furnace, and with an enlarged conduit communicating at its upper end with said furnace and at its lower end

with said chimney, of a set of coils arranged within said enlarged conduit; another set of
20 coils arranged within a feed-water heater, and connected at both ends with said former set; said two sets of coils containing pure water; a steam-superheating set of coils arranged
25 above said first set, and connected at one end with the steam-space of the said boiler; a regulating-valve arranged between the said enlarged conduit and the said furnace, for the purpose as described.

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

WILHELM SCHMIDT.

Witnesses:

FRITZ SPERLING,
W. HAUPT.