

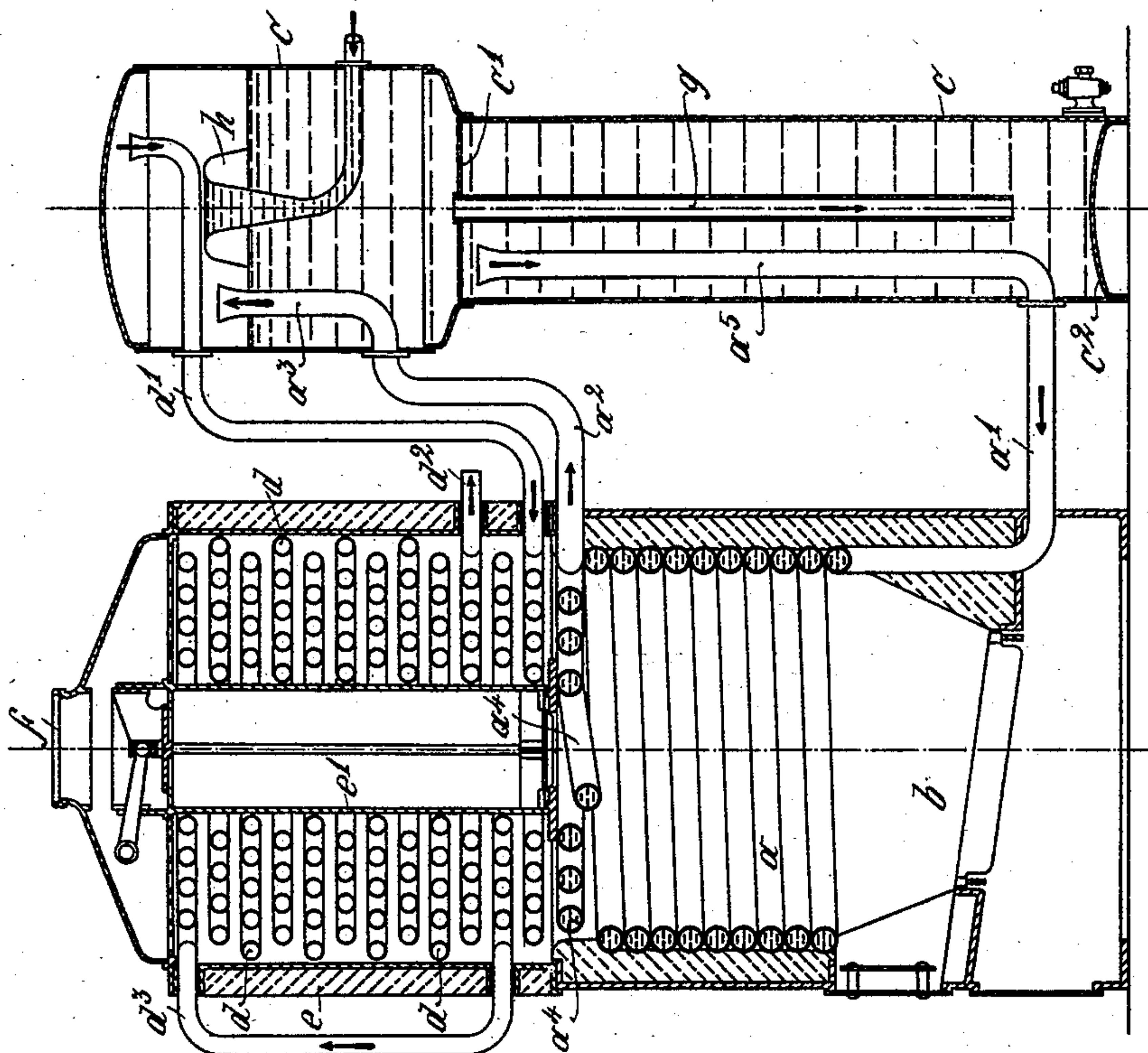
(No Model.)

W. SCHMIDT.

COMBINED TUBULAR BOILER AND SUPERHEATER.

No. 539,827.

Patented May 28, 1895.



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UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF WILHELMSHÖHE, GERMANY.

COMBINED TUBULAR BOILER AND SUPERHEATER.

SPECIFICATION forming part of Letters Patent No. 539,827, dated May 28, 1895.

Application filed December 22, 1893. Serial No. 494,485. (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 Wilhelmsöhe, near
5 Cassel, in the Province of Hesse-Nassau, Kingdom of Prussia, German Empire, have invented a new and useful Combination Consisting of a Tubular Boiler and a Superheater, of which the following is an exact specification.

10 This invention refers to combinations of steam-boilers and superheaters, and my improvements in such combinations relate, first, to the arrangement of a tubular boiler with coiled pipes, and, second, to the arrangement
15 of a reservoir connected with both ends of the boiler-coil, but with only one end of the superheater-coil, as will be more fully described hereinafter.

Before entering into the details of the mode
20 of construction of my improved combination shown in the drawing, I think it necessary to give some preliminary statements and explanations, in order to render the idea of the invention perfectly clear and intelligible.

25 If steam is to be superheated to a temperature of about 300°, the heating-gases should have, as is well known, a temperature of at least from 500° to 600°. The said former temperature will be reached best by arranging
30 the superheater above the steam-generator, and exposing it to the furnace-gases of the same, or, in other words, by arranging the superheater behind the steam-generator with regard to the direction of the furnace-gases
35 of the latter, and exposing it to a zone of said gases, in which the temperature amounts to about 600°. The fire-gases need, thus, be cooled down by the boiler proper but to about 600°, while generally, in a steam-generator
40 without superheater an exhaust of the heat down to 250° is required. As is well known, however, the greatest part of steam is generated in the fore-part of a boiler, the remaining part, that is generated by exhausting the
45 heat from 600° down to 250°, being of but small quantity, and necessitating comparatively large heating-surfaces. Extended trials made with locomotive-engines have proved, that about fifty per cent. of the whole of
50 the steam is generated in the small part surrounding the fire-box. It results from this,

that, when arranging a superheater for temperatures of about 300° above or behind a steam-generator, the latter not only may have a comparatively small heating-surface, but
55 should have such a one; and it will be seen, further, that such boiler with superheater will yield at least the same effect, as a larger boiler, that consumes a like quantity of fuel, since the furnace gases of both boilers are exhausted in like degree, *i. e.*, are escaping into the
60 smoke-stack with the like low temperature. Owing to these facts, now, the boiler or generator employed in my improved combination is composed of coils or coiled pipes. These
65 latter offer, in themselves, certain advantages for every boiler-plant. They could, however, not be employed in a more extensive degree, especially for large plants, as there arise in the practical use of them serious drawbacks
70 difficult to be overcome, as will be shown in the following.

The main point to be considered in the use of coiled pipes as steam-generators consists in the rapid circulation of the water or of the
75 mixture of water and steam within the coils. Such circulation is indispensably requisite. The same is considerably hindered or delayed, however, by the great friction arising between the water and the inner walls of the pipes,
80 especially if the latter are of a somewhat great length and of but small inner section. This disadvantage could be overcome, seemingly, by using pipes with larger section. This section, however, necessitates dimensions of such
85 size, that it is nearly impossible to bend such pipes. A perfect change, however, in all these circumstances occurs, if the tubular boiler with coiled pipes is combined with a superheater. There is no necessity any more for
90 providing so large a heating surface for properly exhausting the heat of the fire- or furnace-gases, but a boiler of but the fifth or sixth size with coils of but small section will be sufficient for delivering the desired effect, even if a
95 larger number of horse-powers is required. The heat of the fire need not be cooled by the heating-surfaces of the boiler proper down to 250°, as this is performed by the superheater; and the generation of steam will be a regular
100 one, and free of shocks, as the circulation of the water, or of the mixture of water and steam.

respectively, within the short coil with its small section is a very active one. The best effect, however, of the combination of a tubular boiler (with coiled pipes) with a superheater is attained by arranging a reservoir between the boiler-coil and the superheating coil, for the purpose of separating water and steam. I have represented this arrangement in the accompanying drawings, in which is shown a vertical section through the tubulous boiler, the superheater and the said reservoir.

The coil a of the tubulous boiler, which is heated from the furnace b , is connected by its two ends a' a^2 with the reservoir c , coil-end a' terminating into the lower compartment of the reservoir by the mediation of a bent tube a^5 extending upward within said compartment; coil-end a^2 terminating into the upper compartment of the reservoir by the mediation of a bent tube a^3 likewise extending upward within that respective compartment. The further details of the reservoir will be more fully described hereinafter.

The uppermost portion of the reservoir forms a steam-dome, and the saturated steam is led from that dome by the mediation of pipe d' into the superheating coil d , from which the superheated steam is led away by pipe d^2 . The feed-water for the boiler, or for coil a respectively, enters the latter through the pipes a^5 a' , and leaves the coil, after being heated and partly turned into steam within the same, by the pipes a^2 a^3 . The mixture of water and steam separates within the upper compartment of the reservoir c , the steam collecting within the dome, the boiling water mixing with the feed-water, and heating the same.

The superheater consists of a number of superposed flat horizontal coils, which are connected with each other to a continuous passage. This connection of the coils, however, is made in such a way, that two divisions are formed out of them; the first division, next to the boiler-coil, being passed by the steam in a direction like that of the furnace-gases; the other division being passed by the steam in the opposite direction; that is to say, opposite to the direction of the furnace-gases. Both divisions are connected by the bent tube d^3 . The said superheating-coils are arranged in the annular space between the outer wall e and the inner wall e' . The furnace-gases coming from the fire-place b are led through the said space, and leave the whole apparatus at f . It will be seen now, that the circulation of the water, or of the mixture of water and steam respectively, within the boiler-coil will be a very intense one, as, first the said coil is but short, and has but a small section; and as, second, the contents of coil a are constantly under the pressure of the water-column within the lower compartment of reservoir c . The generation of steam is, therefore, a very intense and rapid one, as well as free of shocks, and the steam then enters the superheating coils with-

out the least addition of water, as the latter is perfectly kept back by the reservoir. The water now circulates again and again through the boiler-coil, so that the whole of the water within reservoir c is heated to a high degree of temperature. This circulation will, as a matter of course, be the more active the greater the difference in pressure between the water-column within the lower compartment of the reservoir, and the water- and steam-column within the boiler-coil; and further, the less the resistance offered by the friction between the said water- and steam-column and the inner walls of the boiler-coil. It results herefrom, that the whole of the water contained within, or entering, the said boiler-coil cannot be turned into steam at so rapid a circulation, and it becomes thus, necessary to provide the reservoir c for separating both parts of the water-and-steam mixture leaving the boiler-coil, as but the steam can be permitted to enter the superheating-coil, while the hot water must remain.

Concerning now the special construction of the reservoir, the latter is divided into two superposed compartments by a horizontal plate c' having secured to it a vertical tube g extending downward to the neighborhood of the bottom c^2 . The vertical tube a^5 communicating with end a' of the boiler-coil is arranged in the same compartment of the reservoir, and extends upward to the neighborhood of plate c' aforementioned. The purpose of this arrangement is to separate and precipitate sediments and the like contained in the feed-water, for preventing the boiler-coil from becoming incrustated. The feed-water enters the upper part of the reservoir through the funnel h , and the sediments separated by the heating of the water flow, together with the latter, down into the under compartment of the reservoir through tube g . The water, then, in order to enter the opening of tube a^5 , flows upward again, while the sediments remain back, and precipitate on the bottom c^2 .

The uppermost part of the vertical boiler-coil a , or that part situated between the coil a proper and the pipe a^2 , is formed to a horizontal coil a^4 , the purpose of which is to break the intense heat discharged by the fire, so that the superheater is prevented thereby from becoming pervious.

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

1. The combination with a superheater, consisting of a column of horizontal coils forming two superposed divisions, of a tubular boiler also consisting of coiled pipes, the ends of the boiler coil being connected with a reservoir divided in two compartments, one of the latter being adapted to cause the separation of the sediments, the other the precipitation of the same, said former compartment being connected with the lower end of the lower superheating coil-column, the

upper end of the latter being connected with the upper end of the upper superheating coil-column, for the purpose as described.

2. The combination with a superheater, consisting of a column of horizontal coils forming two superposed divisions, of a tubular boiler also consisting of coiled pipes, the ends of the boiler coil being connected with a reservoir divided in two compartments by a plate allowing communication between the said compartments, one of the latter being adapted to cause the separation of the sediments, the other the precipitation of the same, said former compartment being connected with the lower end of the lower superheating coil-column, the upper end of the latter being connected with the upper end of the upper superheating coil column, for the purpose as described.

3. The combination with a superheater consisting of a column of horizontal coils forming two superposed divisions, of a tubular boiler also consisting of coiled pipes, the ends of the boiler coil being connected with a reservoir divided in two superposed compartments by a plate carrying a tube, the upper of said compartments being adapted to cause the separation of the sediments, the lower the precipitation of the same, said tube being adapted to convey the sediments from the upper to the lower compartment, said upper compartment being connected with the lower end of the lower superheating coil-column, the upper end of the latter being con-

nected with the upper end of the upper superheating coil-column, for the purpose as described.

4. The combination with a superheater consisting of a column of horizontal coils forming two superposed divisions, of a tubular boiler also consisting of coiled pipes, the ends of the boiler-coil being connected with a reservoir divided in two superposed compartments by a plate carrying a tube, the upper of said compartments being connected with the upper end of the boiler-coil, and with the feed-pipe, and being adapted to cause the separation of the sediments, the lower compartment being connected with the lower end of the boiler-coil, this end terminating shortly below the bottom-plate of the upper compartment, the tube attached with its upper end to that plate, terminating with its lower end shortly above the bottom of the lower compartment, said upper compartment being connected with the lower end of the lower superheating coil-column, the upper end of the latter being connected with the upper end of the upper superheating coil-column, for the purpose as described.

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

WILHELM SCHMIDT.

Witnesses:

R. HERPICH,
E. SCHULTZE.