(No Model.)

W. SCHMIDT.

METHOD OF SUPERHEATING STEAM.

No. 518,162. Patented Apr. 10, 1894.

Fig. 3.

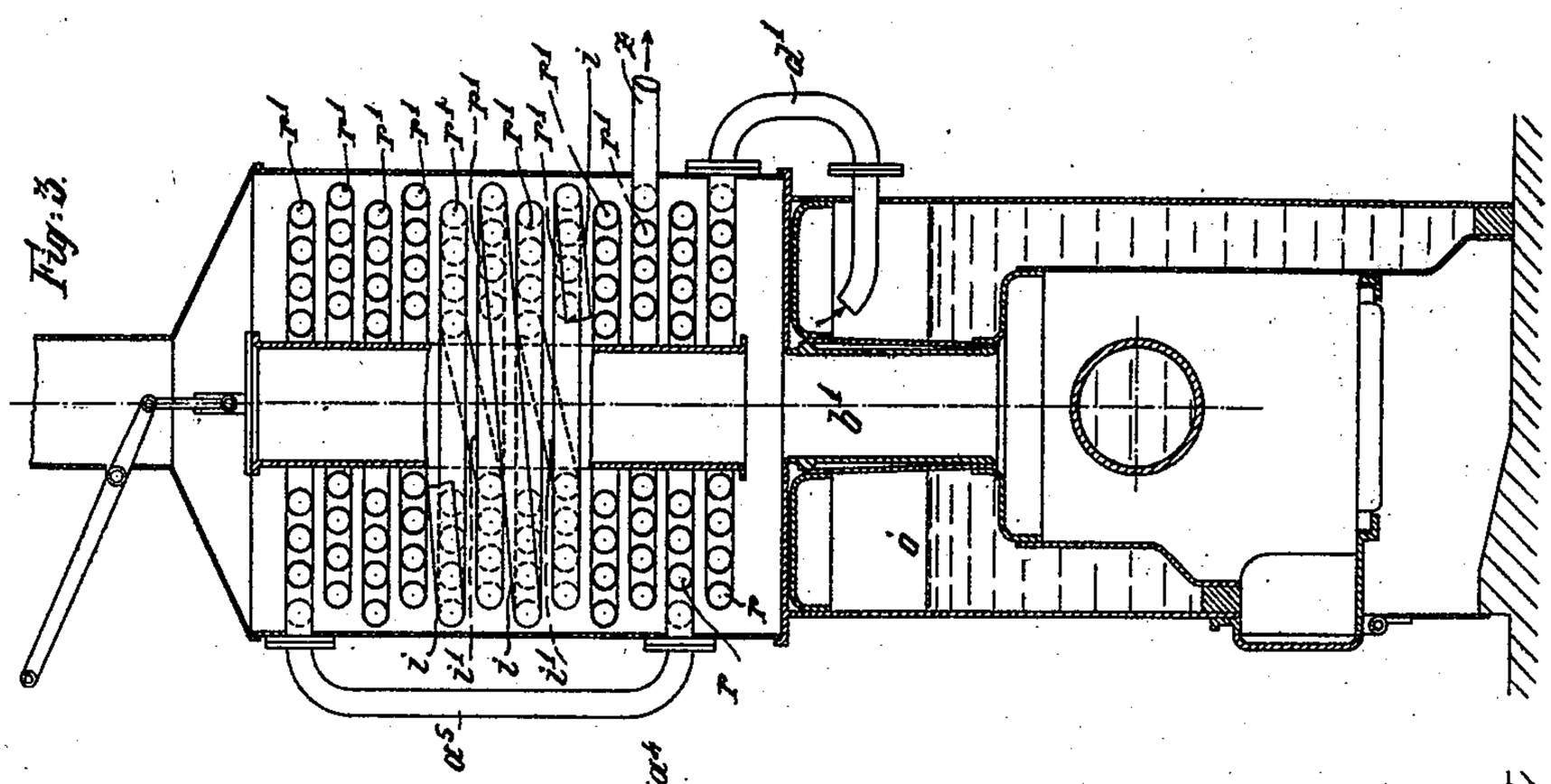


Fig. 2.

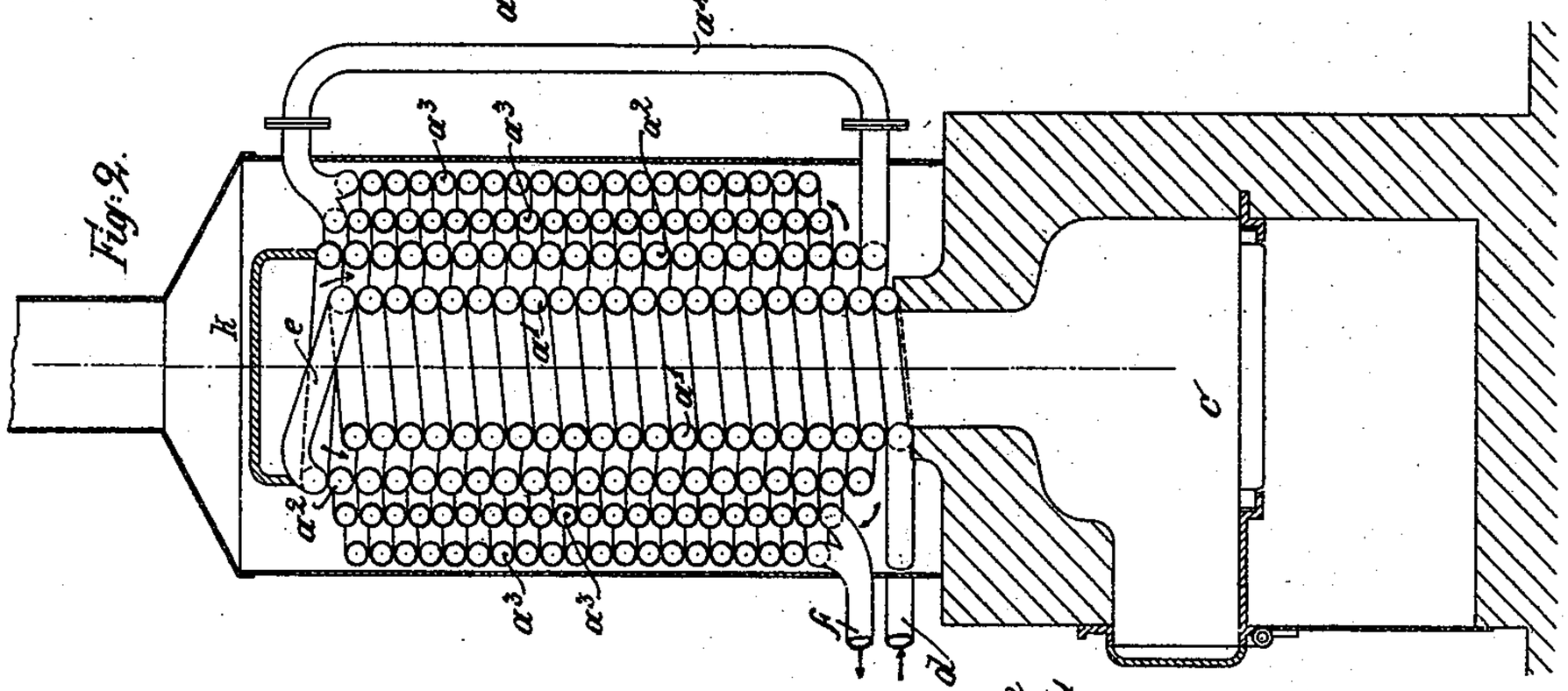
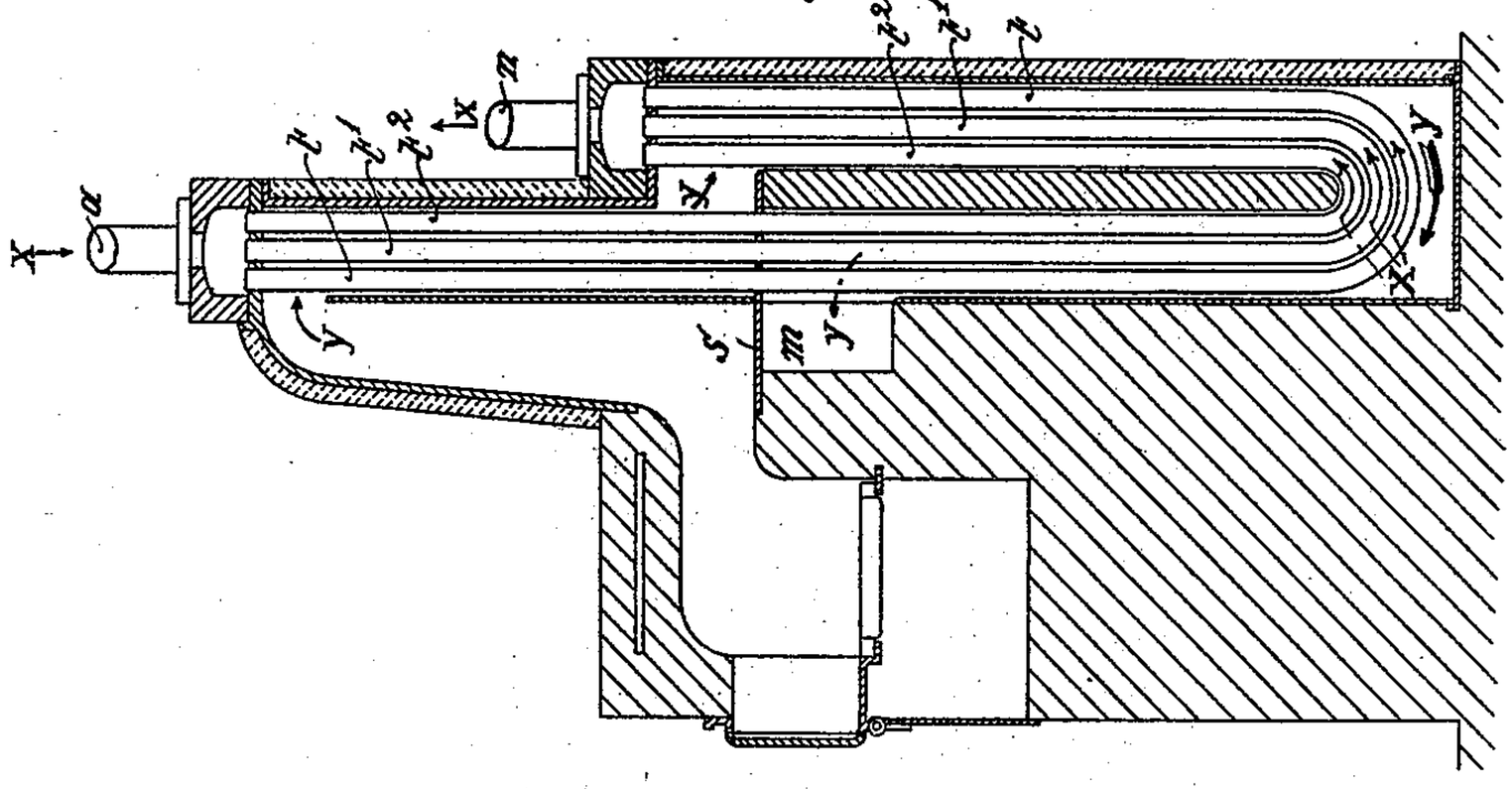


Fig. 1.



Witnesses:
Carl Ruffbach
R. Herpich.

Inventor:
Wilhelm Schmidt
by Robert Gibbs
Attorney.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF WILHELMSHÖHE, NEAR CASSEL, GERMANY.

METHOD OF SUPERHEATING STEAM.

SPECIFICATION forming part of Letters Patent No. 518,162, dated April 10, 1894.

Application filed May 27, 1893. Serial No. 475,727. (No specimens.) Patented in Germany March 20, 1891, No. 59,992; in France March 23, 1891, No. 212,285; in Belgium March 31, 1891, No. 94,349; in Italy April 2, 1891, No. 29,451; in England April 2, 1891, No. 5,697 and June 23, 1892, No. 11,721, and in Austria-Hungary, November 27, 1891, No. 16,464 and No. 40,414.

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 Wilhelmshöhe, near Cassel, in the Province of Hesse-Nassau, Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Methods of Superheating Steam, (for which a patent has been obtained in Germany, No. 59,992, dated March 20, 1891; in Austria-Hungary, No. 16,464 and No. 40,414, dated November 27, 1891; in France, No. 212,285, dated March 23, 1891; in Belgium, No. 94,349, dated March 31, 1891; in Italy, No. 29,451, dated April 2, 1891, and in Great Britain, No. 5,697, dated April 2, 1891, and No. 11,721, dated June 23, 1892,) of which the following is an exact specification.

Heretofore it was not possible to superheat steam up to 600° and more, without injuring the walls of the superheater, which is liable to become red-hot at such an elevated temperature.

The object of my invention is effectively to cool the walls of the superheater, especially at the place next to the furnace, where the combustion gases have their highest temperature.

To carry my invention into effect, I employ two novel means: First. I thoroughly dry the steam in a fore-superheater, arranged in advance of the main heating apparatus, in such a manner, that the fore-superheater absorbs the first and greatest heat coming directly from the furnace and thus renders the blast harmless for the main-superheater. Second. I cause the steam to travel through the said main-superheater in a direction opposite to that of the surrounding combustion gases, thus subjecting the steam successively to more intense heat. Moreover I introduce very wet steam into the superheater, which I may especially accomplish by making the steam to pass into the same directly from the steam-space of an ordinary boiler, and besides I may cause the steam to travel with a considerable velocity through the superheater.

In order that my meaning may be fully understood I will proceed to describe my invention by the aid of the accompanying drawings, in which superheaters for the application of my improved method of superheating steam are illustrated.

The three figures are sectional elevations of three various superheaters for the said purpose.

Figure 1 illustrates a superheater of a most simple construction. t t' t^2 are tubes inside of which the steam blows through and which have the shape of a **U**. They are arranged in a chamber divided into two by the plate s. The entrance of the steam is at a and the way of the same indicated by the arrows x. The blasts coming from the furnace will take the way indicated by the arrows y. It will be seen that the blasts first circulate around that part of the tubes which is nearest a; thus for a short distance the blasts and the steam flow in the same direction, but inside of the lower part of the chamber the currents of the two are reverse to each other. The exit of the steam is at n and that of the blasts at m.

It need scarcely be explained that the wet steam absorbing the first and greatest heat while passing the upper part of the chamber thus being kept cool, will rapidly dry. The blasts, being also cooled down as quickly, will now enter the lower part of the chamber and circulate here around the tubes t t' t^2 on the principle of counter-drafts thus superheating the steam in the most effective manner.

Figs. 2 and 3 represent superheaters in which spiral coiled tubes are employed.

In Fig. 2 the wet steam coming directly from a boiler enters through the pipe d into the interior spiral coiled pipe a' which is placed vertically and centrally over the furnace c. The turns of the spiral are closely in contact with each other, so that the combustion-gases can only ascend inside the coil a'. Thus it will be seen that in this first coil of the superheater the direction in which the steam and the combustion gases travel is the same. The latter strike against a cover k provided at the top of the second spiral coiled pipe a^2, and descend in the annular space between the coils a' and a^2. The steam, at the top of coiled tube a', enters the connecting tube e and thus arrives at the top of the second coiled tube a^2, through which it passes

from top to bottom. This spiral coil is arranged substantially in the same manner as coil a', each two consecutive convolutions of the spiral being in close contact. It will be observed that in this second coil the steam flows likewise in the same direction as the combustion gases heating the coil. The steam having traveled through the described path, is very nearly superheated, and the combustion gases are strongly cooled, yet not so much, as to prevent their employment for heating the steam once more. The latter proceeds, through a connecting rod a^4, to the top of the last exterior spiral coiled tube which does not consist in a single coil but of two parallel coils a^3 a^3 having together the same diameter as each of the coils a' and a^2. The turns of these coils a^3 a^3 need not be in contact with each other, and I prefer to place them a small distance apart. By this arrangement the combustion gases, which in this last part of the apparatus travel opposite to the steam may heat the latter more thoroughly. Finally the steam, being perfectly superheated, leaves the apparatus by the pipe f. It will be seen that the steam, as it approaches the end of coils a^3, is subjected successively to more intense heat.

In Fig. 3 I have shown a form of construction in which the superheater is attached directly to the top of a boiler, the gases proceeding from the furnace of this boiler being also utilized for heating the coils of the superheater. By this arrangement a considerable loss of heat by radiation is prevented. b is a boiler and b' the tube through which the combustion gases ascend to the superheater. The latter is constructed in the following manner: It consists of a series of tubes r and r' coiled in a form of watch springs arranged in horizontal planes one above the other, and connected alternately at their outer ends by means of connecting pipes i, and at their inner ends by means of similar pipes i'. Two of the adjoining helical coiled pipes however are not connected with each other, but the lower of the same, being the upper coil r, connects with the uppermost of the coils r' by means of the pipe a^5. The lowest of the coils r' is in communication with the pipe z, through which the superheated steam leaves the apparatus. The combustion gases are directed in such a manner, as to strike chiefly against the turns of the helical coils, as indicated on the drawings. The wet steam coming from boiler b proceeds through the same and then ascends to the second coil r, then leaving this coil by the pipe a^5 and proceeding to the top coil r'. Up to this point the steam has traveled in the same direction as the combustion gases. Now, in order to superheat said steam completely, it is made to pass through the coiled tubes r' from the top to the bottom, that is to say, opposite to the path of the combustion gases. The steam, being completely superheated by this arrangement, leaves the apparatus by the tube z.

The same arrangements which I have described with reference to their application for superheating wet steam for steam engines, may be also employed for superheating moist air for steam- and air-engines.

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

The method of superheating steam by the direct action of a stream or streams of hot gases or products of combustion, consisting in first drying the steam by exposing it to the first, *i. e.* hottest part of said stream or streams and then superheating the dried steam by exposing it to the following, *i. e.* less hot part of said stream or streams, this latter part flowing in a direction opposite to that of the dried steam, for the purpose as described.

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

WILHELM SCHMIDT.

Witnesses:
HERMAN GRITZ,
JULIUS FRANKE.