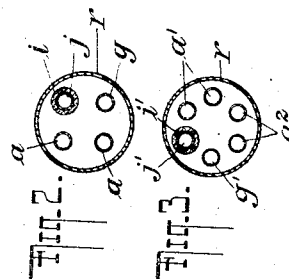
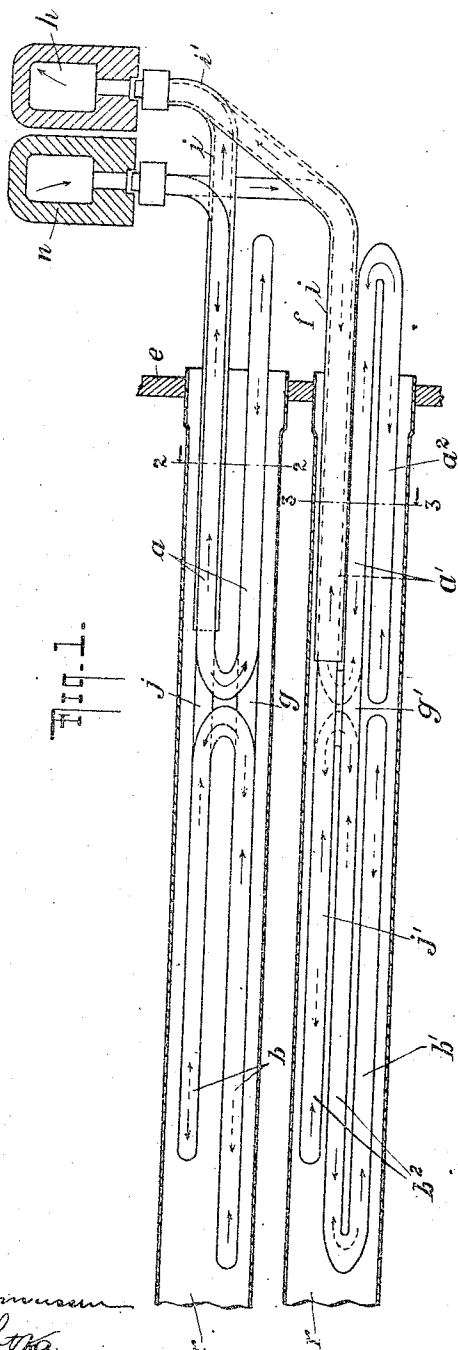


W. SCHMIDT.
TUBULAR SUPERHEATER.
APPLICATION FILED MAR. 2, 1909.

1,010,962.

Patented Dec. 5, 1911
2 SHEETS—SHEET 1.



WITNESSES

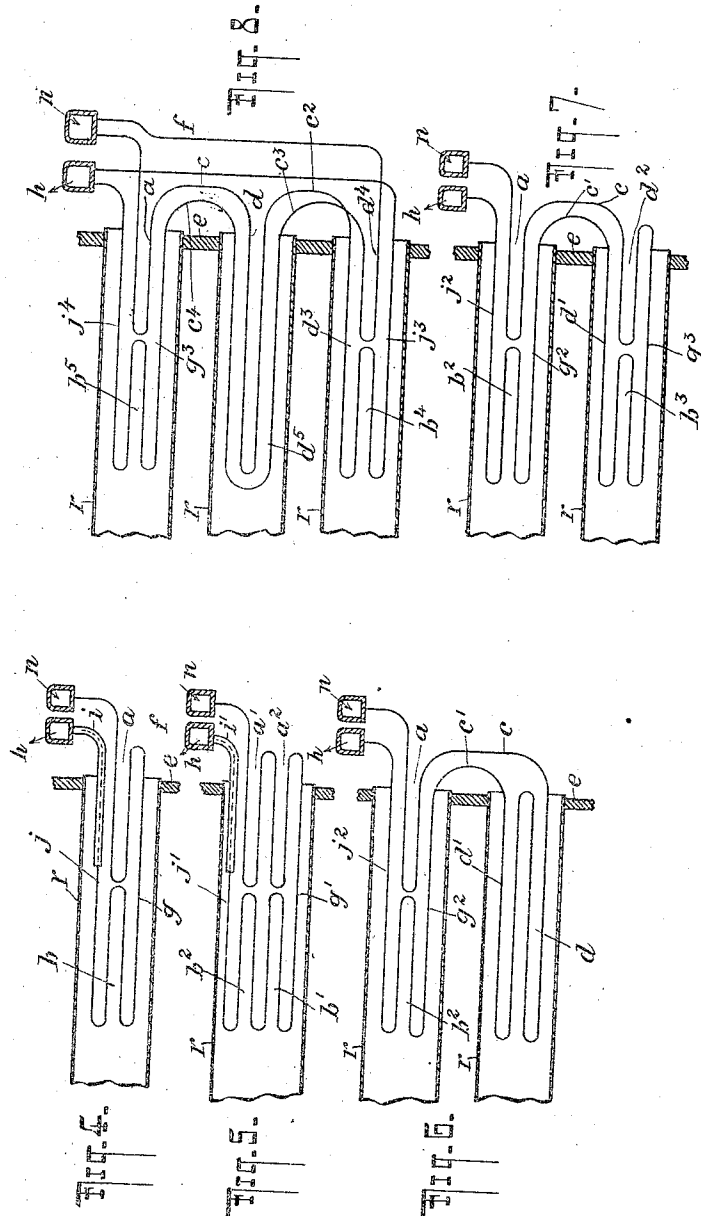
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UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF WILHELMSHÖHE, NEAR CASSEL, GERMANY.

TUBULAR SUPERHEATER.

1,010,962.

Specification of Letters Patent.

Patented Dec. 5, 1911.

Application filed March 2, 1909. Serial No. 480,904.

To all whom it may concern:

Be it known that I, WILHELM SCHMIDT, a subject of the King of Prussia, German Emperor, and resident of Wilhelmsöhne, near Cassel, Germany, have invented certain new and useful Improvements in Tubular Superheaters, of which the following is a specification.

My invention relates to steam superheaters of the general character disclosed in patents issued to me previously, and has for its object to secure improved results as regards the production of dry superheated steam.

In practice it has been found difficult to utilize the heat of the heating gases fully and to cool them to the desired degree, for the reason that the highly superheated steam will, through the walls of the tubes through which such steam is conducted, give off part of its heat to the heating gases which have been previously cooled by contact with water-cooled surfaces, so that part of the heat given to the superheated steam is lost by being retransferred to the cooled heating gases. This, of course, detracts from the efficiency of the superheater.

For the purpose of avoiding the drawback pointed out above, I have, as it were, divided the superheating coil through which the steam passes into a plurality of sections. The section through which the steam to be superheated passes first is exposed to contact with the cooler portion of the heating gases and serves for drying the wet steam coming from a suitable collector or chamber. Another section of the superheating coil, through which the steam passes subsequently, is exposed to the hotter portion of the heating gases, so that the steam is there superheated strongly. As will be seen from the detailed description following hereinafter, this general idea may be carried out in a variety of forms. In some cases it may be desirable to provide a suitable heat insulator for that portion of the steam coil or steam tube, which would otherwise be in contact with the cooler portion of the heating gases in order to further prevent the retransfer of heat from the superheated steam to the cooler heating gases.

Reference is to be had to the accompanying drawings in which—

Figure 1 is a longitudinal section through part of a steam superheater constructed according to my invention; Fig. 2 is a cross section on line 2—2 of Fig. 1; Fig. 3 is a

cross section on line 3—3 of Fig. 1; Fig. 4 is a diagrammatic view illustrating the path of the steam in connection with the upper smoke tube of Fig. 1; Fig. 5 is a diagrammatic view illustrating the path of the steam in connection with the lower smoke tube of Fig. 1 and Figs. 6, 7 and 8 are further diagrammatic views illustrating additional forms of my invention.

Referring particularly to Figs. 1 to 5 *n* indicates a collecting chamber or header, in which the wet steam coming from a boiler is received. *e* indicates the plate for receiving the ends of the smoke tubes *r* through which the heating gases are supposed to travel from left to right to reach the smoke box *f*. From the distributing chamber *n* the steam passes through superheating coils which are located within the smoke tube *r*. Thus as shown in Figs. 1, 2 and 4 the upper smoke tube *r* contains four steam tubes as it were, that is to say, a cross-section of said upper smoke tube will show four steam tubes. The steam first passes through a U-shaped portion *a* traveling in the upper member thereof (see Fig. 1.) in a direction opposite to that of the combustion gases, and in the lower member thereof in the same direction with the combustion gases. In this first U-shaped section of the superheating coil, the wet steam becomes dry; it then passes through the portion *g* in a direction opposite to that of the combustion gases, to the left-hand end of the second U-shaped section *b* which is of the reverse arrangement to the first section *a*, that is to say, in the second section the steam first travels in the same direction as the combustion gases and then in the opposite direction. Finally from the upper left-hand end of the section *b* the steam passes through the portion *j* in the same direction as the heating gases and finally reaches the collecting chamber *h* from which the superheated steam is carried to the place of consumption such as the engine. I have shown a wrapping *i* of asbestos or other suitable heat-insulator applied to that portion of the tube *j* which is exposed to the coolest heating gases, so as to avoid the transfer of heat from the highly superheated steam to the cooler heating gases.

In connection with the lower smoke tube *r* of Fig. 1, I have illustrated a somewhat different arrangement which is also shown in Figs. 3 and 5. Here the steam passes first through two U-shaped sections *a'*, *a''* which

are located in the cooler portion of the smoke tube r , is then conducted through a pipe portion j^1 to a second section located in a hotter portion of the smoke tube and consisting of two U-shaped members b^1, b^2 arranged reversely to the tubes or coils a^1, a^2 . Finally the steam passes to the collecting chamber h through the pipe portion j^1 which may be partly covered with a heat insulation i^1 in the same manner as described for the pipe portion j . As shown in Figs. 1 and 3 these various coils are arranged within the lower smoke tube in such a manner as to show six cross-sections of the steam pipe or coil.

It will of course be understood that the complete superheater comprises a large number of coils of the character described. All the coils may be of the same construction as shown in connection with the upper smoke tube, or they may all be of the same construction as those within the lower smoke tube. The arrangement may further be varied in other ways, three examples of which I have shown in Figs. 6, 7 and 8.

In Fig. 6 four cross sections of the steam pipe are located within each of the smoke tubes. The steam passes first through a U-shaped section a practically identical with the one shown in Figs. 1, 2 and 4 and is then conducted through a pipe section c to a long U-shaped section d contained in the lower smoke tube r . Then the steam passes through a second section d' identical with the section d and through pipe portions c', g^2 to a U-shaped section b^2 arranged reversely to the section a and in a hotter portion of the upper smoke tube r . Finally the steam passes to the collecting chamber h through the pipe portion j^2 .

In Fig. 7 the arrangement of the pipe portions a, c is the same as in Fig. 6. In the lower tube, however, the steam passes first through a U-shaped section d^2 arranged only in the cooler portion of said smoke tube, then through a return pipe g^3 to a U-shaped section b^3 arranged reversely to the section d^2 and exposed to the hotter heating gases. From there on the path of the steam is the same as in Fig. 6 through the pipe sections d', c', g^2, b^2 and j^2 .

In Fig. 8 the steam coils are arranged to pass through three smoke tubes r on their path from the collecting chamber n to the collecting chamber h . The steam first passes through the U-shaped section a , the connecting pipe portion c and the U-shaped section d , these three portions being substantially identical in arrangement with those shown in Fig. 6. Then the steam passes through a connecting pipe portion c^2 and a longitudinal portion d^3 into a U-shaped section b^4 located in the third smoke tube r and exposed to the hotter combustion gases therein. Thereupon the steam is conducted to the collecting chamber h through a pipe

j^3 . Another portion of the steam passes from the collecting chamber n to a U-shaped section d^4 located in the lowermost smoke tube r at the cooler portion thereof and arranged reversely to the coil section b^4 ; then through a connecting portion c^3 the steam passes through a U-shaped section d^5 contained in the second smoke tube and then passes through a connecting pipe portion c^4 to a return pipe g^3 to a U-shaped section b^5 arranged in the hotter portion of the upper smoke tube and reversely to the coil section a . Finally through a pipe portion j^4 the steam is led to the collecting chamber h . It will be understood that the insulation i such as indicated in Figs. 1 to 5 may also be employed in connection with the other forms of my invention.

The steam, by being led back and forth so as to travel at times in the direction opposite to that of the heating gases and at other times in the same direction therewith, will be first dried when exposed to the comparatively lesser heat of the heating gases in the portions of the smoke tubes nearest to the smoke box f , and then the dry steam will be superheated chiefly in those portions of the steam coils which are in the hotter parts of the smoke tubes, that is, farther away from the smoke box f .

I claim as my invention:

1. The combination in a boiler structure provided with heating tubes, with one or more of said tubes, of a superheater located in said tube or tubes and comprising a plurality of U-shaped sections connected in series some of said sections being arranged longitudinally of one another in the same heating tube, as and for the purpose described.

2. The combination with one or more heating tubes, of a superheater element located in said tube or tubes and comprising a plurality of U-shaped sections connected in series so that the steam may pass through them successively, said sections being arranged longitudinally of one another as to each tube, a collecting chamber for receiving the steam after its passage through the superheater, and an insulating covering on the portion of the superheater tube adjacent to said chamber.

3. In a fire tube boiler, a superheater element comprising a plurality of U-shaped sections connected in series, at least two of said elements being arranged longitudinally in a single heating tube, and connecting tubes for carrying steam to and from said sections, the section tubes and the connecting tubes being arranged concentrically with the walls of the heating tube.

4. The combination of a boiler structure provided with heating tubes through which heating gases are adapted to pass and a superheater comprising a plurality of U shaped sections through which steam is

adapted to pass successively, several of said sections being arranged longitudinally of one another in the same tube with the section through which steam passes first nearer the 5 outlet of its tube than the other sections, as and for the purposes described.

5. The combination of a boiler structure provided with heating tubes through which heating gases are adapted to pass, and a 10 plurality of superheater elements comprising each a plurality of sections arranged several sections to a tube within such tubes, the sections through which the steam passes first comprising two connected portions

through which the steam travels in opposite 15 directions, and being located adjacent to the outlet of said structure, while the next section of the superheater extends in a portion farther away from the outlet and therefore exposed to greater heat.

20 In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILHELM SCHMIDT.

Witnesses:

JULIUS FRANKE,
MARTIN SCHMIDT.