W. SCHMIDT.

STEAM SUPERHEATER.

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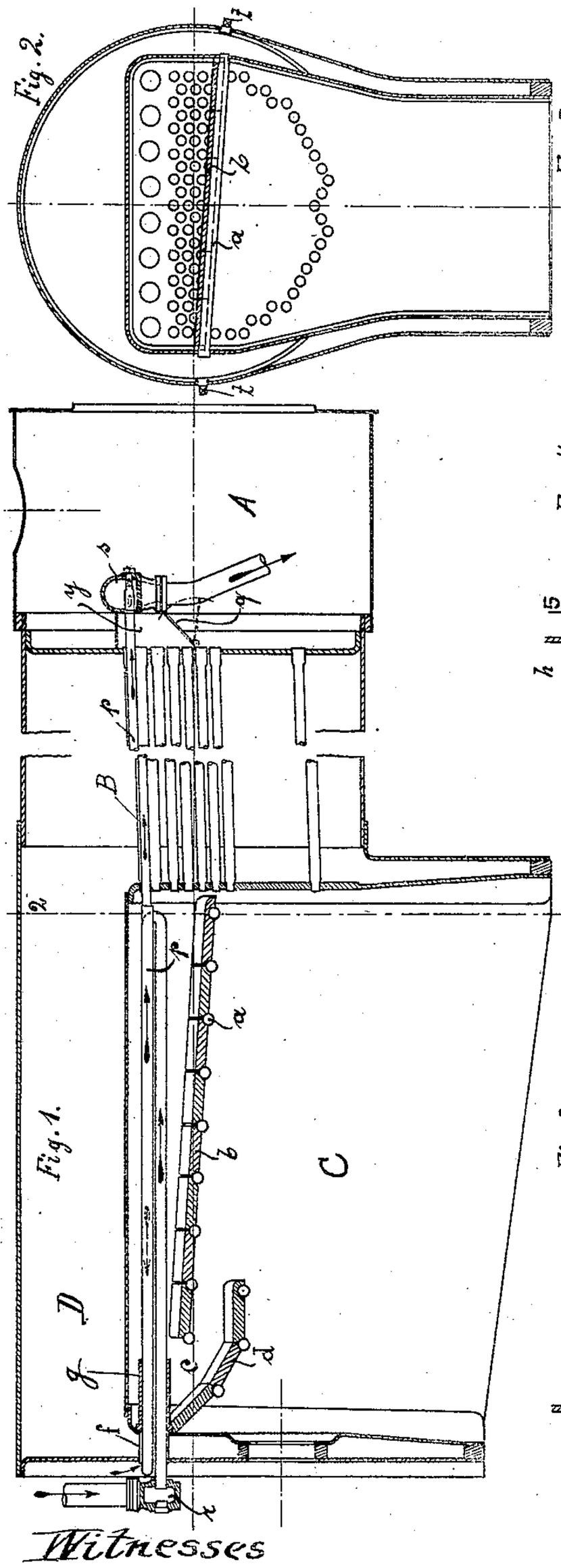

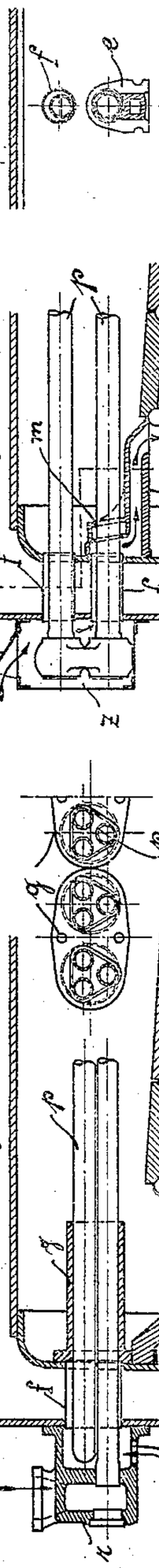

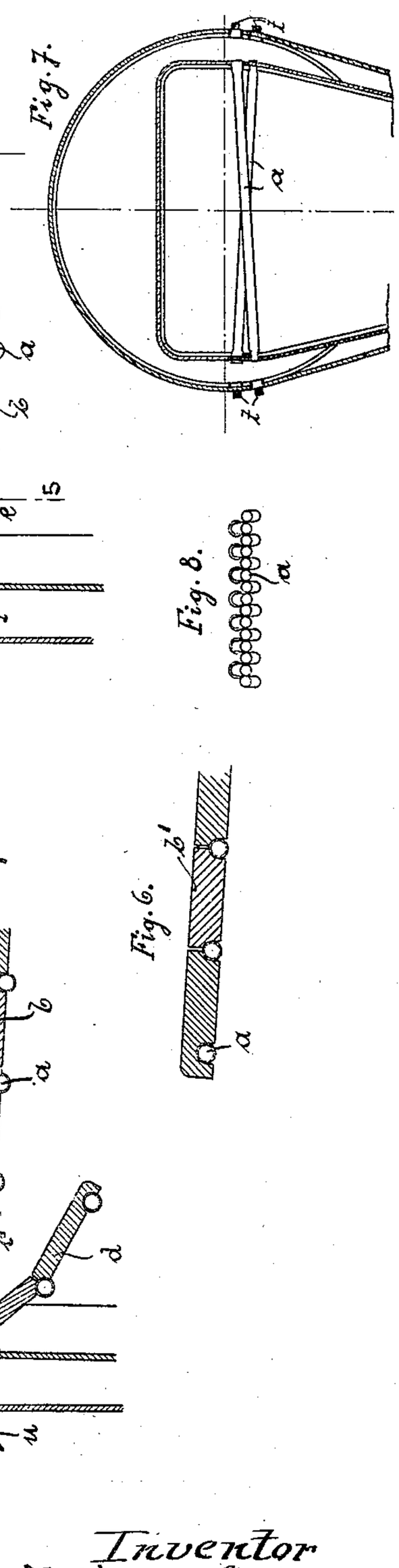

Witnesses

John A. Kebbenbeck.

G. V. Rasmussen

Inventor

Wilhelm Schmidt

By Briesen & Knauth

Attorneys.

UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF WILHELMSHOEHE, NEAR CASSEL, GERMANY.

STEAM-SUPERHEATER.

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To all whom it may concern:

Be it known that I, WILHELM SCHMIDT, Dr. Ing., a subject of the Emperor of Germany, and resident of Wilhelmshoehe, near Cassel, Germany, have invented certain new and useful Improvements in Steam-Superheaters, of which the following is a specification.

My invention relates to superheaters for use with fire tube boilers and particularly to locomotive boilers of this class.

The object of my invention is to provide an efficient superheater chamber in the upper part of the fire box.

In superheaters proposed hitherto in connection with boilers of the locomotive type where the whole or a part of the superheating surface was arranged in the fire box, it has been found impossible to provide a chamber for the superheater capable of withstanding the extraordinary strains due to the hot fire gases and the direct radiation of heat from the fire, and in consequence no practical protection has hitherto been obtainable for the superheater parts arranged within the fire box.

My present invention, according to one complete embodiment, consists of a superheater chamber formed by means of cross water tubes arranged close together in the fire box, or cross water tubes arranged at suitable distances apart in the upper part of the fire box and supporting a fire-proof wall, this protecting wall being provided with a passage or passages for the fire gases, and being so arranged as to inclose a number of boiler smoke tubes which may be also closed off by a casing in the smoke-box provided with a damper for regulation of the flow of fire gases drawn through the passages in the protecting wall. By employing cross tubes in this manner for supporting the protecting wall I obtain an arrangement which can be easily cleaned and overhauled and which has the advantage in addition that a substantial increase of the direct heating surface of the boiler is obtained. Further by inclining the wall from one side of the fire box to the other an arrangement is obtained by which the removal of ashes is facilitated. By using fire brick resting upon the cross tubes as the material for my fire proof wall previously referred to I obtain the desired wall in a very thin and durable form and one which, especially if the bricks are uncemented, permits of very quick and easy removal and replacement of individual bricks where access is desired to the superheater tubes for inspection, cleaning or repair. The cross tubes are conveniently surrounded for a considerable part of their circumferential surface by the fire bricks whereby a further protection is obtained, especially in the upper part through which the steam generated in these tubes flows. Opposite the passage or passages in the protecting cross-wall I provide protecting means for the superheater tubes which protecting means are preferably cooled by means of air.

Referring now to the accompanying drawings (Figures 1–8) which illustrate a special embodiment of a superheater and suitable constructions of a superheater chamber according to my present invention, and details of the same: Fig. 1 is a longitudinal section through the boiler provided in the fire box with a protecting cross-wall and in the superheater chamber with a suitable superheater; Fig. 2 is a cross section on the line 2—2 of Fig. 1; Fig. 3 is a detail of the superheater chamber at the rear wall of the boiler; Fig. 4 is a detail of the modified arrangement of air cooling means at the rear end of the boiler; Fig. 5 is a section on the line 5—5 of Fig. 4; Fig. 6 shows a modified arrangement of the separate bricks on the cross water tubes; Fig. 7 is a central vertical cross section, and Fig. 8 is a central vertical longitudinal section through a modified form of protecting wall according to my present invention.

In carrying the invention into effect the superheater may be of any convenient construction and arranged partly or entirely within the fire box.

According to the form shown in Figs. 1–3 the superheater consists of tubes *p*, extending from the smoke box A through the upper row of smoke tubes B and has a large part of its surface in the fire box C at the rear end of the boiler D. Saturated steam from the boiler enters at *r* at the rear end and circulates through the tubes *p* to a superheated steam header *s*, located in the smoke box A.

In Figs. 4 and 5 another superheater arrangement consisting of two rows of tubes is shown.

Where the superheater parts pass through

the fire box they are located in a superheater chamber which forms the subject matter of my invention.

In the embodiment of my invention shown in Figs. 1 and 2 the cross water tubes required in the wall beneath the superheater tubes are inclined from one side of the fire box to the other. These tubes extend from one side wall of the combustion chamber to the other and in the boiler shell opposite the ends of the tubes there are provided access plugs, *t*. By sloping the tubes in this way I insure that a circulation of water takes place through the cross tubes, *a*. On these tubes *a* there rest separate fire bricks *b*, preferably without any cementing material for binding them together, so that an easily removable wall is obtained. This wall may be sloped downward toward the front of the boiler in order to close off any desired number of smoke tubes. At the rear end of the wall, there is provided an opening or openings *c* through which furnace gases pass from the fire and are guided by means of the wall over the whole length of the superheating surface placed in the chamber. Below the fire gas passage *c* there may be arranged a protecting screen or lip *d* which may be of a similar construction to that of the described protecting wall. Owing to the disposition of the deflecting wall *d*, which overlaps the wall formed by the bricks *b* and shields the opening *c*, direct radiation from the furnace to the superheating tubes cannot take place. As a further protection for the tubes or heating surface in the superheating chamber, I provide cooling air inlets. Thus as shown in Fig. 1 these air inlets are arranged at the rear end of the boiler and effect the cooling of the superheater parts exposed to the hottest fire gases. For this purpose the tubes *p* when they pass through the rear wall of the boiler are surrounded by thimble tubes *f* which connect the rear wall of the boiler with the rear wall of the fire box. Within the furnace chamber, there are provided sleeves *g* (see also Fig. 3) which extend for some distance within the chamber and surround the superheating tubes and guide the cooling air along these tubes.

According to the form shown in Fig. 1 atmospheric air enters the space left between the tubes *p* and the thimble tubes *f* and the sleeves *g*. According to the form shown in Fig. 3 the air passes through an opening *u* either from the atmosphere from an injector or from the air brake. Steam may also be used as means for cooling and regulating.

In the smoke-box of the boiler the tubes closed off by the protecting cross-wall are inclosed by a casing *y* provided with a damper *q*.

The operation of the arrangement above described is as follows: Gases rising from the fire grate enter the superheater chamber through the opening *c*, the maximum proportion of the total furnace gases passing through the opening *c* being determined by the number of smoke tubes shut off by the protecting wall. This proportion of the gases passing through the superheater may be regulated by means of the damper *q* on the casing *y*. No gases are drawn through the superheater chamber when the damper is shut, as it may be for instance when the steam is shut off and the engine is running down hill or is stationary. In that case the superheater parts are cooled against the direct radiation from the furnace by the means above described. Also with the arrangement described, the efficiency of the heating surface within the superheater chamber can be considerably increased if desired by arranging the protecting cross-wall at different levels or giving it different inclinations.

I am enabled by the construction of protecting wall with loose bricks hereinbefore described to render easily accessible the superheater tubes and the boiler smoke tubes closed off by said cross-wall.

Any other convenient arrangement of air inlet for cooling the super-heater tubes may of course be provided but the forms shown are exceedingly convenient and compact.

According to the construction of protecting device for the superheater tubes near the furnace gas inlet shown in Figs. 4 and 5, an air cooled grating is provided opposite that opening. Air from the atmosphere or from a suitable pressure source enters a casing *z* at the rear end of the boiler through an opening provided with a regulator *h*, this air passing through the thimble tubes *f*, connecting the rear walls of the furnace chamber. Within the furnace chamber and surrounding the lower superheater tubes and below said tubes there are provided the air-cooled gratings *e*. As the lower superheater tubes approach the rear fire box walls, and above the gratings, they are surrounded by a suitable packing, *m*, which prevents further progress of the air along the pipes; as seen in Fig. 4 the air passing through the lower thimble tube *f* enters the hollow space in the grating *e*. It will be understood that in this form also inner extension sleeves such as *g* may be provided inclosing the upper superheater tubes.

According to the form shown in Fig. 6, the water tubes *a* are surrounded by the fire bricks *b'* for a considerably greater proportion of their surface. In this way not only a better protection of the water tubes is obtained but also the bricks may be made much thicker without practically taking more space away in the fire box.

Figs. 7 and 8 show a form of my invention in which no fire brick is used, the protecting wall being constituted entirely of

cross water tubes laid closely together with every other tube inclined across the fire box at an angle equal with but opposite to that of the remaining tubes. In this way not only do I obtain efficient protection for the superheater parts but I am also enabled to considerably increase the heating surface of the boiler. This dispenses with the use of the fire bricks *b*, that is, the pipes *a'* form a wall themselves, and thus take the place of the pipes *a* and wall *b* of Fig. 1.

I claim as my invention:—

1. In combination with a fire tube boiler, of the horizontal type, having a fire box at one end:—a superheater in the upper part of the fire box; a baffle wall, between said superheater and the fire, extending from the fire box end of the boiler smoke tubes to a point adjacent the opposite fire box wall so as to leave a passage between its termination and the said opposite wall, some of the smoke tubes entering the space above said baffle wall; and baffle means coacting with said baffle wall to protect said superheater from direct radiation from the fire, some of the gases of combustion passing around the termination of said baffle wall into contact with the superheater and leaving the fire box through the smoke tubes above said baffle wall.

2. In combination with a fire tube boiler, of the horizontal type, having a fire box at one end:—a superheater in the upper part of the fire box; a baffle wall, between said superheater and the fire, extending from the fire box end of the boiler smoke tubes to a point adjacent the opposite fire box wall and comprising transverse water tubes with fire bricks laid thereon, some of the smoke tubes entering the space above said baffle wall; and a baffle means coacting with said baffle wall to protect said superheater from direct radiation from the fire while permitting some of the gases of combustion to pass around the termination of said baffle wall into contact with the superheater and to leave the fire box through the smoke tubes above said baffle wall.

3. In a steam boiler:—a superheater arranged within the upper part of the fire box, a protecting cross wall between said superheater and the fire allowing passage of hot gases from fire to superheater, and means for introducing air from without into contact with the superheater parts first exposed to such hot gases to cool said super-heater parts.

4. In a boiler of the locomotive type:—a superheater arranged within the upper part of the fire box; a protecting cross wall between said superheater and the fire allowing passage of hot gases from fire to superheater, some of the smoke tubes entering the space above said cross wall; means for introducing air from without into contact with the superheater parts first exposed to such hot gases to cool said superheater parts; and a casing, provided with a regulating damper, over the smoke box ends of the smoke tubes above referred to, so that the flow of fire gases over the superheater may be controlled.

5. In a steam boiler:—a superheater arranged within the upper part of the fire box; a protecting cross wall, having a passage at the rear end thereof, between said superheater and the fire; and means for cooling the superheater parts adjacent said passage said means comprising a thimble traversing the fire box wall and surrounding said superheater parts, a free space being left between said parts and said thimble, so that air may pass through said thimble and over said parts to cool them.

In testimony whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

WILHELM SCHMIDT.

Witnesses:

JULIUS FRANLY,

GUSTAV RETTIG.