

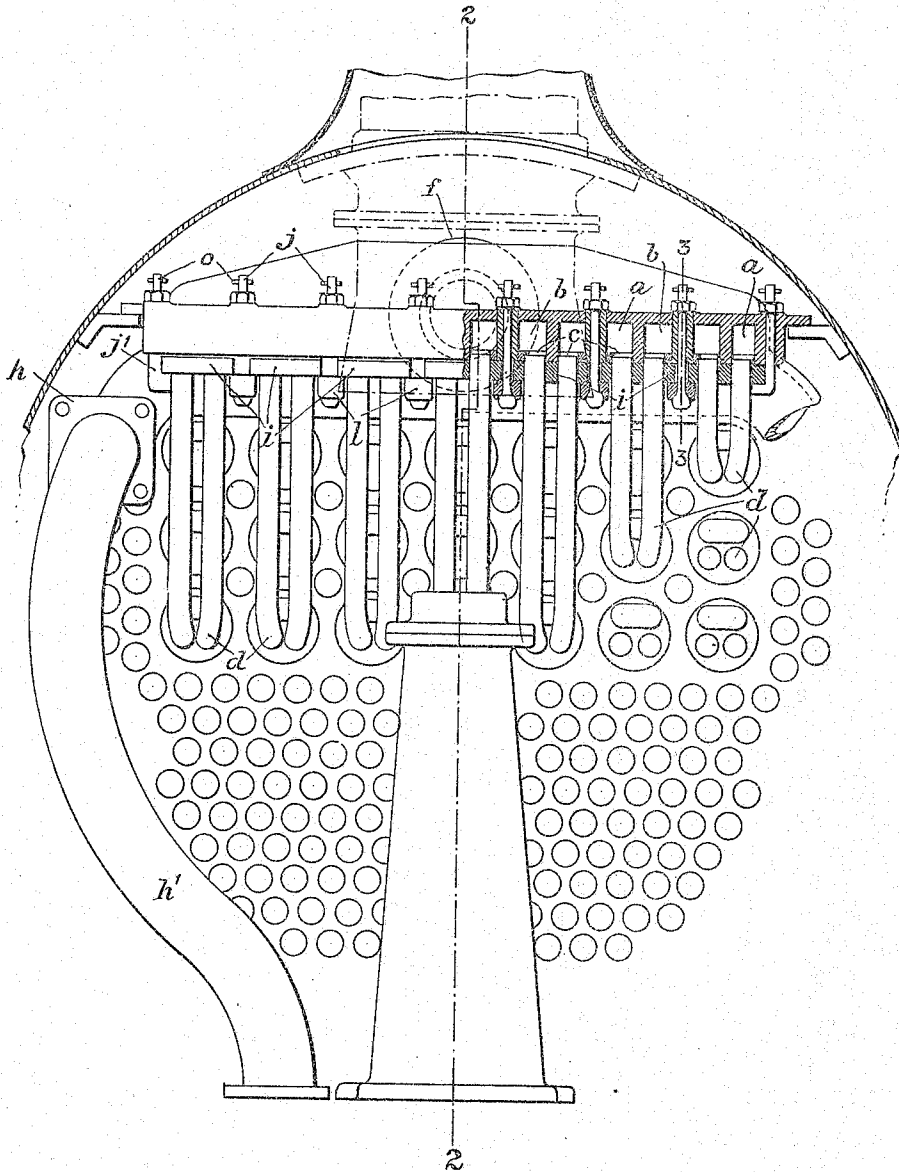
J. H. STIRLING,
STEAM SUPERHEATER.
APPLICATION FILED JUNE 10, 1913.

1,129,915.

Patented Mar. 2, 1915.

5 SHEETS-SHEET 1.

FIG. 1.



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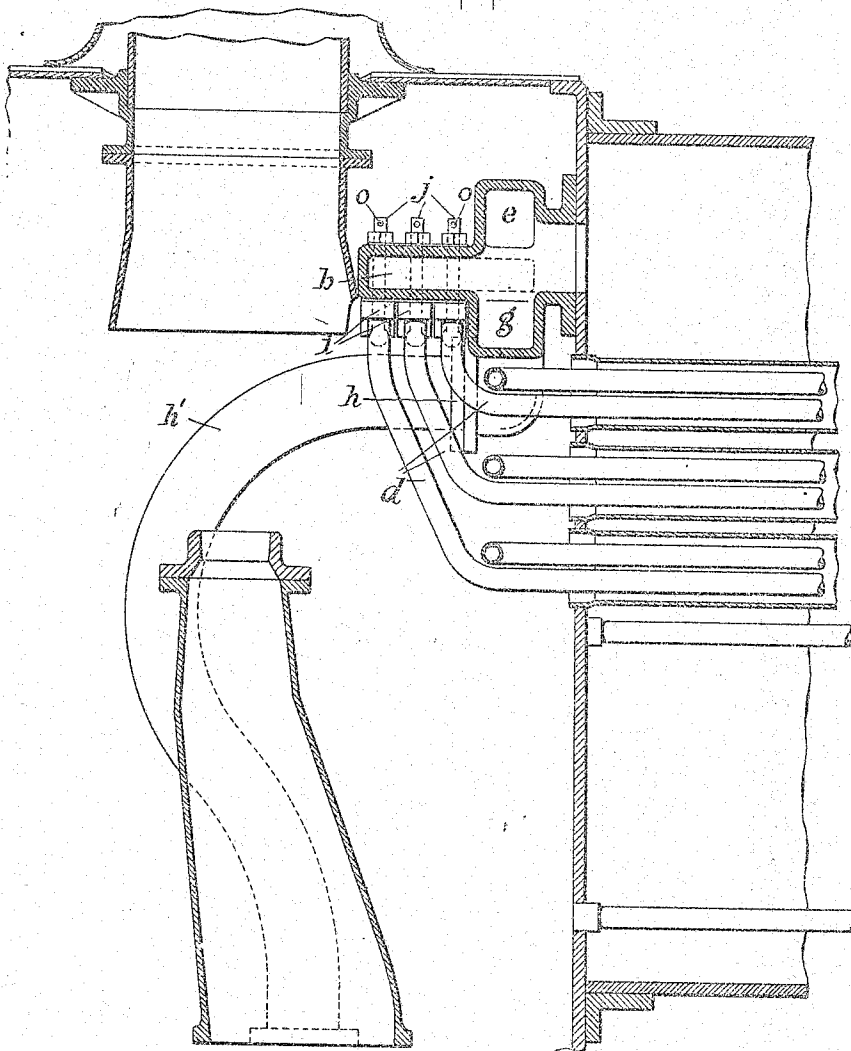
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6 SHEETS—SHEET 2.

Fig. 2.



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5 SHEETS—SHEET 3.

FIG. 4.

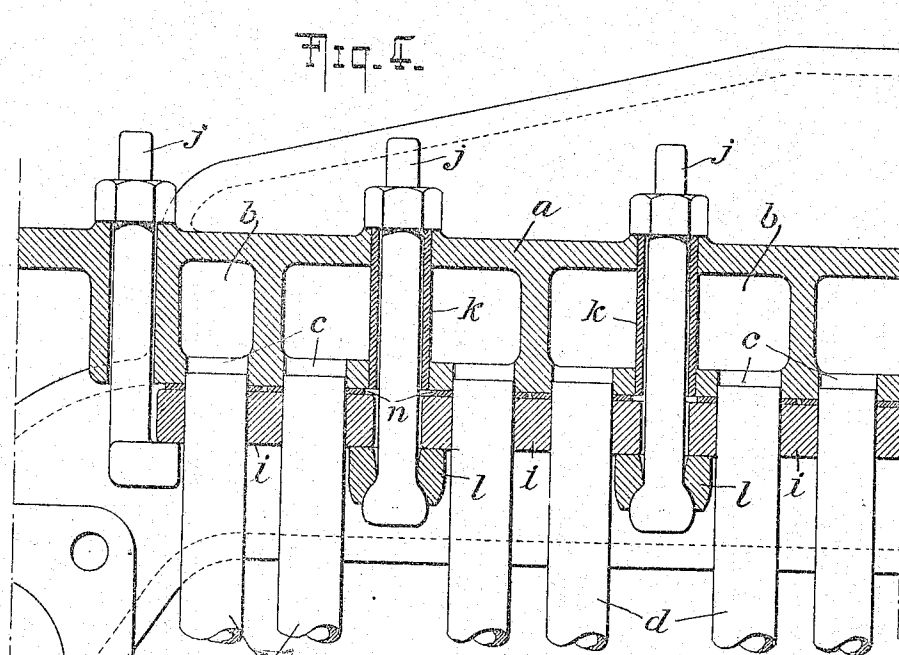
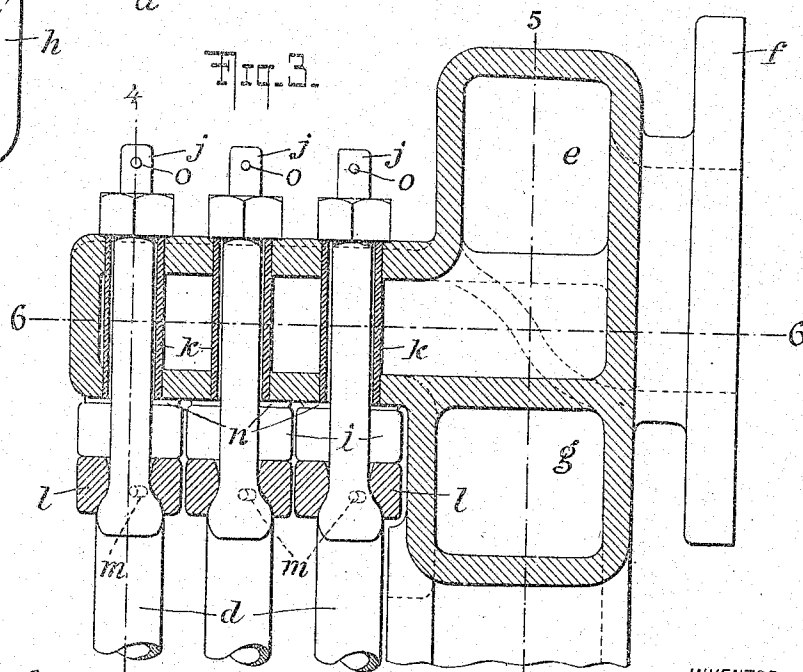


FIG. 3.



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 5 SHEETS-SHEET 4.

Fig. 7.

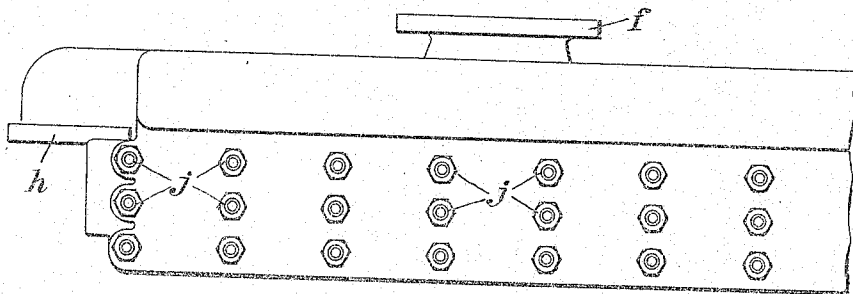


Fig. 6.

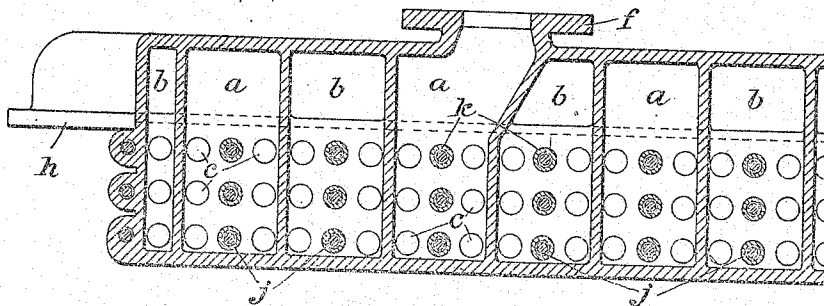
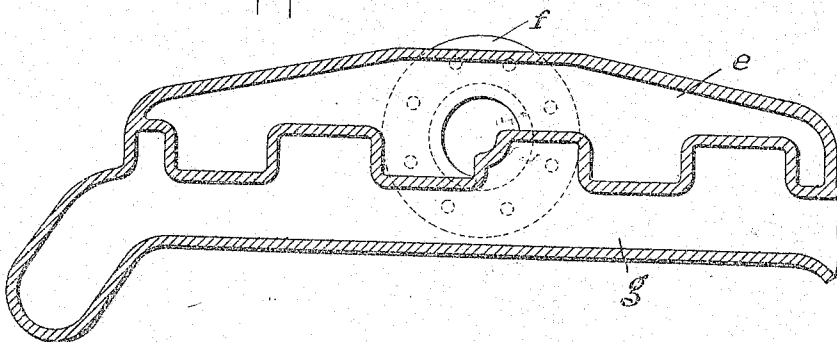


Fig. 5.



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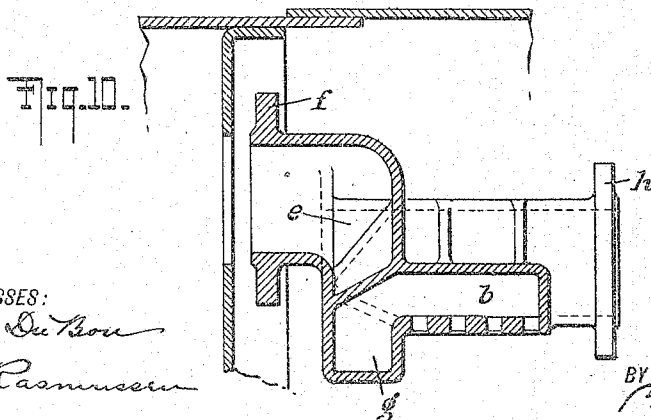
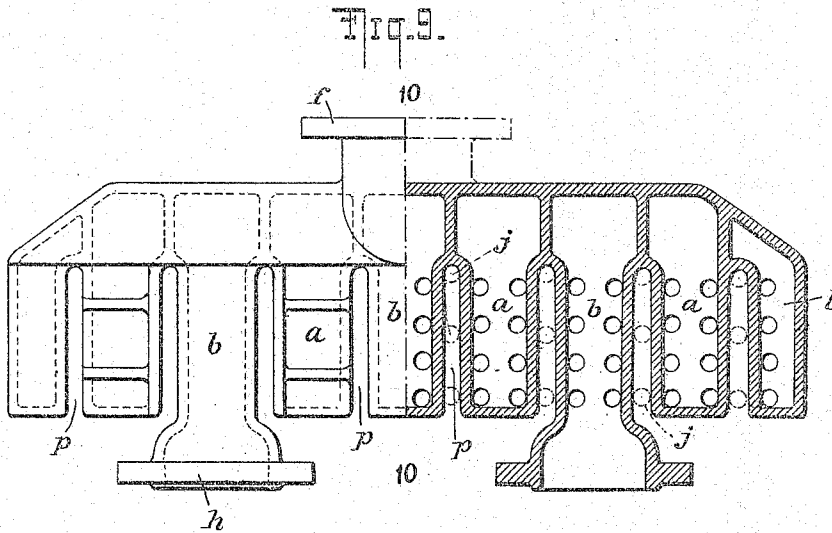
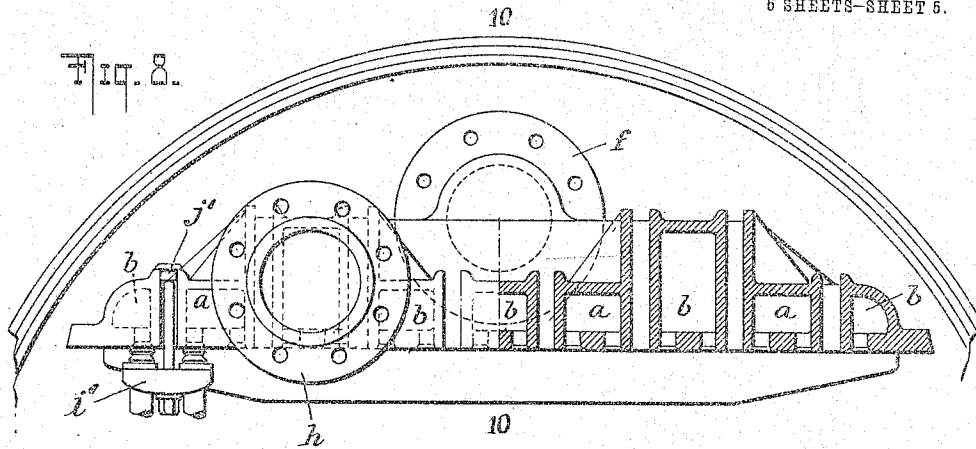
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1,129,915.

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6 SHEETS-SHEET 5.



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STEAM-SUPERHEATER.

1,129,915.

Specification of Letters Patent.

Patented Mar. 2, 1915.

Application filed June 10, 1913. Serial No. 772,763.

To all whom it may concern:

Be it known that I, JAMES HAMILTON STIRLING, a subject of the King of Great Britain and Ireland, residing at St. Stephen's House, Westminster, London, S. W., England, engineer, have invented a new and useful Improvement in Steam-Superheaters, of which the following is a specification.

My invention relates to steam superheaters for use with locomotive and other boilers of the flue tube type in which there are a number of superheater elements or pipes extending into the flue tubes, the ends of said pipes being connected to suitable headers or other collecting means located in the smoke box and preferably in the upper part thereof.

The object of my invention is to provide an improved superheater of the type specified in which the header casting is of simple form thus lending itself easily to foundry operations.

A further object of my invention is to provide a simple and efficient means for connecting the superheater elements to and disconnecting said elements from the header.

Still a further object of my invention is to so arrange the header that the means employed for connecting the superheater elements to the headers are protected to a certain extent from the corroding action of the hot gases as they issue from the flue tubes.

And another object of my invention, in one of its modifications, is to provide a form of header in which the portions thereof which receive the superheated steam shall not be unduly cooled by the portions which receive the saturated steam, and in which further, said two portions are free to expand and contract independently without injurious mutual strain.

My invention consists in a superheater of the type indicated having a header provided with longitudinally extending channels for saturated and superheated steam, and transversely extending chambers opening alternately into said channels, the arrangement being such that the ends of the superheater elements are attached from below to the transverse chambers and that the longitudinal passages are disposed between the

transverse chambers and the tube plate, and preferably one on top of the other.

My invention further consists in a superheater of the type indicated in which the transversely extending chambers are isolated from one another by means of intermediate spaces in which the bolts for attaching the superheater elements to the said chambers are disposed, the arrangement being such that these bolts may be withdrawn by slackening the nuts and without removal of the same from the bolts.

My invention will be better understood by referring to the accompanying drawings in which—

Figure 1 is a transverse sectional view taken through the smoke box of a locomotive provided with my improved superheater; Fig. 2 is a partial longitudinal section taken along the line 2—2 of Fig. 1; Fig. 3 is a vertical longitudinal section, on an enlarged scale, taken through the header proper along the line of a set of connecting bolts as for example, 3—3 of Fig. 1; Fig. 4 is a partial vertical transverse section taken along the line 4—4 of Fig. 3; Fig. 5 is a vertical transverse section, taken along the line 5—5 of Fig. 3, the section being on a reduced scale; Fig. 6 shows a horizontal transverse section, similar to Fig. 5, taken along the line 6—6 of Fig. 3; Fig. 7 shows, on the same scale as Figs. 5 and 6, a plan view of the header; Fig. 8 shows a view, similar to Fig. 1, of the upper part of a smoke box embodying a modified form of my invention; Fig. 9 shows a plan view of the modification of Fig. 8; and Fig. 10 shows a vertical longitudinal section along the line 10—10 of Figs. 8 and 9.

Referring to the embodiment shown in Figs. 1—7 the header is preferably a casting provided with a plurality of chambers *a*, for saturated steam, alternating with a plurality of similar chambers *b*, for superheated steam. These chambers are all of substantially cubical form and arranged side by side across or transversely to the smoke box and to the greatest length of the header. Holes *c*, are provided in the bottom of the chambers for attaching the superheater elements *d* in the manner hereinafter described.

At the rear of the header casting and

preferably one above the other at levels respectively a little above and a little below the level of the chambers just referred to, are channels or main collecting chambers *e* and *g*. These channels extend behind the chambers from substantially one end of the header to the other. Channel *e* has a rear opening surrounded by a tubular flanged boss *f* for connection to the wet or saturated steam pipe (not shown) of the boiler and opens forwardly into each of the chambers *a*. Channel *g* has openings at its two ends, which preferably extend beyond the rows of chambers *a* and *b*, each of which is surrounded by flanges *h* for connection to the main steam pipes *h'* which lead to the engine cylinders; and opens forwardly into each of the chambers *b*. The openings at the ends of channel *g* need not necessarily be at the places indicated but the header may be so formed as to locate them in any other suitable position according to the requirements which may be imposed by other features of the smoke box construction or as may be preferred.

As shown in the drawings the channels *e* and *g* are spaced apart so that the chambers *a* and *b* extend backwardly between said channels and open respectively upwardly and downwardly into the channels. This arrangement, while preferable, is not essential and the channels *e* and *g* might be placed close together and the chambers *a* and *b* arranged to open rearwardly into the channels instead of upwardly and downwardly as shown, as is done *e. g.*, in the modification shown in Figs. 8-10. The inlet and outlet ends of each separate superheating element *d* are expanded into separate tie plates *i* of substantially flat and rectangular form, the element ends being extended beyond the tie plates and registered with the holes *e* in the bottom of the header chambers.

The tie plates carrying the element ends, as just described, are held in position by bolts *j* upon which are threaded rectangular clamp plates *l*, said plates having spherical recesses on their under side which engage corresponding spherical heads formed upon the bottom ends of the bolts. A feather *m* in each bolt prevents said bolt from turning relatively to the clamp plate. Nuts upon the top ends of the bolts engage the header top and serve to tighten and loosen the bolts. The several bolts *j* (except those at the extreme ends of the header) pass up through the chambers *a* and *b* through sleeves *k* which are preferably short pieces of tube expanded into suitable holes in the top and bottom walls of the chambers aforesaid but which may be cast integrally with the header if desired. Each clamp plate *l* overlaps the ends of two laterally adjacent (*i. e.* transverse to the smoke box) tie plates *i* so

that when the corresponding bolts *j* are tightened or loosened two separate superheater elements *d* are affected. The clamp plates *l* are of such dimensions that they abut upon one another longitudinally of the boiler so that the bolts themselves being prevented from rotating by the feather *m*, any particular bolt *j* can be tightened or loosened without affecting any other bolt *j*. The bolts *j* at the extreme ends of the header, since they lie outside of the element ends, may pass through a solid part of the header so that the sleeves *k* may be dispensed with. Their lower ends are hook shaped and provided each with a lateral extension *n* (corresponding to the clamp plate *l* of the intermediate bolts) so as to engage beneath the outer ends of the tie plates *i* of the outer rows of elements *d*. Similarly to the clamp plates *l* the arms of the hook shaped ends just referred to abut upon one another so as to permit any individual bolt to be tightened or loosened without affecting any of the remaining bolts. The spherical form of each bolt end allows it to adjust itself so as to compensate for any irregularities in the thickness of the tie plates *i* or in the clamp plates *l* as well as for any inequalities of surface of the header bottom. To further compensate for such irregularities I preferably provide a certain clearance between the stem of the bolts *j* and the sleeves *k* and the tie plates through which said bolts pass. Rings or gaskets *n* of copper or other suitable material are preferably placed over the element ends where they engage the holes *e* in order to insure steam tight joints. Pins *o* through the tops of bolts *j* may be provided for preventing the nuts from coming entirely off and being mislaid when said nuts are slackened.

In assembling the various parts of my invention, the header being assumed to be suitably fixed in position, I prefer to start by first placing the bolts *j*, with their clamp plates *l*, in the header with their nuts slack. The superheater elements *d* are then placed in position those belonging to the top row of fine tubes being positioned first and followed by those of the remaining rows, working from top to bottom, in succession. The nuts are then tightened. In thus positioning the elements, the clamp plates *l* of two adjacent longitudinal rows constitute, in effect, a guide way along which the tie plates *i* of the respective superheater elements may be slid into position. Should any bolt become injured its nut may be unscrewed, the bolt withdrawn, the clamp plate removed and slipped upon a new bolt, and the latter replaced without in any way disturbing any other bolt. The nuts, being on the top of the header, are entirely out of the direct path of the hot gases as they issue from the fine tubes. The bottom channel *g*, being as

it is below the level of the chambers *a* and *b*, does its own part in thus protecting the nuts and bolts. If desired, spring washers may be placed upon the bolts *j*, between the tie plates and the under surface of the header.

While I prefer to use the arrangement of clamp plates and spherically ended bolts described I may, if I prefer, omit the clamp plates as a separate device and shape the bolt ends so as to engage directly the ends of the tie plates.

While the nuts of the bolts *j* in the arrangement above described are very accessible, access to them may be made even more easy by providing a manhole or door in the smoke box immediately above the nuts as is well known in the art.

The pipes carrying superheated steam to the steam chest, being at the ends of the header beyond all of the superheater elements, cannot interfere in any way with the insertion or removal of any of said elements nor themselves be interfered with.

By suitably modifying the form of the steam chamber the superheater elements may be connected thereto with their inlet ends behind the bolt ends or vice versa, instead of such ends being side by side, the same form of bolt connections being employed.

Referring to the modification of my invention shown in Figs. 8 to 10 the alternated saturated and superheated steam chambers *a* and *b* are separated from one another by intermediate vertically disposed air spaces *p* instead of being integrally united as in the structure of Figs. 1-7. In these spaces *p* are placed the bolts *j'* for attaching the superheater elements *d* to the header. In this form the bolts may be completely removed from the header by merely slackening their nuts and drawing them forward, out of the spaces *p*, one after the other.

The bolts *j'* lying between the chambers *a* and *b* instead of being passed through the centers thereof, as in the structure of Figs. 1-7, a single bolt may be employed to hold a single superheater element in position, the two element ends being expanded into the ends of a single tie plate *i'* and the bolt then being pushed up through the center of this tie plate. Tightening or loosening a given bolt, therefore, no longer affects two superheater elements but only the one element to the tie plate of which the bolt belongs. An advantage possessed by this modification over the form shown in Figs. 1-7 and previously described is that the chambers *a* and *b* are free to expand and contract independently. As their temperatures, due to saturated and superheated steam respectively, tend to be substantially different it will readily be seen that strains in the header casting are necessarily set up

when the superheater is in use if the chambers are tied together as in Figs. 1-7 whereas, where they are spaced from one another, as in Figs. 8-10, these strains should be almost entirely absent.

A further advantage of the construction embodied in Figs. 8-10 is that substantially all loss of heat from superheated chambers *a* to saturated chambers *b* is avoided by reason of the intervening air spaces *p*, whereas in a construction such as is shown in Figs. 1-7, where the saturated and superheated chambers have a metallic wall common to both, the heat loss may be very considerable.

Various changes may be made in the constructions actually shown and described without going outside the spirit of my invention. Thus the saturated channel which extends across the smoke box behind the chambers may, instead of being substantially uniform in cross section, diminish in section toward the ends of the header as the number of chambers remaining to be fed with steam becomes less. These channels also need not be directly one above the other, but may be set forwardly with reference to one another, should it be convenient.

As previously stated I prefer to arrange the header in the upper part of the smoke box, but occasions may arise where some other location would be more suitable and such locations may be chosen within the limits of my invention. Or it might be preferred to employ two headers arranged laterally of the smoke box on opposite sides thereof; this arrangement also lies within the spirit of the claims.

Having described my invention, I claim:—

1. In a smoke box superheater of the class described, in combination with the boiler, a header comprising a plurality of forwardly extending chambers arranged side by side across the smoke box superheater elements, the ends of which are attached from below to said chambers, and a pair of channels for saturated and superheated steam between said chambers and the tube plate and extending across the smoke box, said chambers opening alternately into said channels.

2. In a smoke box superheater of the class described, in combination with the boiler, a header comprising a plurality of forwardly extending chambers arranged side by side across the smoke box superheater elements, the ends of which are attached from below to said chambers, and a pair of channels for saturated and superheated steam arranged one above the other between said chambers and the tube plate, said chambers opening alternately into said channels.

3. In a smoke box superheater of the class described, in combination with the boiler, a header comprising a plurality of forwardly extending chambers arranged side by side

and in the same plane across the smoke box superheater elements, the ends of which are attached from below to said chambers, and a pair of channels for saturated and superheated steam arranged one above the other between said chambers and the tube plate, the lower channel being located below the level of the chambers, said chambers opening alternately into said channels.

4. In a smoke box superheater of the class described, in combination with the boiler, a header comprising a plurality of forwardly extending chambers separated from one another by air spaces and arranged side by side across the smoke box superheater elements the ends of which are attached from below to said chambers, and a pair of channels for saturated and superheated steam arranged one above the other between said chambers and the tube plate, said chambers opening alternately into said channels.

5. In a smoke box superheater of the class described, in combination with the boiler, a header comprising a plurality of forwardly extending chambers separated from one another by air spaces and arranged side by side across the smoke box superheater elements, the ends of which are attached from below to said chambers, and channels for saturated and superheated steam arranged one above the other between said chambers and the tube plate, said chambers opening alternately into said channels and attaching bolts in said air spaces.

6. In a smoke box superheater of the class described, in combination with the boiler, a header comprising a plurality of forwardly extending chambers wholly separated from one another except at their rear by vertically disposed air spaces and arranged side by side across the smoke box superheater elements, the ends of which are attached from below to said chambers, a pair of channels for saturated and superheated steam extending across the smoke box between said chambers and the tube plate, said chambers opening alternately into said channels.

7. In a smoke box superheater of the class described, in combination with the boiler, a header comprising a plurality of forwardly extending chambers wholly separated from

one another except at their rear by vertically disposed air spaces and arranged side by side across the smoke box, superheater elements, the ends of which are attached from below to said chambers, a pair of channels for saturated and superheated steam arranged one above the other and extending across the smoke box between said chambers and the tube plate, said chambers opening alternately into said channels.

8. In a smoke box superheater of the class described, in combination with the boiler, an integral header comprising a plurality of forwardly extending chambers arranged side by side and in the same plane across the smoke box, and a pair of channels for saturated and superheated steam between said chambers and the tube plate and extending across the smoke box, said chambers opening alternately into said channels.

9. In a smoke box superheater of the class described, in combination with the boiler, an integral header comprising a plurality of forwardly extending chambers arranged side by side and in the same plane across the smoke box, and a pair of channels for saturated and superheated steam arranged one above the other between said chambers and the tube plate, said chambers opening alternately into said channels.

10. In a smoke box superheater of the class described, in combination with the boiler, an integral header comprising a plurality of forwardly extending chambers in the same plane wholly separated from one another except at their rear by vertically disposed air spaces, a pair of channels for saturated and superheated steam arranged one above the other and extending across the smoke box between said chambers and the tube plate, said chambers opening alternately into said channels, and bolts within air spaces for attaching a single superheating element to adjacent chambers.

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

JAMES HAMILTON STEINER, [S. S.]

Witnesses:

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W. E. ROGERS.