

June 22 , 1926.

1,589,646

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FEED WATER HEATER

Filed July 13, 1925

Fig. 1.

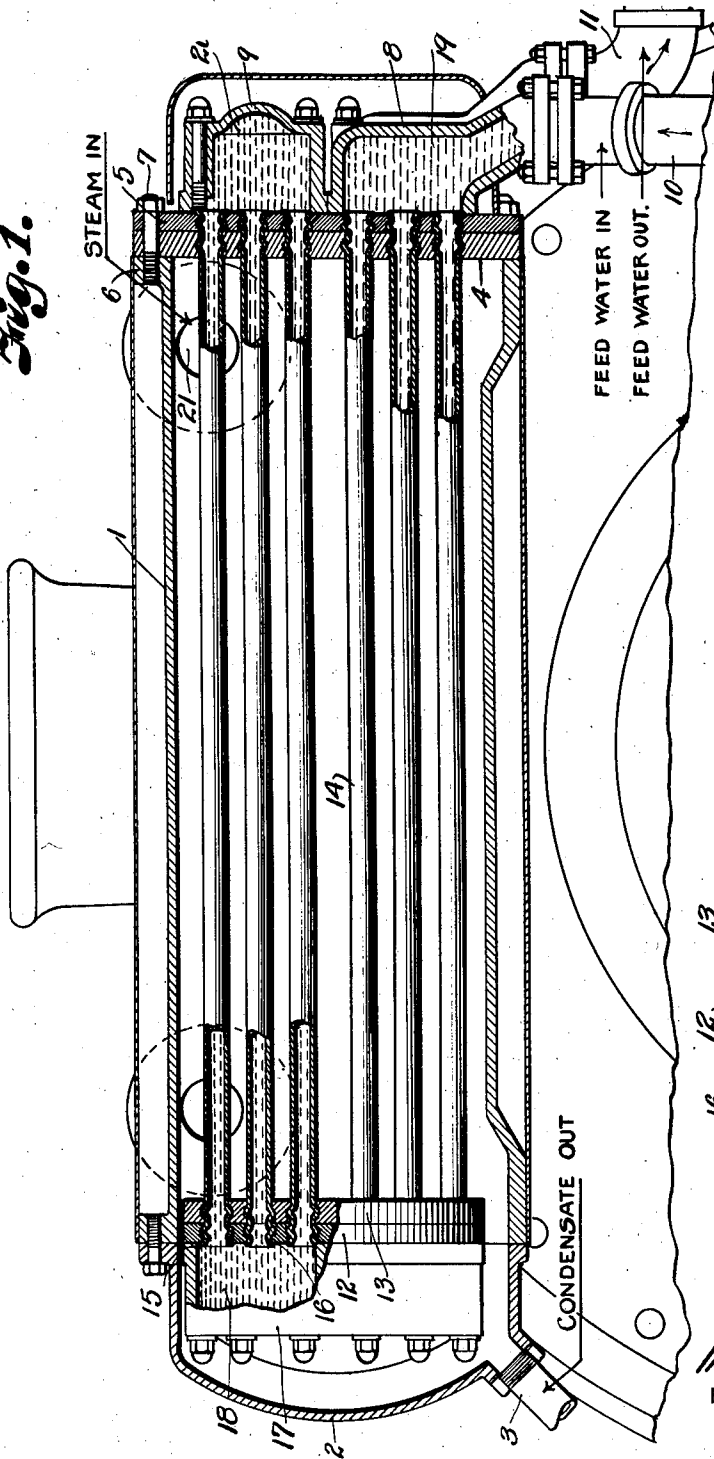
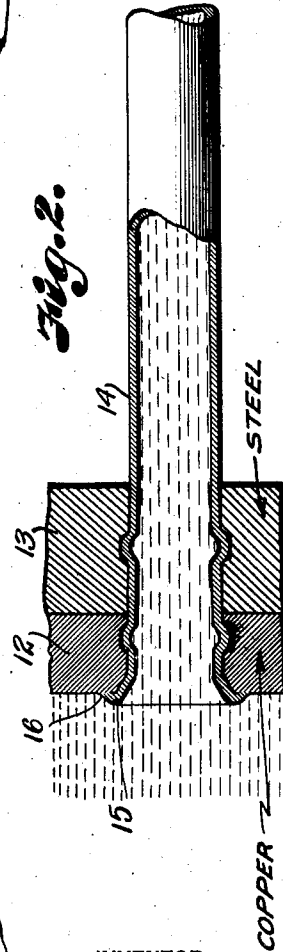


Fig. 2.



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FEED-WATER HEATER.

Application filed July 13, 1925. Serial No. 43,227.

This invention relates to feed water heaters and particularly to the class used on locomotives for heating the feed water delivered to the boilers. Such feed water heaters usually include a shell, tube sheets in the shell having water spaces at their outer faces formed by head caps, and tubes connecting the tube sheets and connecting the spaces or headers at the ends of the shell. The tubes are usually constructed of copper and the tube sheets are usually of steel as are also the head caps. In view of the fact that steel has a different coefficient of expansion from that of copper, the joints between the tubes and the tube sheets become loose and leak. Water erodes or corrodes the tube sheets, eating them away so that the feed water heater is frequently in need of repairs and not infrequently trouble is experienced by leakage around the joints between the tubes and the tube sheets.

My invention contemplates the elimination of the disadvantageous features above enumerated, and I accomplish the desired result by making the tube sheets and tubes of material having the same coefficient of expansion, the ends of the tubes being sealed to the tube sheets, preferably by welding, and the head caps are properly fastened to the tube sheets so as to increase the period of usefulness of the feed water heater.

The novelty of the invention will be clearly understood by reference to the following description in connection with the accompanying drawings, in which—

Fig. 1 is a view partly in section and partly in elevation of a feed heater constructed in accordance with my invention, and

Fig. 2 is an enlarged, sectional view through one of the tubes and one of the tube sheets showing the manner of securing the tube to the tube sheet.

The feed water heater is shown as comprising a shell consisting of a cylindrical member 1 closed at one end by a cap or end wall 2 having a condensate relief port 3. The other end of the cylinder 1 is closed by a tube sheet consisting of a liner disk 4 of steel and a disk 5 of copper, the two disks being bolted to the flange 6 by the bolts 7. Secured to the composite tube sheet are the hollow head caps 8 and 9, the member 8 receiving water from the pipe 10 connected to the tender, the member 9 discharging water through the pipe 11 to the boiler. At the end of the cylinder 1 dis-

tant from the tube sheet 4—5 is another composite tube sheet comprising a disk 12 of copper provided with a liner 13 of steel, the two composite tube sheets being connected by the longitudinally arranged copper tubes 14 which are secured in the tube sheets, preferably by a mandrel in the usual way, the free edge 15 of the tube 14 being flared and welded to the disks 5 and 12 at 16 in an appropriate manner. The plate or tube sheet 12—13 is provided with a head cap 17 to provide a water space 18 in a well known manner, so that the water entering from the pipe 10 may pass back and forth through the tube and the header spaces to exhaust through pipe 11 in the usual way, it being understood that no claim is made in this application to any particular design of feed water heater.

The head members 8, 9 and 17 are preferably secured to the tube sheets by bolts in the usual way. When the water enters the spaces 18, 19 and 20, the relatively thick disks of copper will resist the tendency to erode or corrode, and since the ends of the tubes are welded to the said disks and have the same coefficient of expansion as the disks, liability of leaks around the joints between the tubes and the tube sheets will be entirely eliminated.

I may employ liners or steel members 4 and 13 to give stability to the tube sheets, or in some instances I may eliminate them. It is understood, of course, that the steam, preferably the exhaust steam from the engine, will enter the shell or casing, so I have shown a steam inlet 21 through which the steam may enter the casing and flow around the tubes so that the water in the tubes will absorb the heat of the steam. The steam in turn condenses upon the tubes so that it can flow out through the flow-off port 3, back to the tender.

The main features of this invention are the way in which the tubes are fastened to the tube sheets with the ends of the tubes sealed to the outer faces of the tube sheets and the utilization of metals having the same coefficient of expansion so as to eliminate liability of leaks. A by no means unimportant feature of the invention is the fact that the outer faces of the heads are non-corrodible, that is, the outer faces of the heads are not readily attacked by erosion or corrosion.

In actual practice it has been found that

relatively thick tube sheets of steel have been entirely eroded away from the ends of the tubes, whereas with my invention possibility of the incoming water damaging the tube sheets will be reduced to a minimum is not entirely eliminated.

What I claim and desire to secure by Letters-Patent is:

1. A feed water heater comprising a shell having an inlet and an outlet, composite tube sheets spaced from the ends of the shell and having tube openings, and tubes extending through the tube sheets and secured to the outer members thereof, the tubes and the outer members of the tube sheets being of material having the same coefficient of expansion.

2. A feed water heater comprising a shell having inlet and outlet at its opposite ends, composite tube sheets spaced from the

ends of the shell, each comprising an inner stiffening wall and an outer non-corrodible member, and tubes extending through the tube sheets to connection with the spaces at the ends of the shell and sealed to the outer members of the tube sheets.

3. A feed water heater comprising a shell, composite tube sheets at the ends of the shell, each consisting of copper and steel discs, and tubes extending through the tube sheets and secured thereto.

4. A feed water heater comprising a shell, composite tube sheets at the ends of the shell, each consisting of an inner steel disk and an outer copper disk, and tubes extending through the tube sheets and sealed to the copper disks.

In testimony whereof I affix my signature.

IRVING C. HICKS.