

(No Model.)

2 Sheets—Sheet 1.

J. PHILLIPS.
TUBE PLATE FOR STEAM BOILERS.

No. 513,620.

Patented Jan. 30, 1894.

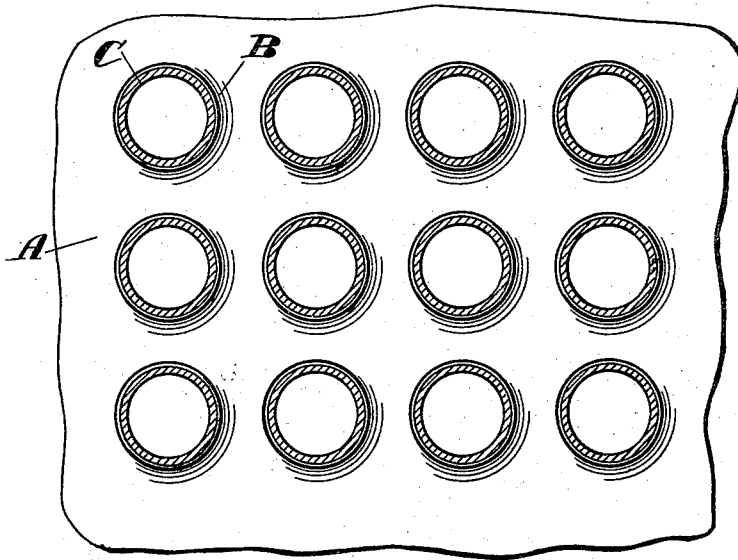


Fig. 1.

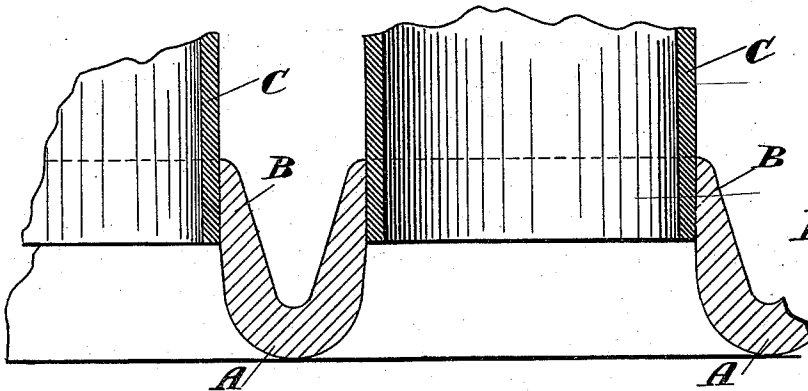


Fig. 2.

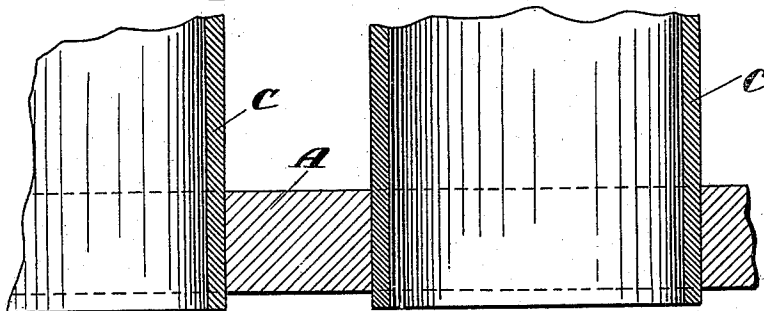


Fig. 3.

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2 Sheets—Sheet 2

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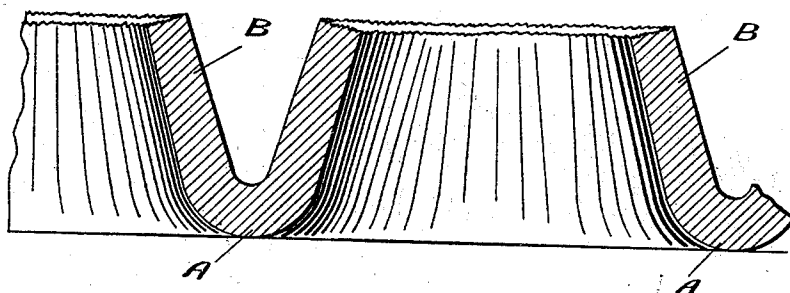


FIG. 4.

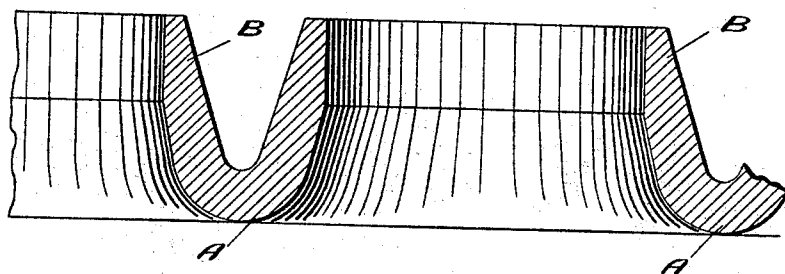


FIG. 5.

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UNITED STATES PATENT OFFICE.

JOHN PHILLIPS, OF LEE, ENGLAND.

TUBE-PLATE FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 513,620, dated January 30, 1894.

Application filed December 17, 1892. Serial No. 455,439. (No model.)

To all whom it may concern:

Be it known that I, JOHN PHILLIPS, residing at Lee, in the county of Kent, England, have invented an Improvement in Tube-Plates of Steam-Boilers, of which the following is a specification.

This invention relates to tube plates of steam boilers and has for its object the special formation of the tube plate so that it shall support the tubes therein, without risk of leak at the joints of the tubes with the plates, even under the influence of very high temperature and considerable pressure of air supply to the furnace.

It has been found in steam boilers, especially, those in use in naval vessels, that when under a pressure of forced draft, the tube ends leak very badly, and in some cases fatal results have been consequent upon extensive leaks of this nature; the explanation of the origin of these leaks seems to be that the tube plates and tube ends either receive more heat from the heating medium than can be transmitted to the water and thus the said tube ends and tube plates become locally heated in certain parts or conversely the parts being at the normal temperature they will in the case of an excess of cold air to the furnace become locally cooled, with the result that the tightness of the joints between the tubes and the plates breaks down, and leaks are accordingly created. The main object of my invention is to overcome these drawbacks.

My invention consists in the provision of nipples or bosses formed as hereinafter described upon the face of the tube plate, projecting from the inner or water side of the tube plate so as to be surrounded by water. The tubes are supported in these said nipples or bosses. By reason of the stiffening effect on the tube plate by the bosses formed thereon, the thickness of the plate can be reduced, compared to that required when a plain flat plate is used, and the amount of bearing surface of the tube in the plate can be regulated by the form and shape of the said nipples or bosses as hereinafter described.

In order that my invention may be the better understood I will now describe one way of carrying it into effect in relation to the drawings hereunto annexed, reference being had to the letters marked thereon.

Like letters refer to like parts in the various figures.

Figure 1 is an end facial view of a portion of a tube plate according to my invention. Fig. 2 is an enlarged sectional view of a portion of the tube plate through two tube ends according to my invention. Fig. 3 is a similar view with an ordinary tube plate. Fig. 4, shows the boss or nozzle as first cast or swaged. Fig. 5, shows the boss or nozzle when bored for the reception of the tube.

Upon the tube plate A I provide a series of bosses B. These bosses B are bored out as hereinafter described and support the tubes C, the latter being expanded tight into the bosses B by a tube expander.

It will be seen from Fig. 2 that the inner side of the tube plate which is in contact with the water, has its surface much increased by reason of the addition of the surface on the bosses. The heat of the tube plate is therefore more readily absorbed by the water and overheating of this part of the boiler is prevented. Moreover it will be noticed by the comparison of Figs. 2 and 3, that my tube plate can be made much thinner than an ordinary tube plate and hence can transmit heat quicker.

My improved tube plate is made of any suitable metal that has sufficient ductility to allow of its being properly worked; such as rolled iron, steel, copper, delta metal or it may be made of cast steel, cast delta metal or other composition of copper or of malleable cast iron.

I will now describe my method of making my improved tube plate by producing bosses from a ductile plate by means of pressure from a hydraulic or other power press and by after boring. The plate is first marked out for the desired positions of the holes, and a small hole is either drilled or punched through the plate in the center of the portion where each tube hole is intended to be. These holes are then enlarged and the bosses formed by punches or formers having the necessary taper formation which force the portion of the plate around the hole into a die situated below on which the plate rests, the die having such a shape as to form the outside of the boss in the desired form as shown in Fig. 4. After the holes and bosses have been thus

formed the excess of metal on the edges of the bosses may be planed or machined off to give the uniform amount of projection of each boss from the plate. The bosses can now be
5 bored out with a parallel bore to receive the tubes, the length of the seatings for the tubes being determined by the angle of cone the bosses are made with, or the amount of metal bored out therefrom, which latter operation
10 reduces the thickness of the metal boss where it comes in contact with the tube.

In cases where the tubes are required to be placed very close together, the bosses can be machined out of a plate having the desired
15 thickness.

Having now described my invention, what I desire to secure by Letters Patent is—

A tube plate for tubular steam boilers, having hollow taper bosses arranged on the inner face of the plate, and adapted by a parallel 20 boring, making an accurate seating and reducing the thickness of the inner end of boss, to support without leakage in the water space, the smoke or heating tubes at a distance away from the outer surface of the tube plate, by 25 the expansion of the tubes therein.

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

JOHN PHILLIPS.

Witnesses:

RICHARD A. HOFFMANN,
CHARLES H. CARTER.