

(No Model.)

H. SCHAUBEL.  
FASTENING BOILER TUBES.

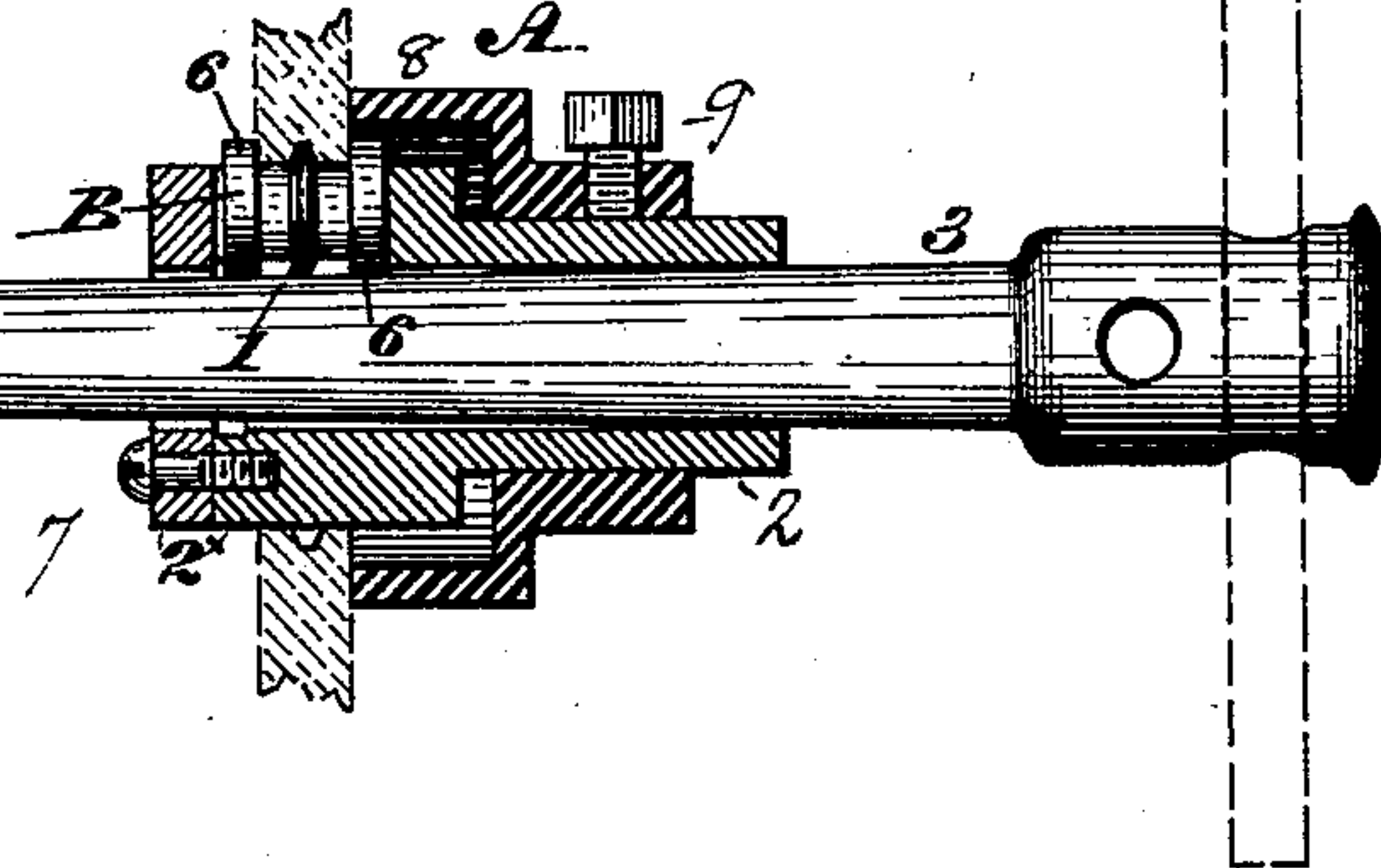
No. 405,226.

Patented June 11, 1889.

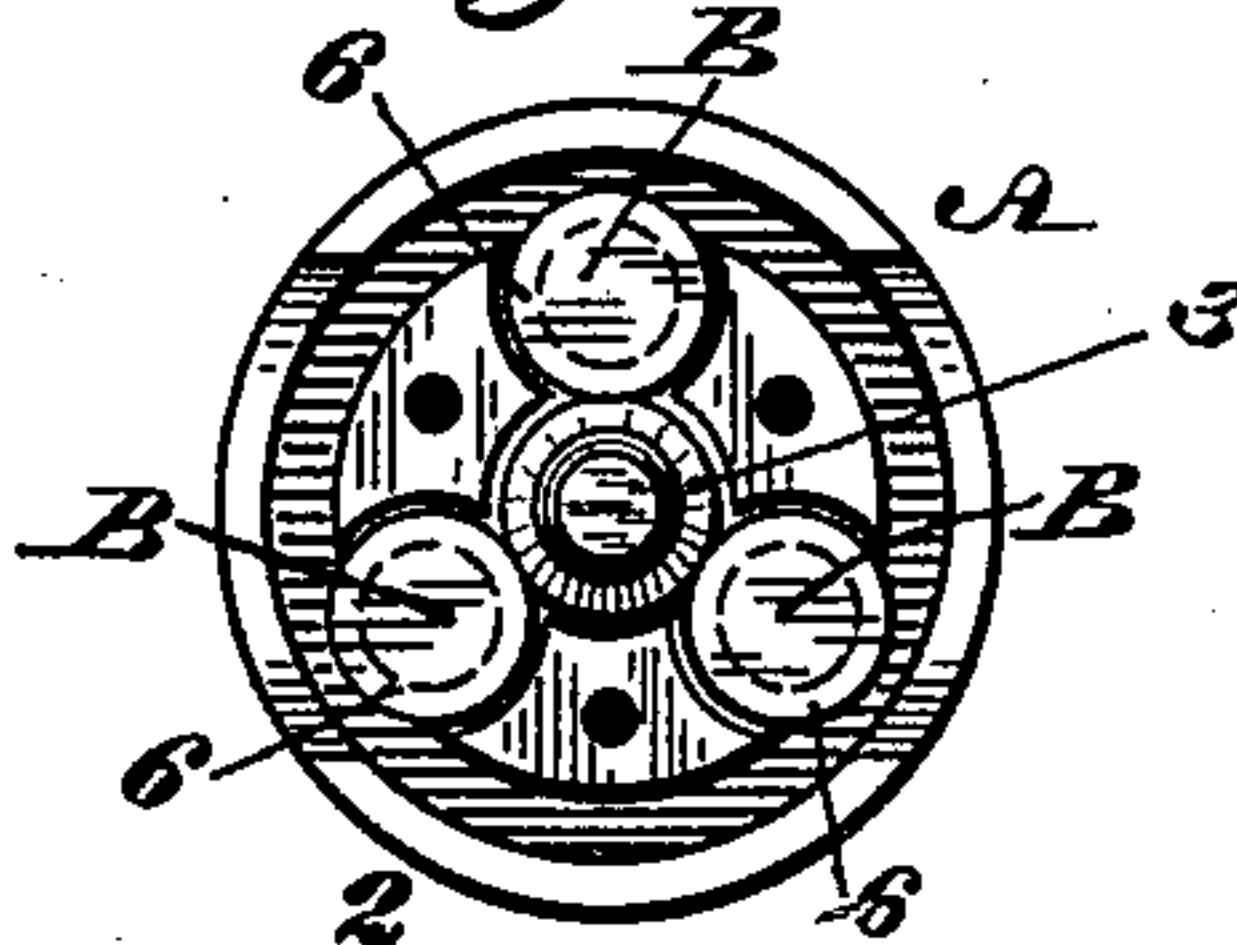
*fig. 4.*



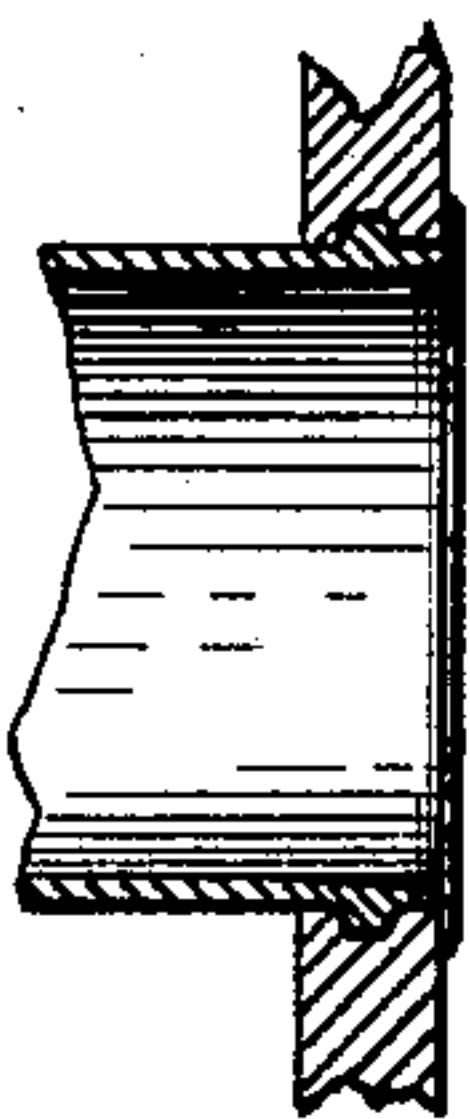
*fig. 1.*



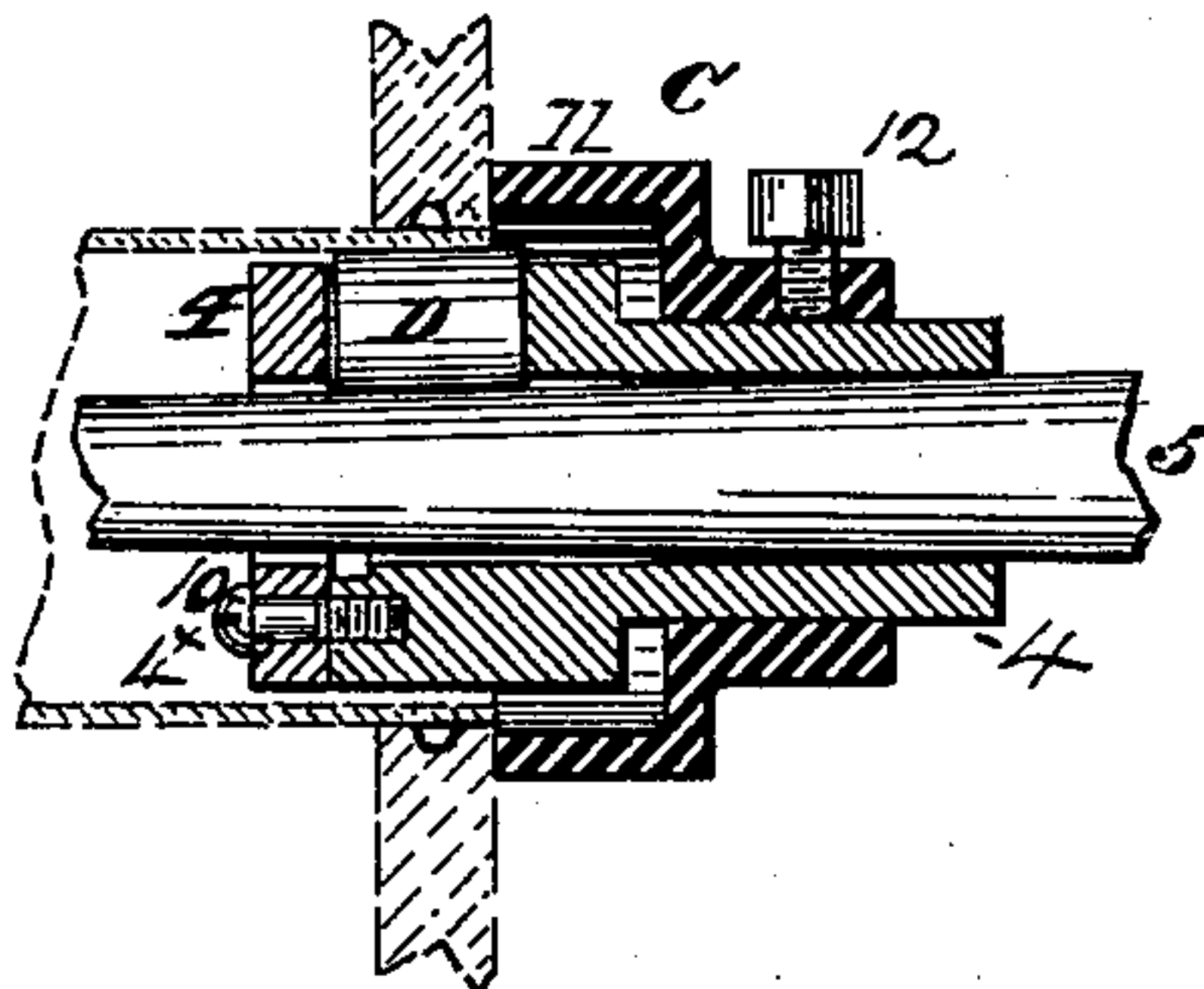
*fig. 2.*



*fig. 5.*



*fig. 3.*



Witnesses

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# UNITED STATES PATENT OFFICE.

HENRY SCHAUBEL, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO HENRY W. MILLER, JR., OF SAME PLACE.

## FASTENING BOILER-TUBES.

SPECIFICATION forming part of Letters Patent No. 405,226, dated June 11, 1889.

Application filed December 21, 1888. Serial No. 294,274. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY SCHAUBEL, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Fastening Boiler-Tubes, which improvement is fully set forth in the following specification and accompanying drawings.

My invention consists of a method of fastening boiler and other tubes to the sheet thereof, embodying a groove in the wall of the opening of the sheet and of a tongue on the tube, said groove and tongue being formed by swaging the metal, whereby the joint is tight and reliable and the strength of the wall of the opening is not reduced, but, on the contrary, is strengthened, owing to the swaging operation to which it is subjected.

Figure 1 represents a vertical section of an apparatus employed for forming a groove in the tube-sheet of a boiler, &c., embodying my invention. Fig. 2 represents a rear view thereof. Fig. 3 represents a vertical section of an apparatus employed for swaging a boiler or other tube embodying my invention. Fig. 4 represents a section of a piece of the tube-sheet after being subjected to the action of the apparatus shown in Fig. 1. Fig. 5 represents a section of a piece of the tube-sheet and of the tube, the latter being swaged to the former.

Similar letters and numerals of reference indicate corresponding parts in the several figures.

Referring to the drawings, A designates an apparatus for grooving the tube-receiving openings in the tube-sheet. The same consists of rollers B, (one or more,) having circumferential ribs 1 and fitted freely in a head or stock 2, through the center of which is longitudinally passed a tapering or conical plug 3, whereby said rollers B may be forced outwardly while resting on the plug as a seat. The head or stock 2 is provided with the cap 2<sup>x</sup>, which is secured to said head by the screws 7, said cap serving to prevent displacement of the rollers. The sleeve 8 is secured to the stock 2 by means of the screw 9, and has its

end abutting against the boiler-plate during the process of grooving.

C designates an apparatus for swaging the tube, the same consisting of plain rollers D, (one or more,) which are freely fitted in a head or stock 4, through the center of which is longitudinally passed a tapering or conical plug 5, whereby said rollers D may be forced outwardly while resting on the plug as a seat. The head 4 is provided with a cap 4<sup>x</sup>, to retain the rollers in place, and a sleeve 11, forming a stop and guide for the tool against the boiler-sheet during the operation of swaging.

The operation is as follows: The plug 3 is withdrawn sufficiently, so that the rollers B are permitted to enter the opening in the tube-sheet. The apparatus is then advanced into said opening until the ribs 1 are at or about the center of the wall of said opening. The plug 3 is now driven into the stock, the rollers B being thereby forced outwardly, and said plug is rotated, whereby the ribs 1 cut into said wall and groove the same. The plug is driven still farther into the stock and again rotated until the ribs are cut the required depth, when the plug is withdrawn, the rollers then receding, so that the apparatus may be removed from the sheet. During the grooving operation the rollers B may be guided by the flanges 6 on the ends of the same, said flanges embracing the side of the wall of the opening. The tube having a plain periphery at its end is now inserted in the grooved opening of the tube-sheet and the apparatus C inserted into said tube, so that the rollers D occupy a position coincident with the groove of the opening of the wall. The plug 5 is then driven into the stock, the rollers D being thereby forced outwardly, and said plug is rotated, whereby the metal of the end of the tube is swaged or formed on its outer periphery with a bead or tongue which enters the groove of the tube-sheet. The plug is driven still farther into the stock and again rotated until the swaging is freely accomplished, when the plug is withdrawn, the rollers then receding, so that the apparatus may be removed from the tube, it being seen that the tube is fastened or connected with the tube-sheet in a

convenient manner, leaving the interior of the tube ungrooved, the joint between the parts being tight and reliably obviating the tendency of the tube to creep and leak. The opening in the tube-sheet will be found to have its strength unimpaired, the swaging of the groove, on the contrary, strengthening said wall—a feature of great importance in boiler sheets and tubes fastened thereto.

It is evident that when the tubes of boilers in use are removed they may be restored or fresh tubes employed, and in either case fastened to the tube-sheet in the manner hereinbefore set forth.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a method of fastening a tube to the

sheet thereof, the herein-described method of forming a groove in the wall of the opening of the tube-sheet, consisting in swaging said wall to form a groove for receiving the tongue on the tube, substantially as described.

2. The herein-described method of fastening a tube to the sheet thereof, consisting in swaging a groove in the wall of the opening of the tube-sheet, inserting a tube into said opening, and then swaging said tube to form an exterior tongue which enters said swaged groove in the tube-sheet, substantially as described.

HENRY SCHLAUBEL.

Witnesses:

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