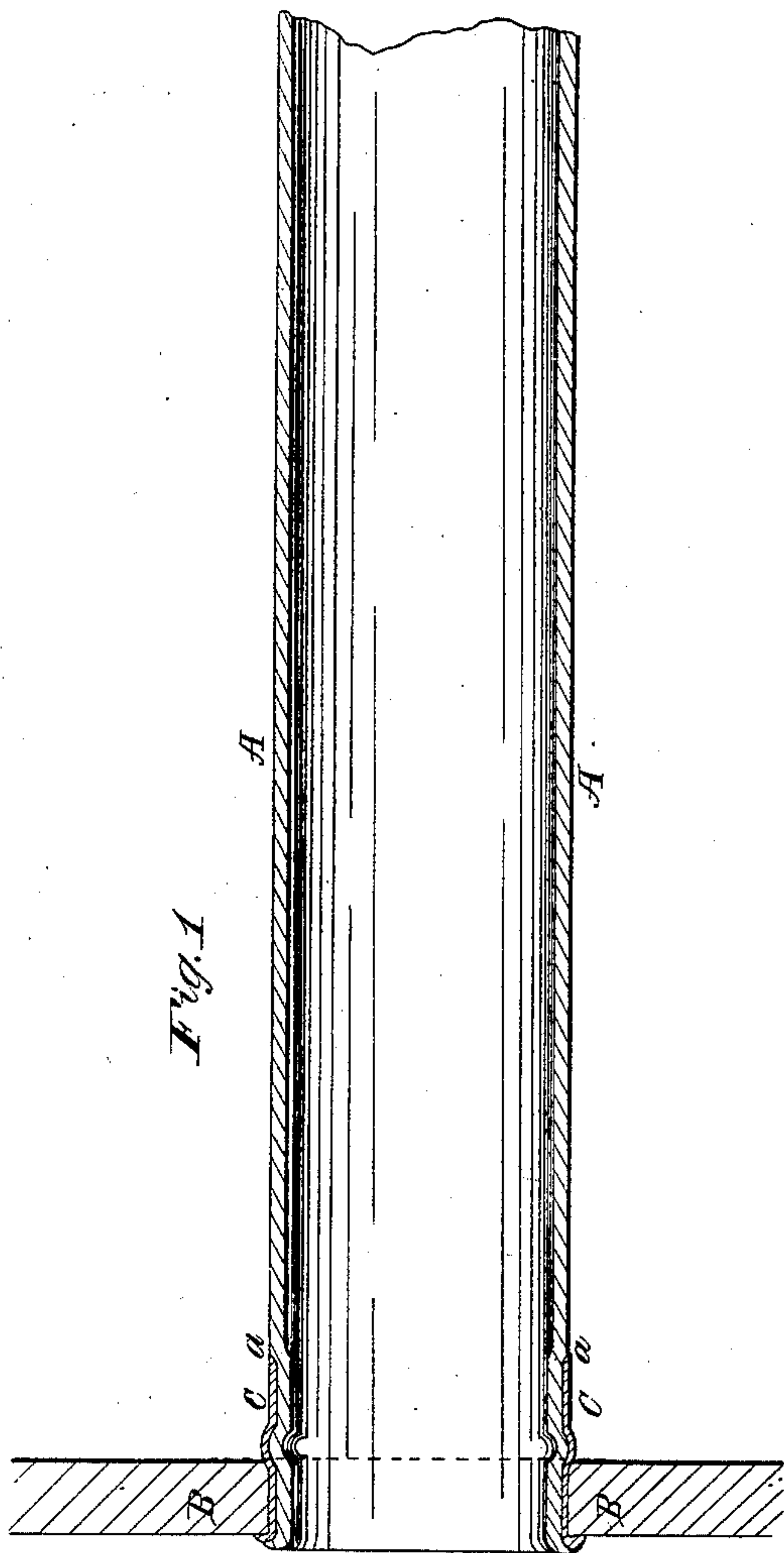


*S. I. Hayes,*

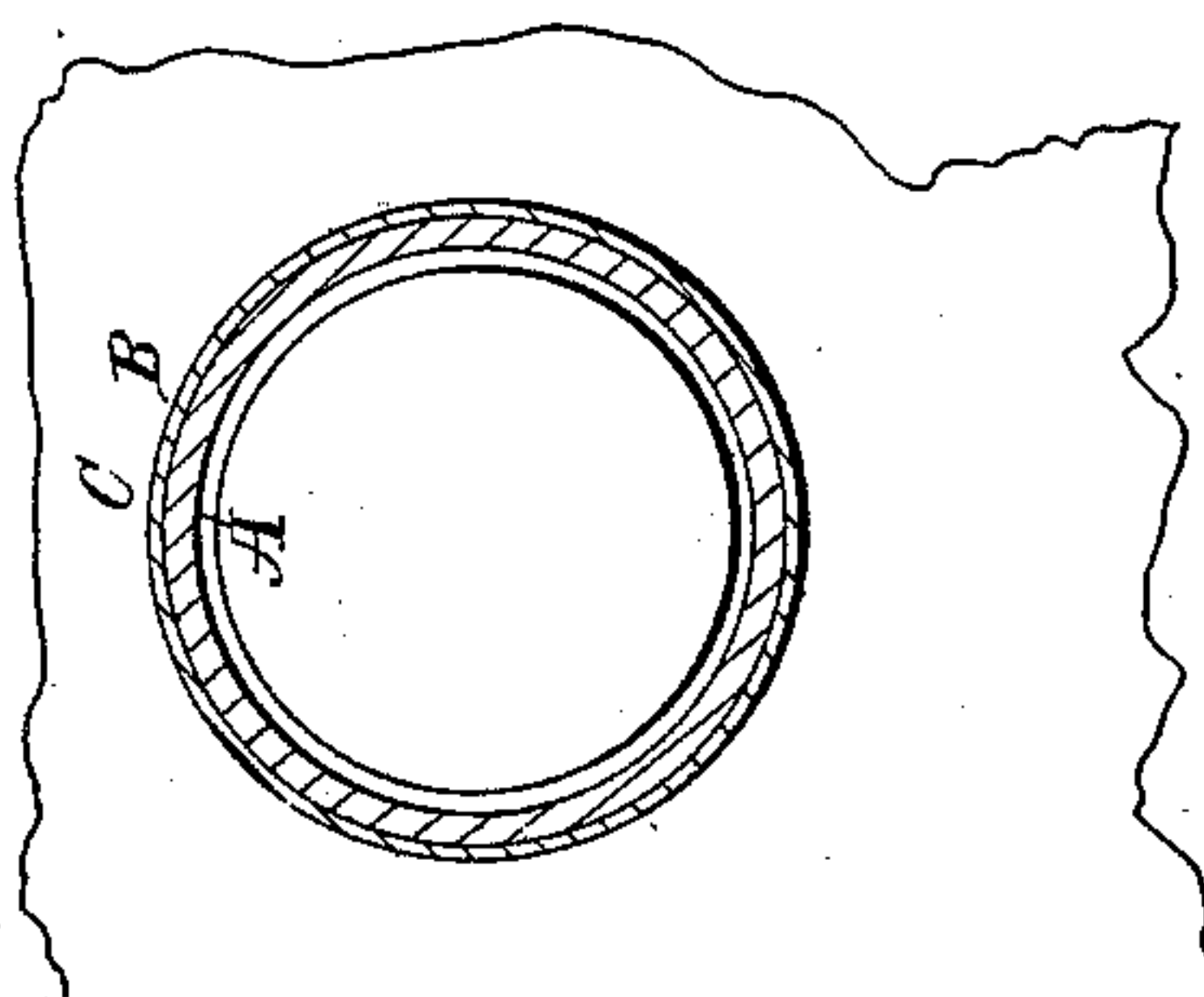
*Securing Boiler Tubes in Tube-Sheets.*

*N<sup>o</sup> 28,479.*

*Patented May 29, 1860.*



*Fig. 2*



*Witnesses:*

*R. S. Spencer  
J. W. Coombs*

*Inventor:*

*S. I. Hayes  
per *M. H. C.*  
Attorneys*

# UNITED STATES PATENT OFFICE.

S. I. HAYES, OF CHICAGO, ILLINOIS.

## MAKING TUBE-JOINTS.

Specification of Letters Patent No. 28,479, dated May 29, 1860.

*To all whom it may concern:*

Be it known that I, S. I. HAYES, of Chicago, in the county of Cook and State of Illinois, have invented a new and Improved  
5 Mode of Making Joints Between Iron Boiler-Tubes and Their Tube-Sheets; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying  
10 drawing, making a part of this specification, in which—

Figure 1 exhibits a section of a tube and tube sheet taken in a plane passing through the center of the tube. Fig. 2 exhibits a  
15 transverse section of the tube taken close to the tube sheet.

Similar letters of reference indicate corresponding parts in both figures.

The object of my invention is so to apply  
20 copper or other soft metal in making the joints between iron tubes and tube sheets in locomotive and other boilers, as to obtain cheaply all the advantage to be derived from its use, that is to say, the making of the  
25 joints perfectly tight, without exposing it to the action of the cinders passing through the tubes and thereby rendering it liable to be cut or worn out; and to this end my invention consists in fitting the exteriors of the  
30 terminal portions of the iron tubes with ferrules of copper or other soft metal so applied as to be interposed between the iron tubes and the sheets and thereby to enable the joints to be made tight by calking, but  
35 as to be protected by the tubes.

To enable others skilled in the art to apply my invention I will proceed to describe it with reference to the drawing.

A represents the iron tube; B, the tube sheet, and C, the ferrule, of copper or other  
40 soft metal. The tube is made long enough to protect through the tube sheet, and for a distance from its end about equal to or a little more than double the thickness of the tube sheet, it is swaged down or otherwise  
45 reduced in size to form a shoulder *a, a*. The ferrule C, is driven tightly on to the exterior of the reduced portion of the tube up to the shoulder *a, a*, and reaches to the end of the tube. The exterior of the ferrule is made  
50 to fit tightly into the hole provided in the tube sheet for the reception of the tube. The tube thus fitted is secured in the tube sheet and calked in the usual manner and the ferrule makes a perfect joint between the  
55 tube and the sheet. This method of making the joint makes it tighter than it is possible to make it without the use of copper or soft metal, and is much cheaper than the common mode of making the entire thickness  
60 of the terminal portion of the tube of a piece of copper brazed to the body of the tube, which mode requires the use of an inner ferrule of iron to protect the copper from the cutting action of the particles of  
65 cinder passing through the tube.

What I claim as my invention, and desire to secure by Letters Patent, is:—

The ferrule of copper or other soft metal applied to the exterior of the iron tube between it and the tube sheet, substantially as  
70 and for the purpose herein specified.

S. I. HAYES.

Witnesses:

C. U. SPENCER,  
JOHN S. PATERSON.