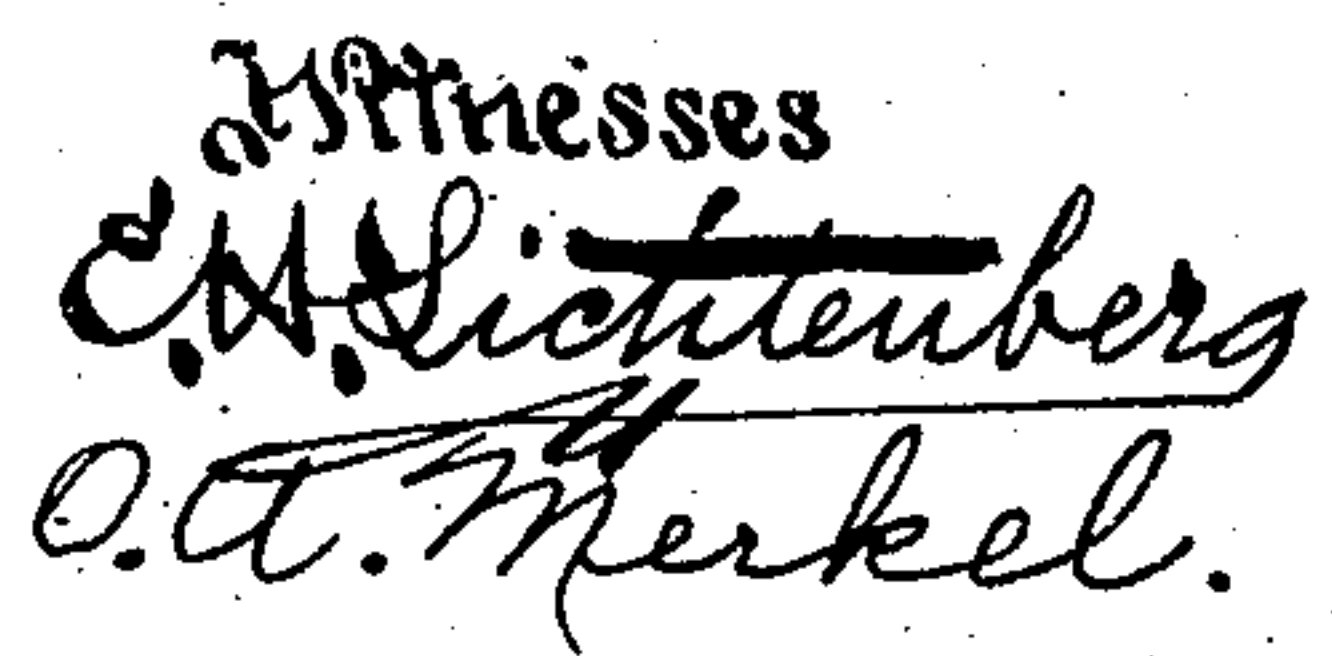


TUBE EXPANDER.

**934,800.**

2 SHEETS—SHEET 1.



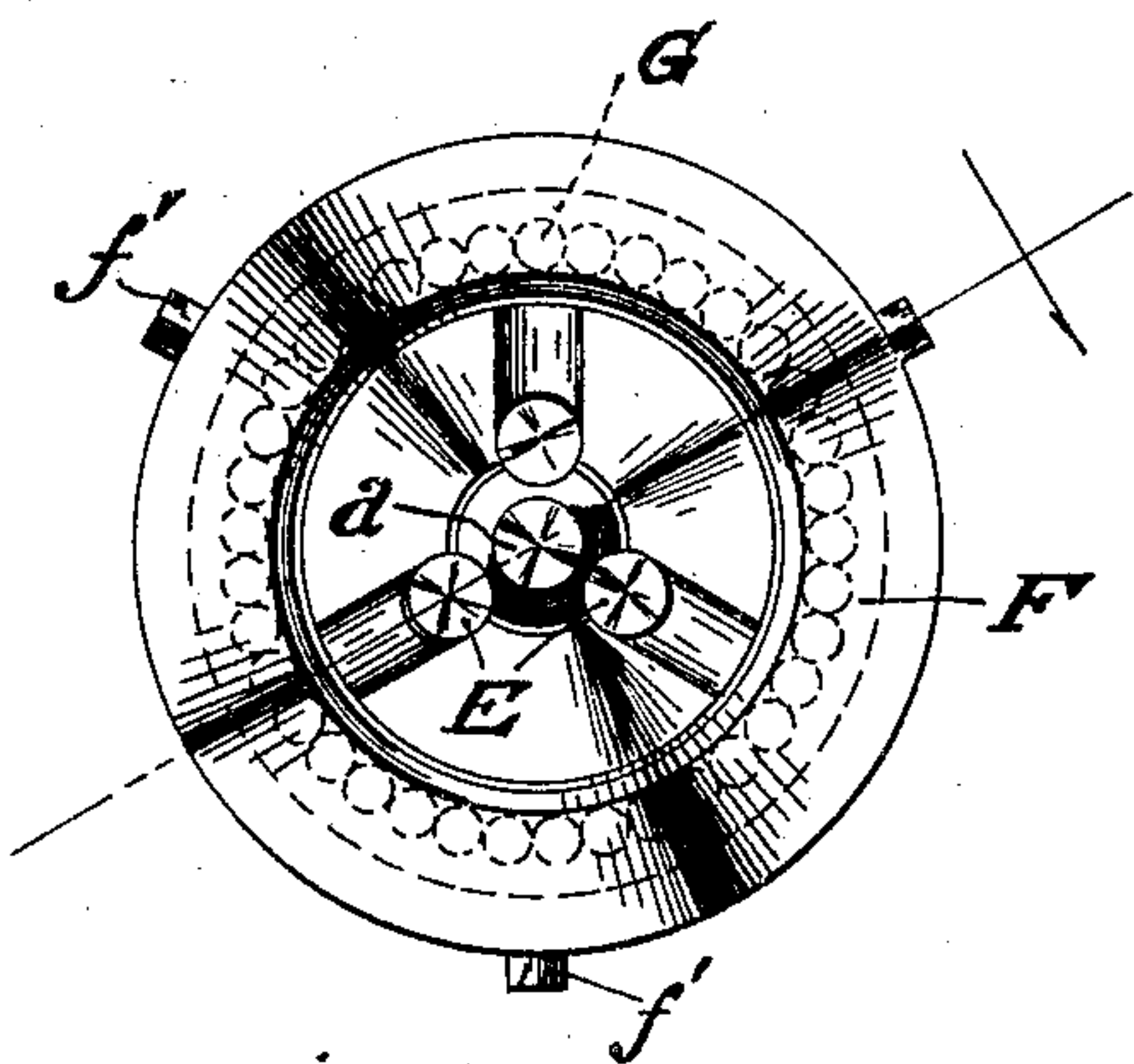
Inventor  
William J. Doerfler  
by *N. Du Bois*,  
Atty.

TUBE EXPANDER.

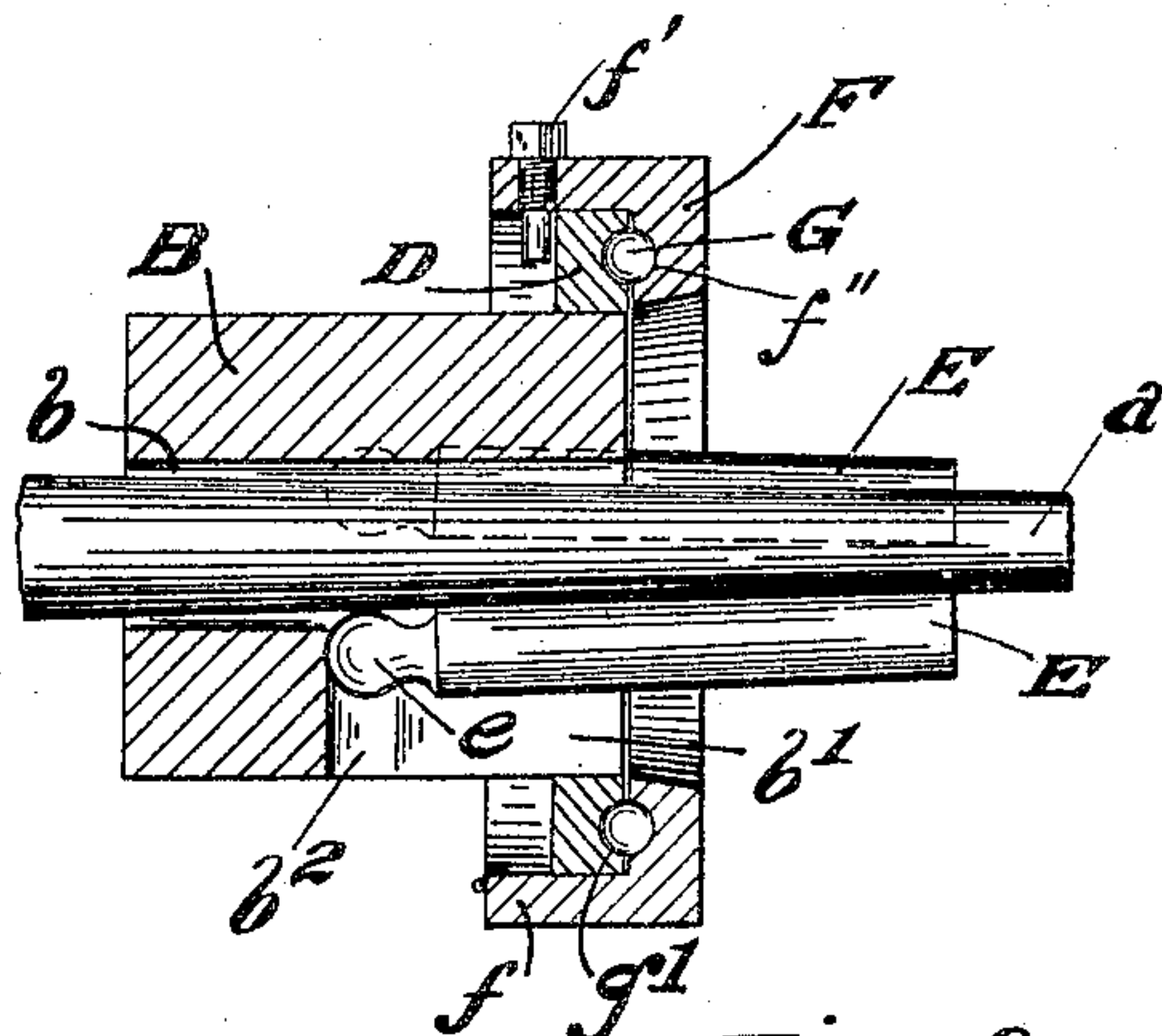
Patented Sept. 21, 1909.

2 SHEETS—SHEET 2.

*Fig. 8.*



*Fig. 7.*



*Fig. 9.*

Witnesses,  
 Fordyce W. Brown.  
 W. St. Hale

Inventor,  
William J. Doerfler.  
by Atty. N. Du Bois.



# UNITED STATES PATENT OFFICE.

WILLIAM J. DOERFLER, OF CLINTON, ILLINOIS.

## TUBE-EXPANDER.

934,800.

Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed January 17, 1908. Serial No. 411,295.

*To all whom it may concern:*

Be it known that I, WILLIAM J. DOERFLER, a citizen of the United States, residing at Clinton, in the county of Dewitt and State of Illinois, have invented a certain new and useful Tube-Expander, of which the following is such a full, clear, and exact description as will enable others skilled in the art to which it appertains to make and use my said invention.

This invention relates to devices for expanding the ends of leaky boiler-flues to effectively stop leaks and for expanding other similar tubes in case enlargement of the end of the tube is desirable.

The purposes of this invention are: to provide a mandrel of improved construction; a head of improved construction cooperating with the mandrel; interchangeable rollers detachably connected with the head; simple and effective means for connecting the rollers with the head and means for reducing the friction of the head against the end of the boiler.

With these ends in view my invention consists in the novel features of construction and combinations of parts shown in the annexed drawings, to which reference is hereby made, and hereinafter particularly described and finally recited in the claim.

Referring to the drawings, in which similar reference letters and numerals designate like parts in the several views: Figure 1 is a perspective view of the complete device. Fig. 2 is an enlarged elevation of a detached straight roller. Fig. 3 is an enlarged elevation of a roller of modified form. Fig. 4 is a vertical axial section through the head and shows the mandrel and one roller in position in the head. Fig. 5 is a vertical transverse section on the line 5-5 of Fig. 1. Fig. 6 is an enlarged perspective view of the head detached, and illustrates the placing of the rollers in the head and Figs. 7, 8, and 9, are respectively an end elevation, a side elevation, and an enlarged partial longitudinal section, of a tube expander equipped with ball bearings.

The mandrel A has a polygonal body and a tapering cylindrical stem  $a$  integral with the body. Holes  $a'$  extending through the mandrel body accommodate a rod or other instrument for turning the mandrel.

The head B is cylindrical and has a central longitudinal bore  $b$  of a diameter somewhat greater than the diameter of the man-

drel stem  $a$ . Longitudinal ways  $b'$  extend from the circumference to the bore of the head and have at their inner ends pockets  $b^2$ . The pockets  $b^2$  have curved bottoms, shown in Fig. 4, conforming to the periphery of the balls  $c$  of the rollers E and serving to keep the balls away from the surface of the stem  $a$  of the mandrel A.

A ring D fits tightly around the head and has segmental transverse notches  $d'$  matching the ways  $b'$ . A screw  $d$ , secures the ring on the head. Rollers E, have integral globular lugs  $e$ . The rollers E fit loosely in the ways  $b'$  and turn freely therein. The lugs  $e$  fit loosely and turn in the pockets  $b^2$  and prevent longitudinal movement of the rollers.

The mandrel, the head, the ring and the rollers are all made of steel suitable for the purpose and the mandrel stem and the rollers are hardened to resist the severe strain to which they are subjected in use.

In order that the device may be effective to operate on tubes of different diameters, rollers of different diameters are provided, adapted to turn in the ways  $b'$  and the pockets  $b^2$  and having cylindrical enlargements  $e'$  varying in size according to the conditions of use.

A number of rollers having enlargements of different sizes may be used with the same head and mandrel, thereby adapting the device for effective use on tubes of different sizes.

In inserting rollers of uniform diameter, such as are shown in Figs. 1 and 6, the cylindrical parts of the rollers may be inserted through the slots  $b'$  as shown in Fig. 6.

In order to insert rollers having cylindrical enlargements  $e'$ , as shown in Fig. 3 the ring D will be detached and the reduced cylindrical parts of the rollers will be inserted in the radial slots  $b'$  with the globular ends of the rollers in the pockets  $b^2$ , and the ring will then be replaced and secured on the head.

When the rollers are in place in the ways, with the globular lugs in position in the pockets, the projecting ends of the rollers will be inserted within the tube to be expanded, the mandrel will then be inserted between the rollers and driven inward until the rollers bind tightly against the inner wall of the tube; a rod or other suitable instrument will be inserted through the hole  $a'$  and the mandrel will be turned to cause the



rollers E to roll on and expand the wall of the tube and this operation will be repeated until the tube is expanded as desired.

5 A practical advantage of a tube expander constructed and arranged as described is that by providing a number of sets of rollers of different sizes a great variety of work may be accomplished by using a single head and a single mandrel, coöperating with all  
10 the rollers of different sizes, and the operator is enabled to execute any ordinary job of work without carrying with him numerous cumbersome sets of heads and mandrels.

15 In case ball bearings are used the ring D will have in its face a circular channel *d'* adapted to accommodate balls G. An annular plate F has on its inner face a circumferential channel *f''*, matching the channel *g'* and accommodating the balls G. The  
20 plate F also has an integral flange surrounding the periphery of the ring D and projecting beyond the face of the ring D. Screws *f'* pass through the flange *f* and serve to keep the plate F in position on the  
25 ring D when the balls G are in place between the ring D and the plate F.

In practical use the plate F bears against the end of the boiler or other structure, having flues to be expanded; and the ring turns

within the plate F, and runs on the balls G, 30 thereby reducing friction to the minimum.

Having fully described my invention what I claim as new and desire to secure by Letters Patent is:

35 In a tube expander, the combination of a head having a central bore and radial pockets having bottoms conforming to the periphery of balls fitting in said pockets also having radial ways lengthwise of the head and extending through the wall of the head  
40 and terminating in the pockets thereof; a ring detachably connected with said head; and rollers provided with cylindrical stems fitting in said ways of said head, also provided with balls fitting in the pockets of  
45 said head and enlarged cylindrical parts extending beyond said head; and a mandrel extending through the bore of said head and contacting with the enlarged parts of said  
50 rollers.

In witness whereof I have hereunto subscribed my name at Clinton, Illinois, this 26th day of September 1907.

WILLIAM J. DOERFLER.

Witnesses:

B. E. CONLY,

FRED L. HOYT.