

(No Model.)

3 Sheets—Sheet 1.

J. T. FUHRMANN & J. M. DAUGHERTY.

FLUE EXPANDER.

No. 555,915.

Patented Mar. 3, 1896.

Fig. 4.

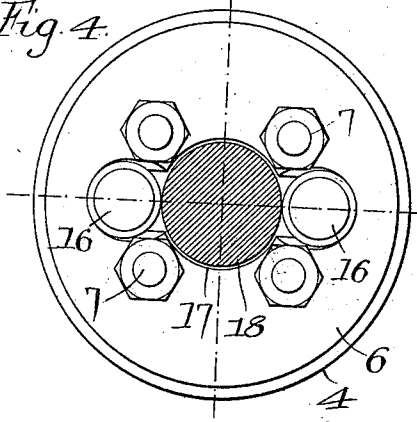


Fig. 3.

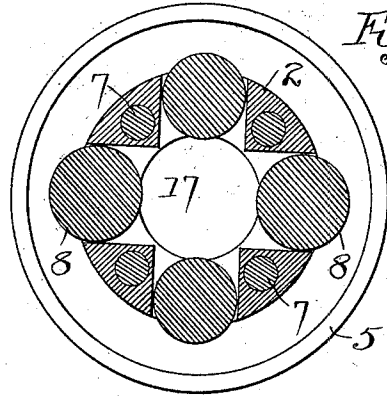


Fig. 2.

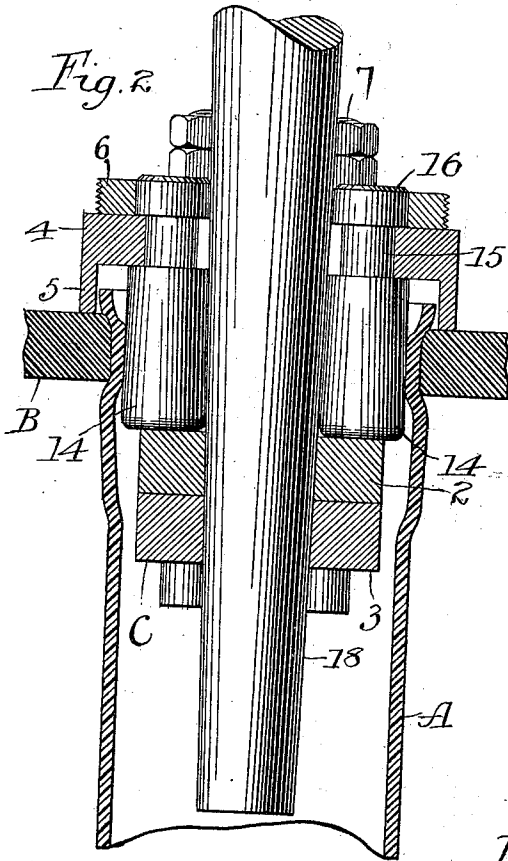
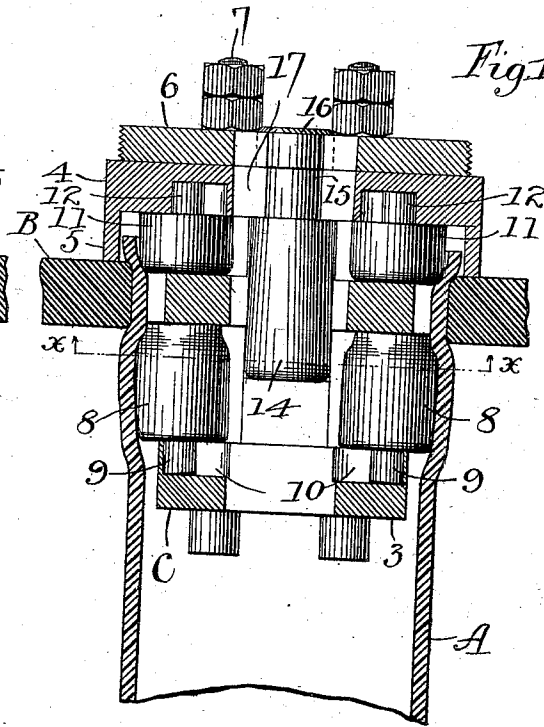


Fig. 1.



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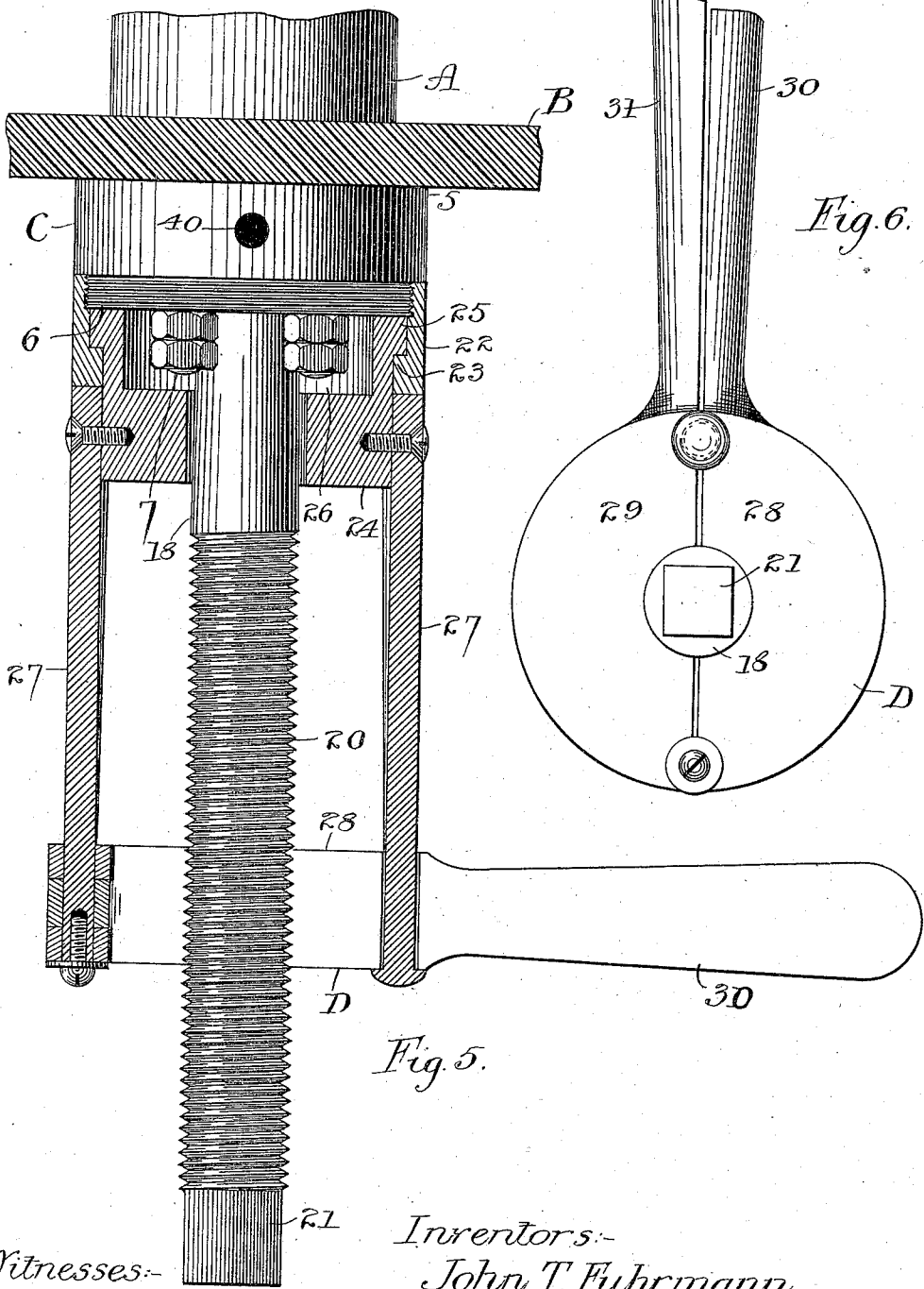
(No Model.)

3 Sheets—Sheet 2.

J. T. FUHRMANN & J. M. DAUGHERTY.
FLUE EXPANDER.

No. 555,915.

Patented Mar. 3, 1896.



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(No Model.)

3 Sheets—Sheet 3.

J. T. FUHRMANN & J. M. DAUGHERTY.
FLUE EXPANDER.

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Patented Mar. 3, 1896.

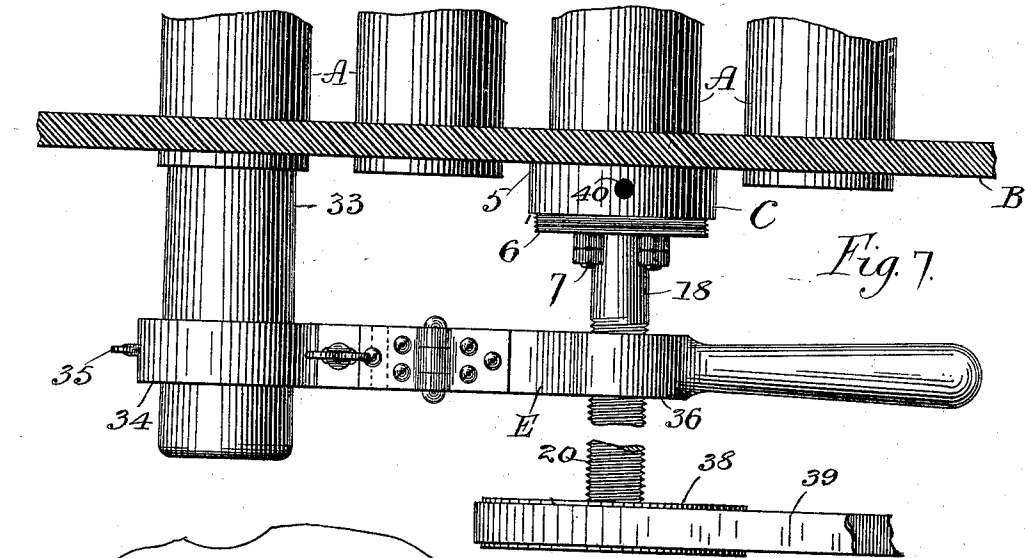


Fig. 7.

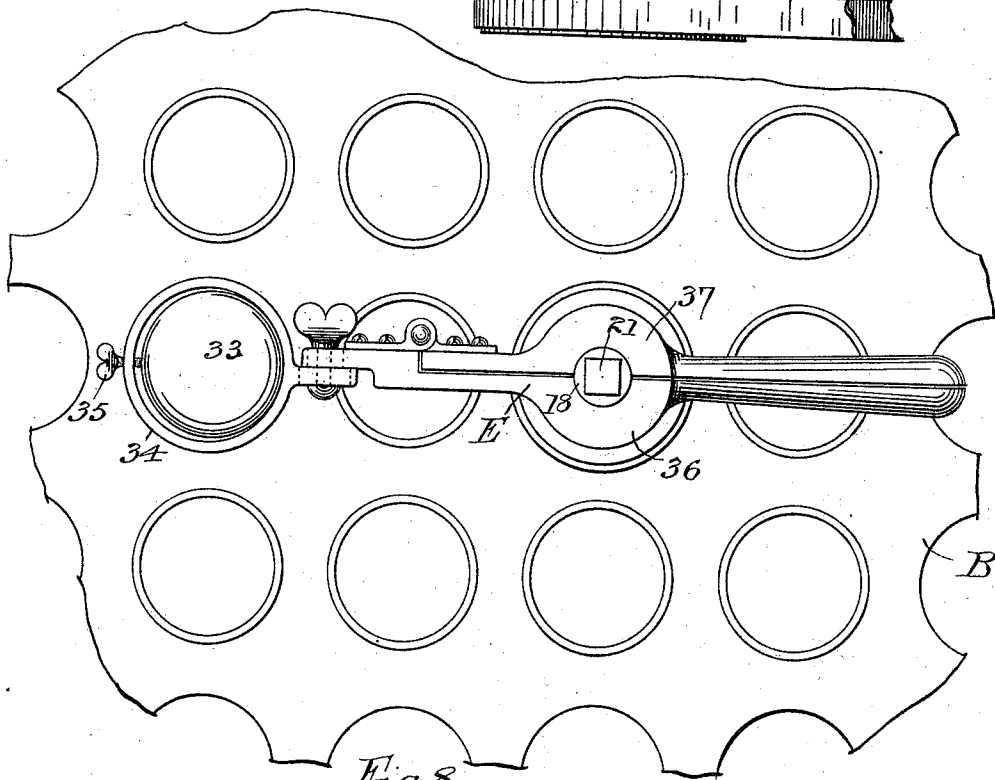


Fig. 8.

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UNITED STATES PATENT OFFICE.

JOHN T. FUHRMANN AND JAMES M. DAUGHERTY, OF ST. PAUL, MINNESOTA.

FLUE-EXPANDER.

SPECIFICATION forming part of Letters Patent No. 555,915, dated March 3, 1896.

Application filed June 9, 1893. Serial No. 477,073. (No model.)

To all whom it may concern:

Be it known that we, JOHN T. FUHRMANN and JAMES M. DAUGHERTY, of St. Paul, Ramsey county, Minnesota, have invented certain
5 Improvements in Flue-Expanders, of which the following is a specification.

Our invention relates to improvements in devices for expanding boiler-flues in the sheet through which they pass and on each side of
10 the sheet to secure a tight joint; and it consists in the construction and combination hereinafter particularly described and claimed.

In the accompanying drawings, forming part of this specification, Figure 1 is a longitudinal section of our device shown in place
15 in the flue, the rolls for expanding the flue on each side of the sheet being shown in contact with it, and the mandrel being removed to more clearly show the working parts of the device. Fig. 2 is a similar view of the same
20 with the mandrel shown in place and the rolls for expanding the flue in the sheet in contact with the walls of the flue. Fig. 3 is a cross-section of Fig. 1 on line *xx*. Fig. 4 is an end
25 view of Fig. 2. Fig. 5 is a sectional detail of the attachment by means of which the expander is operated by power. Fig. 6 is a detail of the clamp for engaging the mandrel when driven by power, and Figs. 7 and 8 are
30 details of a modified form of power driving attachment.

In the drawings, A represents the tube or flue, and B the sheet through which it passes.

C represents the expander, consisting of a
35 tube 2 adapted to be inserted into the end of the flue, to one end of which is secured the annular cap 3 and to the other end the cap 4, having the peripheral flange 5. The cap 6 is secured upon the outer end of the cap 4 by
40 the bolts 7, passing from end to end of the expander through the walls of the tube 2. The tube 2 is notched at opposite sides on its inner end to receive the pair of rolls 8. Each of these rolls has a gudgeon 9 working in a
45 radial socket 10 in the cap 3, which permits it to be crowded outward from the axis of the expander. The other end of the roll is slightly tapered or beveled, as shown, and abuts against the end wall of the notch. In
50 line with these rolls and lying in similar notches in the other end of the tube 2 are the

rolls 11, similarly held in place by means of their gudgeons 12 working in radial sockets in the cap 4. Intermediate of the pairs of
rolls 8 and 11 are arranged the rolls 14, which
55 are held in place by means of the gudgeons 15 working in radial slots in the cap 4, and having enlarged ends or heads 16, which work in radial slots in the cap 6, thus preventing the displacement of the rolls.

The space between the rolls 8 and 11 is substantially equivalent to the thinnest sheet in connection with which the expander is to be used. In case the sheet is thicker than the
60 space between the rolls 8 and 11 other rolls may be substituted for the rolls 8, having their ends next the sheet tapered or beveled farther back to allow for the width of the sheet. Thus by providing sets of interchangeable rolls 8, with their shoulders at different
65 distances from the end adjacent the sheet, the expander may be adjusted for use with sheets of any thickness. The ends of the rolls 11 next the sheet are rounded off, as shown, as well as the gudgeon ends of the
70 rolls 8, so as not to cut the flue.

The rolls 14 are long enough to extend nearly to the centers of the rolls 8, so as to more than bridge the space between the rolls
8 and 11, and are slightly smaller than the
80 rolls 8 and 11. The rolls 8 and 11 are cylindrical, so that when bearing against the tapering mandrel the flue will be expanded most next the sheet on the inside, while the projecting end of the tube will be flared by the
85 pressure of the roll. The rolls 14 are tapered, as shown, one-half as much as the mandrel, so that their outer surface, or that which bears against the tube, is exactly in alignment with the tube, and the tube is thus uniformly ex-
90 panded in the sheet-opening. When the mandrel is inserted it first makes contact with the rolls 8 and 11, bearing with uniform pressure against them all, and does not make contact with the rolls 14 until the first-named rolls
95 are crowded outward on account of the difference in size of the rolls.

The expander is shown arranged to be operated by power by means of the attachment shown in Figs. 5 and 6. The mandrel has a
100 threaded portion 20 and a squared tip 21, by means of which it may be coupled to a driv-

ing-shaft or other power. The periphery of the cap 6 is screw-threaded, as shown in Figs. 1, 2, and 5. Upon this is fitted the screw-threaded collar 22 adapted to engage and hold in place a cap 24, which has a circumferential end flange 25 to engage the flange 23, and thereby hold the cap 25 abutting against the cap 6. The inner end of the cap 24 has a socket 26, into which project the ends of the bolts 7. Fixed to the cap 25 are the outwardly-projecting parallel arms 27. To one of these is pivoted the clamp D, the members 28 and 29 of which are screw-threaded to fit to the other portion 20 of the mandrel, and terminate in the handles 30 and 31, by means of which they may be closed upon the threaded portion of the mandrel and firmly hold it, being steadied by the projecting end of the opposite arm 27, as shown. If the tool is to be used by hand the power attachment is unscrewed and detached.

In the modified construction shown in Figs. 7 and 8 a mandrel 33 is driven into one of the tubes A, and to this is secured the collar 34 by means of the set-screw 35. Pivoted to this collar is the clamp E, having the jaws 36 and 37 adapted in like manner as in the clamp D to be brought into engagement with the screw-threaded mandrel. Power may be applied to the mandrel in any desired way, as by means of a belt-wheel 38 fitted to the squared end of the mandrel and turned by the belt 39 running to any source of power. By the rotating of the mandrel the rolls are turned and bearing on the inner wall of the tube cause the expander to rotate in the same direction as the mandrel. If, however, by reason of any slight obstruction, such as a blister or other projection upon the inside of the tube, the expander is checked in its movement, it may be turned by applying a spanner-wrench to the sockets 40, thus crushing down the obstructions until it turns freely as actuated by the mandrel.

The operation is as follows: The expander being inserted into the open end of the tube until the flange 5 of the cap 4 bears against the sheet, the mandrel is inserted into the expander until the rolls 8 and 11 are brought into contact with the tube on each side of the sheet. The mandrel is then either rotated by hand or by power, and by reason of its bearing contact of the rolls 8 and 11 with the tube the expander is rotated, as described, in the tube, and the pressure of the mandrel forces the rolls outward so as to slightly expand the tube on each side of the sheet, when the mandrel comes in contact with the rolls 14, crowding them outward and causing them to expand the tube in the sheet.

We claim—

1. In a tube-expander, the combination of the cylindrical rolls adapted to be brought into contact with the tube on each side of the sheet, and the intermediate rolls bridging the space between the first-named rolls and having half the taper in an opposite direction of

that of the mandrel, substantially as described.

2. In a tube-expander, the combination of the tubular body having end notches, series of rolls arranged in said notches, caps adapted to be secured on each end of the body, and having radially-elongated sockets serving as bearings for said rolls, substantially as described.

3. A tube-expander, comprising in combination the tubular body, having series of notches at each end, series of rolls arranged in said notches, caps secured upon the ends of said body and having socket-bearings for the gudgeons of said rolls, the series of rolls intermediate of the first-named rolls, journaled in one of said caps and bridging the interval between the other two series of rolls, substantially as described.

4. In a tube-expander, the combination with the tapering mandrel, of the series of cylindrical rolls for expanding the flue on both sides of the sheet, and the intermediate rolls, overlapping the first-named series of rolls so as to completely bridge the interval between, and having a taper opposite to that of the mandrel and of one-half its degree, substantially as described.

5. In a tube-expander the combination of the series of rolls for expanding the tube on the outside of the sheet, interchangeable series of rolls for expanding the tube on the inside of the sheet adapted to adjust the expander for varying thicknesses of sheets, and the series of rolls bridging the space between the outer and inner series of rolls for expanding the tube in the sheet-opening.

6. The combination with a tube-expander of the yoke connected thereto, and projecting outward therefrom, the screw-threaded clamp carried by said yoke, the screw-threaded mandrel fitted to the expander and adapted to be engaged by said clamp, and means for rotating said mandrel, substantially as described.

7. The combination with a tube-expander, of the rotatable collar secured to the outer end thereof, the arms upon said collar, the screw-threaded clamp carried by said arms, and the screw-threaded mandrel fitted to said expander and adapted to be engaged by said clamp, substantially as described.

8. The combination with a tube-expander, of the rotatable collar arranged thereon, the arms upon said collar extending outwardly in line with the axis of the expander, the screw-threaded clamp-jaws pivoted to one arm and adapted to be closed into engagement with the other, and the screw-threaded mandrel fitted to said expander and adapted to be engaged by said clamp-jaws and having an angular tip which can be coupled to a power mechanism, substantially as described.

9. In a tube-expander, the combination of the series of rolls for respectively expanding the tube on each side of the sheet, and the series of rolls more than bridging the space

between the other two series of rolls for expanding the tube in the sheet-opening, substantially as described.

5 10. In a tube-expander, the combination with the cylindrical case, and the mandrel fitted thereto, of the series of rolls arranged in notches in the ends of said case with an interval or space between the two series, the caps fitted to the ends of the case and holding
10 said rolls in place, and the series of rolls bridging the interval between the first two series of rolls, substantially as described.

15 11. The combination with the tube-expander, of a mandrel fitted thereto, having its outer or larger end screw-threaded and adapted to be rotated by suitable power, and a hand-clamp supported on said expander and adapted to engage the screw-threaded portion
20 of the mandrel, whereby as the mandrel is rotated it is forced forward in the expander by means of the clamp, and yet its advance movement can be instantly checked by releasing the clamp, substantially as described.

25 12. In a power-driven tube-expander, the combination of the continuously-rotating mandrel having its outer end screw-threaded, and a screw-threaded clamp carried by the expander and adapted to be brought into engagement with the screw-threaded portion of
30 the mandrel.

13. In a tube-expander, the combination of the series of rolls for expanding the tube on the outside of the sheet, the series of rolls for expanding the tube on the inside of the sheet, the rolls in said last-named series having
35 shoulders near the end adjacent the sheet adapted to the thickness of the sheet, and the series of rolls more than bridging the space between the other two series of rolls, for expanding the tube in the sheet-opening. 40

40 14. In a tube-expander, the combination of the series of rolls having end gudgeons journaled in the expander-case, and the other end in contact with the tube at the outer edge of the sheet-opening, for expanding the outer
45 end of the tube, the series of rolls similarly journaled in the other end of the expander-case, and having shoulders adjacent to the inner edge of the sheet-opening for expanding the tube on the inside of the sheet, and
50 the series of rolls more than bridging the space between said other two series for expanding the tube in the sheet-opening.

In testimony whereof we have hereunto set our hands this 12th day of May, 1893.

JOHN T. FUHRMANN.

JAMES M. DAUGHERTY.

Witnesses:

FRED NEURER,

JOHN B. WALLRAFF.