2 Sheets—Sheet 1.

J. E. MINSHULL.

Tube Expander and Trimmer.

No. 200,558. Patented Feb. 19, 1878.

Fig. 1.

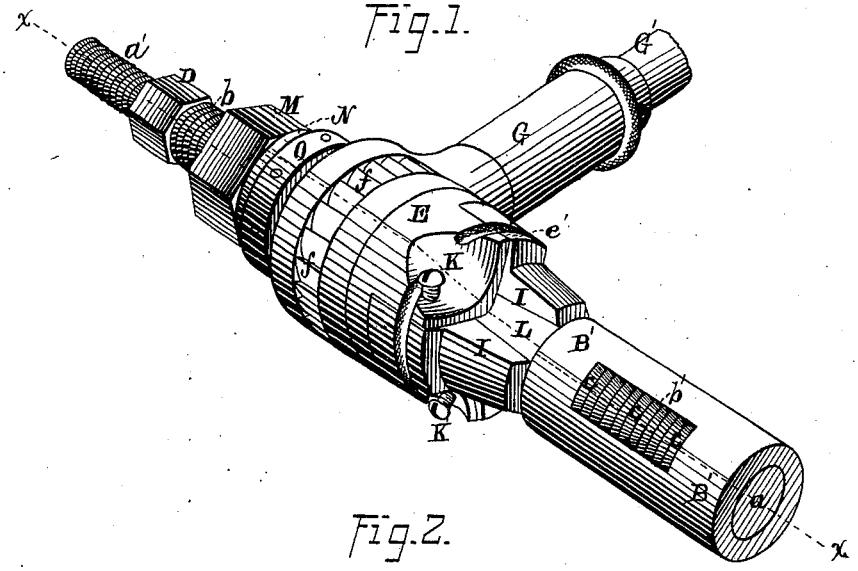
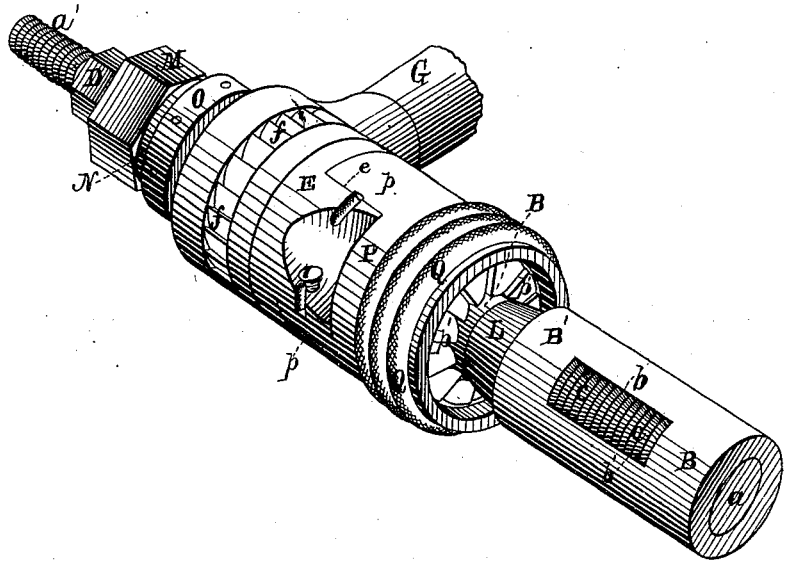


Fig. 2.



WITNESSES:

Jas. C. Hutchinson.

Henry C. Hazard.

INVENTOR.

Jno. E. Minshull, by

Pindle & Lay his attys

2 Sheets—Sheet 2.

J. E. MINSHULL.

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No. 200,558. **Patented Feb. 19, 1878.**

Fig. 3.

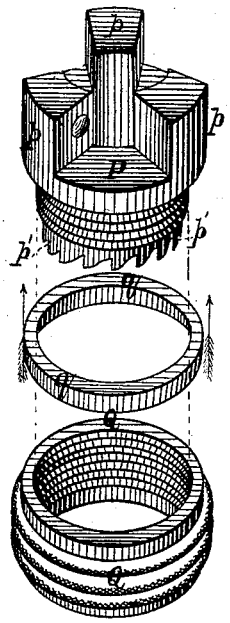


Fig. 4.

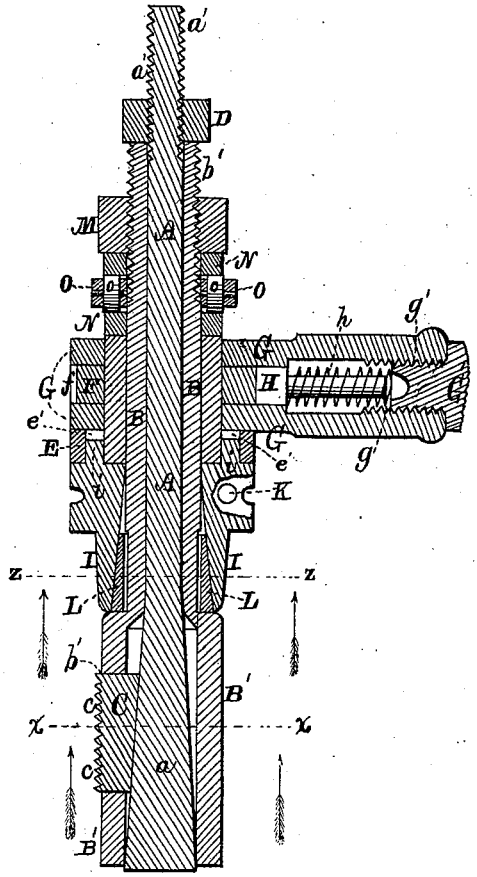


Fig. 5.

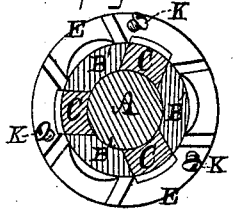
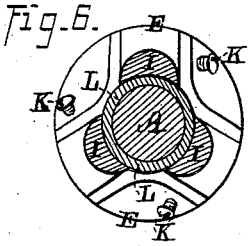


Fig. 6.



WITNESSES:

Jas. E. Hutchinson.

Henry C. Hazard.

INVENTOR.

Jno. E. Minshull, by

Pindle and Co. his Attys

UNITED STATES PATENT OFFICE.

JOHN E. MINSHULL, OF MIDDLETOWN, NEW YORK.

IMPROVEMENT IN TUBE EXPANDER AND TRIMMER.

Specification forming part of Letters Patent No. **200,558**, dated February 19, 1878; application filed August 2, 1877.

To all whom it may concern:

Be it known that I, JOHN E. MINSHULL, of Middletown, in the county of Orange, and in the State of New York, have invented certain new and useful Improvements in Tube-Expanders; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a perspective view of my device as arranged for expanding tubes. Fig. 2 is a like view of the same arranged for use in trimming the ends of the tubes. Fig. 3 is a perspective view of the tube-cutter and its adjustable gage separated from each other. Fig. 4 is a central longitudinal section of the device as shown in Fig. 1, and Figs. 5 and 6 are cross-sections upon line *x x* and *z z* of Fig. 4.

Letters of like name and kind refer to like parts in each of the figures.

The design of my invention is to facilitate the operation of trimming and expanding the ends of boiler-tubes preparatory to the beading or setting of the same within the boiler; to which end it consists, principally, in the construction of the dies and their combination with the revolving head, substantially as and for the purpose hereinafter shown.

It consists, further, in the means employed for lessening the friction of said revolving head, substantially as is hereinafter set forth.

It consists, further, in the construction of the cutter and its combination with the revolving head, substantially as and for the purpose hereinafter specified.

It consists, further, in the means employed for gaging said cutter with reference to the flue-sheet, substantially as and for the purpose hereinafter shown.

It consists, finally, in the device as a whole, its several parts being constructed and combined to operate in the manner and for the purpose substantially as hereinafter set forth.

In the annexed drawings, A represents a round mandrel, having at one end an enlargement, *a*, which decreases regularly in diameter from its outer end until the diameter of the remainder of said mandrel is reached, while at its opposite end said mandrel is provided upon its periphery with a screw-thread, *a'*. Fitted to or upon the mandrel A is a hollow mandrel, B, which has about three-fourths its length, and is provided at one end with a cylindrical enlargement or head, B', that has about one-third the length of said mandrel, while upon the body of the latter is formed a screw-thread, *b*, which extends from its smallest end inward about one-half the distance to said head. The body of the hollow mandrel B fits loosely upon the straight portion of the solid mandrel A, while the head B' of the former is recessed out to the size of the largest portion of the tapering portion *a* of the latter, by which means said tapering part may be withdrawn entirely into said head. At equidistant points within the head B' are formed three radial slots, *b'*, which have about one-half its length, and are arranged in a line with its axis, and within each is loosely fitted a block, C, that is provided upon its outer face with teeth or serrations *c*, and has such radial dimensions as to cause said face to project slightly beyond the periphery of said head.

As thus arranged, the tapering portion *a* of the mandrel A furnishes a bearing for the inner faces of the blocks or dogs C, so that by moving said mandrel longitudinally rearward through the mandrel B said dogs C will be moved radially outward. Such movement of said mandrel A is effected by means of a nut, D, which is fitted upon the threaded portion *a'*, and bears against the small end of said hollow mandrel B.

This construction enables the mandrel B to be securely fastened within the end of a tube, to accomplish which result the head B' is placed within said tube and the dogs C expanded until they engage so firmly with its interior as to prevent displacement by any strain less than such as would cause breakage.

Upon the body or smaller portion of the hollow mandrel B is journaled a head, E, which, having the general form of a cylinder, has its rear portion reduced considerably in diameter, and upon the same has secured a wheel, F, that is provided at its periphery with ratchet-teeth *f*.

Journaled upon the head E, upon each side of the ratchet-wheel F, is the bifurcated end

of a lever, G, within which latter is provided a pawl or detent, H, that is capable of longitudinal motion in a line with the axis of said lever, and by means of a spring, *h*, is held with a yielding pressure upon the periphery of said ratchet-wheel, so as to cause its inner end to engage with the teeth *f*.

In order that the pawl H may be conveniently placed in position, the lever G is made in two parts, the outer of which part, G′, has its inner end *g′* reduced and threaded, and said end fits into the correspondingly threaded recess *g*, that is formed within the inner section for the reception of said pawl and its spring.

The ratchet and lever thus formed enables the head E to be rotated in one direction, for the purpose hereinafter described.

Pivoted within three radial slots, *e*, that are formed at equidistant points within the front end of the head E, are three jaws, I, which have their outer portions reduced in radial dimensions, as shown in Figs. 1 and 4, and have the peripheries of such reduced portions rounded, as seen in Fig. 6.

The rear end of each jaw I is provided with a rearward-projecting stud, *i*, which fits loosely into a corresponding recess, *e′*, that is formed in the head E at the end of the slot *e*, which stud, in connection with a set-screw, K, that passes into one side of said slot *e*, and has its end contained within a countersink that is formed in the contiguous portion of said jaw, operates to confine the latter loosely in position, a considerable amount of radial motion being allowed to the outer end of each jaw.

Fitted loosely upon the mandrel B, with its largest end against the head B′, is a tapering thimble, L, which forms a bearing for the inner faces of the jaws I, and, when the head E is moved longitudinally upon said mandrel, causes the outer ends of said jaws to be moved radially outward or inward.

Longitudinal motion is imparted to the head E by means of a nut, M, which is fitted over the threaded portion *b* of the mandrel B, and operates to press said head toward the opposite end of said mandrel.

In order that the friction between the head E, when revolving upon the mandrel B, and the nut M may be reduced to a minimum, two washers, N, are placed between said head and nut, and between said washers is placed a collar, O, which is provided with a number of rollers, *o*, that are slightly larger in diameter than the thickness of said collar, and are each arranged with its axis in a radial line.

The peripheries of the rollers *o* bear upon the contiguous faces of the washers N, and form rolling bearings for the head E.

To expand a tube, the head B′ of the mandrel B is secured within the end of the tube, with the head E, which has first been moved outward upon said mandrel, in such position as to bring the reduced portions of the jaws I within said tube, after which said jaws are expanded and said head E caused to rotate until the tube has been caused to closely fill its opening within the flue-sheet.

It frequently happens that the tubes project beyond the flue-sheet a greater distance than is necessary for heading or beading, and that, consequently, the surplus stock must be removed before such operation can be performed.

To remove such surplus material from a tube, I employ a head, P, which, at its rear end, is provided with three lugs, *p*, that correspond to and fit into the recesses *e′* of the head E, where they are secured in place by means of the set-screws K.

Upon the front end of the head P are formed cutting-teeth *p′*, which have such inclination as to cause each to cut away some of the metal of the tube when said head is pressed against the latter, and is caused to rotate.

In order that the operation of the cutting-head P may be gaged so as to enable the exact projection necessary beyond the flue-sheet to be secured without special attention, the periphery of said head is threaded from the cutting end rearward about one-half its length, and upon such threaded portion is fitted a nut, Q, which has such length as to cause its outer end to project beyond the said cutting end a distance equal to the usual projection of flue that will be required.

When the cutter-head is caused to operate upon a tube, it can only approach the flue-sheet until the collar Q bears against the latter, by which means the ends of the tubes operated upon must project to the same distance, and contain equal amounts of stock for heading down.

If it is desired to leave more than the usual amount of projection of the tube, the collar Q is removed, and a washer, *q*, corresponding in thickness to the increased length desired, is placed in its rear.

By means of the bearing or gage collar Q, the length of the projecting ends of the tubes can be accurately and readily gaged, while, when it is necessary to dress or sharpen the cutting-teeth *p* of the head P, said collar may be removed, and the desired operation easily performed.

For convenience of adjustment the periphery of the collar Q is milled.

After a tube has been cut to length and expanded, beading-rollers may be placed within the recesses *e′* of the head E, and the end of said tube beaded or headed down upon the flue-plate.

Having thus fully set forth the nature and merits of my invention, what I claim as new is—

1. The expanding-dies I, constructed as described, and provided with the rearward-projecting stud *i*, in combination with the head E, having the recesses *e* and *e′*, and set-screws K, substantially as and for the purpose shown.

2. In combination with the head E and nut M, the washers N and interposed collar O,

provided with radially-pivoted rollers *o*, substantially as and for the purpose set forth.

3. In combination with the head E, provided with the recesses *e*, and arranged to rotate upon the mandrel B, the cutter-head P, provided at its inner end with lugs *p*, that fit into said recesses, and having upon its outer end cutting-teeth *p'*, substantially as and for the purpose specified.

4. In combination with the cutter-head P, having a threaded periphery, the gage-collar Q, fitted upon said threaded periphery, in the manner and for the purpose substantially as shown.

5. The hereinbefore-described device, in which the mandrel A, provided with the tapering portion *a* and threaded portion *a'*, the hollow mandrel B, having the slotted head B' *b* and threaded end *b'*, the dogs C, the nut D, the head E, provided with the recesses *e* and *e'*, the expanding-jaws I *i*, the set-screws K, the nut M, the washers N, and the roller-collar O *o*, are constructed as shown, and combined with means for rotating the same, in the manner and for the purpose substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 30th day of July, 1877.

JOHN E. MINSHULL.

Witnesses:

C. W. CRESSON,

A. V. C. N. POWELSON.