J. J. SMITH.

COMBINED TUBE EXPANDER AND BEADING TOOL.

APPLICATION FILED DEC. 20, 1921.

1,423,545. Patented July 25, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

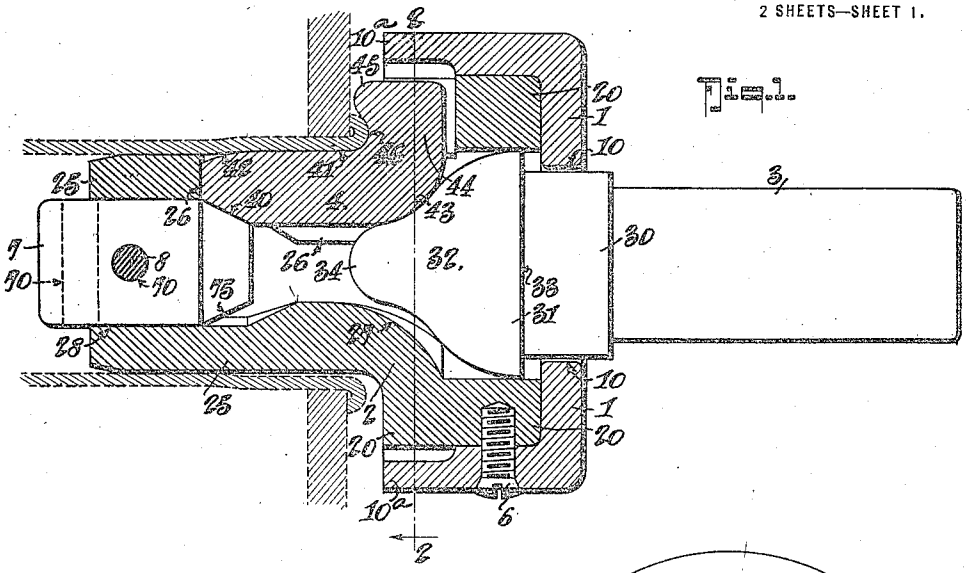
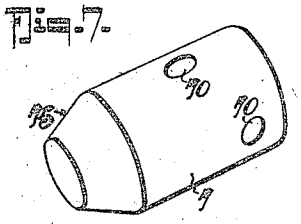


Fig. 7.



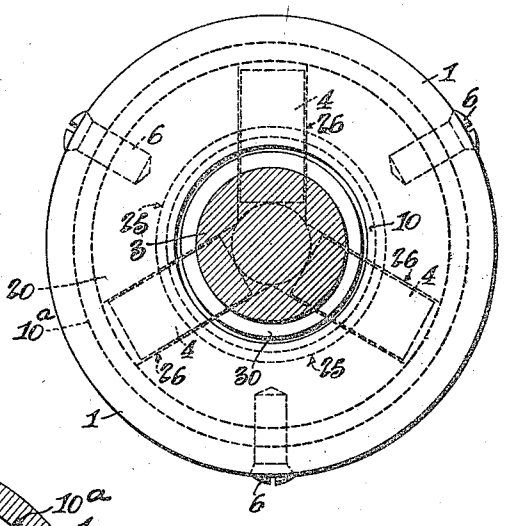


Fig. 4.

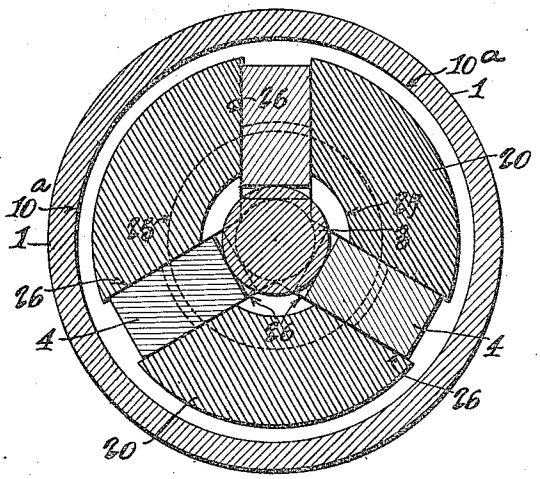


Fig. 2.

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2 SHEETS—SHEET 2.

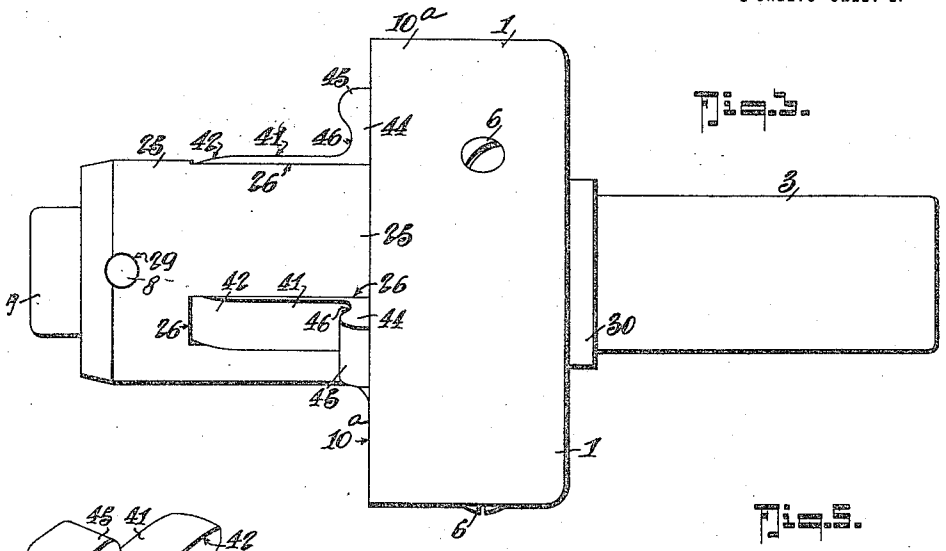


Fig. 3.

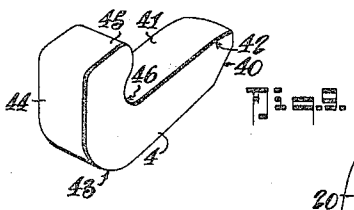


Fig. 4.

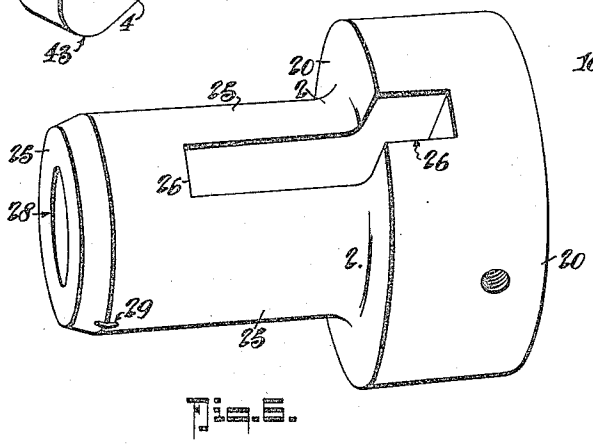


Fig. 5.

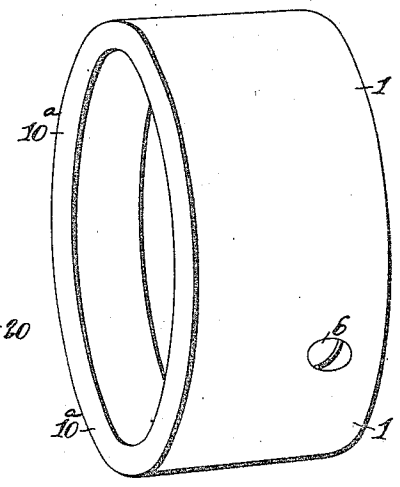


Fig. 6.

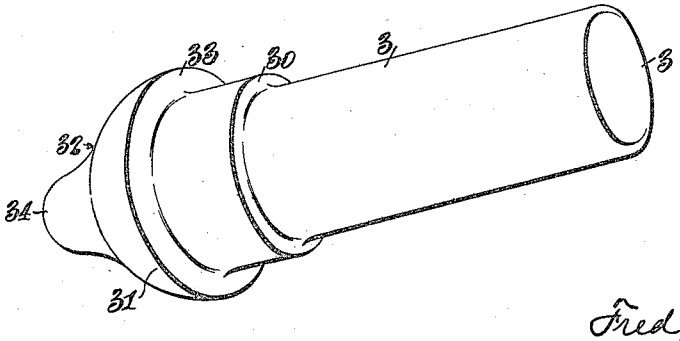


Fig. 7.

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JOHN JAMES SMITH, OF WINNIPEG, MANITOBA, CANADA.

COMBINED TUBE EXPANDER AND BEADING TOOL.

1,423,545. Specification of Letters Patent. Patented July 25, 1922.

Application filed December 20, 1921. Serial No. 523,794.

To all whom it may concern:

Be it known that I, JOHN JAMES SMITH, at present residing in the city of Winnipeg, Province of Manitoba, Dominion of Canada, have invented a new and useful Combined Tube Expander and Beading Tool, of which the following is a specification.

This invention has reference to that type of implements or tools having provision for expanding boiler tubes and for fixing the end of the tube to a close fit against the tube sheet or plate, and primarily my said invention has for its purpose to provide a tool of the general character stated of a compact and relatively economical construction, in which the parts are designed for producing and adapted to produce steam and water tight joints where tubes and flues are secured to the tube sheets of steam boilers as well as flanging or beading the projecting ends of the said tubes and flues so they may be readily formed to a snug fit against the tube sheets.

Heretofore it has been a general practice to employ a number of different tools for first effecting the expansion of the tube to make the desired tight fit where it passes through the tube sheet and for then turning back or flaring the projected end of the expanded tube to produce the desired turned back or bead portion to give the required finish to the tube and sheet connection.

Another and essential feature of my invention is the provision of an implement or tool of the character stated in which is included a main or body portion adapted for removably and adjustably receiving and operatively supporting specially designed members, each of which has one of its ends shaped to form the bead required on the tube or flue end and the other end suitably designed for cooperating with an expanding element that is adjustably mounted within the main or body portion, the several specially designed members being independently supported and sustained within the said main or body portion or frame for being engaged by the expanding element (a hammer impelled mandrel), the operation of which governs the set of the said severally specially designed members for doing the work for which they are provided.

Heretofore it has generally been the practice to employ three different tools for the performance of the following important work, namely: sectional expanders, tube rollers and beading devices, all of which require separate operations.

A common type of sectional expander, known to the trade as a Prosser sectional expander, is for the purpose of developing a shoulder in the tube or flue to produce a joint from the pressure side of the tube sheet of the boiler.

Tube rollers in general use do not meet the desired requirements since in effecting the joints of the tube in the tube sheets, they are more or less destructive to the tube sheets, the tubes and the flues, because the tube holes become enlarged due to frequent rolling to keep them tight in service, as well as effecting a reduction in the walls of the tubes or flues, which in a short time leaves them so thin as to necessitate their removal, together with the tube sheet, earlier than if more desirable tools were available.

Beading tools now in general use for beading and caulking tubes and flues, while not in themselves harmful for the work they are designed to do, the control of the angle at which such tool is held, to get good or bad work, repeatedly results in poor workmanship, as it is possible to caulk the tube away from the joint rather than close up to it.

It is, therefore, most desirable to provide means whereby the beading devices will be automatically controlled in a set position to do good work, as well as having a plurality of beading devices or tools in operation at the same time to economize in production, rather than having an individual beader that is subject to wrong control and separate operation.

My invention, therefore, also has for its purpose to provide a tube expanding and beading tool or implement free from the objections incident in the use of tube rolling expanders and the common types of beading tools now generally employed in the mechanical trades, for applying the tubes or flues to the tube sheets of steam boilers.

I accomplish the desired results in an efficient and economical manner by the peculiar mechanical assemblage of a plurality of specially designed members, all fully explained in the following detailed description, specifically brought out in the appended claims and illustrated in the accompanying drawings, in which:

Figure 1 is a longitudinal section of my construction of combined tube flaring and

beading mechanism, so much of a tube and a tube sheet being shown as is necessary to illustrate a practical application of my said invention.

Figure 2 is a transverse section of my invention, taken on the line 2—2 of Figure 1, looking in the direction of the arrow.

Figure 3 is a side elevation of my improved tube expanding and beading implement.

Figure 4 is an end elevation thereof, the mandrel being shown in cross section.

Figure 5 is a perspective view of the main body or frame portion of the implement.

Figure 6 is a similar view of the cage member hereinafter specifically mentioned.

Figure 7 is a perspective view of the range adjuster.

Figure 8 is a perspective view of the power transmitting mandrel.

Figure 9 is a perspective view of one of the combined beading and expanding working members hereinafter mentioned.

Referring now to the details of construction of my invention, 1 designates the body or main portion of my tube expanding and beading implement and the said main portion constitutes a receiver for a guard or cage 2 which includes a head portion 20 that fits within the said body portion 1 and is fixedly attached to the annular rim thereof, to turn therewith, by a series of screws 6 that pass through the said rim and engage the head portion 20, as is clearly shown in Figures 1 and 4 of the drawings.

The body portion 1, as is clearly shown in Figure 1, is cup-shaped and its end wall has an axial opening 10 for the reception of the annularly enlarged portion 30 of the power transmitting mandrel 3, one end of which is provided with a head 31 having a concavo-convexed external face 32 between its enlarged or shouldered end 33 and its round extremity 34, as is clearly shown in Figures 1 and 8, the reason for which will presently appear. The outer end of the mandrel is shaped to conform to whatever power may be available for operating it. In the present showing, the outer end of the mandrel is adapted to connect with a pneumatic hammer (not shown), the latter being the most convenient means for applying the required power to the mandrel.

The cage 2 is formed with an extension 25 of reduced diameter and in the said reduced extension and the head portion 20 thereof, that is fixedly attached to the main body portion 1, the said member 2 is formed with a series (3) of radial chambers 26 which extend from a central bore 27 out through the periphery of the said member 2, the latter by reason of its peculiar shape constituting a cage for the reception of the working members 4 that operate to expand the tube and turn or bead the outer end of the said tube that projects through the tube sheet, as is best shown in Figure 1.

The outer end of the extension 25 is formed with an enlarged bore 28 of such diameter as to snugly receive therein, what is hereinafter termed the range adjuster, which, in the construction shown, is in the nature of a plug 7 that is provided with a series of longitudinally disposed transverse apertures 70, any one of which is adapted, by proper adjustment of the plug 7, for registering with apertures 29 in the said extended end 25 to provide for the reception of locking pins 8 or other fastening members that serve to hold the adjuster plug 7 in fixed connection with the cage, as shown.

The inner end 75 of the adjuster plug is cone-shaped and the said end constitutes a bearing surface for engaging the correspondingly shaped tapered ends 40 of a plurality of working members 4 that are especially designed to suit the diameter of the tube or flue to be secured to the boiler tube or sheet.

The cone-shaped adjuster plug also assists in maintaining the specially designed working members 4 at a proper angle for effective work.

The number of specially designed members 4 and the chambers in the cage to receive them is governed by the sizes of the tubes or flues to be operated on.

Each working member 4, one of which is shown in detail in Figure 9, includes an outer straight face hereinafter termed the tube spreading surface 41, the inner end of which is inwardly inclined, as at 42, to prevent a sharp division line between the inner ends of the members 4 and the adjacent extended portion of the cage and the outer end of each of the members 4 has a curved bearing heel 43 which merges with the angled or radially projected member 44, as is best shown in Figure 1, by reference to which it will be seen the portion 44 of the members 4 are provided freedom of expansion by reason of the clearance formed by the counterbore in the overhanging rim 10^a of the cup-shaped main frame or housing which is fixedly attached to and turns with the working tools' carrying cage 2 as rotative power is applied to the mandrel in the usual way.

As is clearly shown in Figure 1, the concavo-convexed shape of the mandrel head provides a solid seat for engaging the heel portions 43 of the several working members 4 and by reason of such connection of the parts, as the mandrel is driven inwardly in the direction of its length, by a hammer worked either manually or pneumatically, all of the working members will be simultaneously held under pressure from within the cage, and in the direction of their

length, and thereby hold their spreading faces 41 in close engagement with the internal face of the tube to be spread, and at a number of different places, to thereby expand the flue or tube at a number of different places at the same time.

The turned out portion 44 of each working member 4 is formed with a beading lip 45 which merges with a curved surface 46 that constitutes an outer continuation of the spreading surface 41, it being apparent, by referring to Figure 1, that as the reduced shank of the tube is fed into the tool, the surfaces 46 and the lips 45 of the members 4 operate to turn back the outer rim edge of the tube being worked on and which projects through the tube sheet, and thereby form a bead on the tube end that is crowded fluid tight against the outer face of the said tube sheet, as shown.

By having a number of working members, each with an independent tube spreading surface, a plurality of combined expanding and beading tools is provided, such provision effecting economy in production, when compared with the use of an individual tool that is subject to wrong control and separate operation, it being understood that in my construction of combined tube expanding and beading tool means is always present for holding all of the working members 4 in uniform relation with respect to the turning cage and the internal tube surface being worked when the said members 4 are engaged by the specially designed mandrel which transmits power, from a pneumatic hammer or otherwise, to the said expanding and beading members.

The range of the tool or implement is so regulated that more than one size of tube or flue may be conveniently expanded and beaded.

The shoulder 33 developed at the base of the mandrel head 31 forms a stop in connection with the body portion 1 to prevent the mandrel falling out of its operative position in the tool. The shank portion 30 of the said mandrel permits the cage to adjust itself to its position next to the shoulder 33.

From the foregoing taken in connection with the drawings, the complete construction, the manner of operation and the advantages of my tube expanding and beading tool will be readily apparent to those familiar with the work of applying tubes and flues to the flue sheets of steam boilers.

The construction of the tool is such that the weight thereof and the power transmitting mandrel are such that one man can readily handle it and a pneumatic hammer when one is used in connection with the mandrel, since as the mandrel is a part of the tool and is kept in position by the body or guard portion, the operator is enabled to conveniently rotate the tool on the mandrel with one hand as with the other hand he controls the pneumatic hammer or other power for feeding the mandrel inwardly.

It is obvious that while the hollow body 1, illustrated in detail in Figure 5 and operatively applied as in Figure 1, prevents the mandrel falling out of its operative position, it also serves to prevent the working members from falling apart from the mandrel when applying the tool to the operative position onto the end of the tube to be worked.

What I claim is:

1. In a combined tube expanding and beading tool, a cup-shaped body having an axial opening, a cage including a tubular shank insertable into the tube end to be worked, the said cage having a plurality of radially extended chambers that open from the bore of the shank through the peripheral face thereof, a combined expanding and beading element mounted, one in each of the said chambers in the cage, an expanding mandrel that extends through the axial opening in the cup-shaped body and engages the combined tube expanding and beading elements and adapted, as it is being forced lengthwise into the body portion and the cage to hold the several expanding and beading elements in working engagement with the tool, and means mounted upon and cooperative with the cage for regulating the set of the said expanding and beading elements to suit the diameter of the tube being worked.

2. The combination in a tube expanding and bending tool, of a plurality of independent working members, an expanding mandrel and an adjuster independent of and separated from the mandrel, for controlling the range of radial projection of the working surfaces of each of the said members.

3. The combination in a tube expander and bending tool, of a plurality of independent working members, an expanding mandrel, an adjuster independent of and separated from the mandrel, for controlling the range of radial projection of the working surfaces of each of the said members, and means for securing the adjuster to its set positions relatively to the working members.

4. The combination in a tool of the character described; a cup-shaped body, a cage comprising a tubular shank and an annularly enlarged guard that fits within and is adapted for being fixedly attached to the annular rim of the cup-shaped body adjacent its disk portion, the said disk portion having an axial aperture in alignment with the bore of the cage, the cage having a plurality of radial chambers that extend from the bore through the periphery there-

of, a plurality of working members, one of such members fitting within each of the said radial chambers in the cage, each working member including a tube spreading surface that terminates at the outer end in a tube beading portion, a power transmitting mandrel endwise movable through the axial aperture in the cup-shaped body, the said mandrel including a head portion that engages the inner edge of all of the working members and a member in the inner end of the cage shank that constitutes a bearing for the inner ends of all of the said working members.

5. The combination in a tool of the character described; a cup-shaped body, a cage comprising a tubular shank and an annularly enlarged guard that fits within and is adapted for being fixedly attached to the annular rim of the cup-shaped body adjacent its disk portion, the said disk portion having an axial aperture in alignment with the bore of the cage, the cage having a plurality of radial chambers that extend from the bore through the periphery thereof, a plurality of working members, one of such members fitting within each of the said radial chambers in the cage, each working member including a tube spreading surface that terminates at the outer end in a tube beading portion, a power transmitting mandrel endwise movable through the axial aperture in the cup-shaped body, the said mandrel including a head portion that engages the inner edge of all of the working members, a member in the inner end of the cage shank that constitutes a bearing for the inner ends of all of the said working members, the said bearing consisting of a plug endwise adjustable within the said inner end of the tubular cage, the said plug having a cone surface, the inner ends of each of the working members having a tapered face for seating on the said cone surface and means for effecting longitudinal adjustment of the said plug to regulate the radial projection of the tube engaging faces of the working member.

6. In a tube expanding and beading tool, the combination of a tubular cage adapted to be inserted within the tube to be worked, an expanding mandrel the said cage including a hub-like inner end and an enlarged diameter head portion at the outer end, the body of the cage between the head portion and the hub end having a radial chamber that extends from the bore of the cage through the periphery thereof, a tube expanding and beading element within the radial chamber, means for feeding the cage inwardly and the working element outwardly against the inner wall of the outer end of the tube being worked and other means mounted upon and cooperative with the cage for setting the working element radially relatively to the cage whereby to adapt the tool for working on tubes of different diameters.

JOHN JAMES SMITH.