(No Model.) 2 Sheets—Sheet 1.

D. J. McCORMACK.

BOILER TUBE BEADER AND EXPANDER.

No. 533,662. Patented Feb. 5, 1895.

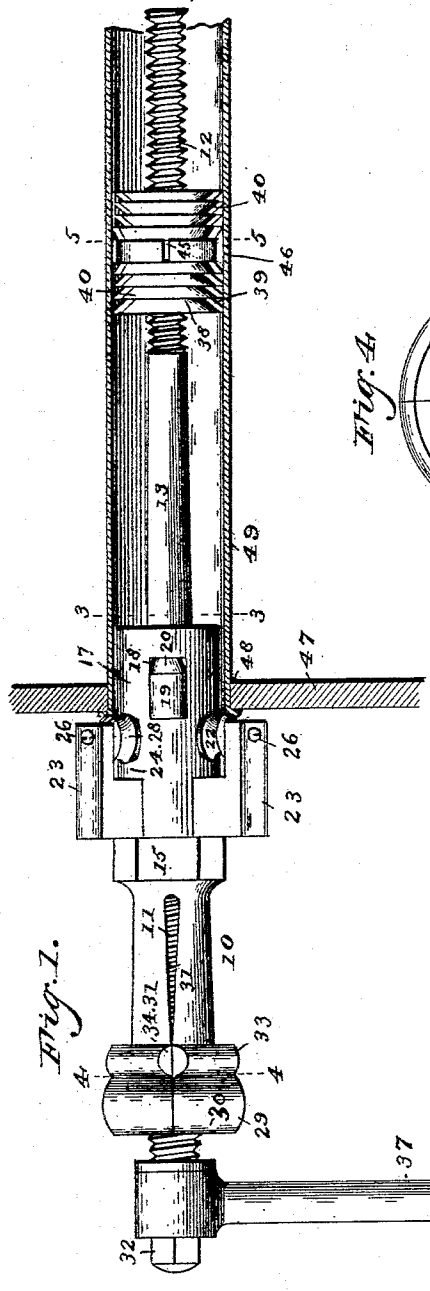

Fig. 1.

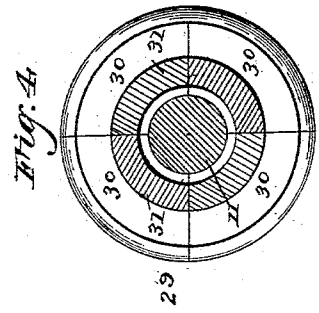

Fig. 4.

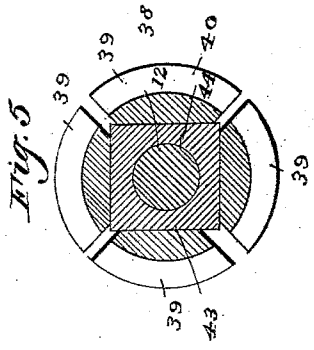

Fig. 5.

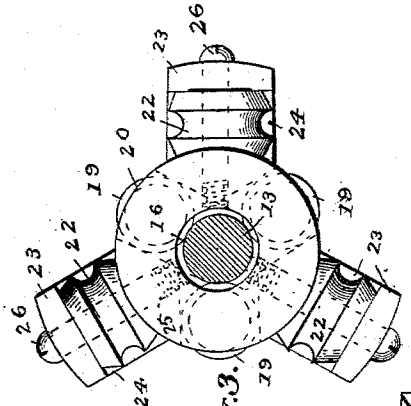

Fig. 3.

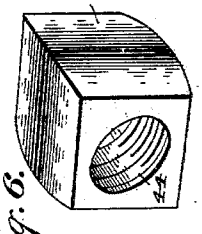

Fig. 6.

Witnesses

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(No Model.) 2 Sheets—Sheet 2.

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BOILER TUBE BEADER AND EXPANDER.

No. 533,662. Patented Feb. 5, 1895.

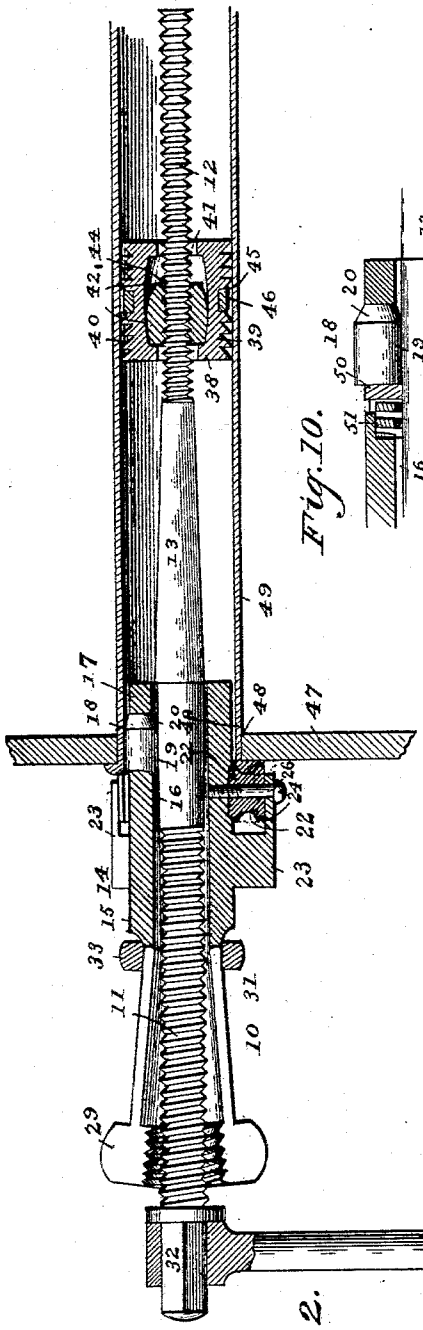

Fig. 2.

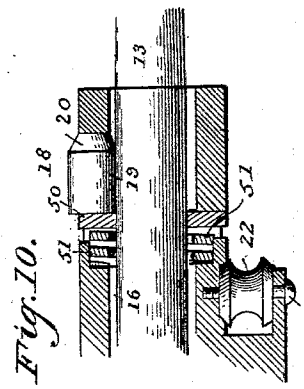

Fig. 10.

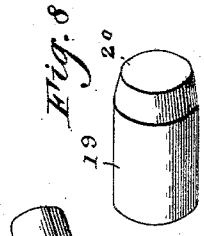

Fig. 8.

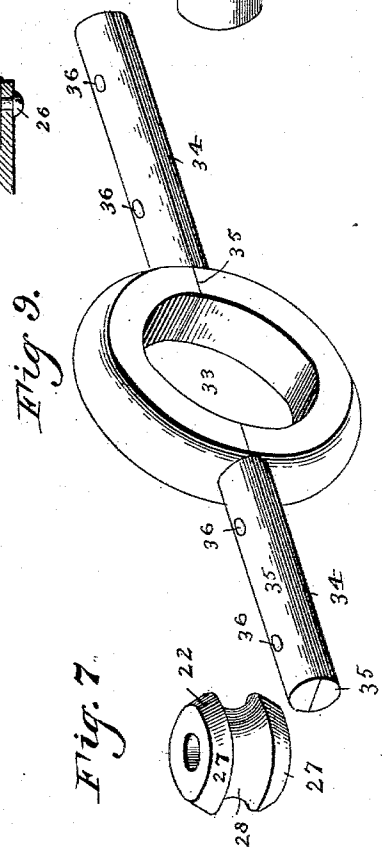

Fig. 9.

Fig. 7.

Witnesses

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UNITED STATES PATENT OFFICE.

DANIEL JAMES McCORMACK, OF ASPEN, COLORADO, ASSIGNOR OF ONE-TENTH TO ALEXANDER CARSTENS, OF SAME PLACE.

BOILER-TUBE BEADER AND EXPANDER.

SPECIFICATION forming part of Letters Patent No. 533,662, dated February 5, 1895.

Application filed March 30, 1893. Serial No. 468,314. (No model.)

To all whom it may concern:

Be it known that I, DANIEL JAMES McCORMACK, a citizen of the United States, residing at Aspen, in the county of Pitkin and State of Colorado, have invented a new and useful Boiler-Tube Beader and Expander, of which the following is a specification.

My invention relates to improvements in beaders and expanders for boiler tubes, and it has for its object to provide a self-feeding device which will expand and bead simultaneously and by one operation, without the previous or auxiliary arrangement of nuts, wrenches and similar devices, such expansion being in that part of the tube which passes through the boiler plate and is contiguous to the edge which is undergoing the beading operation.

Further objects and advantages of my invention, relating to the various parts of the structure and to the means for adjusting, operating, &c., will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings: Figure 1 is a side view of a beader and expander embodying my improvements. Fig. 2 is a central longitudinal sectional view of the same. Fig. 3 is a front view of the head, showing the mandrel or stem in section upon the line 3—3 of Fig. 1. Fig. 4 is a transverse sectional view, upon the line 4—4 of Fig. 1, showing the sectional compensating nut. Fig. 5 is a transverse sectional view, on line 5—5 of Fig. 1, of the feed-nut. Fig. 6 is a detail view of the slidable wedge-block which is employed to expand the feed-nut. Fig. 7 is a detail view of one of the beading-rolls, detached. Fig. 8 is a similar view of one of the expanding rolls, detached. Fig. 9 is a similar view of the clamping-ring, which is employed to contract the compensating-nut. Fig. 10 is a detail sectional view showing a slightly modified manner of mounting the expanding rolls.

Similar numerals refer to corresponding parts in the several views.

10 designates the mandrel which is provided with a threaded body-portion 11, a threaded reduced portion or inner end 12, and an intermediate smooth tapered portion 13.

14 represents a head which is rotatably and slidably mounted upon the mandrel, being provided with a smooth bore 16, and is furthermore provided at its outer end with a hexagonal portion 15 adapted for the engagement of a wrench. This head 14 is provided with a reduced portion or extension 17 provided with three side recesses 18 which communicate with the axial bore 16, and in each of these recesses is revolubly mounted an expanding-roll 19, which is provided with a tapered or slightly beveled inner end, as shown at 20. These rolls 19 fit loosely and are arranged longitudinally in the recesses, and they project at their outer sides slightly beyond the outer surface of the reduced portion of the head.

Ears 23 are formed integral with the body, portion of the head and project inward parallel with the surface of the reduced portion thereof and slightly removed from the same to form recesses 24. These ears are three in number, to correspond with the number of recesses 18 in the reduced portion of the head, and they are arranged opposite the intervals between such recesses, as clearly shown in Fig. 3.

Fitting in registering perforations in the ears 23 and the body of the head, which perforations are shown in Fig. 3 at 25, are the radially-disposed pivot-pins 26, upon which, and between the inner surfaces of the ears 23 and the adjacent surface of the head, are mounted the beading-rolls 22. These beading-rolls are provided with similar tapered or trunco-conical ends 27, and an intermediate semicylindrical annular groove 28, the advantages of which construction will be understood when the nature of the invention is fully disclosed.

The above described alternate disposition of the beading and expanding rolls, enables the latter to be extended outward between the former, as shown in Figs. 1 and 2.

Integrally connected to the outer end of the head is a compensating nut 29, composed of separable sections 30 which are connected, respectively, to the head by the independent spring expansion arms 31. The members or sections of this divided or sectional nut 29, when free, are held out of contact with the

body-portion of the mandrel by the spring-arms 31, and to cause the nut to engage the threaded portion of the mandrel I employ a slidable contraction-ring 33 which embraces the spring-arms and when moved outward, or toward their free ends, contracts the nut or draws its members together.

The contraction ring 33 is provided with lateral handles 34 by which it may be adjusted or moved upon the spring arms, and it is split to form separable sections 35, as shown clearly in Fig. 9, to facilitate its application to the device. The sections 35 are connected by the rivets 36.

Fitted upon an angular portion 32, at the outer end of the mandrel is the operating crank 37.

Adjustably fitted upon the reduced inner portion of the mandrel is the sectional, expansion feed-nut 38, which comprises the sector-shaped sections 39, unconnected and provided with a smooth bore to receive the mandrel. The feed-nut is provided with a serrated exterior surface, the teeth 40 of which incline in opposite directions, or, respectively, outward and inward, from the center, as shown, whereby it may engage the inner surface of the boiler tube to prevent longitudinal movement, or sliding, in either direction. Communicating with the central, axial bore 41 of the feed-nut is a smooth-surfaced cavity 42, which is angular, preferably square, in transverse section and is tapered or reduced in diameter toward its inner and outer ends.

Within the cavity 42 of the feed-nut fits the slidable wedge-block 43, also square in section and tapered toward its extremities, which is provided with a tapped bore 44 to fit the threaded mandrel which extends axially therethrough. This wedge-block is shorter than the cavity in which it is located, to permit of longitudinal movement therein, and when arranged at the center of the cavity it fits loosely therein to permit of the contraction of the feed-nut to withdraw its outer serrated surface from contact with the bore of the boiler tube, as more fully explained hereinafter. This contraction of the feed-nut to disengage it from the tube is automatically accomplished, when the wedge-block is moved to the center or enlarged portion of the cavity 42, by a contraction-spring 46 which lies in an annular groove 45 in the exterior surface of the feed-nut.

To expand the feed-nut to cause it to engage the walls of the boiler tube it is necessary to move the wedge-block longitudinally toward either the inner or the outer end of the cavity 42, such movement being accomplished by the rotation of the mandrel upon which, as above explained, the wedge block is threaded.

The contraction spring 46 is in the form of a divided ring.

In order to illustrate fully the operation of my improved combined-roller, self-feeding beader and expander I have shown in the drawings a boiler plate 47, provided with the usual perforations or openings 48, in one of which is fitted a boiler tube 49. In Figs. 1 and 2 the device embodying my invention is arranged in the operative position in said tube 49. In Fig. 1 the compensating-nut is shown closed or contracted, with the contraction-ring located at the outer ends of the spring-arms or in proximity to the said nut; and in Fig. 2 said compensating-nut is shown extended or disengaged from the compensating thread which is formed upon the body-portion or outer end of the mandrel.

The feed-nut 38 being contracted, as above described, sufficiently to fit loosely in the bore of the boiler tube, the tool, with the outer or compensating-nut open or extended, is inserted into the flue or tube until the beading-rolls come in contact with the end of the latter. Then, by giving the central mandrel three revolutions, the slidable, double-tapered wedge-block 43 is drawn outward to the end of the cavity 42 in the feed-nut thus expanding the latter and causing it to engage the interior surface of the tube. Then, turning the mandrel until the tube is partly expanded, (by the longitudinal movement between the expanding-rolls of the tapered or expanding portion of the mandrel) and sufficient friction secured between the expanding-rolls and surface of the mandrel to prevent the latter from slipping, the outer or compensating-nut is closed by pulling the sliding-ring 33 outward, thus engaging the head with the body-portion of the mandrel, as before described. With the parts arranged thus, the mandrel is rotated by means of the operating handle, which causes the mandrel to feed inward through the feed-nut and also causes a rotation as well as an inward, longitudinal movement of the head carrying the beading and expanding rolls.

The inward or longitudinal movement of the head is due to the rotary movement thereof, acting through the compensating nut and the compensating thread of the mandrel, and the rotary movement of the head is due to the friction contact between the tapered portion of the mandrel and the surfaces of the expanding-rolls.

As the average diameter of the expanding or tapered portion of the mandrel is about equal to that of each of the expanding-rolls, their respective revolutions will be about equal, viz: they will rotate at about the same speed; but, as the diameter of each of the expanding-rolls, in proportion to the diameter of the bore of the boiler tube, is about as one to three, it necessarily follows that the respective revolutions of the head and the mandrel will be, about, as one to three. Consequently, the mandrel will advance, longitudinally, at about three times the speed of the head, such difference in the rates of movement being compensated by the coaction of the compensating thread and nut by which the connection between the head and man-

drel is formed. Thus, in applying the screw as a means of connecting the head and mandrel the feed is regulated, and this, through the difference in the respective rates of rotation of the head and mandrel, and the rotary movement of the head is accomplished by the friction secured, as above described, between the tapered portion of the mandrel and the inner surfaces of the expanding-rolls.

To release the tool after the completion of the operation, rotate the mandrel in the opposite direction three revolutions, thereby repressing the wedge-block into the center or enlarged portion of the cavity in the feed-nut. If the friction contact between the rolls and the surface of the tube holds the tool from being withdrawn easily, continue said reverse rotations of the mandrel, thus forcing the wedge-block into the outer end of the cavity of the feed-nut, whereupon, two or three succeeding revolutions of the mandrel will force the head out of engagement with the tube, by releasing the pressure upon the expanding-rolls.

By extending the expanding-rolls outward between the beading-rolls, and beyond the outer end of the boiler tube upon which the operation is being performed, and by performing said operations simultaneously, as above described, it will be seen that all possibility of compressing the tube so as to obstruct its bore is avoided, the portion of the tube which passes through the boiler plate is expanded perfectly to fit the opening therein, and the bead is turned accurately against the outer surface of the plate.

The alternate disposition of the beading and expanding rolls enables them to operate in close proximity and simultaneously, and enables the expanding rolls to extend outward beyond the bearing surfaces of the beading rolls, as above mentioned.

The tapered ends of the expanding rolls are designed to admit of their being easily fed into the flue, without forming shoulders in the inner surface while expanding the same, and the peculiar construction of the beading-rolls is designed to cause them to compress the metal of the bead together and thus prevent cracking and parting of the fibers at the outer edge. The formation of said beading-rolls with similar outer and inner ends is designed to avoid auxiliary adjustments.

It will be understood that the beading rolls may be used independently of the expanding mechanism, where necessary or desirable, by turning the head by means of a wrench engaged with the angular portion 15, the feed-nut being arranged in the tube and locked in contact with the surface thereof in the manner above described, to prevent longitudinal movement of the mandrel. In this operation the head is turned upon the mandrel and is fed forward by the compensating thread and nut. Furthermore, the expanding rolls may be used independently of the beading-rolls by leaving the compensating nut open and operating as first above described, by rotating the mandrel. The inward movement of the mandrel will spread the expanding-rolls by the action upon the latter of the tapered portion of the mandrel, and the expanding-rolls and the head will be rotated, as above, by the contact with said rolls of the surface of the rotating mandrel.

It should be noted in connection with the above described operation in which the beading-rolls alone are employed, and in which the head receives its rotary movement by the direct application thereto of a wrench, as explained, that whether the mandrel remain stationary and the head turn thereon, or the mandrel turn with the head, the operation will be the same, owing to the fact that the threads at both inner and outer ends of the mandrel are of the same pitch, being, preferably, about twelve to the inch.

In addition to the above-mentioned advantages derived from the alternate disposition of the beading and expanding rolls, experience has taught me that by the use of three rolls of each kind, instead of two or four, the best possible bearing and support for the tool, and great effectiveness in the work accomplished, are obtained.

Where the expansion of tubes is necessary, as in the flue holes of boiler heads, such expansion should occur simultaneously with the operation of beading, and should be continued until the operation of beading is completed, in order to insure the thorough expansion and perfect attachment of the tube to the head. When said operations are performed separately the unsatisfactory connection of the parts is common if not unavoidable.

A further advantage of my invention resides in the slow and steady forward or inward movement of the head, and at the same time the great power which I am thus enabled to apply thereto through the agency of the means employed. As above described the head advances at one third the speed of the mandrel, and therefore if the pitch of the thread upon the mandrel is as above described, twelve to the inch, the head will advance at the rate of one-twelfth of an inch in three revolutions, or one thirty-sixth of an inch in one revolution. Obviously the threads may be made with any desired pitch, to produce the desired relative speed of advancement in the head and mandrel.

By the use of the above-described reversible combination expansion nut for holding the tool in place and assisting in its disengagement, I am enabled to employ the long parallel expanding rolls as explained, thereby providing large bearing surfaces which will not crush or chafe the mandrel and which are not liable, themselves, to be so injured.

Changes in the form, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of my invention.

In Fig. 10, which shows a slightly modified manner of mounting the expanding rolls, a disk 50 is arranged in contact with the rear ends of said rolls, and a coiled spring 51 is arranged to bear against the rear side of said disk, whereby the rolls are normally held pressed inwardly or forwardly in their recesses and at the same time are capable of repression under severe strain.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a device of the class described, the combination of a head, beading and expanding rolls carried by the head, a mandrel in operative relation with the expanding rolls, and means for rotating the head and mandrel and simultaneously advancing the same at different rates of speed, substantially as specified.

2. In a device of the class described, the combination with a rotatable head carrying beading rolls and having interposed cavities, of expanding rolls arranged loosely in said cavities and provided with tapered front ends, a mandrel extending through an axial bore in the said head and provided with a tapered portion in contact with the inner sides of said rolls, and means to simultaneously rotate and advance the mandrel and head at different rates of speed, substantially as specified.

3. In a device of the class described, the combination of a head provided with a central bore and communicating lateral recesses, expanding rolls loosely mounted in said recesses, a mandrel extending axially through the bore of the head and provided with a tapered portion in contact with said rolls, and means for rotating and feeding the mandrel simultaneously in the same direction at different rates of speed, substantially as specified.

4. In a device of the class described, the combination with a head, beading-rolls mounted thereon and expanding rolls carried thereby, of a mandrel extending axially through said head and having a tapered portion in contact with said expanding-rolls, and means for rotating the head and mandrel and simultaneously feeding the same forward in the same direction at different rates of speed, substantially as specified.

5. In a device of the class described, the combination with a rotatable head provided with an axial bore, and a mandrel arranged in said bore and provided with a tapered portion, and means for feeding said mandrel and head simultaneously in the same direction at different rates of speed, of three beading-rolls arranged at regular intervals around the circumference of the head, and a corresponding number of expanding-rolls arranged opposite the intervals between the beading-rolls and extending outward beyond the bearing surfaces of the beading-rolls or slightly between the same, substantially as specified.

6. In a device of the class described, the combination with a rotatable head, a mandrel fitting in an axial bore of said head, and means for feeding the mandrel and head simultaneously at different rates of speed, of a plurality of beading-rolls, a corresponding number of expanding rolls arranged opposite the intervals between the beading-rolls, and arranged at their outer ends between the beading-rolls, and means for communicating motion from the mandrel to the expanding rolls, substantially as specified.

7. In a device of the class described, the combination with a mandrel, beading-rolls and means to operate the same, of a sectional expansion feed-nut provided with a central smooth bore to receive said mandrel, and a tapered wedge-block fitting slidably in a cavity in said feed-nut and provided with a threaded bore engaging a threaded portion of the mandrel, subtantially as specified.

8. In a device of the class described, the combination with a head, a mandrel, and means to operate the same, of a sectional feed-nut provided with a contraction spring and having a cavity tapered toward its terminals, and a tapered wedge-block fitting slidably in said cavity and provided with a threaded bore to engage said mandrel, substantially as specified.

9. In a device of the class described, the combination with a mandrel, of a reversible expansion nut comprising separable spring-contracted sections and having an oppositely tapered cavity, and a wedge-block connected to said mandrel and fitting slidably in said cavity, substantially as specified.

10. In a device of the class described, the combination with a mandrel, of a reversible expansion nut comprising separable sections provided with exterior oppositely inclined serrations and an interior oppositely tapered cavity, and a wedge-block connected to said mandrel and fitting in said cavity, substantially as specified.

11. In a device of the class described, the combination with a head carrying beading and expanding rolls, a mandrel extending axially therethrough and provided with a compensating thread and a tapered portion to engage the expanding rolls, and a feed-nut connected to the mandrel, of a sectional compensating nut connected to the head and adapted to engage said compensating thread, and means to operate said nut to cause engagement and disengagement thereof, substantially as specified.

12. In a device of the class described, the combination with a threaded mandrel, of a head loosely fitted thereupon, a sectional nut connected to the head to engage the outer threaded portion of the mandrel, and a feeding device connected to the mandrel, substantially as specified.

13. In a device of the class described, the combination with a threaded mandrel, a head rotatably fitted thereupon, and feeding devices connected to said mandrel, of a sec-

tional nut provided with spring expansion arms attached to the said head, and a contracting-ring slidably fitted upon said arms, substantially as specified.

14. In a device of the class described, the combination with a threaded mandrel provided with a tapered portion, a feed nut connected to the inner end of said mandrel and a head rotatably mounted upon the mandrel and provided with a nut which is threaded upon the outer end of the mandrel, of expanding-rolls loosely mounted in said head with their inner sides in contact with the tapered portion of the mandrel and their outer sides projecting beyond the surface of the head, the diameter of each of said expanding rolls being equal to the average diameter of the tapered portion of the mandrel, substantially as specified.

15. In a device of the class described, the combination with a mandrel provided with a threaded outer end, a reduced threaded inner end, and an intermediate tapered portion, the pitch of the threads at opposite ends of the mandrel being the same, a head rotatably fitted upon the mandrel and provided with a nut threaded upon the outer threaded portion of the mandrel, expanding-rolls loosely mounted in the head in contact with the tapered portion of the mandrel, and a feed-nut engaged with the inner threaded portion of the mandrel, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

DANIEL JAMES McCORMACK.

Witnesses:
E. HARDY,
FRANK M. BYXBEE.