UNITED STATES PATENT OFFICE.

WILLIAM MILTON BROWN, OF JOHNSTOWN, PENNSYLVANIA.

METHOD OF AND APPARATUS FOR MAKING FERRULES.


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To all whom it may concern:

Be it known that I, WILLIAM MILTON BROWN, a citizen of the United States, and resident of Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Methods of and Apparatus for Making Ferrules, of which the following is a specification.

My invention relates to the manufacture of ferrules and similar annuli from thin, flat metal strips or blanks.

One object of this invention is to provide a novel method of making ferrules having a longitudinal seam with the contiguous surfaces of the seam in close contact.

Another object of the invention is to provide an improved method employing a series of successive cold bending steps whereby the thin, flat blanks are easily and quickly bent, in a progressive manner to form ferrules which are cylindrical in cross section, without the aid of a mandrel or internal support.

A further object of the invention is the provision of novel means whereby the successive cold bending steps are effected in producing cylindrical ferrules from flat and thin metal blanks without the use of an internal support or mandrel.

A still further object of my invention is the provision of bending dies having the novel construction, combination, and arrangement of parts, shown in the drawings and to be described in detail hereinafter, and particularly pointed out in the appended claims.

Referring now to the drawings, forming part of this specification, Figure 1 is a sectional end elevation of a flat metal strip or blank as cut to width preparatory to making a ferrule in accordance with my invention.

Fig. 2 is a sectional end elevation showing the blank of Fig. 1, with one edge thereof as bent or shaped at the completion of the first step of the series of bending operations forming part of my invention.

Fig. 3 is a sectional elevation of the blank showing the blank at the completion of the second bending step of the method forming part of this invention.

Fig. 4 is a sectional end elevation showing the blanks at the completion of the third bending step of my improved method.

Fig. 5 is a sectional end elevation of the completed ferrule at the end of the next or final bending step of the method forming part of this invention.

Fig. 6 is a perspective view showing a completed ferrule as made in accordance with my invention.

Fig. 7 is a sectional elevation showing one arrangement of bending dies constructed and arranged in accordance with my invention, with the dies in closed position, as at the end of the first and second of the series of forming steps.

Fig. 8 is a sectional elevation, similar to Fig. 7, showing the dies in open position, with the partly formed blank as positioned thereof in readiness for the third step of the ferrule forming operation.

Fig. 9 is a sectional elevation showing the dies in closed position with the partly formed blank between the dies at the completion of the third forming operation.

Fig. 10 is a sectional plan similar to Figs. 8 and 9, showing the dies in open position at the commencement of the fourth forming operation.

Fig. 11 is a sectional elevation showing the dies in closed position with the completed ferrule positioned between the dies as at the end of the fourth and final forming operation.

In the accompanying drawings, the numeral 2 designates the stationary bottom die block, and 3 the vertically movable, reciprocatory top die block of a bending machine or press, a steam hammer, or similar apparatus, having opposed die faces. As will be seen by reference to Figs. 7 to 11, the opposed die blocks are provided with registering cavities and projections on the opposite working faces thereof embodying my invention.

The working face of the bottom die 2 is provided with a depression 4 having an open side and an opposite side surface forming a shoulder or jog 5. The depression 4 extends across the face of the die 2 from one side surface to the other and its bottom 6 is curved transversely so as to bend the blank for a short distance inward from one longitudinal edge when the blank A is positioned in the depression, and the top die 3 is moved into its closed position (that as shown in Fig. 3). The face of the top die 3 opposite the depression 4 is pro...
vided with a transversely curved projection 7, so that when the blank A is inserted in the depression 4 and is aligned therein by engagement with the jog 5, the blank of Fig. 1 will be curved to the contour shown in Fig. 2. The blank A after one edge has been bent in this manner, is turned end for end and thereby reversed and the opposite edge is placed in the depression 4, with the unbent edge thereof in engagement with the jog or shoulder 5 so as to again align the blank. The top die 3 is then moved downwardly into the position shown in Fig. 7 and the blank is thereby bent or formed to the contour or cross-section shown in Fig. 3.

The bottom die 2 is also provided with a depression 8 in its upper face having an open side and having a side surface forming a shoulder or jog 9 as is clearly shown in Figs. 7 and 8. The depression has a transverse recess 10 between its ends, this recess having a semi-circular bottom 11 which connects two vertical side walls 12, 12 that tangent with the semi-circular bottom. The vertical side walls 12, 12 are located at the right distance from the shoulder or jog 9 of the depression so that the blank A when a bent edge thereof is put against the shoulder 9 will be centered on the bottom die in readiness for the next bending step of my improved method. The top die 3 has a downwardly extending projection 13, which registers with the recess 10 in the upper opposite face of the bottom die 2, this projection having a rounded bottom 14 which is concentric with the semi-circular bottom of the recess in the bottom die when the top die is in closed position. The side walls 15, 15 of the projection are not parallel but converge upwardly toward the body of the top die, to provide the necessary clearance for the bent ends of the partly formed blanks, a purpose which will be made clear by reference to Fig. 9. The thickness of the upwardly converging projection is made such as will spring the bent edges of the partly formed blank outwardly when the top die is moved into closed position as shown in Fig. 9, so that when the blank is removed from between the dies at the completion of this step of the forming operation, the edges of the blank will spring back and have the contour shown in Fig. 4.

The bottom die 2 is also provided with a semi-circular recess 16 which extends across the working face from one side to the other of the die, and the top die 3 is provided with a similar semi-circular recess 17 which registers with the recess 16 of the bottom die, as is clearly shown in the drawings. The semi-circular recesses 16 and 17 are arranged to form a true circle when the top die 3 is moved downwardly to bring the dies into closed position, or that shown in Fig. 11. While readily understood from the preceding description, the method of forming the blank A, forming part of this invention will now be described.

Thin, flat metal strips of the desired thickness will be cut to the proper width and length, the so-formed blanks being rectangular in cross section, as shown in Fig. 1. A blank A which has been made in this manner is then placed in the depression 4 in the upper face of the bottom die 2 with one edge in engagement with the shoulder or jog 5 at the closed side of this depression. The top die 3 is then caused to descend and engage with the portion of the blank immediately above the depression, the transversely curved projection 7 on the working face of the top die 3 forcing the edge of the plate into the depression and bending this edge of the plate until the blank is formed to the cross section of Fig. 2.

The blank is then reversed and this operation is repeated on the other edge of the blank, a blank having the cross section of Fig. 3 resulting from the action of the dies in this second forming step.

The blank of Fig. 3 is then positioned in the depression 8 on the top face of the bottom die with one bent edge thereof in engagement with the shoulder or jog 9 on the bottom die, this operation aligning the blank with respect to the recess 10 in the working face of the bottom die. The top die 3 is then caused to descend and moving downwardly the projection 13 on the top die engages with the blank and forces it into the recess 10 in the upper face of the bottom die and bends the blank to the contour shown in Fig. 9. The portions of the blank extending above the upper face of the depression 8 in the bottom die having been bent in the preliminary forming operation, and not being confined by the side walls of the recess 10 in the bottom die, will spring outwardly and being restrained will not be given a permanent set. This results in the edges of the blank springing inwardly and the blank assuming the contour shown in Fig. 4 when removed from the recess 10 after the completion of this bending step or operation.

The blank is then positioned within the semi-circular recess 16 in the upper face of the bottom die, preferably in the position shown in Fig. 10, with the open side of the upper formed blank located to engage with the surface of the semi-circular recess in the top die. The dies are then caused to approach and in approaching the blank of Fig. 4 is bent into the truly cylindrical form shown in Figs. 5 and 11, this operation completing the ferrule and forming a cylindrical ferrule like that shown in Fig. 7 with the edges or side surfaces of the seam in close contact.

In this way cylindrical or tubular fer...
rules and similar articles are easily and cheaply formed with a seam of sufficient tightness to resist leakage, experiments having shown that upon plugging one end of a ferrule made in accordance with my invention, and filling it with water no leakage will occur.

Ferrules made in accordance with my invention are adapted for many uses to which short pieces of seamless tubing are now being used, and form a cheap and effective substitute for the costly seamless tubing. The particular use to which ferrules made by my invention have been applied is as a substitute for ferrules made from seamless tubing heretofore used in coring holes in manganese steel castings, such as frogs and switches.

Many modifications in the apparatus applicable for use in carrying out the steps of the method forming part of this invention, may be made without departing from the invention as defined in the appended claims.

While the die cavities and projections, as shown in the integral die block and opposite, reciprocatory top die block, it will be obvious that a series of pairs of forming dies may be employed having opposed forming faces by which a single forming operation is performed in lieu of the dies shown.

I claim:—
1. In the manufacture of annular metal ferrules and the like, the successive steps which consist in first bending one longitudinal edge and then bending the opposite longitudinal edge of a flat metal blank transversely to partly shape the blank to the desired curvature, then bending the partly shaped blank transversely adjacent to its medial line to further shape the blank, and then further bending the blank to complete the shaping operation and forcing the bent longitudinal edges of the blank into close contact at the beginning of the last bending operation to thereby force the flat unbent portions of the blank outwardly and complete the shaping of the annular ferrule.

2. In the manufacture of annular metal ferrules and the like, the successive steps which consist in first bending one longitudinal edge and then bending the opposite longitudinal edge of a flat metal blank transversely to partly shape the blank to the desired curvature, then bending the partly shaped blank transversely adjacent to its medial line to further shape the blank, and then further bending the blank to complete the shaping operation and forcing the bent longitudinal edges of the blank into close contact at the beginning of this bending operation to thereby force the flat unbent portions of the blank outwardly and complete the shaping of the annular ferrule.

3. Apparatus for making ferrules comprising relatively reciprocating dies having opposite die faces, said die faces having face portions arranged to preliminarily bend the ferrule blanks adjacent to the longitudinal edges thereof, and having a recess in one and a projecting tongue on the other die coacting to form a U-shaped slot and arranged to further bend the blanks transversely adjacent to the longitudinal center of the blanks, a shoulder on the slot, a die adapted to center the partly formed blanks relative to the slot, and said die faces having other semi-circular face portions adapted to further bend the blanks and thereby complete the ferrules.

4. Apparatus for making ferrules comprising relatively reciprocating dies having opposite die faces, said die faces having face portions arranged to preliminarily bend the ferrule blanks adjacent to the longitudinal edges thereof, and having a recess in one and a projecting tongue on the other die coacting to form a U-shaped slot and arranged to further bend the blanks transversely adjacent to the longitudinal center of the blanks, said tongue being arranged to spring the edges of the blanks outwardly in bending the blanks, and said die faces having other semi-circular face portions adapted to further bend the blanks and thereby complete the ferrules.

In testimony whereof I have hereunto set my hand.

WILLIAM MILTON BROWN.