Nov. 10, 1931. W. E. RICHTER 1,831,033

APPARATUS FOR FORMING SHEET METAL

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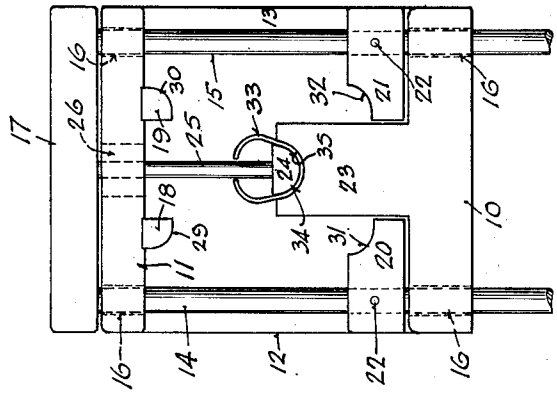


Fig. 3.

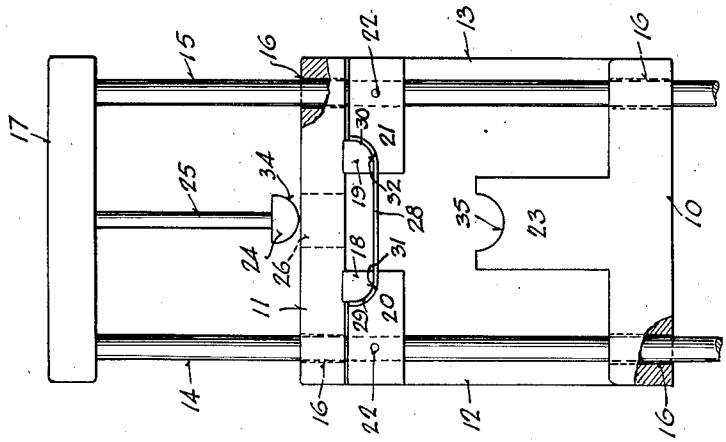


Fig. 2.

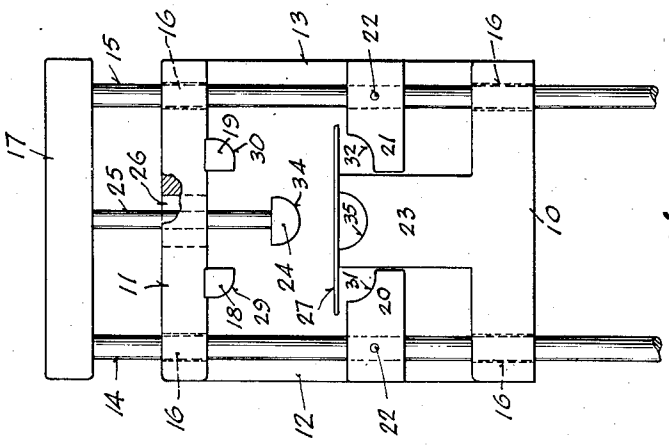


Fig. 1.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR FORMING SHEET METAL

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The invention relates to an apparatus more particularly adapted to the performance of certain preliminary shaping operations upon sheet metal which is to ultimately become welded tubing.

In the manufacture of a welded tube from a flat sheet metal strip, several different forming operations upon the strip are required. The first operation as customarily performed consists in shaping the strip to U-form, this usually being accomplished by subjecting the strip to the action of a set of U-ing tools, constituted by an ordinary stamping punch and die, in a suitable press. The next operation is a crimping one adapted to shape the U-form or grooved strip to approximately tubular formation, ready for further operations designed to produce a truly cylindrical structure having a welded joint. To the performance of the said crimping operation, the U-form or grooved strip is removed from the U-ing punch and die of the press mentioned, and is subjected to the action of a set of crimping tools, also constituted by an ordinary stamping punch and die, in a different press.

It is a purpose of my invention to provide an apparatus adapted to the performance of the U-ing and crimping operations designed to shape a flat sheet metal strip to approximately tubular formation, and heretofore performed in separate presses, wherein the said operations will be combined to be capable of accomplishment by utilization of ordinary stamping punches and dies set up and correlated in a single press.

The full description now to be made of the apparatus and the manner in which it operates, will disclose the improved features of said apparatus.

Figure 1 is an elevational view of an apparatus made in accordance with the invention, disclosing all of the stamping punches and dies in their at rest positions, and a flat sheet metal strip positioned in said apparatus to be acted upon.

Fig. 2 is a view similar to Fig. 1, but disclosing the U-ing punches and dies as having acted to shape the sheet metal strip to U-form, and the crimping punch elevated to be clear of the U-ing operation.

Fig. 3 is a view similar to Figs. 1 and 2, but disclosing the crimping punch and die as having acted to shape the U-form strip into an approximately tubular structure, and the U-ing dies depressed to be clear of the crimping operation.

A stationarily supported frame of the apparatus includes spaced apart, horizontal, lower and upper frame members, represented 10 and 11, tied together in any convenient manner by spaced apart, vertical side frame members, designated 12 and 13, and a movable frame of said apparatus is constituted by spaced apart frame rods, indicated 14 and 15, vertically slidable in the frame members 10 and 11, as at 16, and a horizontal frame member 17 extending between and suitably connected to the upper ends of said rods and situated above the stationary frame in vertical alignment with the frame members 10 and 11 thereof.

The stationary frame member 11 carries downwardly extending, spaced apart, fixed U-ing punches, denoted 18 and 19, which are secured to said frame member in any ordinary or preferred manner, and the rods 14 and 15 support spaced apart, movable U-ing dies, indicated 20 and 21, which are rigidly secured upon said rods, as at 22, between the frame members 10 and 11, to be in vertical alignment with, and complemental to, said fixed U-ing punches.

The stationary frame member 10 carries an upwardly extending, fixed crimping die 23, which is, as disclosed, integral with said frame member and between and in the same vertical plane as the U-ing dies 20 and 21, and the frame member 17 supports a movable crimping punch 24, which is attached to said member 17 by a relatively thin neck piece 25 to be in vertical alignment with, and complemental to, said fixed crimping die. An opening 26 through the stationary frame member 11 allows passage of the movable crimping punch 24 and its neck piece 25.

The complemental U-ing punches and dies, 18, 20, and 19, 21, are adapted to simultaneously operate upon the full width of the op-

posite end portions of a strip of sheet metal, such as indicated at 27 in Fig. 1, and curl said end portions upwardly to form them into part-circle configuration, to thus shape the blank to U-form, as indicated at 28 in Fig. 2. To this end, the spaced apart punches 18, 19 are provided with outwardly facing part-circle shaping faces 29, 30 which extend the full width of the strip, as clearly shown in Fig. 1. The dies 20 and 21 include cooperating concave shaping faces 31 and 32 complementary with the punches 18 and 19 and also extending the full width of said strip.

The complemental crimping punch 24 and crimping die 23 are adapted to operate upon the full width of a portion of the U-form blank at its midlength, to shape said blank to approximately tubular formation, as indicated at 33 in Fig. 3. To this end, the punch 24 includes a convex part-circle crimping face 34, midway between the faces 29 and 30 of the punches 18 and 19, which extends the full width of the blank and tangentially to the horizontal, and the die 23 includes a cooperating concave crimping face 35, also extending the full width of said blank, correspondingly configurated and disposed. The action of the complemental crimping faces 34 and 35 is to throw the end portions of the U-form blank to positions adjacent the thin neck piece 25, but with the edges of said blank sufficiently separated to permit the structure 33 of approximately tubular formation to be pulled lengthwise from about the punch 24.

A flat strip of sheet metal, such as the strip 27, to be shaped to approximately tubular formation, is inserted in the apparatus and situated in proper position to be acted upon by the U-ing tools. As disclosed in Fig. 1, the strip is resting upon the die 23 directly above the movable U-ing dies 20 and 21 and beneath the fixed U-ing punches 18 and 19. The movable frame is then elevated to cause said U-ing dies to lift the strip to said U-ing punches and cooperate with the punches, in the manner clearly disclosed in Fig. 2 and already set forth, to provide the U-form blank 28. The movable frame is then depressed to cause the U-ing dies to situate the U-form blank upon the fixed crimping die 23 in position to be acted upon by the movable crimping punch 24, and said movable frame is further depressed to cause said crimping punch to cooperate with said crimping die, in the manner clearly disclosed in Fig. 3 and already set forth, to provide the structure 33 of approximately tubular formation.

The movable frame can be operated in any manner which may be convenient. Preferably, it is hydraulically operated.

Having thus described the invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. A machine for shaping a flat sheet metal strip into an approximately tubular structure, comprising a pair of relatively movable frames, a U-ing punch upon one of said frames, a complementary cooperating U-ing die upon the other frame, said U-ing punch and die being disposed to crimp both edges of the metal sheet simultaneously, a crimping punch upon the same frame as the U-ing die, and a complementary cooperating crimping die upon the frame carrying the U-ing punch, said crimping die being disposed to receive the U-ed metal sheet from the U-ing die and to cooperate with the crimping punch to form the same into substantially tubular shape throughout its length.

2. A machine for shaping a flat sheet metal strip into an approximately tubular structure, comprising a pair of relatively movable frames, a crimping punch upon one of said frames, a complemental cooperating crimping die upon the other frame, spaced apart U-ing punches upon the frame having said crimping die arranged at each side of said crimping punch and opposite said crimping die, and complemental cooperating spaced apart U-ing dies upon the frame having said crimping punch arranged at each side of said crimping die and opposite said crimping punch, all of said punches and dies being in the same plane.

3. A machine for forming a tubular blank from a metal sheet which comprises two separate pairs of die members, means operating one pair of said die members to form the metal sheet into U-shape and to thereafter withdraw said die members therefrom, said means being operable to cause said second pair of die members to form the U-shaped blank into substantially tubular shape.

4. A machine for forming a tubular blank from a metal sheet which comprises a plurality of separate pairs of die members, and means for operating said pairs of die members successively to form the metal sheet in successive steps into a tubular blank, each pair of die members being adapted to be withdrawn from the sheet metal blank prior to the action of the next succeeding pair of die members thereon.

5. A machine for forming a tubular blank from a sheet metal strip, comprising two relatively movable frame members and two separate pairs of die members carried by said frame members for successive operation on the sheet metal strip by reversal in movement of said frame members relative to each other.

6. In a machine for performing die pressing operations to make tubular blanks, in combination, two pairs of complementary dies disposed for relative reciprocatory movement to perform die pressing operations, the complementary dies being disposed to perform successive die pressing operations as they reciprocate in opposite directions.

7. In a machine for performing die pressing operations to make tubular blanks, in combination, two pairs of complementary dies disposed for relative reciprocatory movement to perform die pressing operations, the dies of one pair being disposed to deliver the blank to the dies of the other pair as the dies reciprocate, to provide for the performing of successive die pressing operations upon the blank.

8. In a machine for performing die pressing operations to make tubular blanks, in combination, two pairs of complementary dies disposed for relative reciprocatory movement to perform die pressing operations, the dies of one pair being disposed to operate inside the dies of the other pair to provide for performing successive die pressing operations as the dies reciprocate in opposite directions and to deliver the blank from one pair to the other pair of dies.

9. In a machine for performing die pressing operations to make tubular blanks, in combination, two pairs of complementary dies disposed for relative reciprocatory movement to perform die pressing operations, the complementary dies of one pair being disposed to be actuated into cooperative relation to perform a die pressing operation while the complementary dies of the other pair are separated to provide for delivering the blank from one set of dies to the other and performing successive die pressing operations.

10. In a machine for performing die pressing operations to make tubular blanks, in combination, two pairs of complementary die members, and means for effecting relative reciprocating movement of the complementary dies, the die members being so disposed that as the die members of one pair are actuated into pressing relation the die members of the other pair are separated, a transfer of the blank being operated upon from one die member to another being effected by the dies as they move relative to one another.

11. In a machine for performing die pressing operations to make tubular blanks, in combination, two pairs of complementary die members, and means disposed to be given a reciprocating motion for actuating the die members relative to one another, the dies being disposed on the actuating means in such relative positions that as one pair of cooperating dies moves toward pressing relation the other pair is separated, the blank being transferred from one die member to another as a result of the reciprocating movement, thereby to perform two pressing operations and complete a blank for each complete reciprocating movement of the actuating means.

12. In a machine for performing die pressing operations to make tubular blanks, in combination, two pairs of complementary die members, a frame carrying one die member of each pair, means disposed for reciprocating movement carrying the other die members, the die members being so disposed that one pair of die members cooperate to perform a die pressing operation when the actuating means is moved in one direction and the other pair of die members function to perform a die pressing operation when the actuating means is moved in the opposite direction, thereby to perform two die pressing operations for each complete reciprocating movement of the actuating means.

13. In a machine for performing die pressing operations on sheet material, in combination, two pairs of complementary die members, a frame supporting one die member of each pair, means disposed for reciprocating movement carrying the other die members, the pairs of die members being disposed to perform die pressing operations as the reciprocating means is actuated in opposite directions, and to transfer the sheet material from one die member to another as one pair of die members is being separated and another pair actuated into pressing relation thereby to perform successive die pressing operations as the means for actuating the die members is moved in opposite directions.

In testimony whereof I have signed my name at Milwaukee, Wisconsin, this 24th day of November, 1928.

WALTER E. RICHTER.