

Jan. 14, 1941.

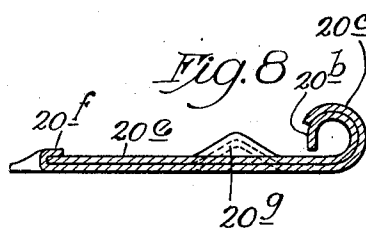
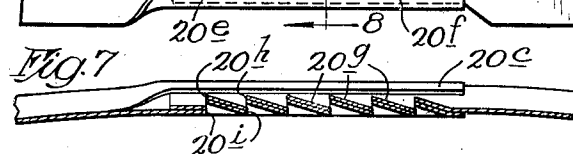
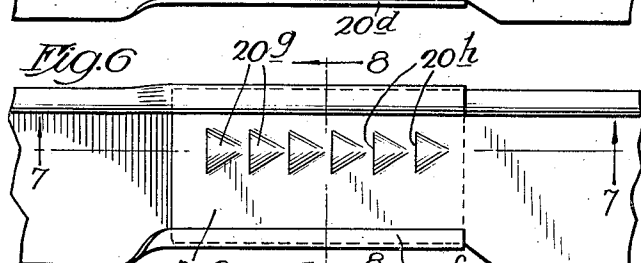
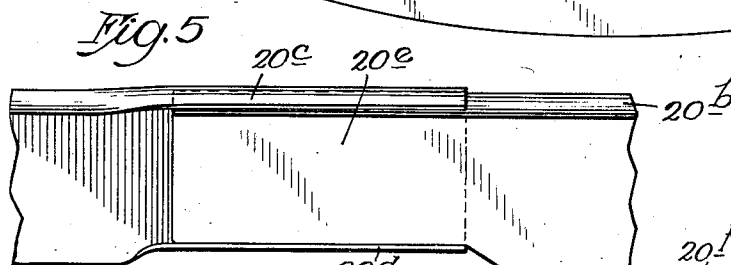
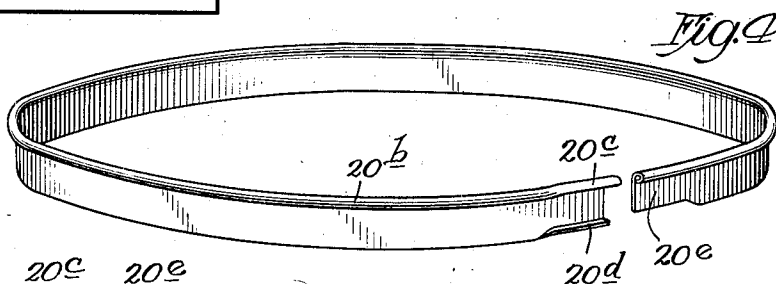
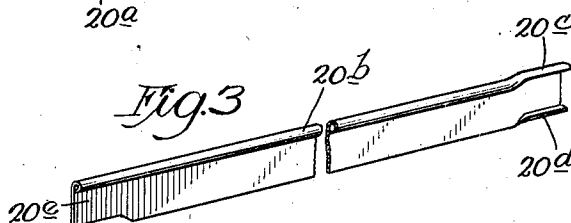
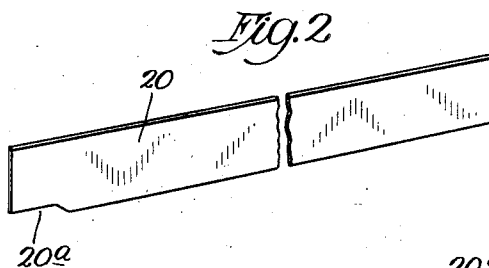
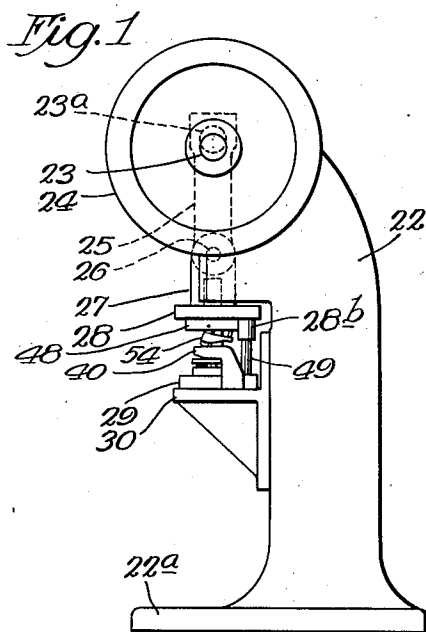
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2,228,494

HOOP FORMING APPARATUS

Filed July 17, 1937

4 Sheets-Sheet 1



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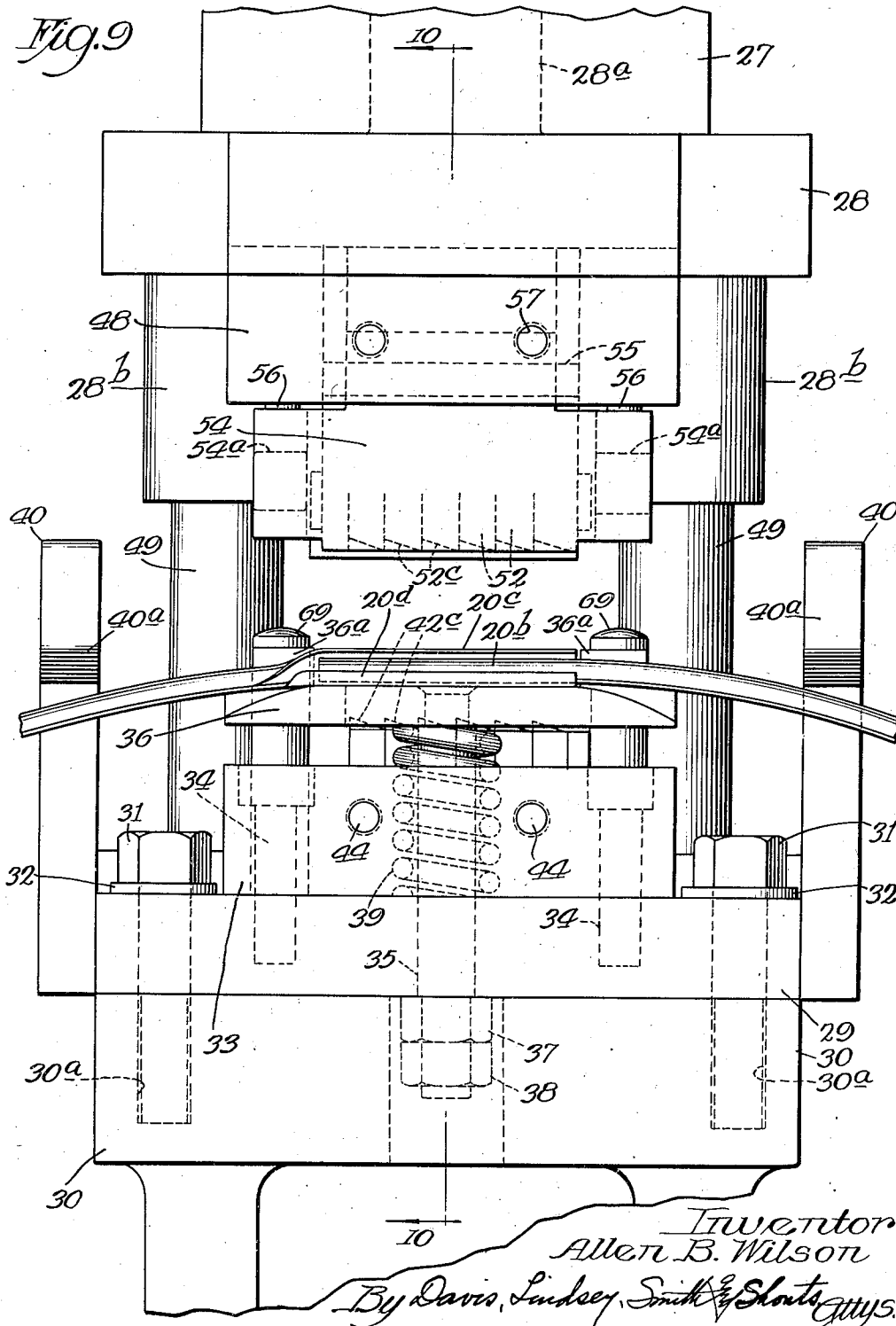
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HOOP FORMING APPARATUS

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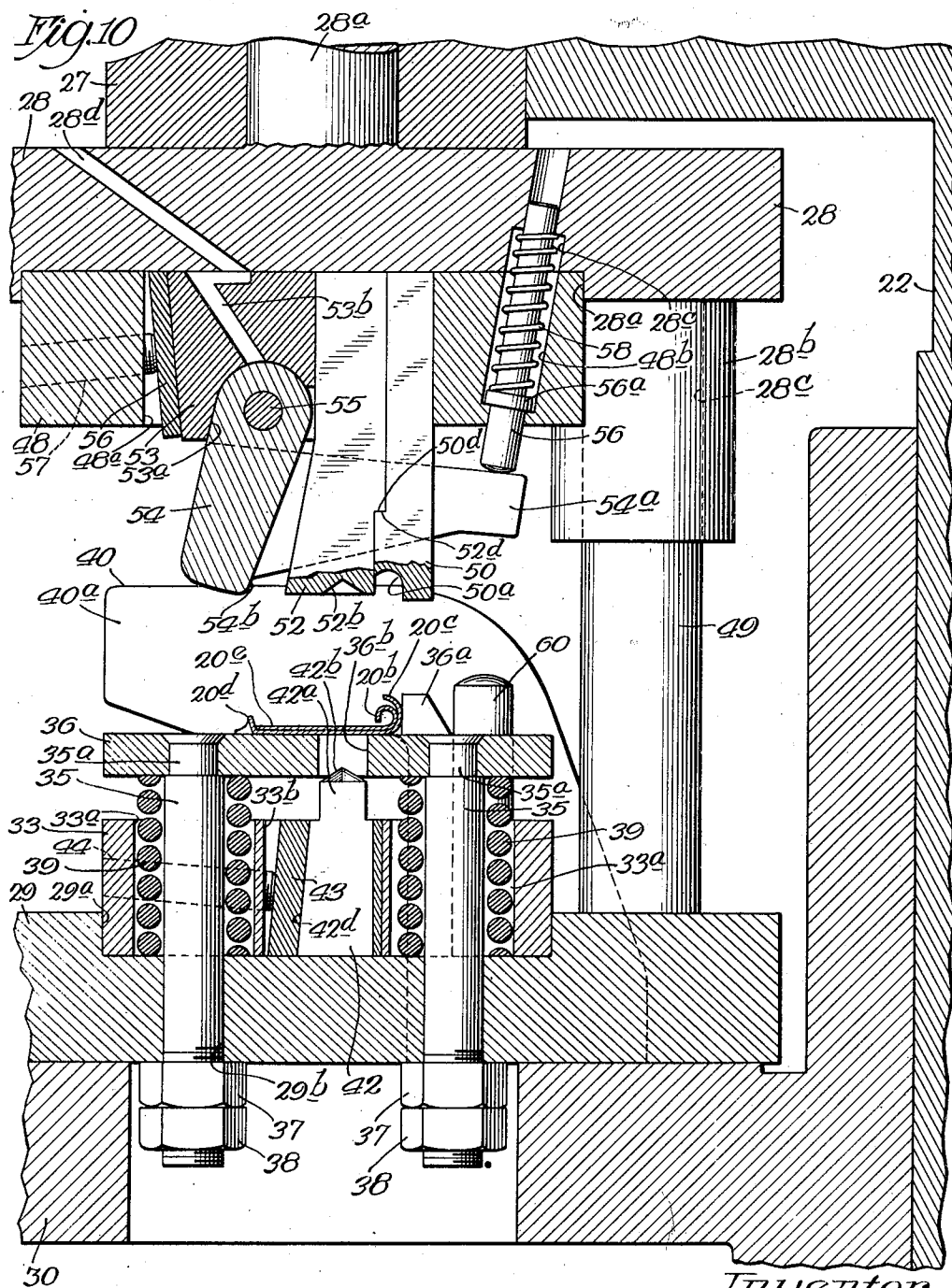
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HOOP FORMING APPARATUS

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4 Sheets-Sheet 3



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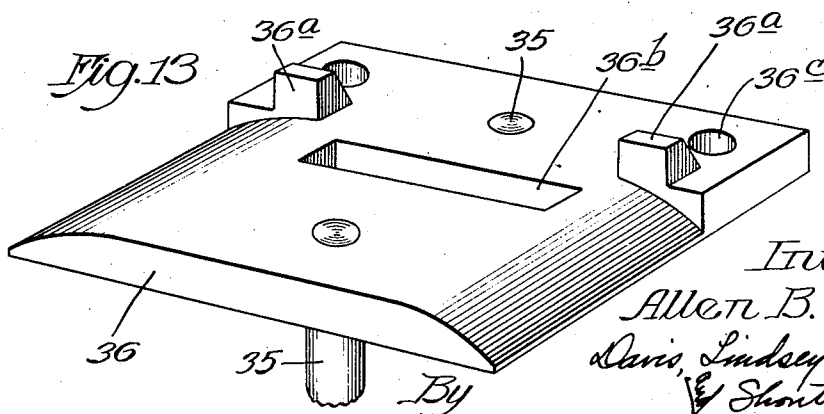
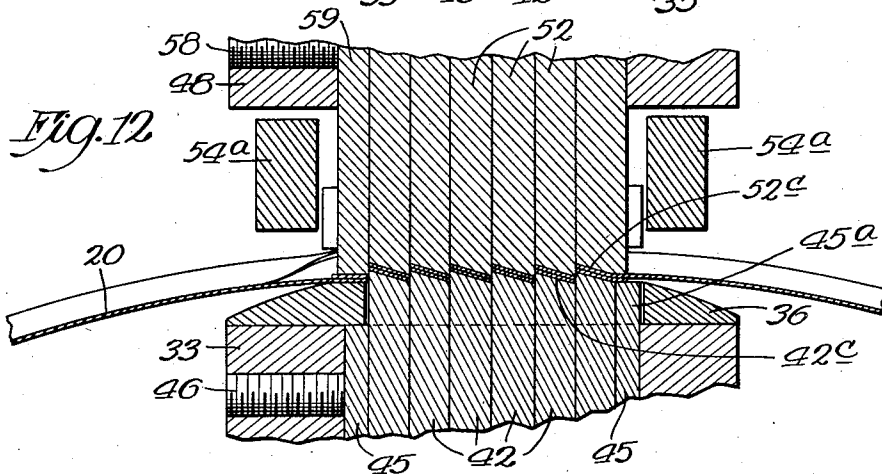
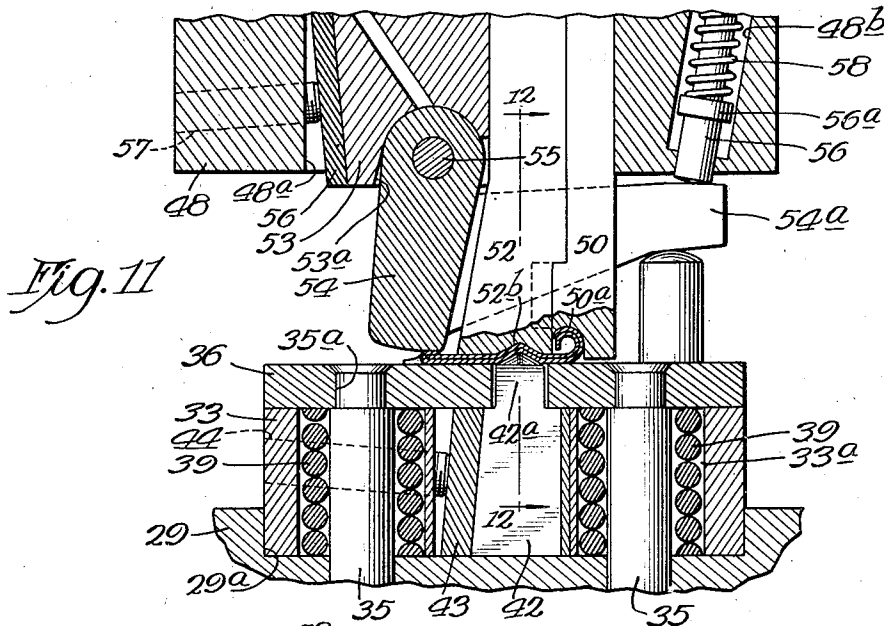
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HOOP FORMING APPARATUS

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,228,494

HOOP FORMING APPARATUS

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Application July 17, 1937, Serial No. 154,143

7 Claims. (Cl. 113—1)

This invention relates to improvements in hoop forming apparatus and its purpose is to provide improved means for forming metal hoops adapted to be applied to barrels and the like, such as the metal hoop which is described and claimed in my copending application Serial No. 91,133, filed July 17, 1936.

In that application there is disclosed a form of metal hoop adapted for application to butter tubs, barrels, or the like, wherein the overlapping ends of a metal band are secured together, without the use of rivets, by forming a bead along one edge of the band throughout its length, enlarging this bead at one end of the band and forming a transversely projecting flange at the edge of the band opposite the enlarged portion of the bead, cutting away a portion of the other end of the band opposite the bead to form a tongue of lesser width than the band, then overlapping the two ends of the band with the bead on the tongue extending within the enlarged portion of the bead at the other end of the band, then bending the flange upwardly over the tongue, and finally punching the overlapping portions of the ends of the band to provide an interlocking joint. By this method, there is provided a metal hoop which is relatively strong and inexpensive and which may be manufactured without the use of rivets and other similar fastening means.

The principal object of the present invention is to provide improved apparatus for forming a metal hoop of the type referred to, comprising means for operating upon the ends of the metal band, after the bead has been formed thereon, to bend the metal parts into final position with respect to each other and to punch the overlapping ends of the band to provide the interlocking joint. Another object of the invention is to provide improved apparatus capable of being operated by a punch press for closing the enlarged portion of the bead upon the beaded portion of the tongue which is enclosed therein, for bending the flange about the edge of the tongue opposite the bead and for providing a series of intermeshing punched projections in the overlapping ends of the band which prevent relative endwise separation thereof. Still another object of the invention is to provide bending and punching apparatus adapted to operate upon the overlapping ends of a metal band to perform the abovementioned operations in a predetermined sequence. Other objects relate to various features of construction and arrange-

ment of the apparatus which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which one form of the improved apparatus is illustrated in connection with the formation of one form of metal hoop. In the drawings—

Figure 1 shows a somewhat simplified side elevation of a form of die punch which has embodied therein the improved apparatus of the present invention;

Fig. 2 is a perspective view of a strip of sheet metal which is employed in forming the metal hoop to be operated upon by the apparatus illustrated in Fig. 1;

Fig. 3 is a perspective view of the metal strip illustrated in Fig. 2 after it has been operated upon to provide a bead along one edge thereof with an enlargement of the bead at one end of the strip and a transversely projecting flange at the edge of the strip opposite the enlarged portion of the bead;

Fig. 4 is a perspective view of the metal strip or band illustrated in Fig. 3 after it has been bent into circular form preliminary to overlapping the ends thereof;

Fig. 5 shows an enlarged side elevation of the band after the ends thereof have been overlapped with the bead at one end telescoping within the enlarged portion of the bead at the other end of the band;

Fig. 6 shows a side elevation of the overlapping ends of the band after they have been operated upon by the apparatus of the present invention to close the enlarged portion of the bead about that part of the bead which is telescoped therein, after the transverse flange has been bent upwardly about the edge of the tongue which is opposite the bead, and after the interlocking projections have been formed in the overlapping ends;

Fig. 7 is a longitudinal sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 shows a vertical sectional view taken on the line 8—8 of Fig. 6;

Fig. 9 shows an enlarged front elevation of the bending and punching apparatus of the present invention which is embodied in the punch press shown in Fig. 1, illustrating thereon the metal hoop illustrated in Figs. 4 and 5 before the hoop has been operated upon by the bending and punching apparatus;

Fig. 10 shows a vertical section taken on the line 10—10 of Fig. 9;

Fig. 11 is a partial sectional view similar to that of Fig. 10 showing the relative positions of the parts after they have been actuated to close the enlarged portion of the bead about the beaded portion which is telescoped therein, to bend the flange about the edge of the tongue opposite the bead and to form interlocking punched projections in the overlapping ends of the band;

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 11; and

Fig. 13 is a perspective view of the die plate which is embodied in the apparatus shown in Figs. 9, 10, 11, and 12.

In Figs. 2 to 8, inclusive, of the drawings, there is illustrated a form of metal hoop which may be produced by the use of the present invention. This hoop is adapted to be formed from an elongated strip 20 of sheet steel or the like, having parallel longitudinal edges, which is initially cut to the desired length and which has an edge portion cut away at one end thereof as shown at 20^a. This elongated strip is then provided along the edge thereof opposite the part 20^a with a bead 20^b which extends throughout the length of the strip but is enlarged or partially opened at the end of the strip opposite the part 20^a, as shown at 20^c. The lower edge of the strip, opposite the portion 20^c, is then bent to form an outwardly extending flange 20^d. The space between this flange and the enlarged bead portion 20^c is such that these two parts receive between them the tongue 20^e which is formed at the opposite end of the strip by cutting away the part 20^a. Having formed the strip in the form illustrated in Fig. 3, it is bent, by rolls or the like, into the circular form shown in Fig. 4. In this condition, the tongue 20^e is adapted to overlap the opposite end of the band with the bead 20^b on the tongue telescoping within the enlarged portion 20^c of the bead on the opposite end of the band and with the lower edge of the tongue 20^e positioned immediately above the outwardly extending flange 20^d. This condition of the parts, after the ends have been overlapped, is shown in Fig. 5. After the ends have thus been overlapped, the outer portion of the flange 20^d is bent upwardly, as shown at 20^f, to enclose the lower edge of the tongue 20^e and the enlarged portion 20^c of the bead is contracted into close engagement with the portion of the bead 20^b which is telescoped therein. The two overlapping parts are then held against relative transverse movement and, in order to prevent relative endwise movement thereof, the overlapping end portions of the strip are operated upon by punches and dies to form a longitudinal series of punched projections 20^g. In forming these projections, the metal is sheared transversely so that the projections have edges 20^h which overlap and abut against the shoulders 20ⁱ which lie in the plane of the metal, so that the two ends of the strip or band are held firmly against relative endwise movement tending to separate these ends. Having formed the projections 20^g, the hoop is completed and is in readiness for application to a barrel, butter tub, or the like, except that it is usually necessary to expand the unbeaded edge of the hoop to impart to the hoop a flare corresponding to that of the barrel. In some instances this flare may be created by the act of driving the hoop onto the tapered wall of the barrel.

The apparatus of the present invention is illustrated in Fig. 1 as being embodied in a punch

press comprising an upwardly extending standard 22 having a base portion 22^a adapted to rest upon a floor or other support. This punch press is provided with a driving motor or other suitable driving mechanism for actuating a shaft 23 having mounted thereon a flywheel 24 and provided with an eccentric portion 23^a which imparts a reciprocating motion to a connecting rod 25 during the rotation of the shaft. The connecting rod 25 is pivotally connected at 26 to a reciprocating ram 27 which is slidably mounted in the upper part of the standard 22. This ram has secured to the lower end thereof a die block 28 having a stem 28^a which enters an aperture in the ram, as shown in Fig. 10. This die block 28 is adapted to reciprocate vertically with respect to a stationary punch block or shoe 29 which is carried by a bed plate or bracket 30 secured on the face of the standard 22 and adapted to be adjusted to any desired stationary position thereon. The die block 28 and the punch block 29 are adapted to carry parts which operate upon the metal of the band or strip 20 to change this band from the condition shown in Fig. 5 to that shown in Figs. 6, 7, and 8.

The punch block or shoe 29 is detachably secured to the bed 30 by means of cap screws 31 which pass through apertures in the block and enter threaded holes 30^a in the bed, washers 32 being mounted beneath the heads of these cap screws, as shown in Fig. 8. The punch block 29 is provided on its upper side with a recess 29^a adapted to be closely fitted by a punch holder 33 which is secured to the punch block 29 by screws 34. This punch holder is provided with a pair of circular apertures 33^a which are loosely engaged by pins 35 carrying at their upper ends the spring pad or shoe 36 upon which the overlapping ends of the strip or band 20 are adapted to be seated, as shown in Figs. 9 and 10. The upper ends of the pins 35 are reduced in diameter as shown at 35^a and these reduced portions are riveted in apertures formed in the spring pad 36 so that a rigid connection is established between these parts. The pins 35 slidably engage apertures 29^b which are formed in the punch block 29 and their lower ends are threaded for engagement with nuts 37 and lock nuts 38. Coil springs 39 are mounted around the pins 35 within the apertures 33^a which are formed in the punch holder, the lower ends of these springs seating on the bottom of the recess 29^a in the punch block and the upper ends of the springs engaging the under side of the spring pad 36 so that the springs tend to force the spring pad upwardly to a limiting position which is determined by the location of the nuts 37 and 38 on the lower threaded ends of the pins 35. The spring pad 36 is provided with a pair of upwardly extending lugs 36^a which have vertical shoulders against which the enlarged bead portion 20^c of the strip is adapted to seat when the overlapping ends of the band are placed on the spring pad as shown in Fig. 10. In this way, the overlapping ends of the band are accurately positioned for engagement with the punches and the dies which are brought into engagement therewith by the relative movement of the blocks 28 and 29. In order to prevent the fingers of the operator from being injured by the punches and the dies carried by these blocks, the punch block 29 is provided with a pair of upwardly and forwardly extending arms 40, having the form shown in Figs. 9 and 10, which have parts 40^a extending over the strip or band 20, as shown in Fig. 9, at opposite sides of the pad 36.

The punch holder 33 is provided between the apertures 33^a occupied by the springs 39 with another aperture 33^b which forms a recess for receiving a series of punches 42 which rest at their lower ends on the bottom of the recess 29^a formed in the punch block. These punches are provided at their upper ends with projections 42^a having V-shaped extremities 42^b which are inclined transversely of the punch block, as shown at 42^c, in Figs. 9 and 10, so that they form a series of teeth adapted to penetrate the overlapping ends of the metal band when the projecting portions 42^a of these punches are brought into engagement with the overlapping band ends by the downward movement of the spring pad 36 and the consequent relative movement of the punch projections 42^a through the slot 36^b which is formed in the spring pad. The punches 42 are provided with inclined lateral edges 42^d aligned with each other and adapted to be engaged by a shim or filler plate 43. This shim 43 is in turn engaged on its opposite sides by a pair of set screws 44 which are threaded into apertures formed in the punch holder 33 and which may be adjusted for the purpose of clamping the punches 42 rigidly in position in the aperture 33^d of the punch holder. The endmost of the series of punches 42 are engaged on their flat faces within the recess 33^b by other filler plates or shims 45, shown in Fig. 12, and another set screw 46, threaded into an aperture in the punch holder 33, engages one of these shims 45 for the purpose of clamping the punches in a direction at right angles to the direction in which they are clamped by the set screws 44. One of the shims 45 has a part 45^a adapted to extend upwardly into the slot 36^b in the spring pad, when the spring pad is depressed, as shown in Fig. 12, thus supporting the edge of the lower end of the strip or band 20 adjacent to the contacting punch 42. At the other end of the series of punches, the shim 45 terminates flush with the upper surface of the punch holder 33. By this arrangement, the series of punches 42 are secured firmly in place within the punch holder and it will be apparent that punches of various forms may be secured in the same punch holder to operate upon bands of different widths and that the spring pad 36 may be replaced by another spring pad of the proper configuration for cooperation with a different set of punches.

The die block 28, which is adapted to reciprocate vertically with respect to the die punch 29, is provided in its lower face with a recess 23^a fitted by the upper portion of a die holder 48 and the die block is further provided with a downwardly extending boss 23^b provided with an internal cylindrical bore 28^c which is slidably engaged by a guide pin 49 secured to and extending upwardly from the punch block 29, so that the two blocks are held in proper relationship to each other during their relative vertical movement.

The die holder 48 is provided with an aperture 48^a having mounted therein a curling die 50, a series of complementary dies 52, adapted to cooperate with the dies 42, and a block 53 having pivoted thereon a bending tool or die 54 carried by the pivot pin 55. The block 53 has an inclined lateral face engaged by a shim or filler plate 56 which is, in turn, engaged on its outer side by a pair of set screws 57 by which the dies 50 and 52 and the block 53 are securely clamped within the aperture 48^a with their upper surfaces bearing against the die block 28. The parts which

are thus mounted within the aperture 48^a of the die holder are clamped in a direction at right angles to that in which they are clamped by the set screws 57, by means of a set screw 58, shown in Fig. 12, which engages a plate 59 mounted within the aperture 48^a and extending downwardly with its extremity substantially flush with the extremities of the dies 52, as shown in Fig. 12.

The curling die 50 is provided at its lower end with a curved operating surface 50^a which is adapted to engage the partially opened bead portion 20^c of the metal band to press this bead portion downwardly and close it tightly upon the telescoping bead portion 20^b, when the curling die 50 is lowered by the downward movement of the ram 27 and the die block 28. The dies 52 are provided at their lower ends with V-shaped recesses 52^b which are adapted to have the metal of the band or strip 20 projected into them by the V-shaped extremities 42^b of the punches 42. The faces of these V-shaped notches 52^b in the lower ends of the dies 52 are inclined transversely of the respective dies, as shown at 52^c in Fig. 9, to conform to the inclination of the end faces 42^c of the punches 42 so that when the punches 42 and dies 52 are closed upon each other, as shown in Fig. 12, the end faces of the punches and dies lie parallel to each other and form a saw-tooth arrangement which is adapted to impart a corresponding configuration to the projections 20^e which are formed thereby in the overlapping ends of the strip. The lower part thereof enlarged above the surface 50^a and the adjacent edge faces of the dies 52 are correspondingly recessed so that the curling dies 50 and dies 52 co-act with each other on horizontal shoulders 50^d and 52^d.

The bending tool or die 54 is adapted to perform the function of bending the flange 20^d of the metal band upwardly about the lower edge of the tongue 20^e on the opposite end of the band and in order that this tool may be actuated at the proper time during the downward movement of the die block 28, this tool is provided with a pair of parallel rearwardly extending arms 54^a each of which is normally actuated in a downward direction by a spring pad or pin 56 mounted in an aperture 48^b formed in the die holder and an aligning aperture 28^c formed in the die block. These apertures are enlarged in the intermediate parts thereof to form a chamber adapted to receive a coil spring 58 which is mounted around the pin 56 with one end thereof engaging a collar 56^a secured to the lower part of the pin and with the other end of the chamber within the die block 28. This spring normally moves the pin 56 downwardly so that it engages one of the arms 54^a to swing the bending tool 54 away from the adjacent punches 52, as shown in Fig. 10, to the extent permitted by the wall 53^a of the recess in the block 53 in which the upper part of the bending tool 54 is mounted. The block 53 is provided with a passage 53^b through which the bearing of the bending tool 54 may be oiled, the oil passing to the passage 53^b through another passage 28^d which is formed in the die block.

Assuming that the die block 28 is in its upper position, as shown in Fig. 10, and that the overlapping ends of a metal band, constructed and arranged as shown in Fig. 5, have been placed upon the spring pad 36 in the manner shown in Figs. 9 and 10, the ram 27 and the die block 28 are then moved downwardly with the result that the overlapping band ends are

first engaged by the curling die 50, the curved surface 50^a co-acts with the open bead portion 20^c. If the metal of this bead portion is not too stiff, it may immediately be bent downwardly and be closed upon the bead portion 20^b telescoped therein, but if considerable resistance is offered by the metal, the closing of the bead portion 20^c may not be finally accomplished until the curling die 50 in its downward movement has brought about a partial or a complete depression of the spring pad 36 against the compression of the springs 39. During this downward movement of the curling die 50 and the spring pad 36, and preferably at an early stage thereof, the extremities of the arms 54^a carried by the bending tool or die 54 are engaged on their under sides by stop pins 60 which are carried by the punch block 29 and which extend upwardly through apertures 36^c in the spring pad so that their upper extremities normally lie considerably above the spring pad 36 when this pad is in its uppermost position. The pins 60 cause the arms 54^a to swing the bending tool 54 toward the right as viewed in Fig. 10 so that, at a proper stage in the downward movement of the die block 28, the lower lateral face 54^b of the bending tool 54 is brought into engagement with the upwardly extending flange 20^d and this flange is then bent over the edge of the tongue 20^e of the band until, as the die 28 reaches its final position, as shown in Fig. 11, the lower end of the bending tool 54 will be in engagement with the flange 20^d and pressing it against the enclosed edge of the overlapping tongue of the band. Before this final stage has been reached, the relative movement of the spring pad 36 with respect to the punch holder 33, will have caused the portions 42^a of the punches 42 to have been projected upwardly through the slot 35^b in the pad, with the result that, as the spring pad 36 reaches its lowermost position, shown in Figs. 11 and 12, the punches 42 will cooperate with the dies 52 to shear the metal of the overlapping ends of the band and project portions of this metal upwardly to form the interlocking projections 20^e previously disclosed. The joint is then completely formed and upon the upward movement of the die block 28, the completed hoop may be removed from its position on the spring pad 36 which will then be returned to its uppermost position by the springs 39.

Although one form of the invention has been shown and described by way of illustration, it will be understood that it may be constructed in various other embodiments coming within the scope of the appended claims.

I claim:

1. The combination in hoop forming apparatus, of a punch and a cooperating die for forming interlocking parts in the overlapping ends of a band, a bending tool movable bodily with respect to said die, and means actuated by relative movement of said first named die with respect to said punch for effecting relative movement of said die and said bending tool for bending a part of one of said ends about a part of the other end.

2. The combination in hoop forming apparatus of means for holding a punch, a pad movable with respect to said punch, resilient means for maintaining said pad normally in a predetermined position, said pad being adapted to support the overlapping ends of a band, a plurality of dies, and means for moving said dies bodily

with respect to said pad for causing one of said dies to bend a part of said band ends and for effecting movement of said pad until said punch is brought into cooperation with another of said dies for forming interlocking projections in said band ends.

3. The combination in hoop forming apparatus, of means for holding a punch, a pad movable with respect to said punch, resilient means for maintaining said pad normally in a predetermined position, said pad being adapted to support the overlapping ends of a band, a die, means for moving said die bodily toward said pad to effect movement of said pad and thereby cause said punch to cooperate with said die to form interlocking projections in said band ends, a bending tool movable with said die, and means actuated by said movement of said die for effecting relative movement of said die and said bending tool for causing said bending tool to bend the edge of one band end about the edge of the other band end.

4. The combination in hoop forming apparatus, of a punch block, a punch holder mounted on said block and having a chamber therein, means for mounting a punch in said chamber, a pad having a slot through which a part of said punch is adapted to project, said pad being adapted to support the overlapping ends of a band, means for resiliently supporting said pad on said punch block, a die holder, a plurality of dies mounted in said holder, means for moving said die holder toward said punch block to cause one of said dies to engage and bend a portion of one of said band ends about a part of the other band end and for moving said pad with respect to said punch block until said punch cooperates with another of said dies to form interlocking projections in said band ends.

5. The combination in hoop forming apparatus, of a punch block, a punch holder mounted on said block and having a chamber therein, means for mounting a punch in said chamber, a pad having a slot through which a part of said punch is adapted to project, said pad being adapted to support the overlapping ends of a band, means for resiliently supporting said pad on said punch block, a die holder, a die and a bending tool carried by said holder, means for moving said die holder to cause said die to engage said band ends to effect movement of said pad with respect to said punch block and thereby bring said punch into cooperation with said die for forming interlocking projections in said band ends, and means actuated upon movement of said die holder for causing movement of said bending tool for bending a part of one band end about the edge of the other band end.

6. The combination in hoop forming apparatus, of a punch block, a punch holder mounted on said block and having a chamber therein, means for mounting a punch in said chamber, a pad having a slot through which a part of said punch is adapted to project, said pad being adapted to support the overlapping ends of a band, means for resiliently supporting said pad on said punch block, a die holder, a die and a bending tool carried by said holder, means for moving said die holder to cause said die to engage said band ends to effect movement of said pad with respect to said punch block and thereby bring said punch into cooperation with said die for forming interlocking projections in said band ends, actuating means carried by said bend-

ing tool, and stationary means carried by said punch block for engaging said actuating means upon movement of said die holder and thereby causing said bending tool to bend a part of one band end about a part of the other band end.

5 7. The combination in hoop forming apparatus, of a punch block, a punch holder mounted on said block and having a chamber therein, means for mounting a punch in said chamber, a
10 pad having a slot through which a part of said punch is adapted to project, said pad being adapted to support the overlapping ends of a band, means for resiliently supporting said pad on said punch block, a die holder, a die and a
15 bending tool carried by said holder, means for

moving said die holder to cause said die to engage said band ends to effect movement of said pad with respect to said punch block and thereby bring said punch into cooperation with said die for forming interlocking projections in said band ends, actuating means carried by said bending tool, stationary means carried by said punch block for engaging said actuating means upon movement of said die holder and thereby causing said bending tool to bend a part of one band
10 end about a part of the other band end, and resilient means for restoring said bending tool to its initial position upon the return movement of said die holder.

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