

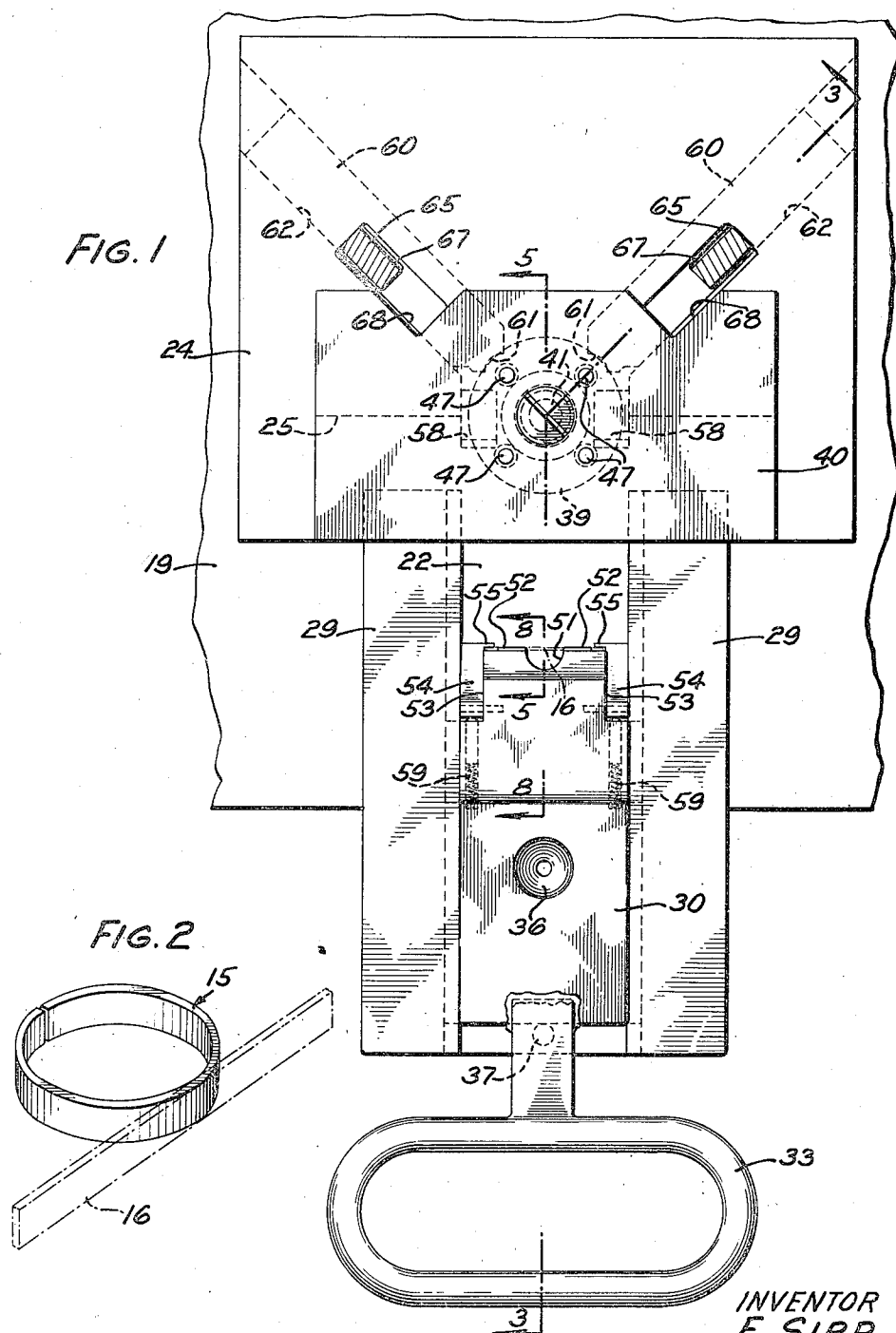
June 8, 1948.

E. SIRP
APPARATUS FOR FORMING AND SIZING RING
SHAPED ARTICLES FROM METAL BLANKS

2,442,908

Filed Dec. 11, 1943

3 Sheets-Sheet 1



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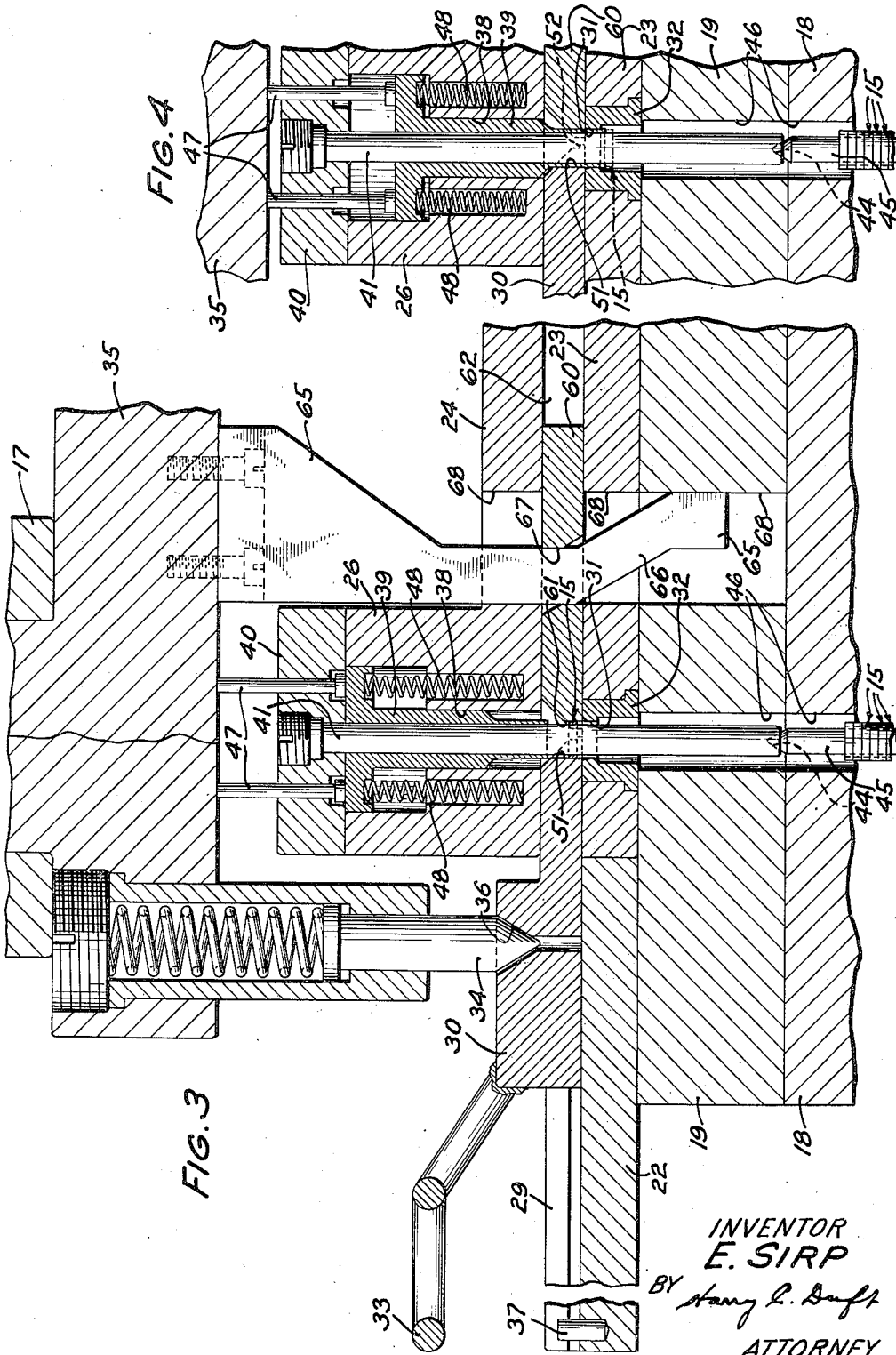
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3 Sheets-Sheet 2



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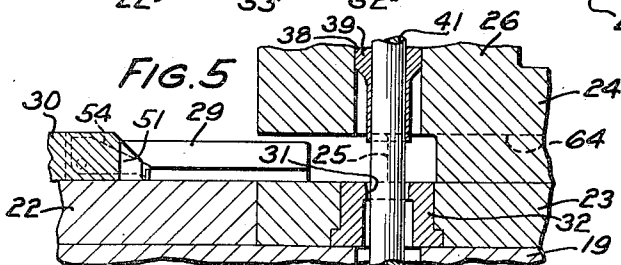
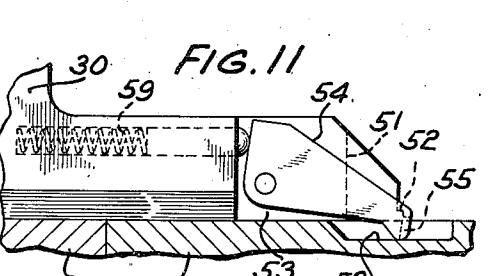
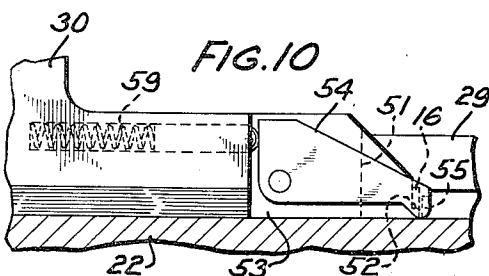
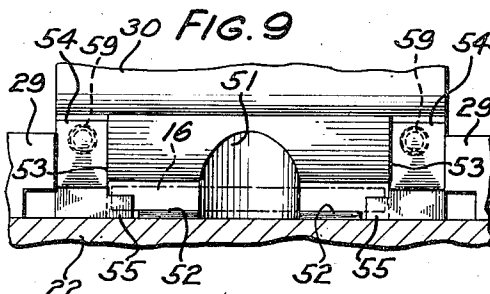
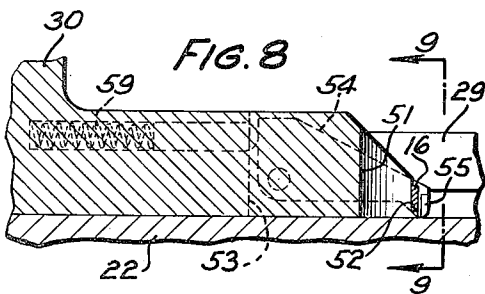
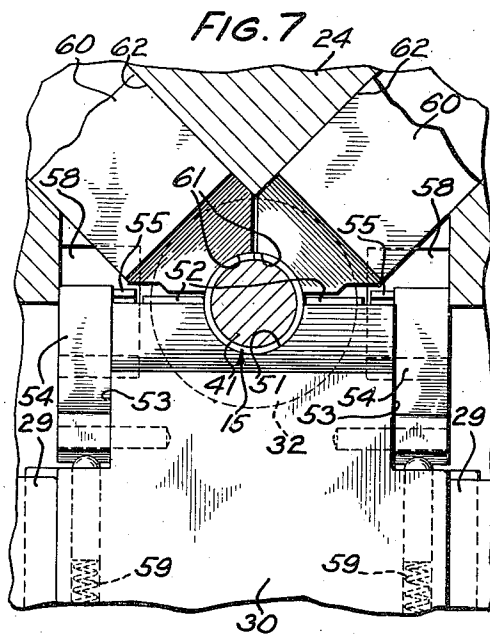
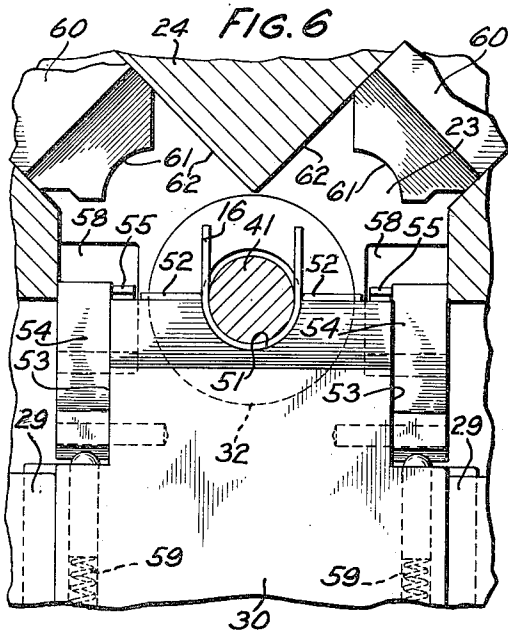
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,442,908

APPARATUS FOR FORMING AND SIZING
RING SHAPED ARTICLES FROM METAL
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ern Electric Company, Incorporated, New York,
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This invention relates to article-forming apparatus and more particularly to apparatus for forming ring-shaped articles from metal blanks.

An object of the invention is to provide a practicable and efficient apparatus for forming accurately sized ring-shaped articles from metal blanks.

In accordance with the above object, the present invention, in one embodiment thereof, as applied to forming accurately sized ring-shaped straps for vacuum tubes, comprises a carriage having a die formation, the carriage being slidable on a stationary bed of a usual type punch press to carry a blank strip of metal predeterminedly positioned and held thereon, by pivotal retaining fingers relative to the die formation, into forming engagement with a stationary mandrel of circular cross section, which movement of the carriage partially forms the strip therearound, the fingers being withdrawn from the strip before the completion of the partial forming operation. Thereafter, in the advance of a reciprocable press platen, actuators carried thereby effect operation of die members which are slidable radially of the mandrel into engagement with the ends of the strip to complete the bending of the strip into circular or ring-shaped form around the mandrel and a follow-up strip-plunger surrounding the mandrel advances the ring-shaped strap through a stationary sizing die on the press bed, from which it drops along the mandrel onto an aligned stacking rod.

Other objects and advantages of the invention will more fully appear from the following detailed description taken in conjunction with the accompanying drawings, in which

Fig. 1 is a fragmentary plan view of that portion of the apparatus carried upon the press bed with the blank strip carriage shown in its retracted position, and the actuators carried by the reciprocable press platen for advancing the slidable die members carried on the press bed shown in section;

Fig. 2 is a perspective view of a blank strip in broken outline and the completed ring-shaped strap formed therefrom in full lines;

Fig. 3 is a fragmentary irregular vertical section taken on the line 3-3 of Fig. 1, the parts being shown in the positions assumed thereby at the completion of the strap-forming operation;

Fig. 4 is a fragmentary view similar to Fig. 3 after the stripper plunger has advanced and moved the strap through the sizing die;

Fig. 5 is a fragmentary vertical section taken

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on the line 5-5 of Fig. 1, the blank strip carriage being shown in its retracted position;

Fig. 6 is an enlarged fragmentary plan view showing the strap partially formed around the mandrel;

Fig. 7 is a view similar to Fig. 6 showing the strap completely formed around the mandrel;

Fig. 8 is an enlarged vertical section taken on the line 8-8 of Fig. 1 showing a blank strip supported on one of the retaining fingers;

Fig. 9 is a vertical section taken on the line 9-9 of Fig. 8;

Fig. 10 is a side elevational view of the inner end of the carriage with the blank strip retaining fingers in their actuated position supporting a blank strip shown in broken outline; and

Fig. 11 is a view similar to Fig. 10 after the fingers have been released from their blank strip supporting position upon the strip engaging the mandrel.

The present embodiment of the invention as shown in the drawings may be used advantageously for forming small ring-shaped metal bands or straps (Fig. 2) for use on certain types of vacuum tubes, the straps being formed from thin flat metal blanks (Fig. 1) and the outside diameter of the strap is approximately one-quarter inch and its height one-sixteenth inch.

As shown in the drawings, referring particularly to Figs. 1 and 3, the strap-forming apparatus embodying the features of this invention is operatively connected to a punch press which may be of any usual type. Since it is not essential to a complete understanding of the invention, the punch press has not been fully illustrated, except those parts directly concerned with this invention, which consist of the following: A vertical reciprocable platen and a stationary bed (Fig. 1 and 3, respectively). Fixed to the upper face of the press bed 18 is a bolster plate 19, to which is secured a plate 22 overhanging the left end thereof (Fig. 3) or its forward end, as viewed in Fig. 1. Abutting the right end of the plate 22 and secured to the bolster plate 19 is a die plate 23. Attached to the upper face of the die plate 23 is an irregular shaped plate 24, which is shouldered or stepped upwardly, as indicated at 25 (Figs. 1 and 5), upon its lower face to provide clearance between a head portion 26 thereof and the die plate for a purpose which will be apparent, presently. Slidable upon the plate 22 between cooperating lateral guide strips 29 attached to the plate is a carriage or slide 30, which is centered relative to a die aperture 31 of a die 32 carried in the die plate 23, and the platen 17. A handle

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33 attached to the forward end of the carriage 30 provides means whereby an operator may slide it to and from its advanced position (Figs. 3 and 1) respectively. In the advanced position of the carriage 30 (Fig. 3), to be described presently, a spring-pressed cone-ended pin 34 carried by a supporting block 35 attached to the platen 17 is entered in a cone-shaped depression 36 in the carriage 30 during the lowering of the platen and before the strip-forming operation is completed to accurately locate and hold the carriage during the forming and sizing operations. A stop pin 37 fixed to the plate 22 limits the movement of the carriage in its retracted position.

Reciprocable in a shouldered aperture 38 formed in the head portion 25 of the plate 24 and centered with the die aperture 31 is a spring-retracted stripper plunger 39 in the form of a shouldered sleeve, its lower end being reduced and having a diameter closely fitting the diameter of the die aperture. Fixed to the upper face of the head portion 26 of the plate 24 is a retaining plate 40 for the plunger 39. Attached to and depending from the plate 40 is a long mandrel 41, which is centered with the plunger 39 and die aperture 31 and is closely fitted to the inner diameter of the plunger, but clears the die aperture by the thickness of the wall of the formed strap 15. The lower end face of the mandrel 41 is formed with a cone-shaped depression 44, in which is entered an aligned cone-ended stacking rod 45, shown fragmentarily, onto which the formed bands 15 drop during the operation of the apparatus. Aligned apertures 46 are provided in the bolster plate 19 and press bed 13 for the mandrel 41 and stacking rod 45, respectively, and it will be understood that the rod is removably supported in a suitable manner. A plurality of pins 47 are reciprocally carried in the retaining plate 40 and are engaged at their upper ends by the lower face of the block 35, the lower headed ends of the pins resting on the upper face of the stripper plunger 39. Thus, when the platen 17 moves downwardly, the plunger 39 also moves downwardly against the action of springs 48 and its lower reduced end passes through the die aperture 31 to the position shown in Fig. 4.

At its inner end face (Figs. 1, 8 and 9), the carriage 30 is angularly shaped and provided with a semi-circular die formation 51 having a diameter which is similar to that of the die aperture 31. Extending from the extreme inner end face of the carriage 30, which is coincidental with the axis of the die formation 51, at its bottom edge and laterally from each side of the die formation are ledges 52 for supporting upon its longitudinal edge face the flat metal blank strip 16 placed thereon by the operator when the carriage is in its retracted position, shown in Figs. 1 and 8. Pivoted, as indicated upon each side face of the carriage 30 in recesses 53 formed therein are spring-pressed lever-like blank-retaining fingers 54 having rounded lower forward edges which normally ride upon the upper face of the plate 22 and die plate 23 in the reciprocation of the carriage. Extending laterally from and integral with the inner opposed faces of the fingers 54 at a point forward of the inner end of the carriage 30 and of the blank 16 are vertical walls 55, which, in the normal position of the fingers, serve to retain the blank on the supporting ledge 52 of the carriage 30 during its transfer from the loading position (Figs. 1 and 8) and until the blank engages the mandrel 41.

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At this point in the movement of the carriage 30, the rounded lower forward edges of the fingers 54 move downward into depressions 58 formed in the die plate 23, as shown in Fig. 11, under the action of associated springs 59. This described movement of the fingers 54 withdraws the blank-retaining walls 55 thereof from holding relation with the blank and the blank is now supported between the periphery of the mandrel 41 and the end face of the carriage 30 and resting upon the ledges 52 thereof. In the continued advance movement of the carriage 30 to the position shown in Figs. 3 and 6, the blank 16 is partially wrapped around the mandrel 41 to the formation particularly shown in Fig. 6, due to the entrance of the stationary mandrel into the die formation 51 of the carriage as the latter is advanced to the position shown.

To complete the forming of the ring-shaped strap 15, two reciprocable die members 60 having arc-shaped die formations 61 at their inner ends are subsequently moved along paths arranged angularly to the movement of the carriage 30 and aligned radially of the mandrel 41 into engagement with the extending ends of the blank 16 to shape and wrap them around the mandrel to the position shown in Fig. 7. The die members 60 are slidable in ways 62 formed in the lower face of the plate 24 and slide at their lower faces on the die plate 23. Depending from the lower face of the block 35, attached to the platen 17, are two actuators 65 for the die members 60, the actuators being cam-shaped at their lower ends, as indicated at 66, and are entered in suitably shaped apertures 67 in the die members. Aligned apertures 68 are provided in the bolster plate 19, die plate 23 and plate 24 for the passage of the actuators 65 during their reciprocation with the platen 17.

The operation of the heretofore-described apparatus is as follows: In Fig. 1, the apparatus is shown in its normal position or just after the completion of a strap-forming operation, the carriage 30 having been retracted by the operator after the platen 17 (not shown in Fig. 1) has moved upwardly and withdrawn the holding and positioning pin 34 from the depression 36 in the carriage. It will also be understood that in the upward movement of the platen 17, the cam actuators 65 movable therewith have retracted the die members 60 from their advanced forming operation, shown in Figs. 3 and 7, to the positions shown on Figs. 1 and 6 and that the stripper plunger 39 is moved to its retracted position (Fig. 3). Further, in the retraction of the carriage 30, the blank strip-retaining fingers 54 on the carriage are moved from their released positions shown in Figs. 6, 7 and 11 to their blank strip-retaining positions shown in Figs. 1, 5, 8 and 10. The operator now places a blank strip 16, shown in broken outline in Fig. 1, on the carriage ledges 52, where it will be held by the retaining walls 55 of the fingers 54 (Fig. 8) and slides it forward to the position shown in Figs. 3 and 6. In timed relation with the forward vertical side face of the blank strip being moved into engagement with the periphery of the mandrel 41, the rounded forward lower edges of the fingers 54 drop into the depressions 58 in the die plate 23, thus permitting the retaining walls 55 to move out of the path of the outer ends of blank strip 16, which is then partially wrapped around the mandrel 41 to the position shown in Fig. 6 by the die formation 51 on the carriage 30. Following the partial forming of the strap

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15, the press platen 17 begins its down stroke, which may be initiated by a manual actuation of the press clutch (not shown) or the press clutch may be automatically actuated by means (not shown) set in motion by the advance movement of the carriage 30.

As the platen 17 descends, the spring-pressed holding and positioning pin 34 carried thereby first enters the cooperating depression 36 in the carriage 30, thereby accurately positioning and firmly holding the partially formed strap 15 between the carriage die formation 51 and the mandrel 41. In the continued descent of the platen 17, the cam actuators 65 moving therewith slide the die members 69 into engagement with the free outer ends of the partially formed blank strip 16 and complete the forming of the strap 15 by wrapping the ends of the strip around the mandrel 41 (Figs. 3 and 7). In timed relation to the actuation of the die members 69, the spring retracted stripper plunger 39 is moved downwardly when the lower face of the support 35 on the moving platen 17 engages the pins 47, which are engaged by the plunger, as shown in Fig. 3. As the plunger 39 moves downwardly, the reduced lower annular edge face thereof engages the annular upper edge face of the strap 15 and moves it downwardly through the sizing die aperture 31 (Fig. 4), which serves to further wrap the band 15 around the mandrel and give it its final size when used. As each strap 15 is formed, it moves down the mandrel 41 and drops onto the stacker rod 45. This completes a cycle of operations including the positioning of a strip blank 16 on the carriage while retracted, advancing the carriage, and forming the blank into a sized circular strap 15 and the operation may be continued as described above.

What is claimed is:

1. In an apparatus for forming articles from blanks, a mandrel about which a blank is formed, a plurality of dies movable radially of and to and from said mandrel for forming the blank therearound, means movably mounted on one of said dies for supporting the blank in its movement to the mandrel, means for withdrawing said supporting means for said blank when the blank engages the mandrel, and means for actuating said dies to form an article.

2. In an apparatus for forming articles from blanks, a mandrel about which a blank is formed, a plurality of dies movable radially of and to and from said mandrel for forming the blank therearound, one of said dies having movable blank supporting seats thereon at each side of its die formation for supporting the blank in its movement to the mandrel, said seats being movable upon the blank being pressed against said mandrel for withdrawing them from the blank, means for moving said one die into operative relation with said mandrel to press the blank thereagainst and partially wrap the blank therearound, and means for actuating said other dies to form an article.

3. In an apparatus for forming articles from blanks, a mandrel about which a blank is formed, a plurality of dies movable radially of and to and from said mandrel for forming the blank therearound, one of said dies being movable along a line arranged intermediate said other dies, said one die cooperating with said mandrel to partially form the blank and arrange portions thereof in the path of said other dies, means for supporting the blank in its movement to the mandrel, means for actuating said dies to form an

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article, a sizing die surrounding, in spaced relation, said mandrel, and means for forcing the article through said sizing die while said forming dies are in their forward actuated positions.

4. In an apparatus for forming articles from blanks, a mandrel about which a blank is formed a plurality of dies movable in a common plane radially of and to and from said mandrel for forming the blank therearound, one of said dies being movable along a line arranged intermediate said other dies, said one die cooperating with said mandrel to partially form the blank and arrange portions thereof in the path of said other dies, means movably mounted relatively to and carried on said one die for supporting and longitudinally centering the blank thereon in its movement to the mandrel, means for withdrawing said supporting means for said blank when the blank engages the mandrel, and means for actuating said dies to form an article.

5. In an apparatus for forming ring-shaped articles from strip blanks, a mandrel about which a blank is wrapped to form an article, a plurality of dies movable radially of and to and from said mandrel and adapted to completely embrace the mandrel for forming the blank therearound, cooperating means movably mounted on one of said dies for supporting and predeterminedly positioning the blank on a longitudinal edge face in its movement to the mandrel, means for withdrawing said supporting means for said blank when the blank engages the mandrel, means for moving said one die into operative relation with said mandrel to partially wrap the blank around the mandrel, and means for actuating said other dies to complete the wrapping of the blank around the mandrel to form a ring-shaped article.

6. In an apparatus for forming articles from blanks, a mandrel about which a blank is formed, a plurality of dies movable radially of and to and from said mandrel for forming the blank therearound, means arranged for movement longitudinally of said mandrel for moving the formed article along said mandrel out of the path of said dies, means movably mounted on one of said dies for supporting the blank in its movement to the mandrel, means for withdrawing said supporting means for said blank when the blank engages the mandrel, means for actuating said dies to form an article and for actuating said formed article moving means, and a sizing die surrounding, in spaced relation, said mandrel, said formed article moving means forcing the article through said sizing die while said forming dies are in their forward actuated positions.

7. In an apparatus for forming articles from blanks, a mandrel about which a blank is formed, a plurality of dies movable radially of and to and from said mandrel for forming the blank therearound, a sizing die surrounding said mandrel, a stripper sleeve surrounding and movable longitudinally of said mandrel and into said sizing die for moving the formed article along said mandrel out of the path of said forming dies and through said sizing die, means movably mounted on one of said forming dies for supporting the blank in its movement to the mandrel, means for withdrawing said supporting means for said blank when the blank engages the mandrel, and means for actuating said forming dies to form an article and for actuating said stripper sleeve.

8. In an apparatus for forming articles from strip blanks, a mandrel about which a blank is wrapped to form an article, a plurality of dies movable radially of and to and from said man-

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drel for forming the blank therearound, means arranged for movement longitudinally of said mandrel for moving the formed article along said mandrel out of the path of said dies, means movably mounted on one of said dies for supporting the blank in its movement to the mandrel, means for withdrawing said supporting means for said blank when the blank engages the mandrel, means for actuating said one die to partially wrap the blank around the mandrel, and means movable at right angles to the movement of said dies and operatively connected to the other of said dies for actuating the same to complete the forming of an article and said formed article moving means in timed relation.

9. In an apparatus for forming ring-shaped articles from strip blanks, a mandrel about which a blank is wrapped to form an article, a plurality of dies movable radially of and to and from said mandrel for forming the blank therearound, means for supporting said dies in their movement, means on one of said dies for supporting the blank on a longitudinal edge face in its movement to the mandrel, said means including pivotal elements at each side of the die formation normally resting on said die supporting means and arranged to predeterminedly position the blank relative to the die formation and having portions effective to retain the blank on its longitudinal edge face in its movement to the mandrel, said die supporting means having portions adapted to permit said pivotal elements to move and thus their blank-retaining portions out of the path of the blank at substantially the instant the blank engages said mandrel, means for moving said one die into operative relation with said mandrel to partially wrap the blank around the mandrel, and means for actuating said other dies to complete the wrapping of the blank around the mandrel to form a ring-shaped article.

10. In an apparatus for forming articles from strip blanks, a mandrel about which a blank is wrapped to form an article, a plurality of dies movable in a common plane radially of and to and from said mandrel for forming the blank

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therearound, one of said dies being movable along a line arranged intermediate said other dies, means for supporting said dies in their movements, said one die having seats at each side of its die formation for supporting the blank on a longitudinal edge face in its movement to the mandrel, spring-pressed pivotal elements on said one die at each side normally urged against said die-supporting means and arranged to longitudinally center the blank with the die formation and having portions effective to retain the blank on its longitudinal edge face in its movement to the mandrel, said die-supporting means having depressions for permitting said pivotal elements to move and thus their blank-retaining portions out of the path of the blank at substantially the instant the blank engages said mandrel, means for moving said one die into operative relation with said mandrel to partially wrap the blank around the mandrel, and means for actuating said other dies to complete the wrapping of the blank around the mandrel to form an article.

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