Dec. 27, 1955 L. ANDERSEN 2,728,133

MACHINE FOR MAKING METALLIC RINGS

Filed Dec. 14, 1950 2 Sheets-Sheet 1

Fig. 1

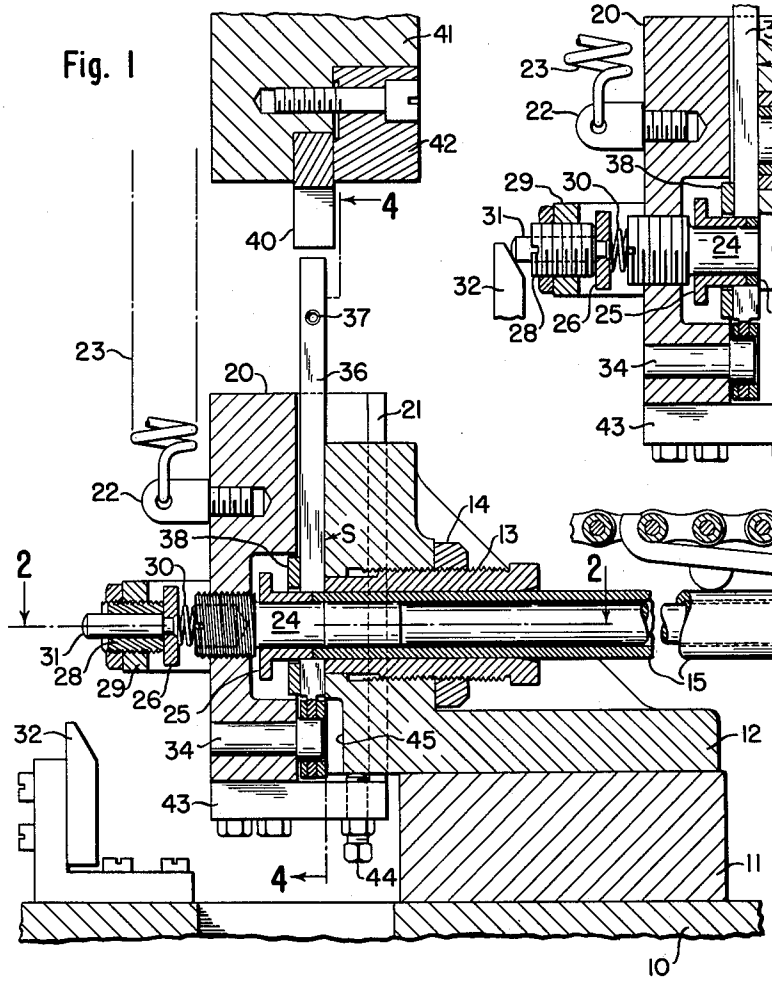


Fig. 3

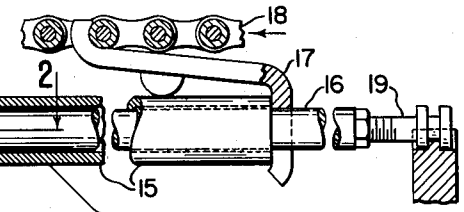


Fig. 2

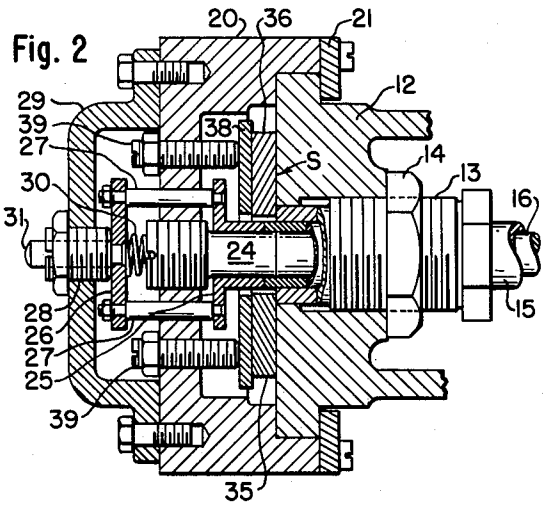
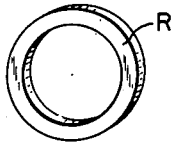


Fig. 10



INVENTOR
LAURITS ANDERSEN

ATTORNEYS

Dec. 27, 1955 L. ANDERSEN 2,728,133

MACHINE FOR MAKING METALLIC RINGS

Filed Dec. 14, 1950 2 Sheets-Sheet 2

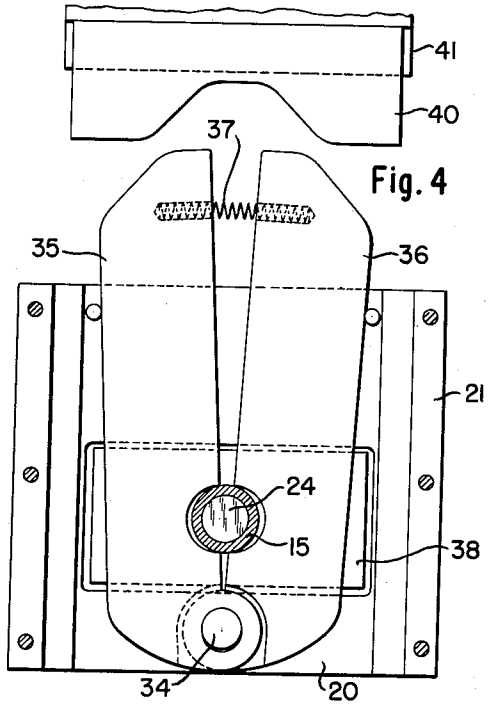


Fig. 4

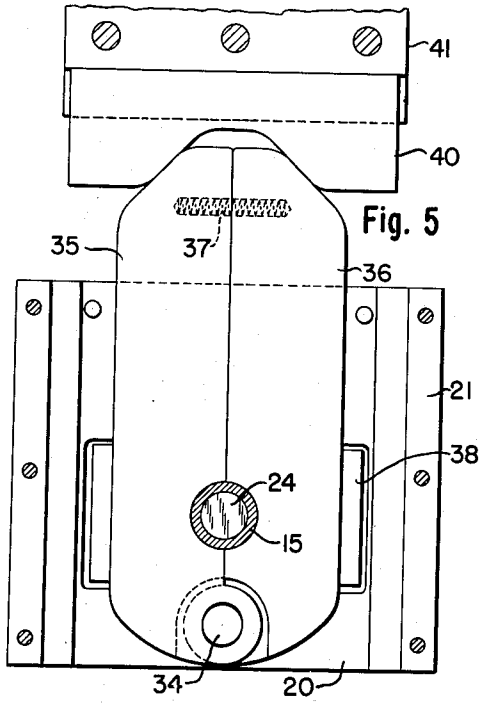


Fig. 5

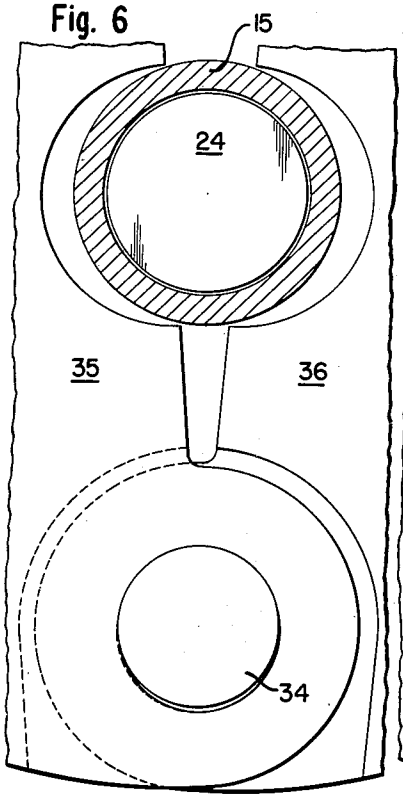


Fig. 6

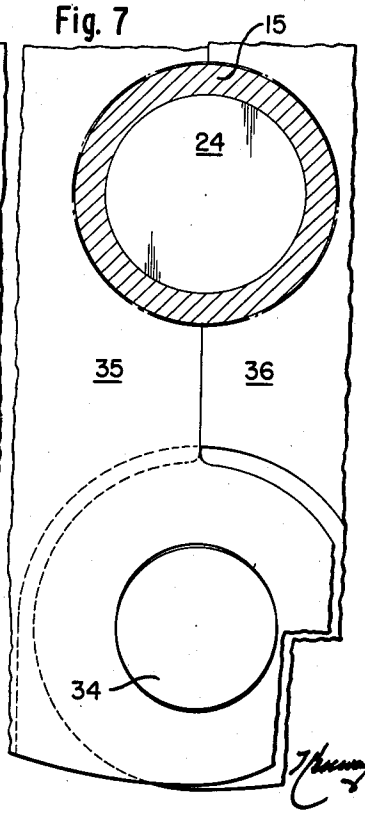


Fig. 7

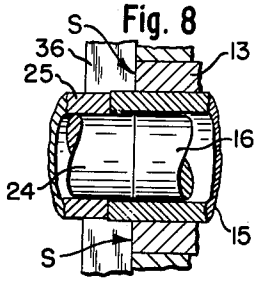


Fig. 8

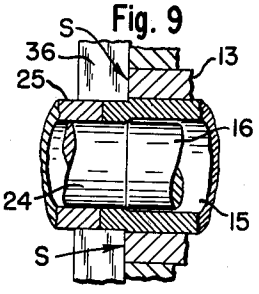


Fig. 9

INVENTOR
LAURITS ANDERSEN

Harvey Jenney, Wilkinson & Wilkinson

ATTORNEYS

United States Patent Office

2,728,133

Patented Dec. 27, 1955

2,728,133

MACHINE FOR MAKING METALLIC RINGS

Laurits Andersen, Arlington, Mass., assignor to Herbert E. Edwards, Wellesley, Mass.

Application December 14, 1950, Serial No. 200,833

9 Claims. (Cl. 29—34)

This invention comprises a new and improved apparatus for forming and cutting or shearing metallic rings from tubular stock.

The primary object of the invention is to provide a process for simultaneously forming rings with extreme accuracy and uniformity and then separating them from tubing so that they may be at once and without additional mechanical treatment applied as bands on projectiles. Heretofore such rings have been cut from tubing having a sliding fit upon a mandrel, and under such conditions it has been impossible to eliminate a distortion in the sheared ring commensurate with the tolerance necessary for a sliding fit between the tubing and the mandrel. To the distortion of the ring inherent to the sliding fit is added a distortion caused by the dragging action as the ring, firmly anchored at its top point at the time of shearing impact, finds an unsupported bottom portion during the shearing operation. A partially egg-shaped ring results having its wall thickness deformed through stretching. The result is that rings heretofore manufactured from mandrel supported tubing have required a separate forming or coining operation to correct the inaccuracies due to the shearing step and to bring the inside diameter and wall thickness to the specifications required in the finished rings.

By the process of the present invention the rings are first formed in the tube to the required final shape and dimensions and then sheared at a single operation, thereby making an important economy in both the cost and time of manufacture.

The improved process of this invention is characterized by the steps of supporting one end of the tubing upon an inside forming die, reducing the diameter of the supported end of the tube by swaging it against the inside forming die, and then shearing the reduced end of the tubing while maintaining it under full swaging pressure.

While the improved process is not restricted to any specific machine or apparatus, it may be advantageously carried out in a press of any commercial construction having a stationary bed and a reciprocatory cross head. In adapting such a press to carry out the process above defined, a reciprocatory head carrying the inside forming and shearing die is arranged initially in line with a stationary outside shearing die having an aperture through which the end of the tubing may be presented to the inside die. A pair of swaging elements is mounted on the head for closing movement about the inside die, and the cross head of the press is provided with means for closing the swaging elements preparatory to relative movement between the reciprocatory head and the outside shearing die.

These and other features of the invention will be best understood and appreciated from the following description of a preferred machine for carrying out the process of the invention selected for purposes of illustration and shown in the accompanying drawings, in which:

Fig. 1 is a view in elevation, partly in section, of the operating instrumentalities of the machine,

Fig. 2 is a sectional view on the line 2—2 of Fig. 1,

Fig. 3 is a fragmentary view in vertical section showing the shearing dies in the position occupied at the conclusion of the shearing step,

Figs. 4 and 5 are fragmentary views in elevation illustrating more particularly the swaging tools,

Figs. 6 and 7 are corresponding fragmentary views on an enlarged scale,

Figs.. 8 and 9 are fragmentary views in longitudinal section corresponding to Figs. 4 and 5, and

Fig. 10 is a view in perspective of the ring produced by the process.

In the drawings is shown the bed **10** of a punch press carrying a bolster plate **11** to which is rigidly secured a stationary angular casting **12** apertured to receive a hardened threaded bushing **13** which constitutes the outside shear member of the machine and whose inner face is flush with the vertical face of the casting **12**. The bushing **13** is adjustably held in place by a large lock nut **14** and is of the proper internal diameter to receive with a close sliding fit the tube **15** from which the rings are to be sheared and formed. As herein shown, the tubing is supported internally by a mandrel **16** which has an internal sliding fit with the tubing **15**.

Any suitable feeding mechanism may be employed for advancing the tubing toward the left as seen in Fig. 1, intermittently as successive rings are sheared from its left-hand end. As herein shown, the feeding mechanism may include a hook **17** secured to a sprocket chain **18** which is arranged to be advanced toward the left by a spring or other suitable means. The mandrel **16** may be adjustably secured in position by a threaded stud **19** having a flanged head which interfits with a fixed bracket as shown in Fig. 1.

The casting **12** is provided at either side with vertical ribs, as shown in Fig. 2, which form guideways for a reciprocatory head **20** having gibs **21** secured to its rear face in sliding contact with the ribs of the casting **12**. A stud **22** projects from the outer face of the head **20** and to this is connected a powerful tension spring **23** tending normally to lift the head **20** after the latter has been depressed by action of the cross head of the press as will be presently explained.

The head **20** carries an inside shearing and forming die in the shape of a cylindrical plug **24** which is threaded into the body of the head and adjusted so that its outer end lies in the shearing plane S, that is, the plane determined by the end of the outside shearing die **13** and the vertical face of the casting **12**. The plug **24** is herein shown as being cylindrical in shape and is hardened and ground to the exact inside diameter desired in the finished product. A flanged stop sleeve **25** surrounds the plug or inside die **24** and serves as a positive limit for the feeding movement of the end of the tube **15** as the latter is advanced by the feeding mechanism above mentioned and presented in position upon the plug **24** as shown in Figs. 1 and 2. The stop sleeve **25** is connected to a bridge **26** by a pair of struts **27** and its position is accurately gauged and fixed by a stop screw **28** threaded into a bridge or cap **29** bolted to the outer face of the head **20** as best shown in Fig. 2. A compression spring **30** is interposed between the outer threaded end of the plug **24** and the bridge **26**. This spring **30** tends at all times to urge the stop sleeve **25** toward the left as shown in Figs. 1–3, and to hold the bridge **26** against the stop screw **28** while at the same time permitting periodic movement of the stop sleeve toward the right for the purpose of ejecting the severed ring. Ejecting movement of the sleeve is effected by means of a cam follower herein shown as a stud **31** which projects outwardly through and beyond the stop screw **28** and is movable with the head into contact with a wedge cam **32** supported in

stationary position by the bed 10 of the press. It will be understood that toward the bottom of the stroke of the head 20 the pin 31 is forced toward the right by the action of the cam 32, the finished ring is stripped off the plug 24 and the ejecting step thus carried out.

The head 20 is recessed to receive the plug 24 already described, and also to accomodate outer swaging elements herein shown as a pair of plates 35 and 36 pivotally mounted on a pivot pin 34 carried by the head 20. These plates are provided with semi-circular swaging faces located concentrically with respect to the plug 24 and shaped to compress, conform and swage the end of the tubing 15 accurately to the plug 24. The swaging elements extend at their upper end above the head 20 and are normally separated by a compression spring 37. They are backed up adjacent to the plug 24 by a hardened wear plate 38 which, in turn, is adjustably supported by screws 39 threaded into the body of the head 20 as shown in Fig. 2. By adjustment of the wear plate 38 the outer faces of the swaging plates are rigidly supported in the shearing plane S of the machine.

The shear plates 35 and 36 are tapered at their upper ends as shown in Figs. 4 and 5. Swaging or closing movement of the plates is effected by a forked cam 40 secured in the cross head 41 of the press by a clamping plate 42 as shown in Fig. 1. The cam 40 not only effects closing movement of the swaging plates 35 and 36, but acting through them depresses the head 20 after the swaging plates have been closed and while they are held positively closed, and thus effects the shearing operation. The head 20 is provided at its lower end with an arm 43 which extends inwardly beneath the casting 12 and carries a suitable stop screw 44 by which the initial position of the head 20 may be accurately adjusted. The casting 12 is provided with a recess 45 in line with and beneath the end of the outside shearing die 13 into which the conformed and sheared ring may fall when it is pushed off the end of the plug 24 in the ejecting step.

Fig. 1 shows the head 20 with the plug 24 aligned with the mandrel 16 and the tubing 15 advanced by its feeding mechanism to a point determined by the stop sleeve 25. At this point the swaging plates 35 and 36 are separated, as shown in Figs. 4, 6 and 8. Now when the cross head 41 descends, the cam 40 first acts to close the swaging plates 35 and 36 thereby reducing the inside diameter of the end of the tubing accurately to the plug 24 and at the same time reducing the outside diameter of this portion of the tubing and conforming the wall to uniform thickness. This stage is represented in Figs. 5, 7 and 9 of the drawings. It will be noted that the end of the tubing 15 surrounding the plug 24 has by this step been appreciably reduced in both inside and outside diameter. Now while the end of the tubing is held securely in this conformed and swaged condition by the swaging plates 35 and 36, the cross head of the press, acting through the swaging plates, depresses the head 20 causing the ring R to be sheared from the end of the tubing along the shearing plane S, as indicated in Fig. 3. As the sheared ring is brought into line with the recess 45 of the casting 12, the cam 32 is effective to advance the stop sleeve 25, stripping the finished ring from the plug 24 and permitting it to drop out of the press.

When the cross head 41 is again lifted, the spring 30 restores the stop sleeve 25 to its initial position and the spring 23 restores the head 20 to its initial position, whereupon the feeding mechanism 17—18 operates to advance the tubing 15 and to present its freshly cut end to the plug 24 in readiness for a repetition of the cycle.

It will be apparent that the swaging action of the plates 35 and 36 causes the end of the tubing 15 to conform accurately in size and shape to the plug 24, thus eliminating the clearance in the tubing necessary for the reception of the plug in the feeding operation. In this swaging operation the thickness of the wall of the ring is maintained uniform and the ring is so securely and positively held by the locked swaging plates that there is no opportunity for distortion during the shearing operation. The result is that the sheared ring may be immediately utilized and applied as a band to the shell without intermediate operations other than annealing, there being no waste of material at any point in its production.

It is to be noted that the tubing must have at all times a free sliding fit upon its mandrel 16 in order that it may be fed step by step to the inner shearing die. The process of my invention, however, is characterized by carrying out the swaging operation in a location beyond the end of the mandrel where there is no disturbance or distortion of the tubing upon the mandrel. The tube is, therefore, left free to be advanced in the rapid and automatic operation of the machine herein shown.

The inner end of the mandrel 16 is hardened and slightly enlarged as compared to the body of the mandrel so that the tubing makes a close sliding fit with it. Its end face is ground to provide a shearing edge which is located in the shearing plane S and acts on the inside upper half of the ring. Similarly, the upper half of the combined swaging surfaces of the plates 35 and 36 comprise shearing edges located in the shearing plane and acting on the outside upper half of the ring.

It sometimes occurs that in the tubing there is a slight eccentricity between its inner and outer walls. To compensate for such slight eccentricity in the tubing it is desirable to provide a slight clearance in the mounting of the swaging plates 35 and 36 upon their pivot 34. These plates are thereby allowed to float and make a slight initial adjustment if that is required by inaccuracy in the dimensions of that section of the tubing being presented to the inner shearing die 24.

Having thus disclosed my invention and described in detail the best manner known to me for carrying it out, I claim as new and desire to secure by Letters Patent:

1. A machine for forming and cutting rings from tubing, comprising a stationary die having an aperture for the passage of a tube and a concentric mandrel, a movable die having a solid plug fitting within the end of the tube, a pair of swaging tools mounted on the movable die, means for closing the said tools to compress and reduce the end of the tube to the dimensions of the plug, and means for moving the movable die while the swaging tools are held in closed position to shear a ring from the tube.

2. A machine of the class described comprising a solid cylindrical inside forming and shearing die, a pair of swaging tools movable to reduce the end of a tube surrounding said die accurately to the dimensions of said die, a cooperating outside shearing die and a concentric mandrel therein, and means for moving the inside die and the swaging tools with respect to the outside die.

3. A machine of the class described comprising a reciprocatory head carrying a solid inside forming and shearing die, a pair of swaging tools pivotally mounted on the head for closing movement about the die, an outside shearing die having an aperture through which the end of a tube may be presented to the inside die, a mandrel located in the axis of said outside shearing die, and means for moving the head together with its swaging tools with respect to the outside shearing die and mandrel.

4. A machine of the class described comprising a press having a stationary bed and a reciprocatory cross head, an outside shearing die supported on the bed and having an aperture for a tube, a mandrel located in the axis of said outside shearing die, a head movably mounted beneath the cross head, a solid inside forming and shearing die projecting from said head, swaging tools also mounted on the head and having semi-circular swaging faces, and means movable with the cross head for closing the swaging tools upon the end of a tube presented to the inside die thus compressing the end of the tube and reducing it to the diameter of the inside forming die.

5. A machine of the class described comprising a press

having a stationary bed and a reciprocatory cross head, an outside shearing die having an aperture for a tube, a mandrel located in the axis of said outside shearing die, a head movably mounted beneath the cross head, an inside forming and shearing die projecting from said head in a position to be surrounded by the tube, a pair of swaging plates pivoted to the head below said inside die and having curved swaging faces movable to enclose a tube end presented to the inside die and swage it, the said plates extending upwardly above said head and into the path of the cross head, and a cam on the cross head for closing the swaging plates.

6. A machine of the class described comprising a solid inner forming and shearing die, means for feeding the end of tubing to enclose said die, swaging tools having cooperating semicircular swaging faces and being movable to swage the end of the tube into accurate fit about the inner die, means for locking the swaging tools in closed position upon the tube end, an outside shearing die enclosing the tubing, a concentric mandrel for supporting it internally, and means for relatively moving the two dies while the swaging tools are maintained in locked position.

7. A machine for the class described comprising a mandrel and means for feeding tubing longitudinally thereon, a solid inner forming and shearing die located entirely beyond the end of the mandrel, an outer shearing die surrounding the mandrel, swaging tools having semicircular swaging faces and being movable to swage the end of the tube advanced into a position beyond the mandrel into accurate fit upon the inner shearing die while leav- the tubing undisturbed upon the mandrel, and means for

relatively moving the outside and inside shearing dies while the swaging tools are maintained in swaging position.

8. A machine of the class described comprising a cylindrical inside forming and shearing die in combination with a pair of swaging members movable to reduce the end of a tube surrounding the inside die and having an outside shearing edge acting on the upper half of the tubing, cooperating shearing dies dies confining the body of the tube, and means for relatively moving the two sets of dies to shear a swaged ring from the end of the tubing.

9. A power operated press having a reciprocatory die-carrying head, a solid inside die adjustably fixed in said head and projecting therefrom into free space, a pair of outside shearing and swaging dies pivotally mounted below the said inside die and extending at their upper ends above said head, and a cross head mounted to reciprocate in a path above the die-carrying head and having a cam shaped to engage and close the swaging dies toward the solid inside die and then to depress the die-carrying head, whereby the end of a tube may be first swaged to finished shape upon the solid inside die and then severed while held against deformation.

References Cited in the file of this patent

UNITED STATES PATENTS

765,825	Felker	July 26, 1904
891,626	Loss	June 23, 1908
1,715,138	Lothrop	May 28, 1929
1,800,005	Braun	Apr. 7, 1931
2,412,930	Walklet	Dec. 17, 1946