

Nov. 14, 1944.

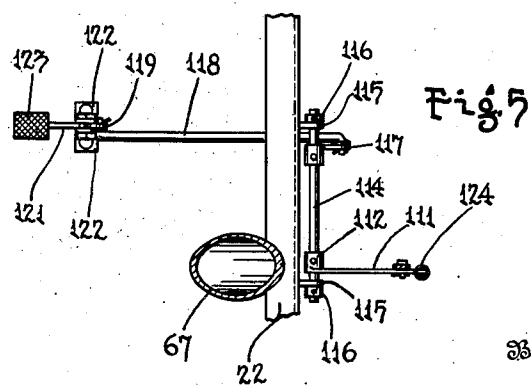
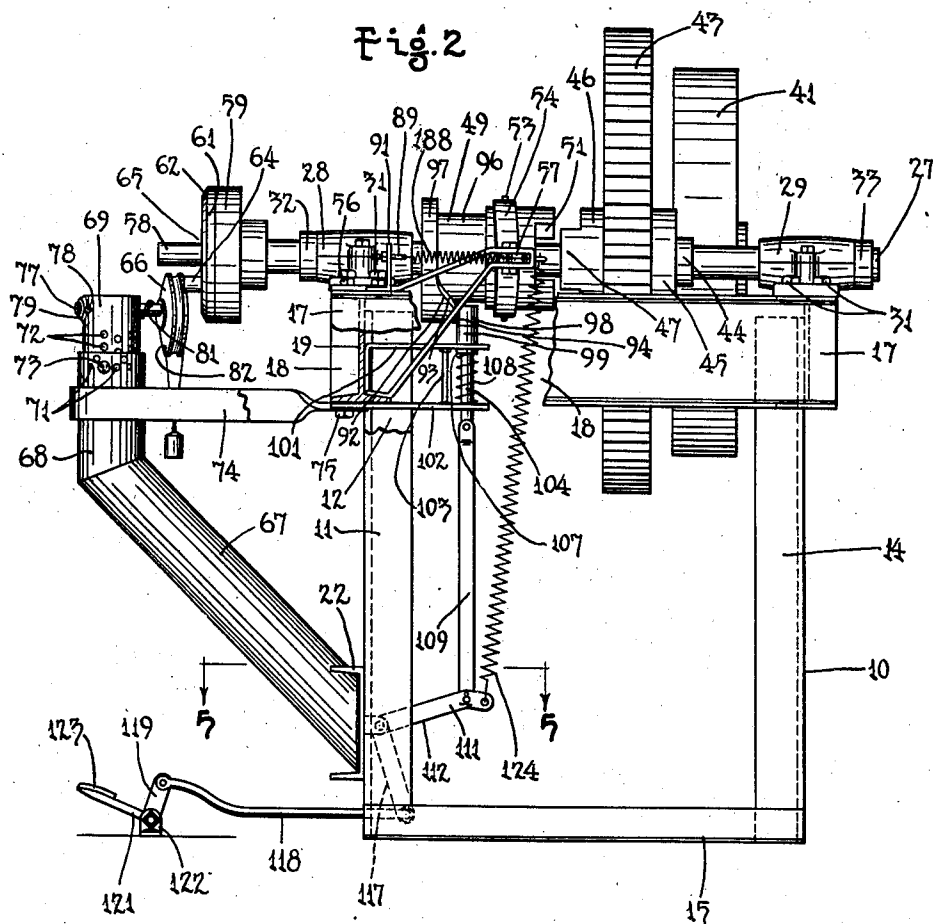
A. J. ANDERSON

2,362,522

EYE-FORMING MACHINE

Filed July 6, 1942

3 Sheets-Sheet 2



Inventor
Andrew J. Anderson

By *Carwell & Lagaard*
Attorneys

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Fig. 3

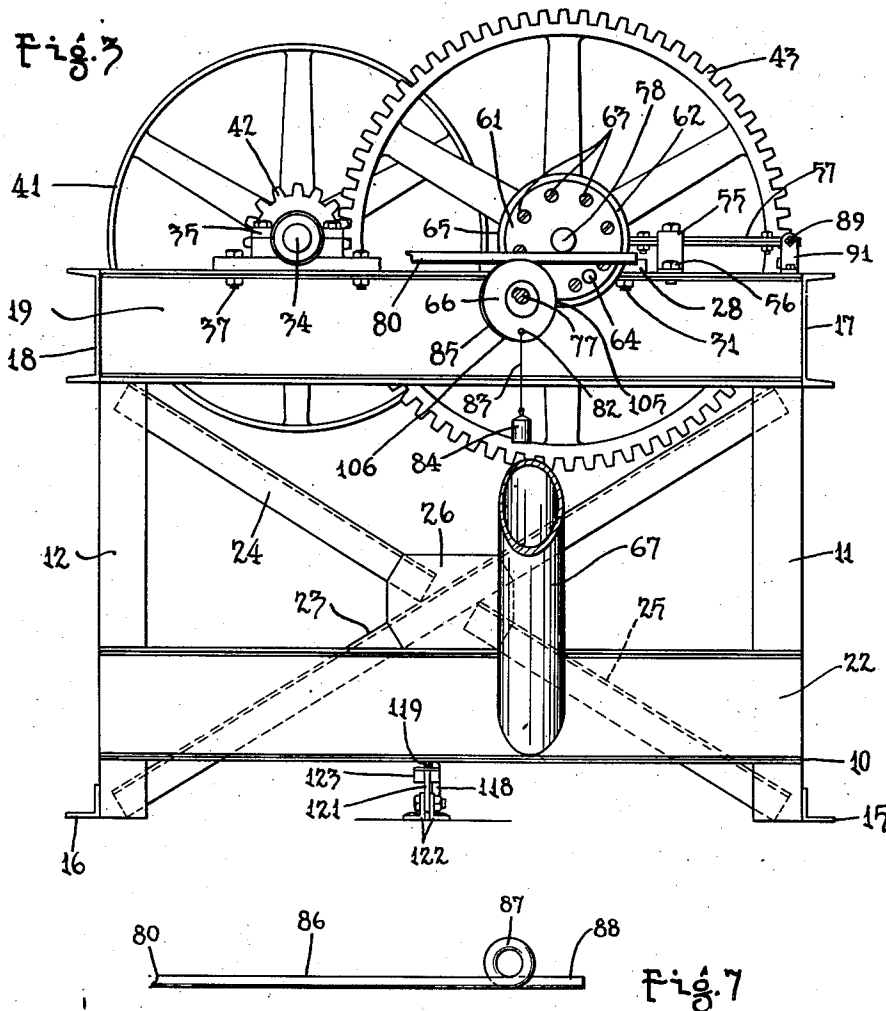


Fig. 7

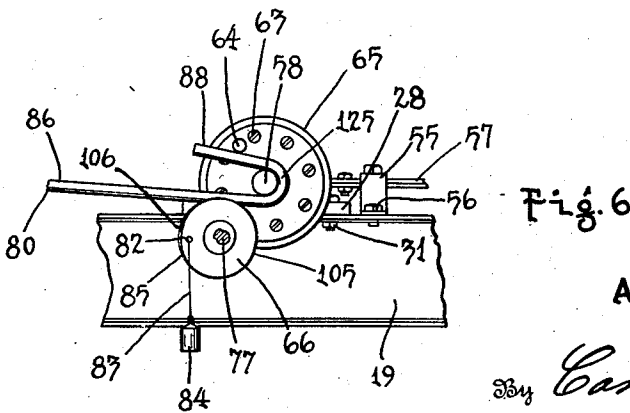


Fig. 6

Inventor
Andrew J Anderson
By *Carroll Lagaard*
Attorney

UNITED STATES PATENT OFFICE

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EYE-FORMING MACHINE

Andrew J. Anderson, Minneapolis, Minn.

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12 Claims. (Cl. 140-104)

My invention relates to machines for forming eyes or loops in metal rods and has for an object to provide a machine in which a closed loop may be formed in a rod and in which the ends of the rod lie in parallelism.

An object of the invention resides in providing a work head for engagement with the rod and in moving the work head through a predetermined angle in each cycle of operation thereof.

Another object of the invention resides in providing a machine in which bending of the rod is procured in addition to that procured by the work head to compensate for the spring back of the rod.

A still further object of the invention resides in providing a feed device for feeding the rod to the work head and in causing further movement of the rod through the action of the feed device, whereby the bending of the rod by the work head is augmented.

An object of the invention resides in constructing the feed device with a rotatable guide member driven through the movement of the rod and adapted to bend the rod in addition to the bending produced by the work head.

Another object of the invention resides in constructing the feed device with a cam surface having a high portion and a low portion and along which the rod travels and in providing driving means between the guide member and rod to procure rotation of the rod and bending of the rod through movement of the guide member.

A still further object of the invention resides in providing threads acting between the guide member and support therefor by means of which the rod is moved axially with reference to the work head, so that the eye is formed in a helix and the bent portion of the rod clears the unbent portion thereof.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is a plan view of an eye forming machine illustrating an embodiment of my invention.

Fig. 2 is a rear elevational view of the structure shown in Fig. 1.

Fig. 3 is an elevational sectional view taken on line 3-3 of Fig. 1.

Fig. 4 is a fragmentary plan view similar to Fig. 1 and showing the parts in altered position.

Fig. 5 is a plan sectional view taken on line 5-5 of Fig. 2.

Fig. 6 is a fragmentary elevational sectional view taken on line 6-6 of Fig. 4.

Fig. 7 is a plan view of a device formed on the machine such as shown in the other figures.

In the formation of an eye in a rod intermediate the ends thereof and where it becomes

desirable to have the portion of the rod adjacent the eye lie in parallelism, considerable difficulty arises due to the spring back in the rod. Where the work head travels through 360°, the rod will spring back upon release from the head with the portions of the rod out of parallelism. The present invention overcomes the difficulty by providing a construction in which the leading end of the rod is rotated through an angle of 360° and the trailing end at the same time rotated through an additional angle to cause the portions of the rod to spring back into parallelism when released from the machine.

My invention comprises a frame 10 which is provided with four legs 11, 12, 13 and 14. These legs are constructed from angle stock. The two legs 11 and 14 are connected together at their lower ends by means of a longitudinal frame member 15, while the legs 12 and 13 are similarly connected together at their lower ends by means of a longitudinal frame member 16. The upper ends of the legs 11 and 14 have connected to them a longitudinal frame member 17 in the form of a channel, while the legs 12 and 13 have similarly connected to them a longitudinal frame member 18, also in the form of a channel. Extending across the two legs 11 and 12 at the same elevation as the frame members 17 and 18 is a transverse frame member 19 which is in the form of an I-beam and which is arranged with its web overlying one of the flanges of the legs 11 and 12. The lower flange of this I-beam is notched to fit the said legs, whereby the parts may be secured together as shown. A similar transverse frame member 21 is attached to the uppermost ends of the legs 13 and 14 in the same manner as the frame member 19 and at the same elevation. The legs 11 and 12 also have attached to them at an elevation somewhat above the frame members 15 and 16 a transverse frame member 22 which is in the form of a channel and which overlies the coplanar flanges of the legs 11 and 12. For bracing the frame work, two diagonal braces 23 and 25 are employed which are secured to the legs 11 and 12 at their upper and lower ends and which are also attached to an attaching plate 26. All of the frame members of the frame 10 may be welded together in accordance with the usual practice or the same may be secured together by means of bolts, rivets, or in any other suitable manner.

My invention includes a work shaft 27 which extends across the two transverse frame members 19 and 21 and which is journaled for rotation in two bearings 28 and 29 secured to the upper flanges of the transverse frame members 19 and 21 by means of bolts 31. This shaft is held from axial movement relative to the bearings 28 and 29 by means of collars 32 and 33, which are secured to said shaft and which abut against the ends of said bearings.

The shaft 27 is driven in the following manner: Extending across the transverse frame members 19 and 21 is a countershaft 34 which is journaled in two bearings 35 and 36 which are secured to the upper flanges of the transverse frame members 19 and 21 by means of bolts 37. This shaft, similar to shaft 27, is held from endwise movement by means of collars 38 and 39 which are attached to the ends of said shaft and which abut against the outer ends of the two bearings 35 and 36. The countershaft 34 is driven by means of a pulley 41 fast thereon. This pulley may be belted to any suitable source of power. Also secured on the shaft 34 is a spur pinion 42 which meshes with a spur gear 43 rotatably mounted on the shaft 27. The gear 43 is held from axial movement on the shaft 27 by means of a collar 44 secured to said shaft and engaging the hub 45 of said gear. The said gear has on the opposite side thereof another hub 46 which is counterbored to receive a collar 40 similar to the collar 44 and which is also secured to the shaft 27.

The hub 46 is constructed to form a jaw 47 which constitutes one of the elements of a jaw clutch indicated in its entirety by the reference numeral 48. This jaw clutch includes a sliding clutch member 49 which is splined to the shaft 27 and which is constructed with a jaw 51 forming the other element of the jaw clutch 48. The clutch member 49 is formed with a groove 52 therein which receives two pins 53 projecting from a forked operating lever 54. Lever 54 is pivoted to a bracket 55 secured to the transverse frame member 19 by means of bolts 56. The lever 54 has an arm 57 extending outwardly beyond the bracket 55 by means of which the lever 54 may be swung to operate the clutch 48. The jaw clutch 48 is adapted to be moved into engaging position by means of a spring 188 which is connected at one end to the extreme end of the arm 57 and at its other end to a hook 89 mounted on a lug 91 secured to the transverse frame member 19. This spring tends to move the arm 57 in a clockwise direction and to throw the jaw 51 into engagement with the jaw 47.

The shaft 27 extends outwardly beyond the frame member 19 and is formed with a reduced shaft end 58 which projects outwardly beyond a face plate 59 secured to the end of the said shaft. This shaft end constitutes a mandrel about which the stock is wound. The face plate 59 carries a facing 61 which is formed with a beveled or frusto conical surface 62 at the marginal portion thereof. The facing 61 is secured to the face plate 59 by means of screws 63 which extend through said facing and are screwed into the face plate proper. The face plate 59 has attached to it a pin 64 which is eccentrically situated with reference to the mandrel 58 and which operates upon the stock as will be presently more fully described. The face plate 59 and associated parts form the work head of the machine which is indicated in its entirety by the reference numeral 65.

The means for feeding the stock to the work head 65 includes a feed roller 66 which is mounted for rotation in the following manner: Issuing angularly upwardly from the transverse frame member 22 is a standard 67 which is formed at its upper end with an upright 68. The upright 68 is tubular in form and receives a post 69 which is slidable within said upright and also rotatable with reference to the same. The upright 68 has a number of circumferentially disposed holes 71 in it, while the post 69 similarly has a number of vertically disposed holes 72. A pin 73 may be

inserted in any of these holes to hold the post 69 in adjusted position with reference to the upright 68. To brace the upright 68, a brace 74 is employed which is bent about the upright and which is bolted to the lowermost flange of the transverse frame member 19 by means of bolts 75. The standard 67 is provided with a stub shaft 77 which extends through the uppermost portion of the same and which projects outwardly therefrom. This shaft is held rigidly in position by means of a set screw 78 threaded into a boss 79 formed on said upright. The shaft 77 has a single thread 81 formed on it which is of a coarse pitch. Rotatably mounted on the shaft 77 is a roller 66 which is formed with a corresponding thread to engage the thread 81. Roller 66 serves as a guide for guiding the stock to the work head 65 and has a cam surface 85 along which the stock travels. This cam surface is lowest at the locality 105 and highest at the locality 106. The cam surface 85 may be made as a spiral or the same may be made as a surface of revolution with its axis eccentric as shown in the drawings. The roller 66 has formed in it a hole through which a cable 83 extends. A weight 84 is attached to this cable. This weight serves to move the roller 66 until the hole 82 is lowermost. The hole in the roller 66 through which the shaft 77 extends is farthest from the circumference of the roller at the locality of the hole 82 or the high portion 106 of the cam surface 85. When the hole 82 is lowermost, the portion 106 of the cam surface 85 of guide roller 66 is most remote from the axis of the shaft 27. The cam surface 85 is formed as a groove in which the stock travels which is roughened or provided with serrations adapted to engage the stock, so that the said roller will not slip relative to the stock when the stock is fed into the machine.

The clutch 48 may be disengaged by means of the following construction which is best shown in Figs. 2, 4 and 5. Formed on the clutch member 49 is a cam 92 which has a volute cam surface 93 terminating in a plane surface 94. At the end of the plane surface 94 is provided a stop 95. The cam 92 is carried by a hub 96 formed on the member 49 and may be constructed as part of a flange 97 integral with said hub.

Operating in conjunction with the cam 92 is a cam follower 98 which is preferably in the form of a roller rotatably mounted on a sliding rod 99. The rod 99 is guided for sliding movement in two guides 101 and 102 which are secured to the transverse frame member 19. A tie rod 103 between these guides holds the same in proper spaced position. The rod 99 is reduced in diameter as indicated at 104, where the same passes through the guide 102 which provides a shoulder 107 on said rod. A compression coil spring 108 acts between the guide 102 and the shoulder 107 and serves to urge the roller 98 upwardly. Pivoted to the lowermost end of the rod 99 is a link 109 which is also pivoted to one arm 111 of a bell crank 112. Bell crank 112 includes a shaft 114 best shown in Fig. 5, which is journaled in two bearings 115 secured to the transverse frame member 22. Collars 116, secured to the ends of the shaft 114, hold the bell crank from axial movement within the bearings 115. The bell crank 112 includes another arm 117 which has pivoted to it a substantially horizontally extending link 118. Link 118 is pivoted to an arm 119 of another bell crank 121 which is journaled in a bearing 122 adapted to be secured to the floor on which the machine is placed. Bell crank 121 is

provided with a foot pedal 123 by means of which the bell crank 121 may be manipulated. A tension coil spring 124 is connected to the end of the arm 111 of bell crank 112 and also to the bracket 55 supporting lever 54. This spring raises the arm 111 and link 109 and also holds the bell crank 121 with the pedal 123 uppermost. It will readily be comprehended that when the pedal 123 is depressed, roller 98 is moved downwardly and out of engagement with the cam 92.

While my improved invention may be used for various different purposes, I have shown in Fig. 7 one device capable of being made on the machine. This device consists of a rod 80 which is formed intermediate its ends with a loop or eye 87. The forward or leading end of the rod is indicated by the reference numeral 88, while the rearward or trailing end of the rod is indicated by the reference numeral 86. The device here shown has the ends 86 and 88 parallel to one another and the eye 87 is closed.

The method of operation of my invention is as follows: When the head 65 comes to rest, the pin 64 occupies the position shown in Figs. 1 and 3. The leading end 88 of rod 80 is then inserted between the mandrel 58 and the pin 64 and projected outwardly beyond the work head 65, until the extreme end of the rod engages a suitable stop not shown in the drawings. The rod is then moved down until the same rests upon the low portion 105 of the cam surface 85 of roller 66. At the same time, the end of the rod is caused to bear against the surface 62 of the facing 61 of the work head 65. The position of the rod 80 when the machine is ready to start is best shown in Figs. 1 and 3. The pedal 123 is next depressed which withdraws the roller 98 from engagement with the cam 92. This releases the clutch member 49. Spring 188 now moves the lever 54 in a clockwise direction as viewed in Fig. 1, which brings the clutch jaw 51 into engagement with the clutch jaw 47. Gear 43 now drives shaft 27 and the head 65 which is carried thereby. As soon as the shaft 27 commences to rotate, pedal 123 is released. Roller 98 now engages the cam 92 upon the outward periphery and when the shaft 27 has rotated sufficiently, is raised into a position back of the cam surface 93. As the head 65 rotates, pin 64 carries the end 88 of the rod 80 with it, causing the rod to become wrapped about the mandrel 58 as indicated at 125 in Fig. 6. As the rod is being wrapped about the mandrel 58, the end 86 of the rod is drawn in toward the work head 65 to provide the material for forming the eye. During such movement, the rod travels along the cam surface 85 and, due to the serrations or roughening of this surface, causes rotation of the roller 66. Rotation of said roller moves the high portion 106 of the cam surface 85 toward the stock, thereby raising the end 86 of the stock. At the same time, the hole 82 travels upwardly and correspondingly, the weight 84 is raised. While the roller or guide member 66 is rotating, the cam advances along the shaft 77 due to the threads 81 and shifts the stock outwardly away from the head 65. This causes the bent portion 125 to form a helix whereby the end 88 of the stock may clear the end 86 when the same approach each other as shown in Fig. 6. As the head 65 rotates, formation of the eye continues until the work head 65 reaches its original position. When the work head approaches this position, the roller 98 engages the cam surface 93 and forces the member 49 outwardly and away from the gear 43. When the roller reaches the

portion 94 of cam surface 93, the clutch has been disengaged and the work head 65 comes to rest. The stop 95 prevents over-travel of the shaft 27 and brings the work head 65 to rest at a predetermined position. During the rotation of the shaft 27, roller 66 has also been rotating, and due to the cam surface 85 on said roller, the end 88 of the rod 80 has also been rotated. As will be noted from Fig. 6, the end 88 of the rod has been rotated in a counterclockwise direction, while the end 86 has been rotated in a clockwise direction. This procures a total relative rotation between the two ends of the rod greater than 360°, so that the spring back of the bent parts can be compensated for and the ends of the rod brought into parallelism when the work is removed from the machine. At the same time, the roller 66 has been moved axially along the shaft 77 due to the threads 81 and has receded from the head 65. This forms the eye 87 in a helix, so that the trailing end 86 of the rod 80 may clear the leading end 88. When the rod is removed, weight 84 returns the roller to normal position as shown in Fig. 3.

The advantages of my invention are manifest. By means of the feed device used for feeding the rod into the machine, the rod can be bent through an angle greater than 360° by rotation of the work head through an angle of 360°. Thus, the spring back of the stock can be compensated for. The machine is simple in construction and positive in action. The operation of the machine is automatic, so that when the machine is started, the loop or eye is formed without effort on the part of the operator. The feed device of my invention produces the additional rotational movement of the stock and, in addition, advances the stock axially relative to the mandrel to form the eye into a helix, whereby the bent end of the stock may clear the unbent end and make a closed loop.

Changes in the specific form of my invention, as herein described, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In combination, a rotatable work head, means for rotating said head through a predetermined angle, means for feeding stock to said head and including a guide member, means on said head for engaging the stock to cause bending thereof during rotation of the head and means for moving said guide member to procure additional rotational movement of the stock in a direction to augment the bending procured by said work head.

2. In combination, a rotatable work head, means for rotating said head through a predetermined angle, means for feeding stock to said head and including a guide member having a surface of revolution along which the stock travels, pivot means for rotatably supporting said guide member, said pivot means being eccentrically disposed relative to the surface of the guide member, means on said head for engaging the leading end of the stock to procure rotational movement thereof in one direction and movement of the trailing end of the stock toward the head, said movement of the trailing end of the stock causing rotation of the guide means and rotational movement of the trailing end of the stock in the opposite direction.

3. In combination, a rotatable work head, means for rotating said head through a prede-

terminated angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a cam surface along which the stock travels, said guide member being situated on the side of the stock opposite the mandrel, engaging means on said head for engaging the leading end of the stock and bending the same about the mandrel, said means causing movement of the trailing end of the stock toward the mandrel, the stock during such movement rotating the guide member to advance the high portion of the surface of the cam toward the stock.

4. In combination, a rotatable work head, means for rotating said head through a predetermined angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a cam surface along which the stock travels, said guide member being situated on the side of the stock opposite the mandrel, said cam surface being movable toward and from the mandrel upon rotation of the guide member, engaging means on said head for engaging the leading end of the stock and bending the same about the mandrel, and means for rotating said guide member during the movement of said head to rotate the trailing end of the stock about the mandrel in a direction opposite to the direction of the rotation of the leading end of the stock.

5. In combination, a rotatable work head, means for rotating said head through a predetermined angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a cam surface along which the stock travels, said guide member being situated on the side of the stock opposite the mandrel, engaging means on said head for engaging the leading end of the stock and bending the same about the mandrel, serrations formed on said cam surface for engagement with the stock, said engaging means causing movement of the trailing end of the stock toward the mandrel, the stock during such movement being geared to the guide member and rotating the guide member to advance the high portion of the cam surface toward the stock.

6. In combination, a rotatable work head, means for rotating said head through a predetermined angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a cam surface along which the stock travels, engaging means on said head for engaging the leading end of the stock and bending the same about the mandrel, said means causing movement of the trailing end of the stock toward the mandrel, the stock during such movement rotating the guide member to advance the high portion of the cam surface of the guide member toward the stock, and means for returning the guide member to a position with the low portion of the cam surface adjacent the stock when the formed stock is removed from the guide member.

7. In combination, a rotatable work head, means for rotating said head through a predetermined angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a cam

surface along which the stock travels, means for yieldingly holding the guide means with the low side of the cam surface thereof adjacent the stock, engaging means on said head for engaging the leading end of the stock and bending the same about the mandrel, said means causing movement of the trailing end of the stock toward the mandrel, the stock during such movement, rotating the cam in opposition to said yielding means to advance the high portion of the surface of the cam toward the stock.

8. In combination, a rotatable work head, means for rotating said head through a predetermined angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a surface along which the stock travels, a support for rotatably supporting said guide member, threads acting between said guide member and support for advancing said guide member axially in a direction away from the work head and means for returning said guide member to its original position.

9. In combination, a rotatable work head, means for rotating said head through a predetermined angle, means for feeding stock to said head and including a guide member, means on said head for engaging the stock to cause bending thereof during rotation of the head and means for simultaneously moving said guide member to procure additional rotational movement of the stock in a direction to augment the bending procured by said work head.

10. In combination, a rotatable work head, means for rotating said head through a predetermined angle, means for feeding stock to said head and including a guide member, means on said head for engaging the stock to cause bending thereof during rotation of the head and means for moving said guide member about the axis of said work head to procure additional rotational movement of the stock in a direction to augment the bending of the stock by said work head.

11. In combination, a rotatable work head, means for rotating said head through a predetermined angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a surface along which the stock travels, a support for rotatably supporting said guide member, said guide member having a cam surface engaged by the stock, and rotated throughout a portion of a revolution during the feeding of the stock to procure additional bending of the stock and means for returning said guide member to its original position.

12. In combination, a rotatable work head, means for rotating said head through a predetermined angle, a mandrel axially disposed relative to said head, means for feeding stock to said head in a direction tangent to the mandrel, said means including a rotatable guide member having a surface along which the stock travels, a support for rotatably supporting said guide member, means acting between said guide member and support for advancing said guide member axially in a direction away from the work head and means for returning said guide member to its original position.

ANDREW J. ANDERSON.