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PATENTED JUNE 19, 1906.

N. W. HARTMAN.  
ELBOW FORMING MACHINE.  
APPLICATION FILED JUNE 3, 1903.

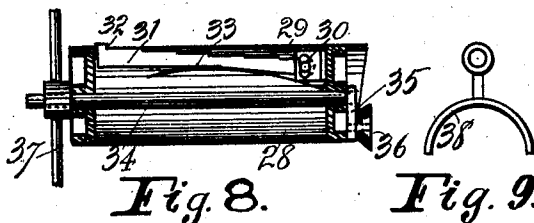
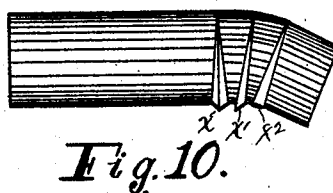
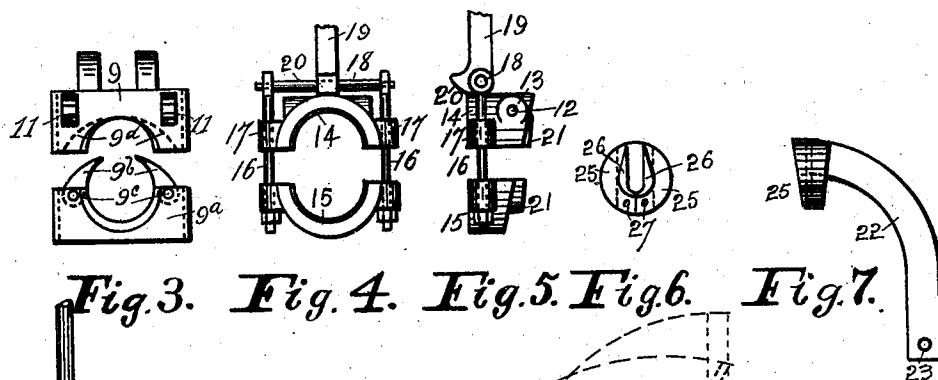


*Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.*

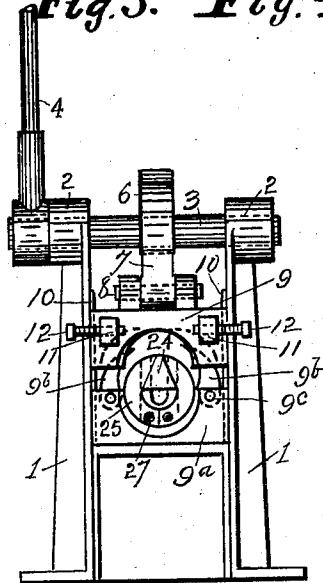


*Fig. 2.*

Witnesses:  
S. A. Dorland  
S. Thompson

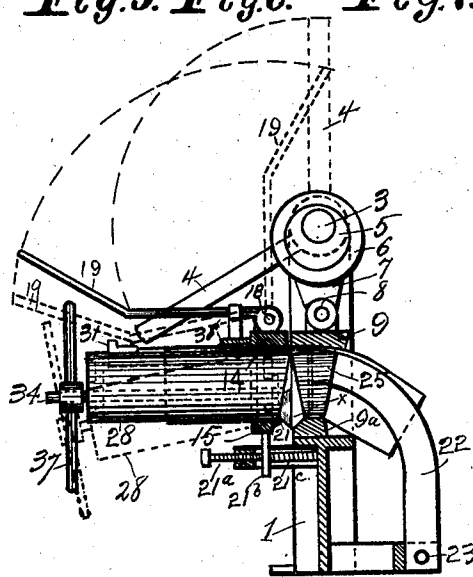


*Fig. 1.*

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By Andrew Hall His Atty.

# UNITED STATES PATENT OFFICE.

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## ELBOW-FORMING MACHINE.

No. 823,683.

Specification of Letters Patent.

Patented June 19, 1906.

Application filed June 3, 1903. Serial No. 159,962.

*To all whom it may concern:*

Be it known that I, NOBLE W. HARTMAN, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Elbow-Forming Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to a machine for making elbows for sheet-metal pipes; and its object is to provide means for quickly, cheaply, and uniformly forming crimps or folds circumferentially on one side of a sheet-metal pipe or tube, whereby it is curved and bent at any desired angle. I attain these objects by means of the devices and arrangement of parts hereinafter described and shown, and illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical sectional elevation of my machine; Fig. 2, a front elevation of the same with the crimping-jaws and core or holder hereinafter referred to removed; Fig. 3, a front elevation of the clamping-jaws hereinafter referred to; Fig. 4, a front elevation of the crimping-jaws hereinafter referred to detached; Fig. 5, a side view of the same; Fig. 6, a front elevation of the expanding mandrel hereinafter referred to detached; Fig. 7, a side elevation of the same; Fig. 8, a central longitudinal sectional elevation of my removable core hereinafter referred to, showing my spring-gage and creasing-wheel in place; Fig. 9, an end view of the presser foot or fork hereinafter referred to detached, and Fig. 10 a sheet-metal elbow showing the three stages of the formation of the crimps hereinafter referred to.

Like characters of reference indicate like parts throughout the drawings.

In the drawings, 1 is a frame or housing adapted and arranged to be secured upon a bench with the front toward the operator, as in Fig. 2. Upon the top of the two uprights of the housing is mounted and journaled, as at 2, a shaft 3, to the projecting end of which is secured a lever 4, by means of which the shaft is turned. Upon the shaft is secured a

cam 5, provided with a cam-strap 6, having a link 7, which is pivoted, as at 8, to the top of a jaw 9, which is vertically movable on guides or ways 10 on the housing.

Fixed between the uprights of the housing 1 is a jaw 9<sup>a</sup>, opposed to the movable jaw 9, the two jaws when closed presenting an opening therethrough of about the size of the blank to be crimped, one-half of the opening being in the upper jaw, the other half in the lower jaw. 9<sup>b</sup> 9<sup>b</sup> are curved fingers pivoted, as at 9<sup>c</sup>, upon the jaw 9<sup>a</sup> at opposite sides of the opening and adapted to swing apart. The adjacent margins of the two fingers are formed as arcs of the circle described by the circumference of the elbow at its crimped portion. In the lower face of the upper jaw are recesses (indicated by the dotted lines 9<sup>d</sup>, Fig. 3) which when the upper jaw is lowered receive the upper outer portions of the pivoted fingers 9<sup>b</sup> and press the points of the fingers toward each other with a wedge-like action.

On the front face of the jaw 9 is a pair of lugs 11, pierced horizontally to receive pins 12, which form pivots for like lugs 13 on jaw 14. (See Fig. 5.) 15 is a companion jaw to the jaw 14, and through the two jaws is an opening circular when the jaws are closed and of the size of the blank to be crimped. To each side of the lower jaw 15 is secured a rod or bar 16, which passes through guides 17 on the upper jaw 14, and which are connected at the top by a shaft 18. (See Figs. 4 and 5.) 19 is a lever secured at its lower end upon the shaft 18 and terminating at its lower end in a cam 20, which rests upon the top of the upper jaw 14. This cam when the lever is thrown downwardly, as shown in Fig. 1, presses the upper jaw downwardly. At the same time the lever 19 as it swings upon its fulcrum formed by the point of the cam pulls upwardly on the rods 16, connected to the lower jaw, and thus the two jaws by a single movement of the lever are drawn powerfully together.

The adjoining faces of the two pairs of jaws 9 9<sup>a</sup> and 14 15 are inclined or beveled away from each other downwardly, as illustrated in Fig. 1. Upon the rear sides of the jaws 14 and 15 is formed a backwardly-projecting blade or edge 21, (see Fig. 5,) curved in an arc of the circle of the blank to be crimped. The jaws 9 9<sup>a</sup> are countersunk to receive the

edged portion 21 when the jaws 14 15 are swung on their pivotal support 13, as hereinafter described. The throw of the jaws 14 15 outwardly is limited by set-screw 21<sup>a</sup>, projecting into a slotted bracket of the frame of the machine and abutting against an arm 21<sup>b</sup>, which projects downwardly from the jaw 15 into the slot of the bracket. 21<sup>c</sup> is a spring interposed between the housing of the machine and the arm 21<sup>b</sup> and holds the jaw normally in the position determined by the set-screw 21<sup>a</sup>.

22 is a bracket detachably and rigidly secured to the base of the machine by means of a removable pin 23. This bracket or arm curves upwardly and forwardly and terminates in a wedge-shaped extremity 24 (see Fig. 2) within the opening of the jaws 9 9<sup>a</sup>, the apex of the wedge being turned upwardly. 25 is an expanding mandrel composed of two equal halves circular in outline and of such dimension as to fit loosely within the interior of the blank to be crimped. The two halves of the mandrel 25 are slotted vertically in their adjacent faces, (see dotted lines, Fig. 6,) and into the recess formed by these two slots is slipped a plate 26, upon which the two halves of the expanding mandrel are pivoted or hinged, as at 27. The plate 26 is U-shaped, and the adjacent edges of the upwardly-extending arms of the U-shaped plate slide in slots or grooves formed in the opposite sides of the wedge-shaped end of the bracket 22. The inner adjacent faces of the two pivoted halves of the expanding mandrel are recessed, as shown in Figs. 2 and 6, to exactly fit the wedge-shaped end of the brackets 22 when the pivoted parts of the mandrel are in closed position. The two pivoted halves of the expanding mandrel do not swing asunder sufficiently to permit them to drop away from the supporting wedge-shaped end of the bracket 22. The meeting portions of the parts 26 between the pivots 27 are designed to remain in contact to prevent the entry of any portion of the sheet-metal blank between them. To accomplish this, the pivot-holes of the pivot 27 are somewhat enlarged, as illustrated in Fig. 6, to permit a slight movement of the parts 26 upon the pins 27.

28 is a core or holder consisting of a hollow cylinder closed at each end. At top the shell of the core is slotted longitudinally, as at 29. Within the core, at the inner end thereof, is pivoted, as at 30, one end of a gage 31. This gage consists of a thin flat bar having its upper edge formed in steps, as at 32, the successive notches of the steps forming stops for the outer end of the blank to be crimped during the succession of operations hereinafter to be described. 33 is a spring secured at one end within the shell of the core 28 and pressing outwardly against the pivoted gage 31 to cause its stepped or notched edge to project through the slot 29. Passing

through the core 28 longitudinally and eccentrically is a shaft 34, journaled at its opposite extremities in the ends of the cylindrical core. Secured to the inner projecting end of the shaft 34 is a crank-arm 35, upon the extremity of which is mounted and journaled a crimping-wheel 36. Upon the opposite projecting front end of the shaft 34 is a crank or hand-wheel 37.

The operation of my device is as follows: Assuming that the parts are assembled as here described, the core or holder 28 is slipped into the pipe-blank to be crimped, so that the outer end of the blank rests against the outer notch in the gage. The gage yields to inward pressure, so that the blank may be slipped onto the core or holder to any desired point. The notches in the gage form stops for holding the blank in the proper position on the holder longitudinally. The shaft 34 has previously been turned so that the crimping-wheel lies within the circumferential line of the core and is out of the way of the blank. The end of the blank projects considerably beyond the end of the core. The blank is now pushed into the opening between the two pairs of jaws 9 9<sup>a</sup> and 14 15, so that the inner end of the core rests against the forward end of the expanding mandrel 25. The meeting ends of the core and the expanding mandrel are sloped or beveled away from each other downwardly to correspond with the bevel of the adjacent faces of the two pairs of jaws. (See Figs. 7 and 8.) The end of the blank which has been passed through the jaws projects over the curved bracket 22, as illustrated in Fig. 1. The lever 4 is now swung downwardly, clamping the blank between the jaws 9 9<sup>a</sup> and the mandrel 25. As the upper jaw descends upon the blank the pressure is communicated to the top of the two pivoted halves of the mandrel 25, which are forced downwardly and are spread apart by the wedge-like action of the wedge-shaped end of the part 24 of the bracket 22. The blank is now firmly grasped and clamped upon the expanding mandrel by the jaws 9 9<sup>a</sup>. The lever 19 is next thrown downwardly from the upright position indicated by the dotted lines in Fig. 1 to the position shown by the solid lines, thus by the action of the cam 20 on the end of the lever throwing the jaw 14 downwardly and at the same time through the bars and cross-piece 18 pulling upwardly on the lower jaw 15 and causing the two jaws to clamp between them and the core 28 the tube-blank. Secured to the lever 19 is a presser foot or fork 38, (illustrated in Fig. 9,) which now rests upon the top of the tube-blank. The tube-blank is now firmly clasped between the two pairs of clamping-jaws 9 9<sup>a</sup> and 14 15 and is internally supported by the expanding mandrel and the core. The eccentric shaft 34 is now by means of the crank 37 given a turn,

and the sharp edge of the crimping-wheel 36, traveling in a path eccentric to the axis of the tube-blank, causes the wheel 36 to form in the bottom side of the tube-blank a sharp downwardly-projecting crease  $x$  (see Fig. 10) between the separated portions of the front and back jaws. The wheel 36 is now again swung upwardly and out of the way. The lever 19 is next given a further downward swing, as indicated by the dotted lines in Fig. 1. The pressure on the foot 38, secured to the lever 19, swings the pair of jaws 14 15 upon their pivotal support 13 downwardly, throwing the core and tube-blank into the position indicated by the dotted lines in Fig. 1, flattening the creased portion of the blank between the two pairs of jaws, the rear pair of jaws and the mandrel remaining stationary. This final downward movement of the lever 19 causes the inwardly-projecting edge 21 of the jaws 14 15 to catch one side of the crease in the tube-blank and to tuck it in between the wall of the blank and the other side of the crease, so that the two halves of the creased portion lie side by side, as illustrated at  $x'$ , Fig. 10. The lever 19 is now raised to its upright position, thus releasing the blank and core from the grasp of the jaws 14 15. The core is now withdrawn from the tube-blank the distance of one notch on the gage 31, which fixes the point of the next succeeding crimp in the tube-blank. The lever 4 is now raised to its upright position, thus also releasing the tube-blank from the grip of the jaws 9 9<sup>a</sup> and the mandrel 25. The blank and its core are now pressed farther into the machine until the core again comes into contact with the now open expanding mandrel, the curve which has been formed by the crimp in the blank passing downwardly over the curved arm or bracket 22. Again the lever 4 is lowered, again causing the mandrel 25 to expand and this time to catch tuck  $x'$  between the jaws 9 9<sup>a</sup>, the upper jaw 9 causing the pivoted curved fingers 9<sup>b</sup> to catch the tuck  $x'$  and to press it flat into the completed crimp  $x^2$  as it comes between the mandrel and the jaws 9 9<sup>a</sup>. Again the lever 19 is lowered to its second position, again the crank 37 is given a turn, forming the crease in the tube-blank, again the lever 19 is given its second downward throw, forming the second tuck  $x'$ , and again when the lever is lifted the core is withdrawn one notch from the tube-blank, and again these operations are repeated until the desired number of crimps are formed in the tube-blank and until the desired curvature of the elbow is obtained. When the desired number of crimps have been formed, the core is removed and the finished elbow is removed from the machine.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an elbow-forming machine, a pair of

interior supports for the tube-blank, a pair of mechanisms which clamp the blank upon said interior supports, a creasing-wheel journaled in one of said interior supports and adapted to form an outwardly-projecting circumferential crease on one side of the tube-blank, and means for deflecting one of said interior supports and its cooperating clamping mechanism relatively to the other internal support and its cooperating clamping mechanism, whereby a tube-blank may be bent while engaged with said internal supports and said external clamping mechanisms.

2. In an elbow-forming machine, two internal holders for a tube-blank, two pairs of clamping-jaws which cooperate with said internal holders, a creasing-wheel mounted eccentrically upon one of said holders and between said two holders, means for revolving said creasing-wheel, and means for the axial deflection of said holders and internal supports relatively to each other.

3. In an elbow-forming machine, a holder for the tube-blank, an expanding mandrel for the tube-blank, a pair of jaws for clamping the tube-blank upon the holder, a pair of jaws for clamping the tube-blank upon the expanding mandrel, a crank-shaft eccentrically mounted in the holder, a creasing-wheel on the crank of the shaft, means for turning the shaft and means for the axial deflection of the holder and the mandrel relatively to each other.

4. In an elbow-forming machine, a pair of adjacent holders for the tube-blank, a creasing-wheel mounted to travel eccentrically within the blank between the holders, a clamping mechanism cooperating with one of said holders, a pair of clamping-jaws cooperating with the other of said holders, a curved projecting edge upon one of said clamping-jaws adapted to engage one side of the crease formed in a tube-blank by said creasing-wheel, a pivotal support for said edged jaw, and means for swinging said jaw on its pivotal support.

5. In an elbow-forming machine, a curved bracket, a mandrel on the end of the bracket, a pair of jaws which clamp the tube upon the mandrel, a holder adapted to be slipped into the end of the tube-blank, another pair of jaws which clamp the tube upon said holder, a creasing-wheel operatively mounted at the inner end of said holder and adapted to form a crease in one side of the tube-blank, a pivotal support for said latter pair of jaws, means for swinging said latter pair of jaws on their pivotal support, and a curved projecting portion on said latter jaws adapted to engage one side of the crease formed by said creasing-wheel.

6. In a machine for forming elbows, a pair of clamping-jaws for clamping the tube-blank, a pivotal support for said pair of jaws, a lever

fulcrumed upon one of said jaws and connected with the other jaw, the arrangement being such that by the movement of the lever the jaws are first moved into clamping position and are then by the further movement of the lever swung upon their pivotal support.

7. In an elbow-forming machine, a cylindrical holder for the tube-blank having a longitudinal slot therein, a stepped gage-bar pivotally supported at one end within said slot, and a spring arranged to hold the stepped portion of the gage-bar normally beyond the outer surface of the holder.

8. In an elbow-forming machine, a holder for the tube-blank adapted to be slipped into the end of the blank, a shaft mounted and journaled eccentrically to the axis of the holder, a crank at one end of said shaft, a creasing-wheel mounted on said crank, and means at the other end of the shaft for turning the shaft and operating the creasing-wheel.

9. In an elbow-forming machine, a curved bracket having a wedge-shaped extremity, a two-part mandrel having in the meeting

faces of the two parts a recess corresponding with the wedge-shaped extremity of the bracket, and pivotal connections between the two parts of the mandrel opposite the apex of the wedge-shaped recess, said mandrel being supported upon said wedge-shaped extremity of the bracket.

10. In an elbow-forming machine, a pair of clamping-jaws, one of said jaws being fixed and the other movable, a lever, and connections between the movable jaw and the lever, another pair of clamping-jaws, another lever mounted upon one of said latter jaws, connections between the latter lever and the latter jaws for moving them into and out of clamping position, and pivotal connections between said two pairs of jaws which permit said latter jaws to be swung upon the jaws first mentioned.

In testimony whereof I affix my signature in presence of two witnesses.

NOBLE W. HARTMAN.

Witnesses:

CHAS. E. CHITTENDEN,  
S. A. DORLAND.