No. 737,339. PATENTED AUG. 25, 1903.

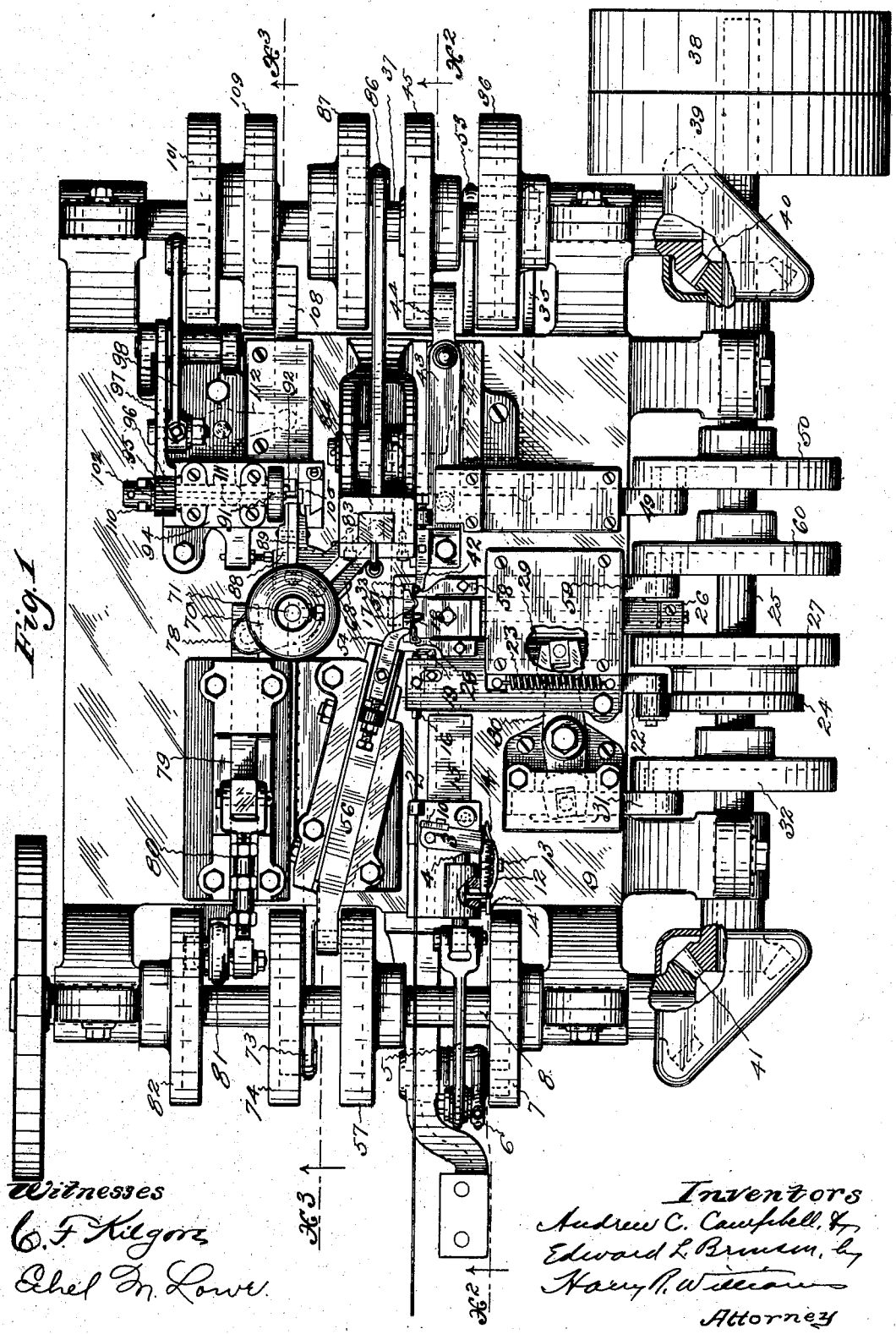
A. C. CAMPBELL & E. L. BRONSON.

WIRE BENDING MACHINE.

APPLICATION FILED NOV. 14, 1902.

NO MODEL. 8 SHEETS—SHEET 1.

Fig. 1



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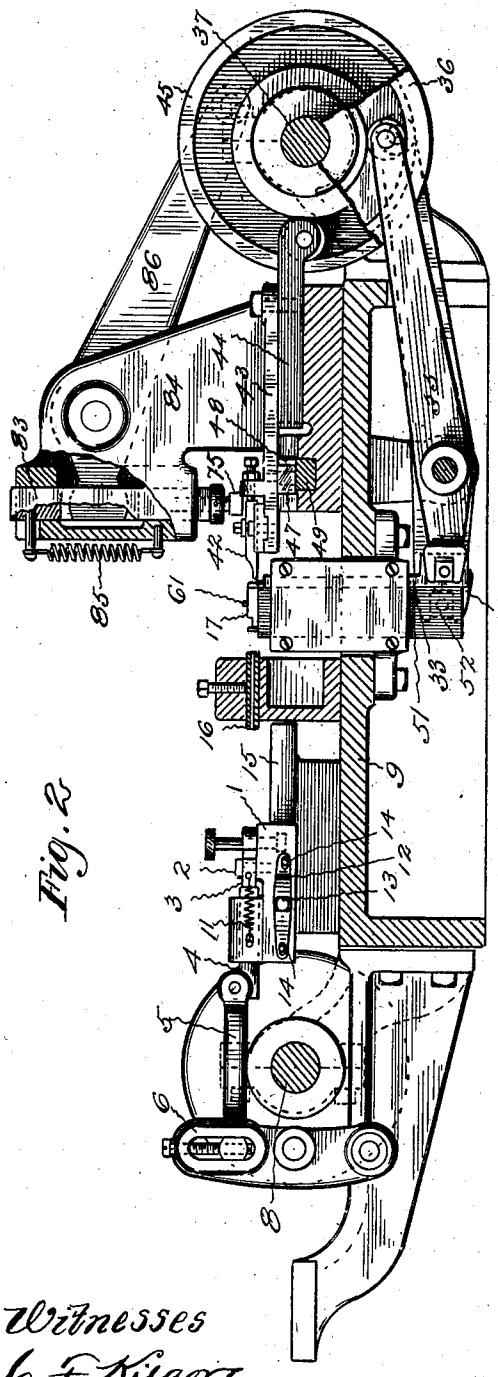


Fig. 2

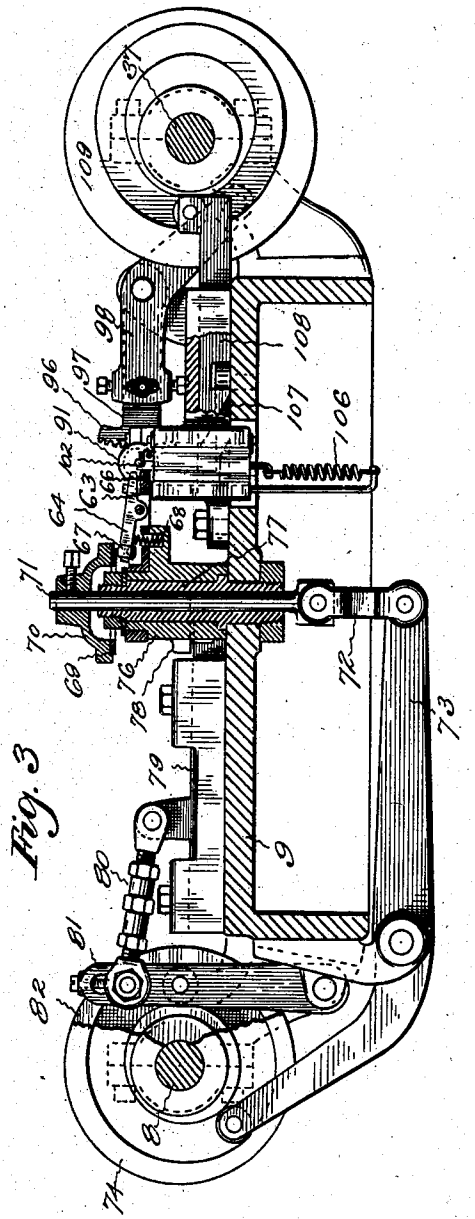


Fig. 3

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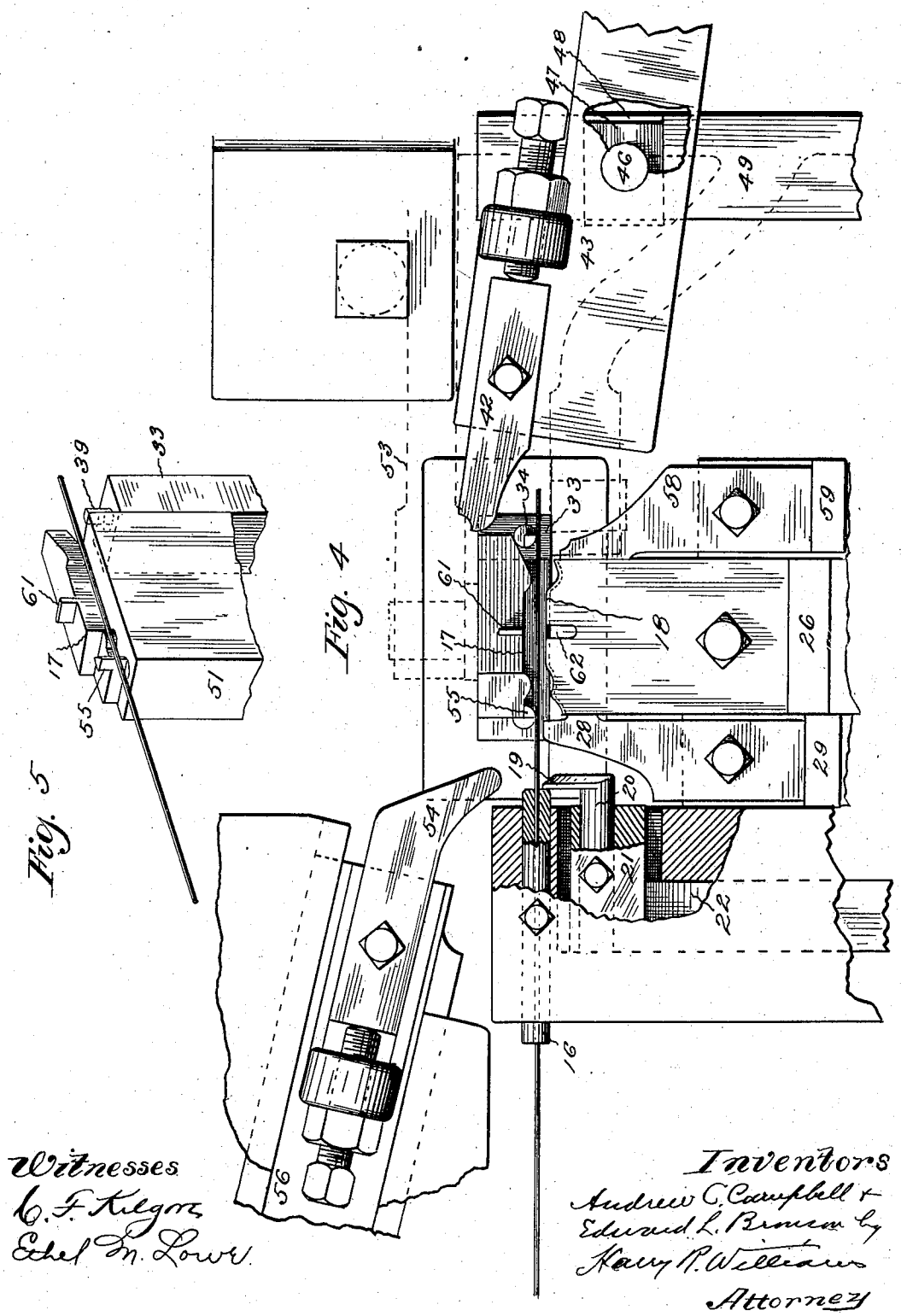
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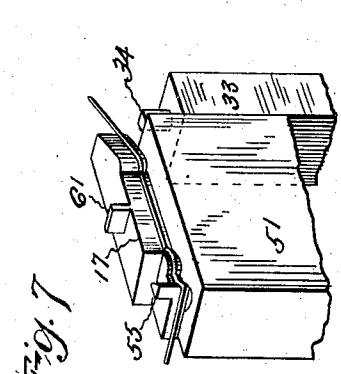


Fig. 7

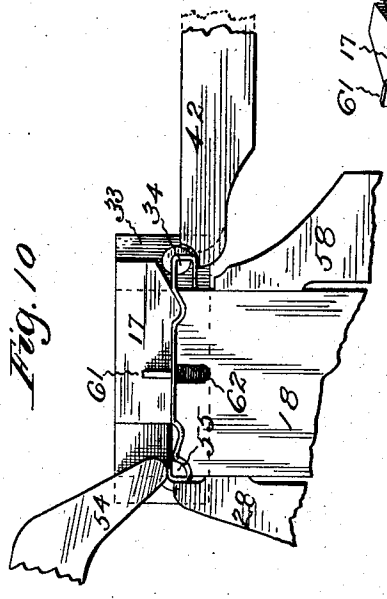


Fig. 10

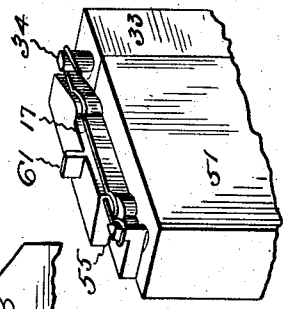


Fig. 11

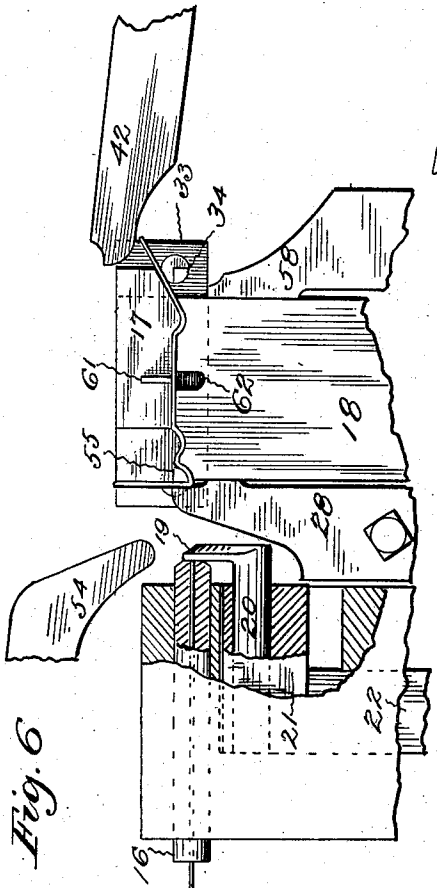


Fig. 6

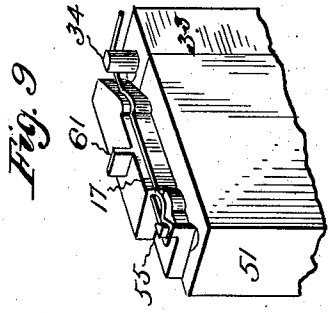


Fig. 9

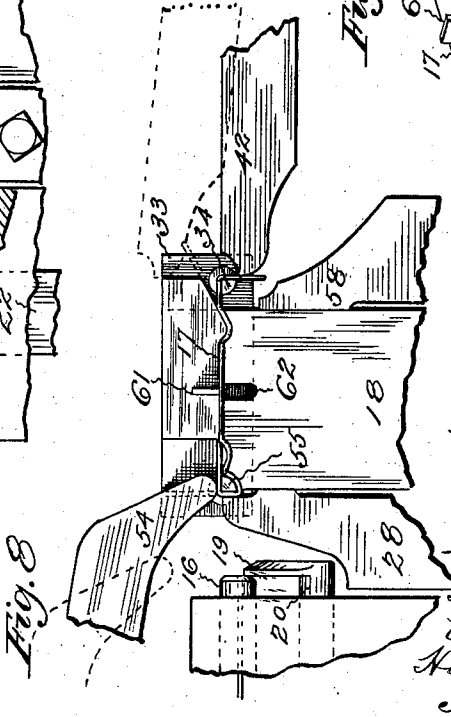


Fig. 8

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WIRE BENDING MACHINE.

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NO MODEL. 8 SHEETS—SHEET 5.

Fig. 14

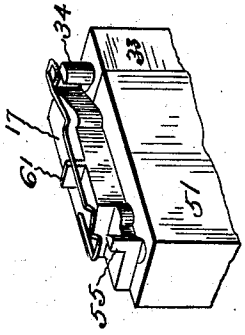


Fig. 13

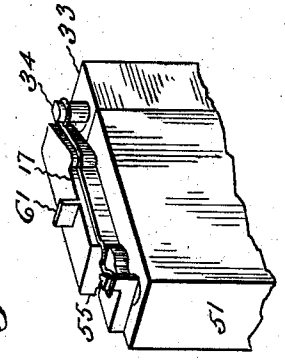


Fig. 16

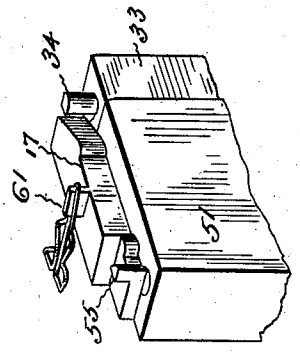


Fig. 12

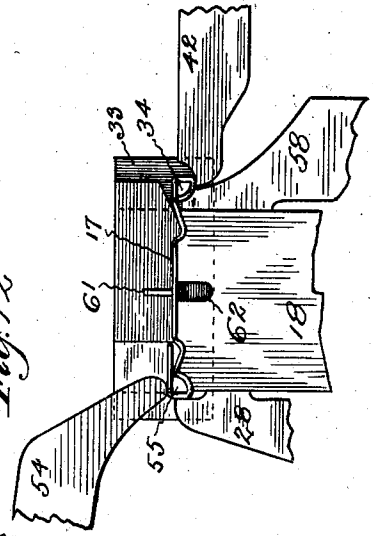
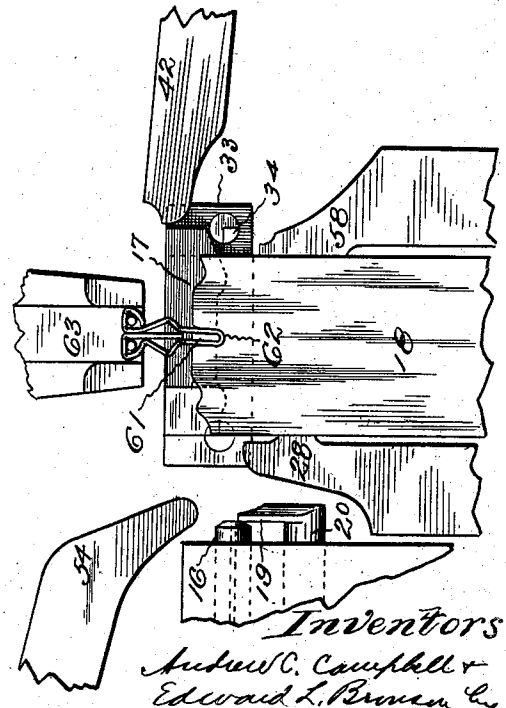


Fig. 15



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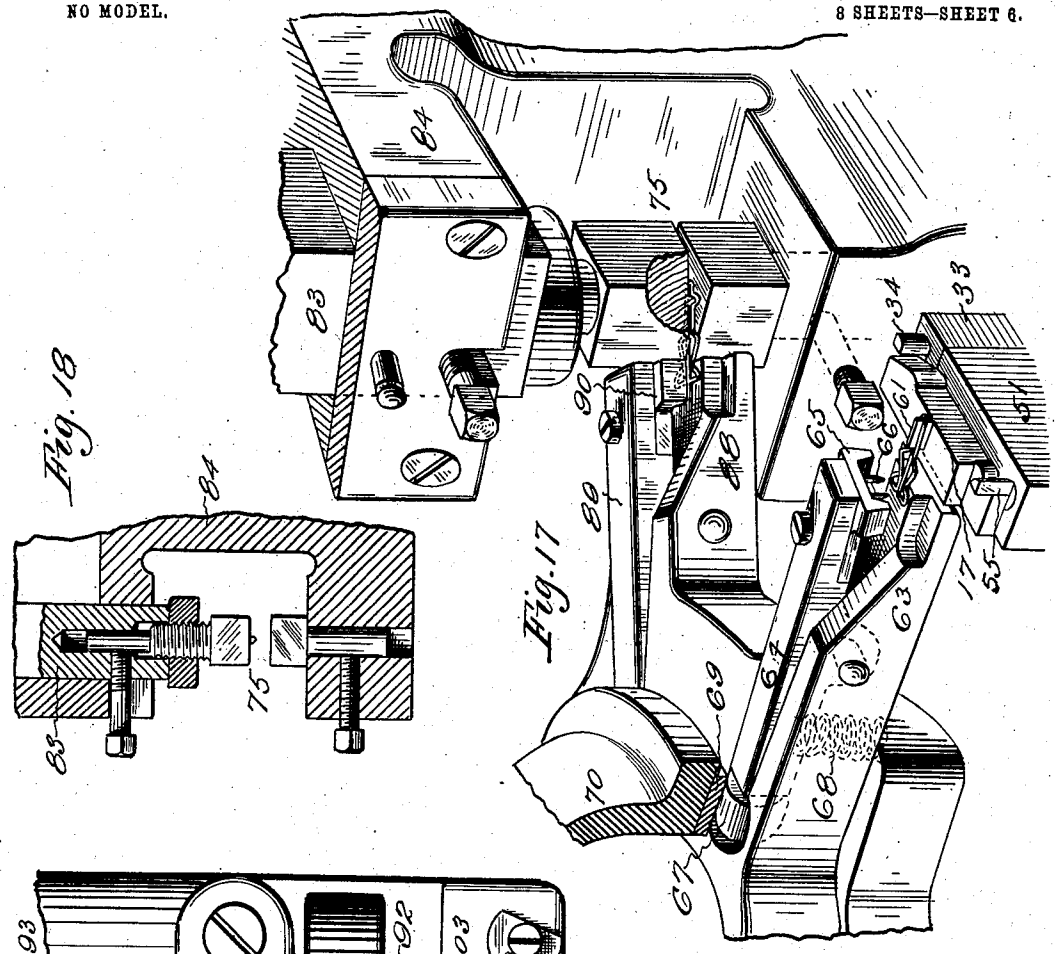
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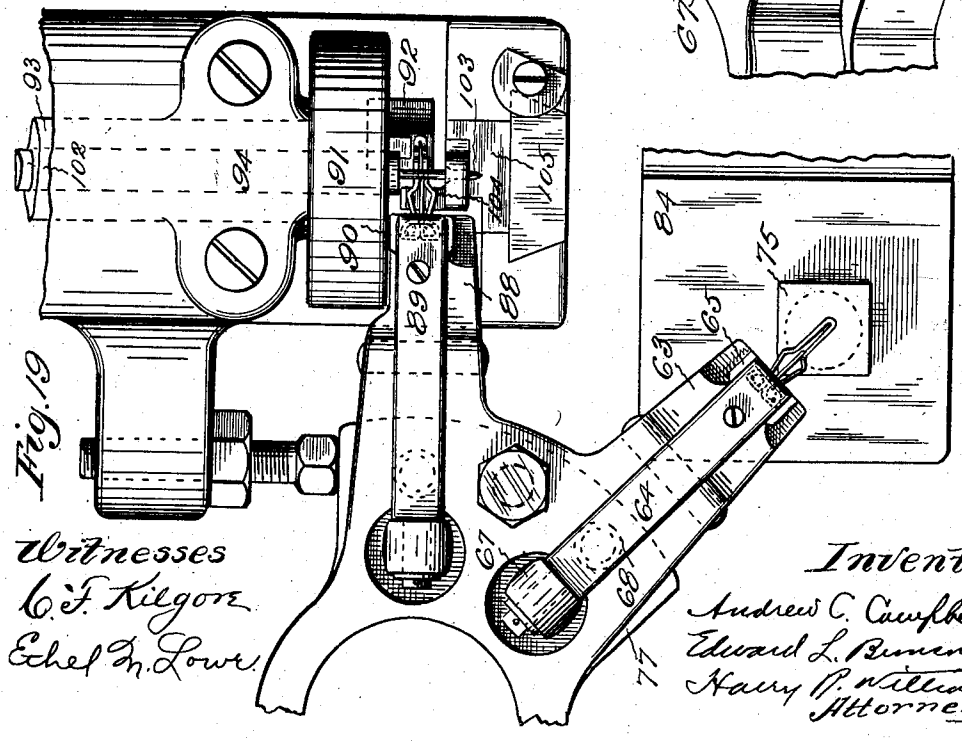
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WIRE BENDING MACHINE.

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NO MODEL. 8 SHEETS—SHEET 6.





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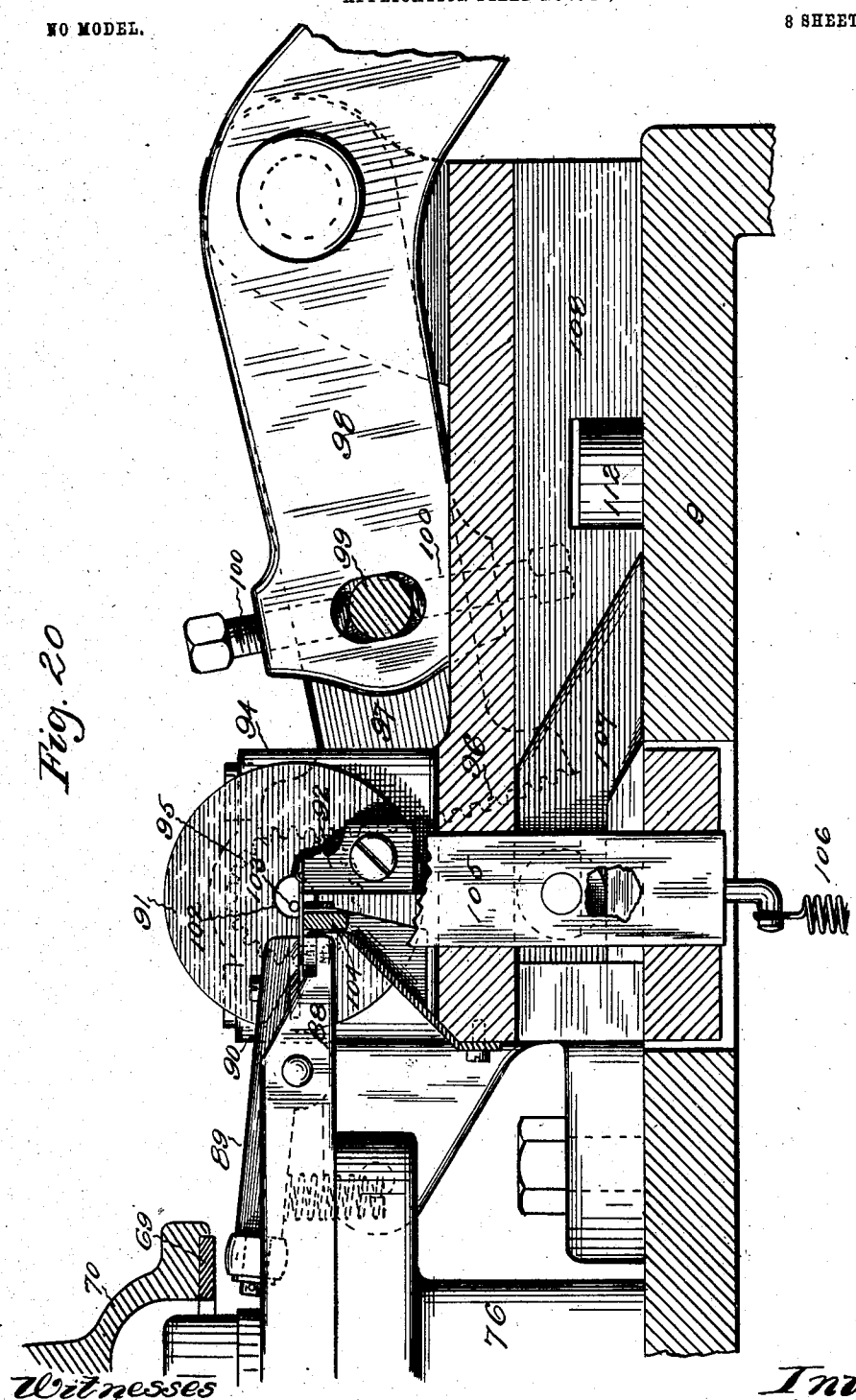
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WIRE BENDING MACHINE.

APPLICATION FILED NOV. 14, 1902.

NO MODEL. 8 SHEETS—SHEET 7.

Fig. 20



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Fig. 24

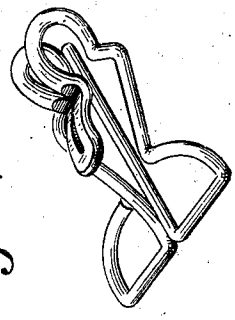
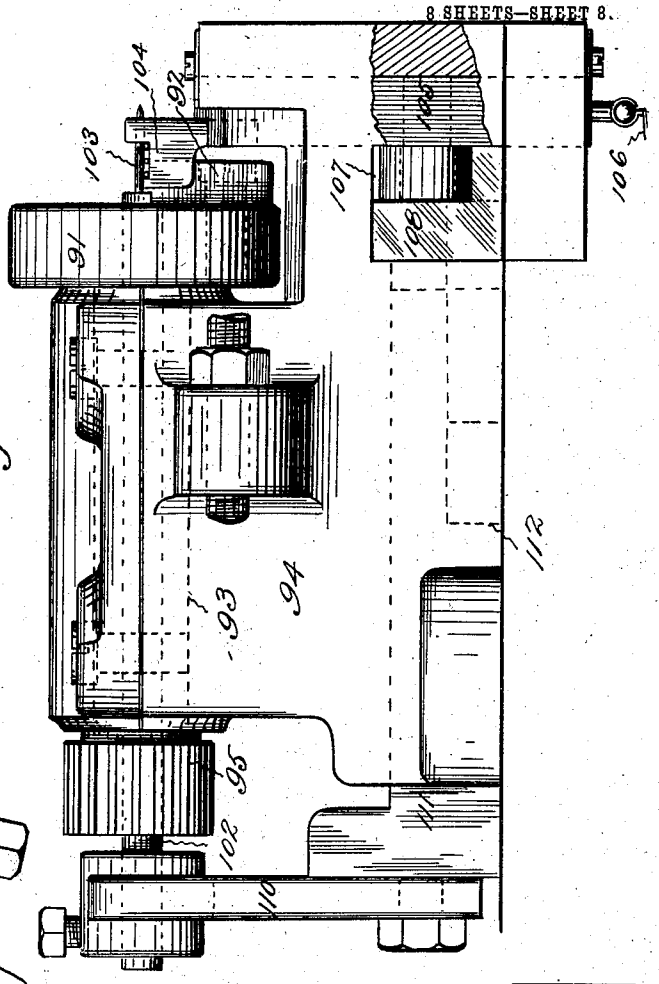


Fig. 22



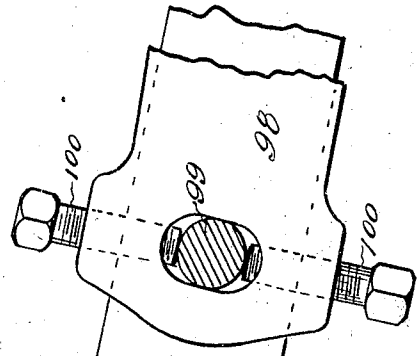


Fig. 23

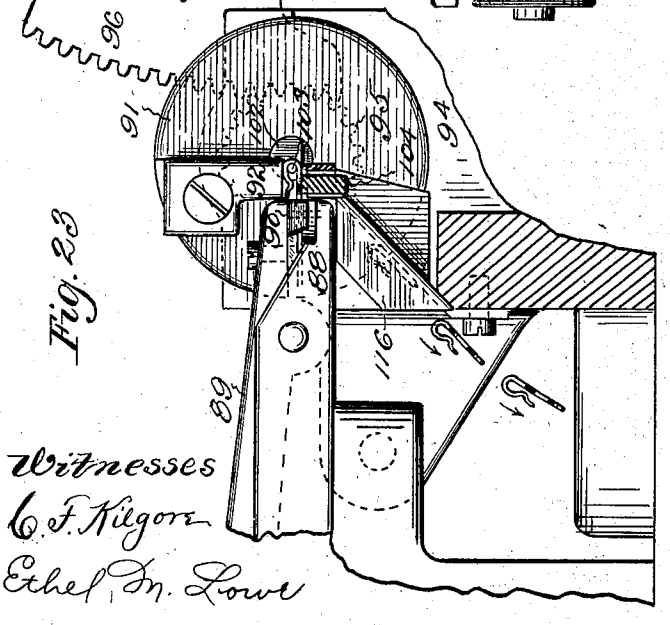
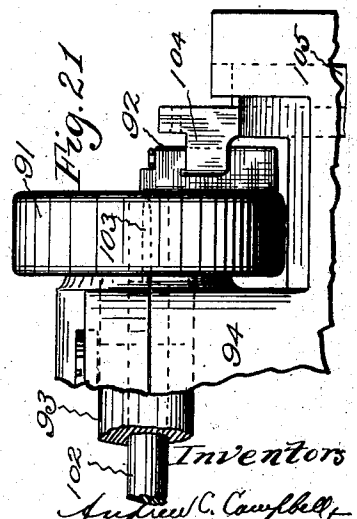


Fig. 21



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No. 737,339. Patented August 25, 1903.

UNITED STATES PATENT OFFICE.

ANDREW C. CAMPBELL AND EDWARD L. BRONSON, OF WATERBURY, CONNECTICUT, ASSIGNORS TO THE E. J. MANVILLE MACHINE COMPANY, OF WATERBURY, CONNECTICUT, A CORPORATION OF CONNECTICUT.

WIRE-BENDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 737,339, dated August 25, 1903.

Application filed November 14, 1902. Serial No. 131,434. (No model.)

To all whom it may concern:

Be it known that we, ANDREW C. CAMPBELL and EDWARD L. BRONSON, citizens of the United States, residing at Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Wire-Bending Machines, of which the following is a specification.

This invention relates to a machine for bending wire into garment-hooks.

The object is to provide a machine which will produce perfect hooks very rapidly.

The machine that is illustrated has mechanisms for intermittently feeding and cutting off the required lengths of wire, forming the lengths into blanks, bending the ends of the blanks into eyes, folding the blanks at the middle and bringing the eyes together, swaging the tongues, and winding the tongues to form the hooks.

Figure 1 is a plan of the entire machine. Fig. 2 is a vertical section on the plane indicated by the dotted line x^2 x^2 of Fig. 1, showing the feed mechanism, the female bending-die and its raising and lowering mechanism, the mechanism for reciprocating one of the eye-bending fingers, and the swaging mechanism. Fig. 3 is a vertical section on the plane indicated by the dotted line x^3 x^3 of Fig. 1, showing the mechanisms for gripping and transferring the folded blanks from the forming-dies to the swaging-dies and to the hook-winder and the mechanism for operating the winder. Fig. 4 is a plan, on larger scale, of the cutter, the forming-dies, and the eye-bending fingers, with the dies open and wire fed between. Fig. 5 is a perspective view of the female forming-die, showing its original position with relation to the wire. Fig. 6 is a plan showing the forming-dies closed upon a cut length of wire and one of the fingers moved to bend back an end of the wire. Fig. 7 is a perspective view of the female forming-die, showing its position with relation to the blank. Fig. 8 shows the forming-dies closed upon the blank and the fingers moved to complete the eye at one end and commence the bending of the eye at the other end. Fig. 9 is a perspective view of the female die, showing its relation to the blank with the eye formed at one end and commenced at the other end. Fig. 10 is a plan of the forming-dies closed upon the blank and the fingers in the positions occupied when the eye is completed at one end and partly bent at the other end. Fig. 11 is a perspective view of the female die and the blank with the completed eye at one end and the partly-bent eye at the other end. Fig. 12 is a plan of the forming-dies closed upon the blank and the fingers in the positions occupied when both eyes are completed. Fig. 13 is a perspective view of the female die and the blank with both eyes formed. Fig. 14 is a perspective view of the female die, showing its relation to the blank just before it is folded at the middle to bring the eyes together. Fig. 15 is a plan view of the dies and fingers with the blank folded at the middle to bring the eyes together. Fig. 16 is a perspective view of the female die and the folded blank. Fig. 17 is a perspective view of the transferring-arms about to take a folded blank from the female forming-die and a swaged blank from the swaging-dies. Fig. 18 is an elevation of the swaging-dies and their support. Fig. 19 is a plan of the transfer-arms and hook-winder. Fig. 20 is a sectional view showing in elevation the hook-winding mechanism, with a blank in position to be wound into hook form. Fig. 21 is a side elevation of the hook-winder with the blank as it is left by the transferring-fingers. Fig. 22 is a side elevation of the winding mechanism with the blank held by the raised support and the projected mandrel. Fig. 23 is an elevation of the hook-winding mechanism with a blank wound into hook form. Fig. 24 is a perspective view of a completed hook.

The wire is intermittently fed into the machine by any suitable mechanism. The feed mechanism shown has a slide 1 with a wire-guide 2 on one edge. On top of this slide is a lever 3, that is engaged by a plunger 4, which is connected by a link 5 with a lever 6, having a roll in a cam-groove in the disk 7 on the shaft 8, that is supported at one side of the bed 9. When the plunger is pushed forward, the jaw 10 on the lever clamps the wire, and then further

movement of the plunger moves the slide and feeds the wire. A spiral spring 11, connecting the plunger and the lever, retracts the lever and releases the wire when the plunger is drawn back. A leaf-spring 12, held by a screw 13 to the side of the slide, presses two pins 14, that pass through the slide, against the way 15, on which the slide moves and causes sufficient friction to prevent the slide from moving except when desired. The amount of this friction may be varied by turning the screw which holds the spring. After the clamp has released the wire the slide retracts for feeding another length of wire, Figs. 1 and 2.

The forward movement of the feed-slide advances a length of wire through the guiding-tube 16 into position between the female forming-die 17 and the male forming-die 18, Fig. 1. When the wire is in this position, Fig. 4, a length is cut off by the cutter 19. This cutter is on a post 20, that is held in a block 21, fastened to a slide 22, Fig. 4. The front end of this slide has a roll held by a spring 23 in engagement with the edge of the cam 24 on the shaft 25, that is supported at the front of the bed, Fig. 1. At the proper time the cam drives the slide forward and the cutter severs the wire. When a length of wire is between the male and female forming-dies, the female die 17 remains stationary while the male die 18 is moved backwardly and the wire compressed between them. The male die is mounted on a slide 26, the front end of which has a roll in a cam-groove in the disk 27 on the shaft in front of the bed, Fig. 1. After the wire has been blanked by the forming-dies a finger 28 is pushed backward, so as to bend an end of the wire rearward, as shown in Fig. 6. This finger is mounted on a slide 29, that is engaged by the forked end of a lever 30, that has its other forked end engaged with a slide 31, which has a roll in a cam-groove in the disk 32 on the shaft in front of the bed, Fig. 1. The cam reciprocates the slide and the oscillation of the lever causes the finger to move backwardly at the proper time to bend the end of the wire toward the rear. The blank is now in the position illustrated in Fig. 7. At this time the vertical slide 33, with the eye-mandrel 34, is raised so that the mandrel is lifted from below the wire into a position in front of the wire—that is, from the position shown in Fig. 7 to the position shown in Fig. 9. The lower end of the vertical slide 33 is engaged by the end of a lever 35, which has a roll in a cam-groove in the disk 36 on the shaft 37, that is supported at one side of the bed, Figs. 1 and 2. On the cam-shaft 25 at the front is a loose pulley 38 and a fixed pulley 39. The cam-shaft 37 at one side is driven from the shaft 25 by beveled gears 40 and the cam-shaft 8 at the other side is driven from the shaft 25 by beveled gears 41, Fig. 1. After the slide 33 with the eye-mandrel 34 has been raised the finger 42 is moved from the position shown in Fig. 6 to the position shown in Fig. 8, so as to bend an end of the wire forward around the mandrel. The bending-finger 42 is adjustably fastened to a lever 43, that is pivotally mounted on a slide 44, Fig. 2. The slide 44 has a roller in a cam-groove in the disk 45 on the side shaft, Figs. 1 and 2.

The lever 43 has a pin 46 and a block 47, which block lies in a groove 48 in a slide 49, Fig. 4. The slide 49 has on its front end a roll in a cam-groove in the disk 50, that is on the shaft in front of the bed, Fig. 1. The cam 50 and the slide 49 through the block and pin draw the free end of the lever 43 toward the front of the machine, so the finger 42 will bend the end of the wire forwardly around the mandrel 34, as shown in Fig. 8. Then the cam 45 reciprocates the slide 44, carrying the lever 43, so that the finger 42 will bend the end of the wire sidewise around the mandrel 34 from the position shown in Fig. 8 to that shown in Fig. 10. In the meantime the female die has been lowered, so that the relation between the blank and this die is changed from that shown in Fig. 7 to that shown in Fig. 9.

The lower end of the slide 51, to which the female die is attached, has a block 52, that is engaged by the forked end of a lever 53, which has a roll in a cam-groove in one face of the disk 36, Figs. 1 and 2. After the female die has been lowered the finger 54 is moved sidewise, so as to bend one end of the wire around the mandrel 55, that projects up from the female die from the position shown in Fig. 6 to the position shown in Fig. 8. The finger 54 is adjustably mounted on the slide 56, Fig. 4, which has a roll in a cam-groove in the disk 57 on the side shaft 8, Fig. 1. After the ends of the wire have been folded to the positions shown in Figs. 10 and 11 the finger 58 is pushed rearwardly to bend the end of the wire around the mandrel 34 and complete the eye at that end of the blank, Fig. 12. The finger 58 is mounted on the slide 59, that has a roll in a cam-groove in the disk 60 on the front shaft, Fig. 1. The blank is now formed to the shape illustrated in Fig. 13. At this time the female die, by means of the cam 36 and lever 53, Fig. 2, is lowered still farther, so that the blank is in front of the folding-rib 61, as shown in Fig. 14. When the blank is in this position, the male die, which has a recess 62 in its edge, is forced farther back by the cam 27 to the position shown in Fig. 15, and this folds the blank at the middle around the folding-rib and brings the eyes together, as shown in Fig. 16. The eyes of the blank now lie above an arm 63, Fig. 17. Pivoted to this arm is a lever 64 with a jaw 65, having pins 66, that are adapted to pass through the eyes of the blank into sockets in the arm. The other end of the lever has a roll 67, that, by the spring 68, is held in contact with an annular plate 69, Fig. 17. This plate is secured to an annular frame 70,

mounted on a spindle 71, that is connected by a link 72 with a lever 73, pivoted to the side of the machine and having a roll in a cam-groove in the disk 74 on the side shaft 8 of the machine, Fig. 3. This cam is timed to open the jaw and receive the eyes, then allow the spring to close the jaw and thrust the pins through the eyes and hold the blank very firmly in exact position on the arm 63. After the female die has been lowered farther by the mechanism described to withdraw the folding-rib from between the tongue of the blank the arm 63 is swung from the position shown in Fig. 17 and carries the blank from the forming-dies to the swaging-dies 75—the position represented in Fig. 19.

The arm 63 is mounted on a sleeve 76, supported by a hollow spindle 77, Fig. 3. Projecting from the sleeve is a lug 78, that is connected with a slide 79, that by an adjustable link 80 is connected with a lever 81, having a roll in a cam-groove in the disk 82 on the side shaft 8, Figs. 1 and 3.

When the blank has been carried between the swaging-dies, the male die is brought down and swages and indents the end of the tongue of the blank, Fig. 17. The male die is fastened to a vertical slide 83, supported by a standard 84, mounted on the bed. The slide 84 is drawn down by a spring 85 and is raised by the lever 86, Fig. 2, that has a roll in a cam-groove in the disk 87, Fig. 1. After the tongue has been swaged and indented the arm 63 is returned to take another folded blank from the forming dies. The eyes of the blank which has been swaged and indented now lie above an arm 88, that projects from the sleeve 76. This arm has a lever 89 with a jaw 90 on one end and a roll on the other end, that is engaged by the annular plate 69, so that the jaw is opened and closed at the same time as the jaw 65, Fig. 17 and 20. When a blank is carried from the forming-dies to the swaging-dies, a blank is carried from the swaging-dies to the winder, which curves the tongue around and forms the hook, Fig. 19.

The winder has a disk 91, with a block 92 on its face. This disk is mounted on an end of a sleeve 93, that is supported in a standard 94 on the bed, Fig. 19. On the other end of the sleeve is a pinion 95, Fig. 22, meshing with which is a segment 96 on an arm 97, that is connected with a lever 98 by means of a stud 99, projecting from the arm between the screws 100, Fig. 20. The lever 98 has a roll in a cam-groove in the disk 101 on the side shaft 37, Fig. 1. Extending through the sleeve 93 and winding-disk 91 is a spindle 102. Projecting from the front end of this spindle on one side of the axis is a mandrel-pin 103. When the winding-disk is rotated, the end of the tongue is curved around the mandrel by the block 92 from the position shown in Fig. 20 to the position shown in Fig. 23. The body of the blank is supported in front of the winder by an arm 104, fastened to a slide 105, Figs. 19 and 22. This slide is drawn down by a spring 106, Fig. 3, and is raised by a roll in a groove 107 in a slide 108, Fig. 20, which has a roll in a cam-groove in the disk 109 in the side shaft 37, Fig. 3. The blank is held in position on the support in front of the winder by the mandrel-pin 103, which is pushed forward after the blank is brought into position, so as to pass above the blank and through a perforation in the top of the slide 105. This holds the mandrel solidly and retains the blank firmly in position, Figs. 19 and 22.

The spindle 102 is connected by a bar 110 with a slide 111, Fig. 22, that is engaged by a lever 112, which engages the slide 108, Fig. 1. By this mechanism the arm 104 is lifted for supporting the blank and the mandrel is pushed forward about the same time. After these parts secure the blank into position the winding-disk is given the rotation for curving the tongue around the mandrel and forming the hook. After a hook has been formed the mandrel is withdrawn into the sleeve, as in Fig. 21, the supporting-arm is lowered, and the grasp of the holding-jaw released and the hook is allowed to drop down through the chute 116, Fig. 23, and out of the machine in its completed form, which is shown in Fig. 24.

The mechanisms of this machine operate positively and continue intermittently as long as power is applied to the fixed pulley. The tools and dies are adjustable and renewable. The blanks when being transferred from one place to another are firmly held, so that accurate hooks are produced; and as the blank forming the swaging and the hook-winding operations are carried on simultaneously without loss of time and interference in transferring the blanks a large number of hooks may be formed on this machine during each day without requiring the mechanisms to run at very high speeds.

We claim as our invention—

1. A machine for forming hooks having forming-dies, mechanism for operating the forming-dies, bending-fingers, mechanism for operating the bending-fingers, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

2. A machine for forming hooks having a feed, mechanism for operating the feed, forming-dies, mechanism for operating the forming-dies, bending-fingers, mechanism for operating the bending-fingers, swaging-dies, mechanism for oscillating the swaging-dies, an oscillatory winder, mechanism for operating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

3. A machine for forming hooks having a feed, mechanism for operating the feed, a cut-

ter, mechanism for operating the cutter, forming-dies, mechanism for operating the forming-dies, bending-fingers, mechanism for operating the bending-fingers, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

4. A machine for forming hooks, having forming-dies, mechanism for operating the forming-dies, bending-fingers, mechanism for operating the bending-fingers, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, and grippers which simultaneously transfer a blank from the forming-dies to the swaging-dies and a blank from the swaging-dies to the winder, substantially as specified.

5. A machine for forming hooks having forming-dies, mechanism for moving one forming-die toward and from the other forming-die, mechanism for moving one forming-die transversely of the plane of movement of the other forming-die, bending-fingers, mechanism for operating the bending-fingers, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

6. A machine for forming hooks having forming-dies, mechanism for moving one forming-die toward and from the other forming-die, mechanism for moving one forming-die transversely of the plane of movement of the other forming-die, a movable eye-mandrel, mechanism for moving the eye-mandrel transversely of the plane of movement of one forming-die, bending-fingers, mechanism for operating the bending-fingers, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

7. A machine for forming hooks having forming-dies, mechanism for moving one forming-die toward and from the other forming-die, mechanism for moving one forming-die transversely of the plane of movement of the other forming-die, bending-fingers, mechanism for operating the bending-fingers, mechanism for moving a forming-die transversely out of the plane of movement of the other forming-die, mechanism for moving one forming-die past the other forming-die, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

8. A machine for forming hooks having forming-dies, one of said forming-dies having a bending-mandrel and a folding-rib and the other having a folding-recess, mechanism for moving one forming-die toward and from the other forming-die, mechanism for moving one forming-die transversely of the plane of movement of the other forming-die, an independently-movable bending-mandrel, mechanism for moving this bending-mandrel into and out of the plane of the forming-dies, bending-fingers, mechanism for operating the bending-fingers, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

9. A machine for forming hooks having forming-dies, bending-mandrel and folding-rib, mechanism for moving one forming-die toward and from the other forming-die, mechanism for moving one forming-die transversely of the plane of movement of the other forming-die, a bending-finger movable backwardly and adapted to bend an end of the wire backwardly around a mandrel, a bending-finger movable sidewise and adapted to bend that end of the wire sidewise around the mandrel, a bending-finger movable toward the front for bending the other end of the wire forwardly around a mandrel and movable sidewise for bending that end of the wire inwardly around the mandrel, a bending-finger movable backwardly for bending that end of the wire backwardly around the mandrel, swaging-dies, mechanism for operating the swaging-dies, an oscillatory winder, mechanism for oscillating the winder, a gripper for transferring the blanks from the forming-dies to the swaging-dies and a gripper for transferring the blanks from the swaging-dies to the winder, substantially as specified.

10. A machine for forming hooks having forming-dies, one die being movable toward and from the other and one die being movable transversely of the plane of movement of the other and bearing a mandrel and folding-rib, a mandrel movable transversely of one of the forming-dies, a bending-finger movable backward, a bending-finger movable sidewise, a bending-finger movable forward and sidewise, a bending-finger movable backward, for bending the ends of the wire about the mandrels, mechanism for feeding the wire to the forming-dies, and mechanism for carrying the blanks from the forming-dies, substantially as specified.

11. Forming-dies for a machine for forming hooks consisting of a die movable toward and from the other die and a die movable transversely of the plane of movement of the

other die, one die having a fixed mandrel, a vertically-movable mandrel and a fixed folding-rib, and the other die having a folding-recess, and mechanism for operating the dies, substantially as specified.

12. In a machine for forming hooks, a transferring mechanism consisting of an arm bearing a jaw with holding-pins and an arm bearing a clamping-jaw, means for opening and closing the jaws, and means for oscillating the arms, substantially as specified.

13. In a machine for forming hooks, forming-dies, swaging-dies, a winder, means for transferring the blanks from the forming-dies to the swaging-dies and to the winder, a mandrel, means for moving the mandrel out of and into the winder, and mechanism for oscillating the winder and curving the blank about the mandrel, substantially as specified.

14. A machine for forming hooks having forming-dies, mechanism for operating the forming-dies, swaging-dies, mechanism for operating the swaging-dies, a winder, mechanism for transferring the blanks from the forming-dies to the swaging-dies and from the swaging-dies to the winder, a slide adapted to support the blank in front of the winder, a mandrel adapted to be projected from the winder for holding the blank to the support, and mechanism for oscillating the winder and curving the blank about the mandrel, substantially as specified.

15. A winding mechanism for a hook-forming machine consisting of a disk, a block attached to and movable with the disk for winding the blank, a mandrel adapted to be projected from the disk for holding the blank while it is being wound, and mechanism for oscillating the disk and reciprocating the mandrel, substantially as specified.

16. A transferring mechanism for a machine for forming hooks consisting of an oscillating arm, a lever carried by the arm, means for oscillating the lever, and a jaw with projecting pins attached to one end of the lever, substantially as specified.

17. In a machine for forming hooks, forming-dies, mechanism adapted to move one die toward the other die in two steps, mechanism adapted to move one die transversely of the other die in two steps, the steps of movement of the transversely-movable die following and alternating with the movements of the other die and means for clamping the blank formed by the dies before the second movement of the die that moves transversely, substantially as specified.

18. In a machine for forming hooks, a forming-die adapted to be reciprocated horizontally, a forming-die adapted to be reciprocated vertically, mechanisms adapted to move forward the horizontal die, then move the vertical die, then move the horizontal die still farther forward, then move the vertical die still farther and afterward return the dies to their original positions, a movable clamp and mechanism adapted to close the clamp upon the blank formed by the dies before the second movement of the vertical die, substantially as specified.

19. In a machine for forming hooks, forming-dies movable in planes at right angles with each other, mechanism adapted to twice move forward one die, mechanism adapted to move transversely the other die between and also after the movements of the first die, a movable clamp and mechanism adapted to close the clamp upon the blank after the second movement of the forwardly-moving die and before the second movement of the transversely-moving die, substantially as specified.

20. In a machine for forming hooks, forming-dies, mechanism adapted to move one die toward the other die in two steps, mechanism adapted to move one die transversely of the other die in two steps, the steps of movement of the transversely-movable die following and alternating with the movements of the other die, a feed adapted to move the wire between the dies before their first movements, a movable clamp, mechanism adapted to close the clamp upon the blank before the second movement of the vertical die, and mechanism adapted to move the clamp away from the vicinity of the dies after the second movement of the vertical die that moves transversely, substantially as specified.

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Witnesses:
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