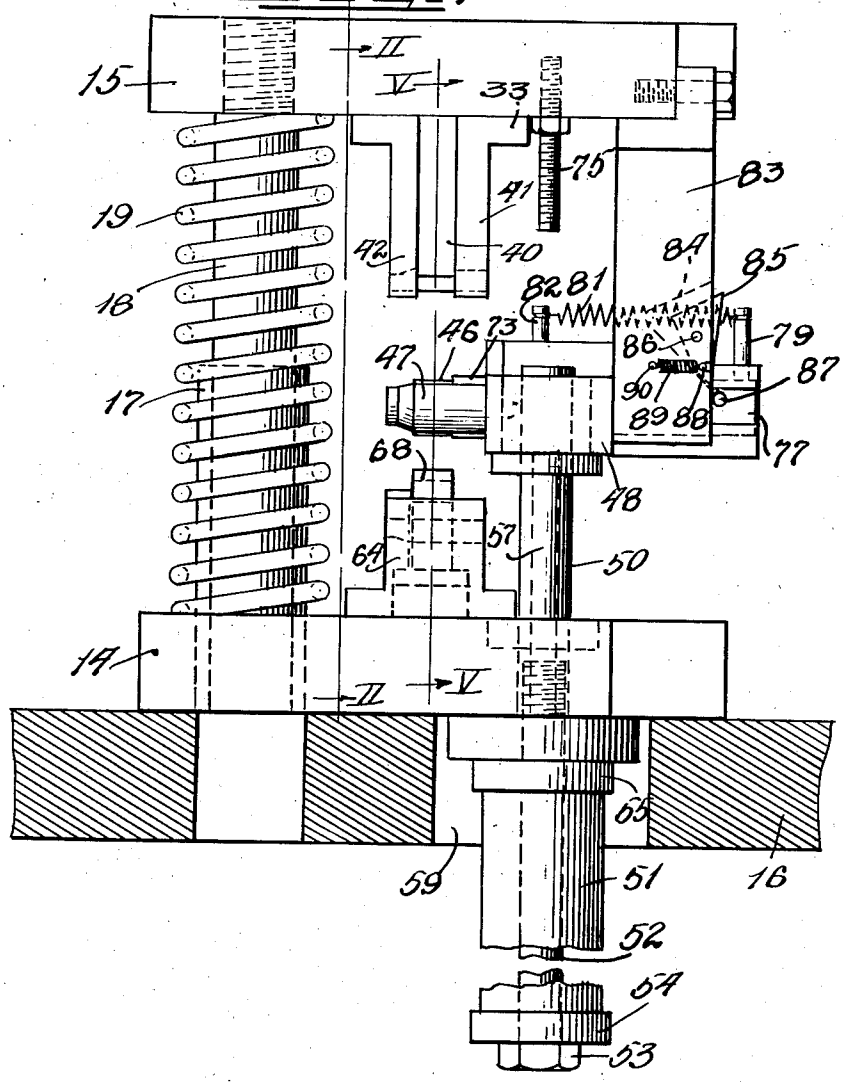
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DIE STRUCTURE FOR METALLIC CARTRIDGE BELT LINKS

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Fig. 1



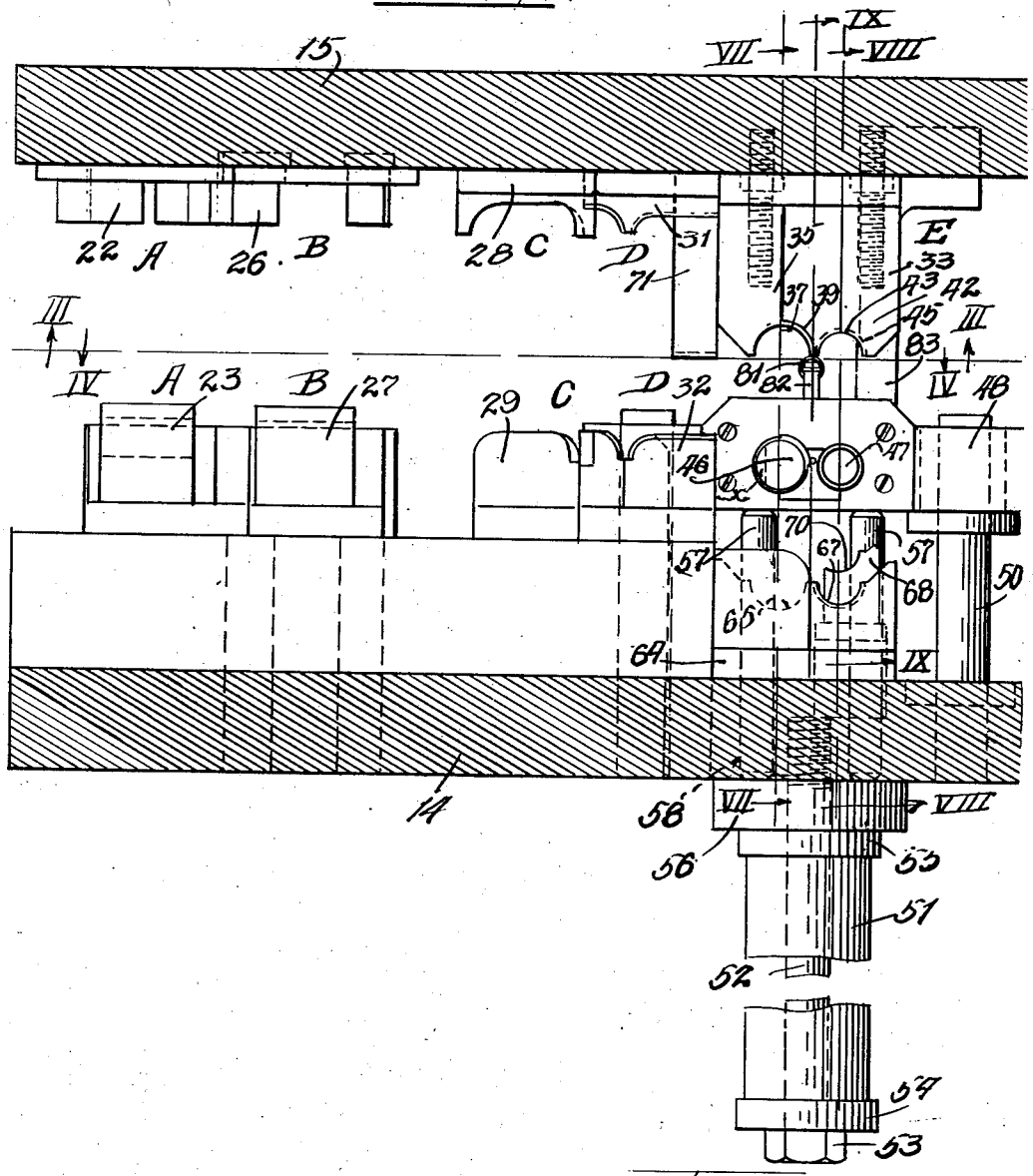
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DIE STRUCTURE FOR METALLIC CARTRIDGE BELT LINKS

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Fig. 2



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Fig. 3

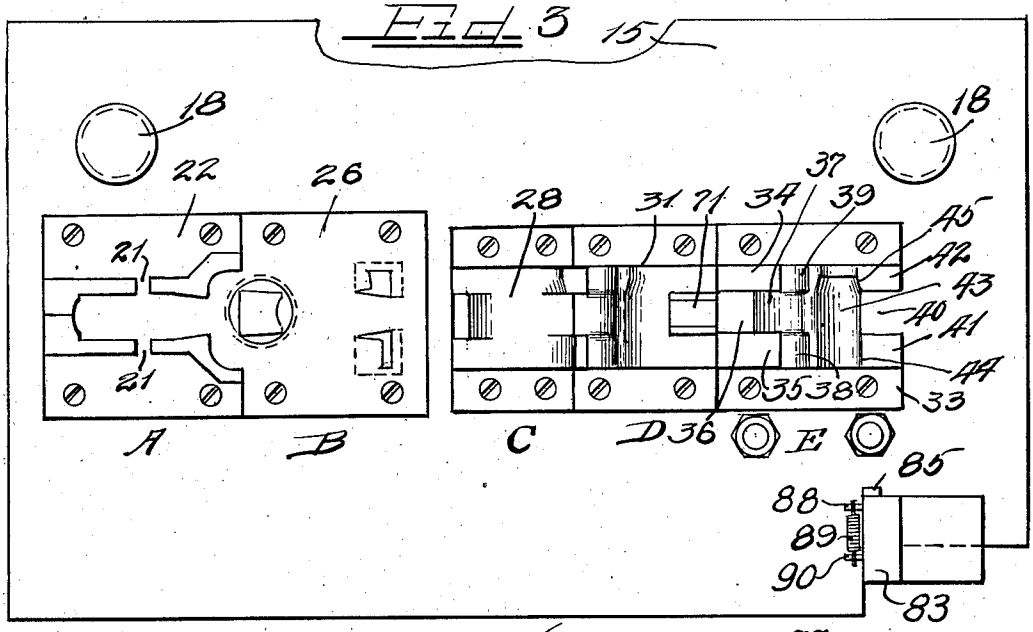
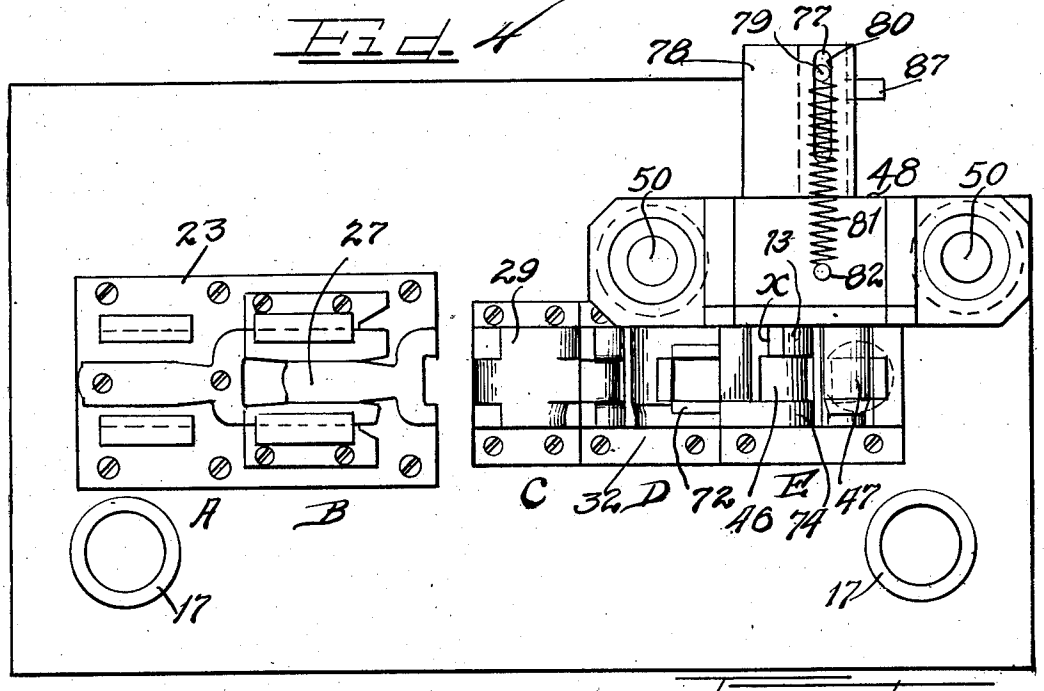


Fig. 4



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Fig. 5

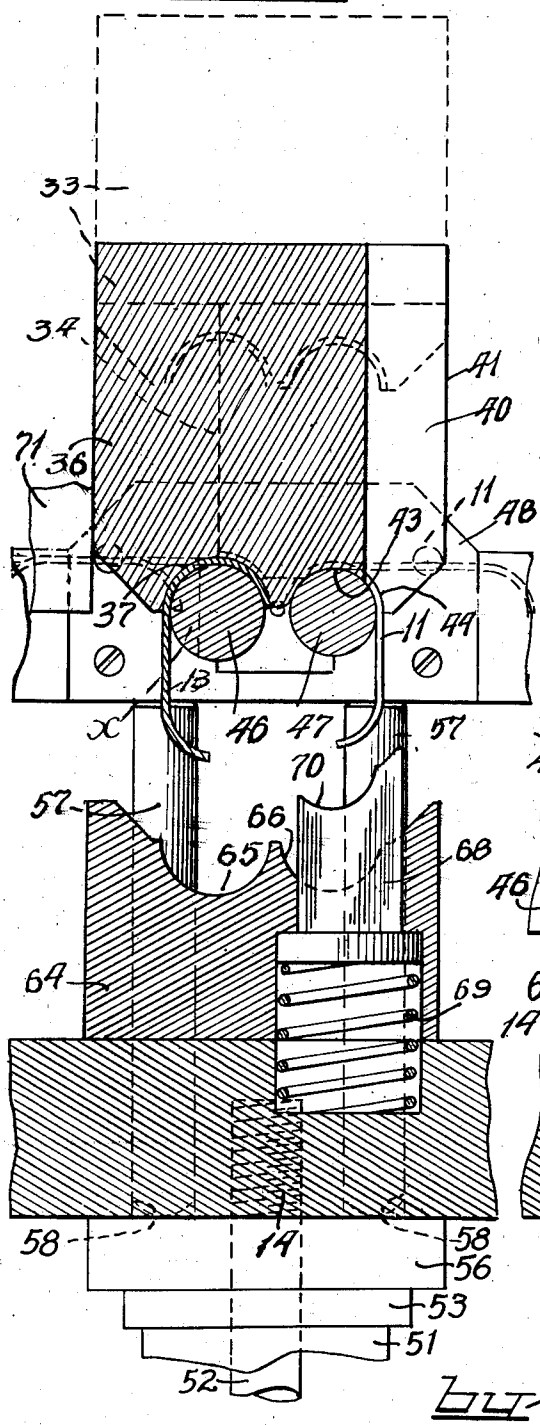
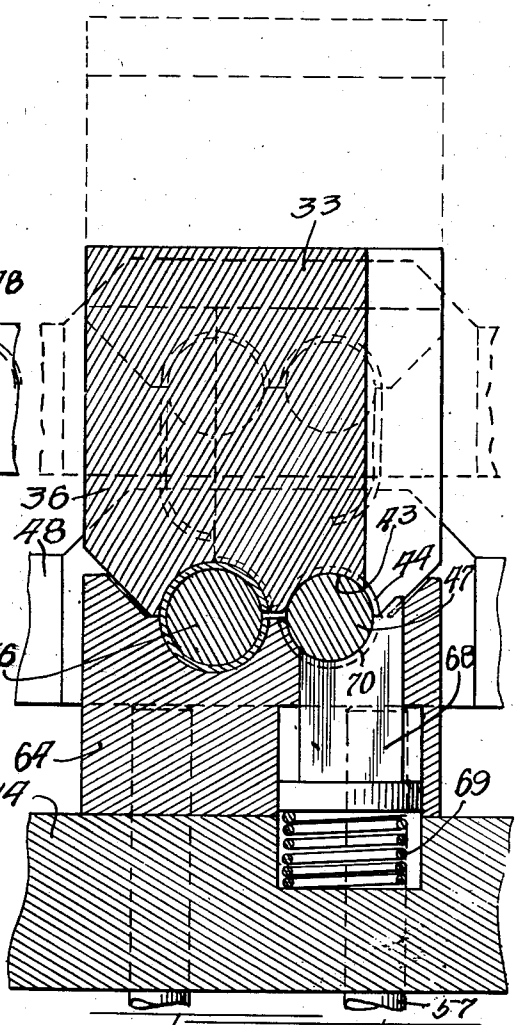


Fig. 6



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Fig. 7

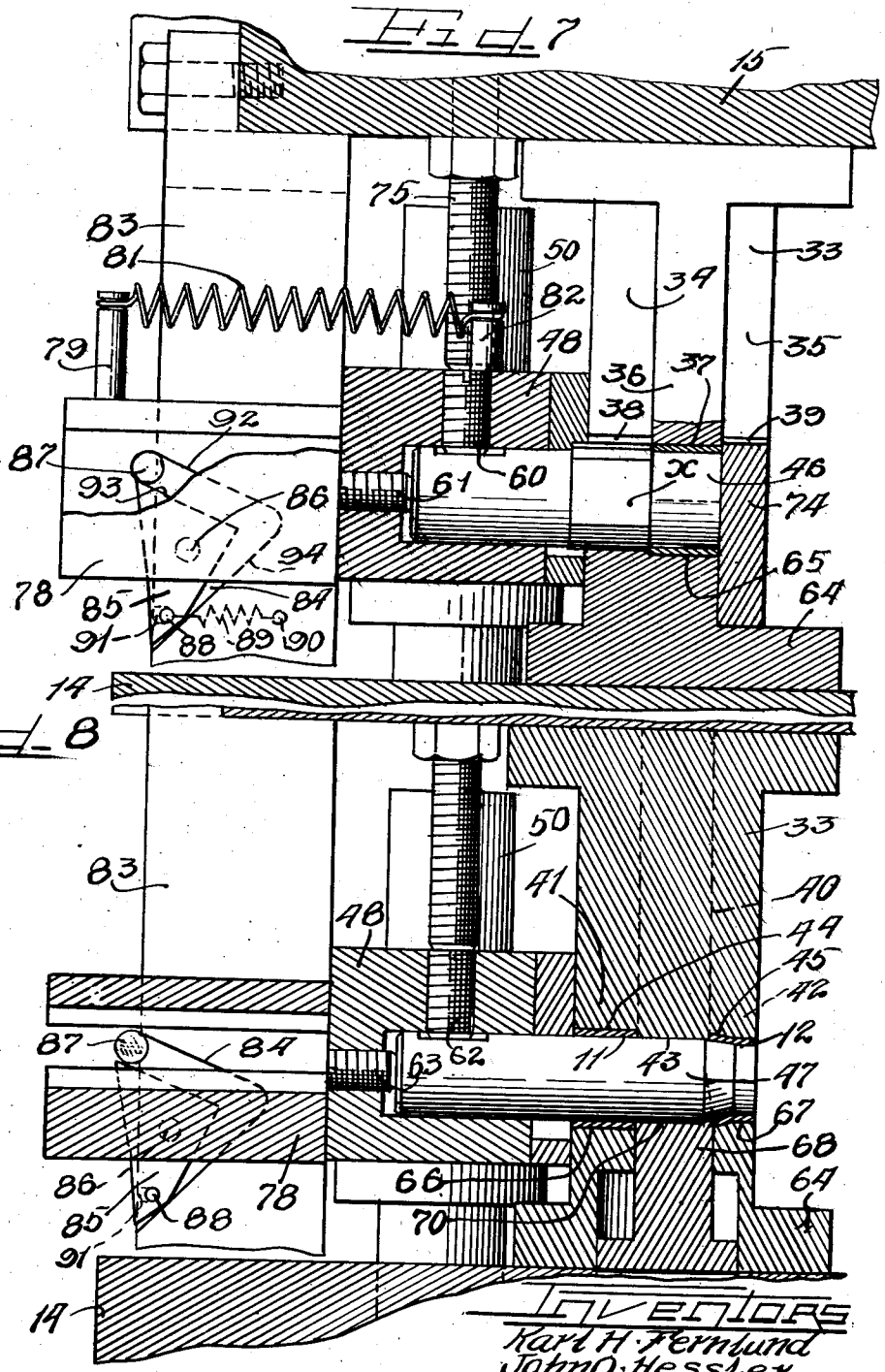


Fig. 8

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Fig. 9

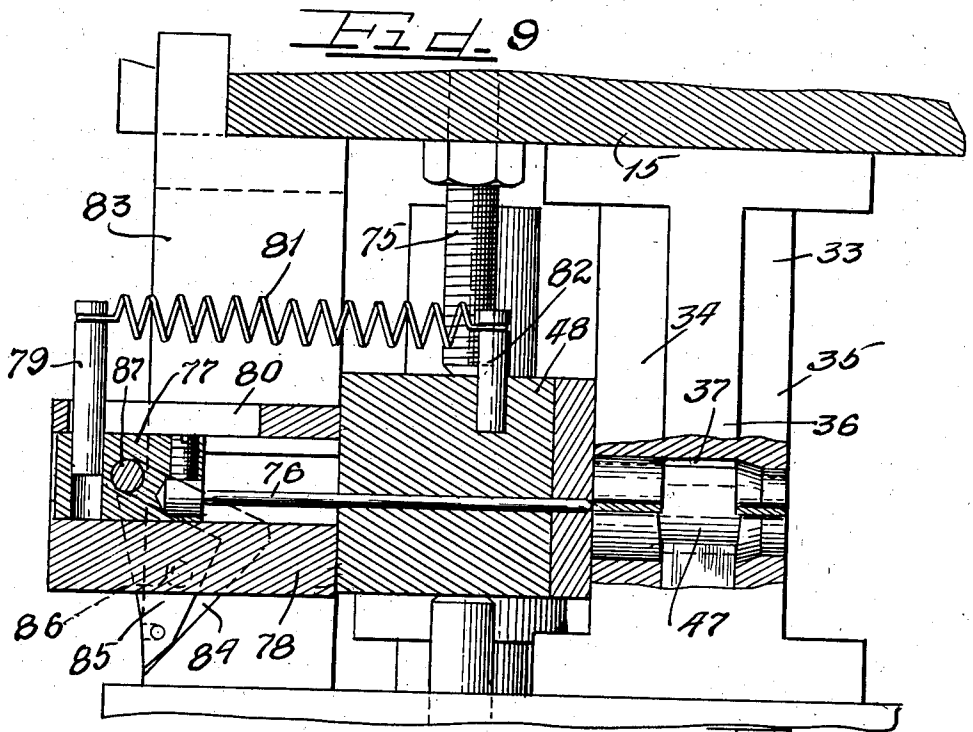
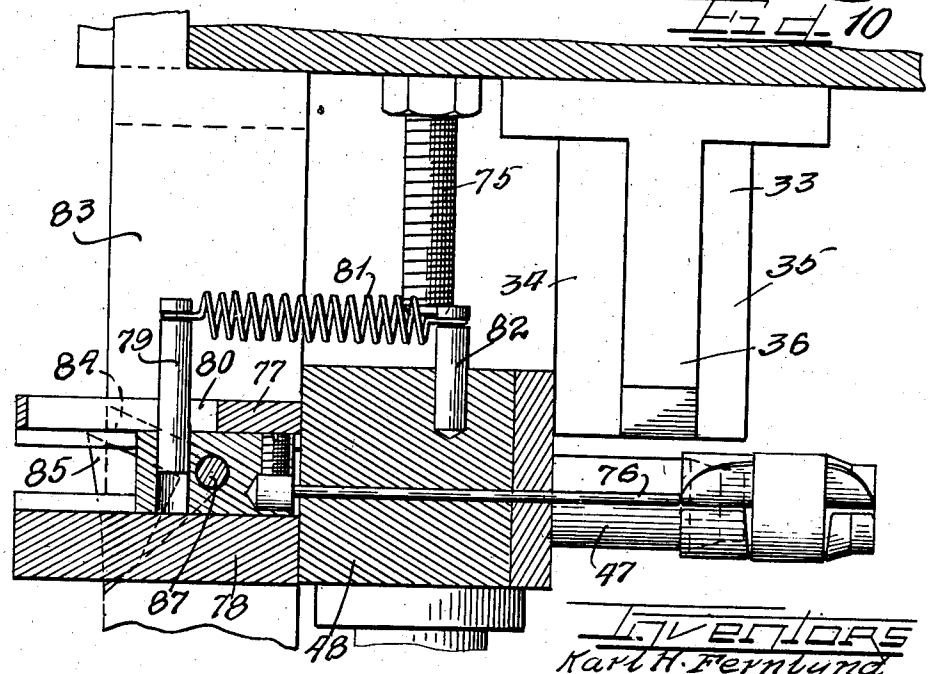


Fig. 10

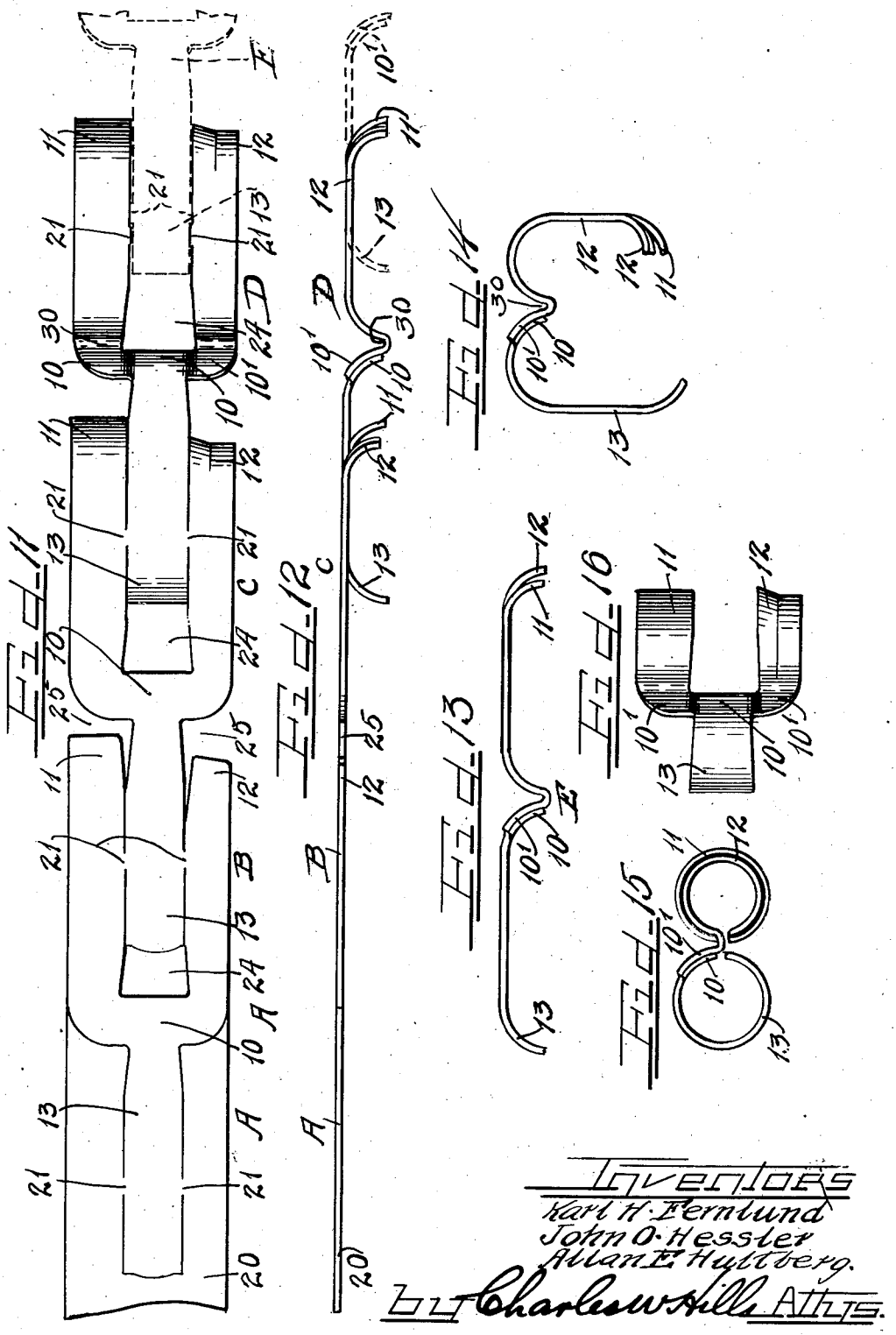


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DIE STRUCTURE FOR METALLIC CARTRIDGE BELT LINKS

Filed June 5, 1942 7 Sheets-Sheet 7



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Patented Aug. 15, 1944 2,355,964

UNITED STATES PATENT OFFICE

2,355,964

DIE STRUCTURE FOR METALLIC CARTRIDGE BELT LINKS

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Application June 5, 1942, Serial No. 445,996

5 Claims. (Cl. 59—6)

This invention relates to the manufacture of metallic cartridge belt links, and more particularly to improved die structure for progressively and efficiently forming the links.

An important object of the invention is to provide a compact unitary and self-contained forming and die structure in which punching and forming members are all assembled on one of the unit elements, and cooperable die and forming members are all mounted on the other element so that, in order to operate this unitary structure it need only be mounted with one of its elements resting on the bed plate of an ordinary punch press with the other element subjected to the reciprocating movement of the punch press head.

A further object is to provide a number of forming fields in the unitary structure through which the metal stock band is progressively fed for progressive preliminary forming of the links in comparatively flat form, and then in the final forming field bending the link loop forming tongues or arms into circular form around forming arbors.

Another important object is to mount the arbor structure on a resilient support for engagement of the embryo links between the arbors and the movable die structure element for preliminary bending of the link tongues toward circular form against the resistance of the resilient support, and then final forming into circular form of the tongues against a stationary die or forming member.

The various features of the invention are incorporated in the structure shown on the drawings, in which drawings:

Figure 1 is an end elevation of the unitary die structure;

Figure 2 is a section on plane II—II of Figure 1;

Figure 3 is a view looking on plane III—III of Figure 2;

Figure 4 is a view looking on plane IV—IV of Figure 2;

Figure 5 is an enlarged section on plane V—V of Figure 1, showing the upper and lower die member;

Figure 6 is a view similar to Figure 5 showing the upper die member in its final position relative to the lower die member;

Figure 7 is an enlarged view on plane VII—VII of Figure 2;

Figure 8 is an enlarged section on plane VIII—VIII of Figure 2;

Figure 9 is an enlarged section on plane IX—IX of Figure 2, showing the ejector mechanism about to operate;

Figure 10 is a section similar to Figure 9 showing the operation of the ejector mechanism;

Figure 11 is a plan view of the stock band with the embryo link formations preparatory to final formation of the link;

Figure 12 is a side view of the structure in Figure 11;

Figure 13 is a side view of the embryo link severed from the band and to be subjected to the arbor structure for progressive forming of the link tongues into the circular loops;

Figure 14 shows the loops partially formed;

Figure 15 is an end view of the finished link; and,

Figure 16 is a plan view of the finished link.

The link to be manufactured by the die structure disclosed is shown in Figures 15 and 16. The link comprises the transversely extending body part 10, from one edge of which at the ends thereof extend the circular loops 11 and 12 for supporting a cartridge, and from whose other edge at the middle thereof extends the circular hinge loop 13, which loop, in the assembly of a belt, engages between the loops 11 and 12 of an adjacent link to receive the body of the cartridge, the cartridges thus forming hinge pins for the assembled belt. In order to get the proper center distance between the axis of the loop 13 and the axis of the loops 11 and 12, the ends 10' of the body are offset a distance from the central portion thereof from which the loop 13 extends.

Referring to Figures 1 and 2, the unitary die structure comprises the die shoe or base block 14 and the punch holding block 15. The structure is mounted in an ordinary punch press with its die shoe resting on the press bed 16 and with the punch holder block in the path of the reciprocated head or ram (not shown) of the press. Telescoping guide posts 17 and 18 extend from the die shoe and punch block, respectively, and are surrounded by spring 19 for holding the punch block to the punch head or ram so that, as the ram is vertically reciprocated, the punch block will be correspondingly moved toward and away from the die block for cooperation of the various forming and die elements mounted on the blocks.

The metal stock band 20 from which the links are to be formed is progressively fed through the die structure in a horizontal plane, the band, during its passage through the die structure being subjected in five die fields for five progressive stages of formation. These five fields are indi-

cated as A, B, C, D and E. Referring to Figure 11, the links take up the full width of the stock band 20, and in the field A the stock is cut to outline the tongue 13 which eventually is bent into circular shape to form the hinge loop of the finished link. The tongue 13 is not fully cut out of the blank, but uncut positions 21 are left at opposite sides of the tongue to serve as ties for holding the embryo links together as the band progresses through the die structure. Referring to Figures 2 and 3, this first cutting of the blank is performed by the punch member 22 on the punch block 15 and the die member 23 on the die block 14.

In the second forming field B, the band is punched to leave the space 24 between the body portion 10 of the link and the end of the tongue 13 of the preceding embryo link, and at the same time the band is cut out to leave the spaces 25 (Figure 11) between the ends of the loop forming tongues 11 and 12 of the one link and the body 10 of the preceding embryo link. This punching operation is performed by the punch member 26 on the punch block 15 and the die assembly 27 on the die block 14.

In the forming field C, the end of the hinge loop forming tongue 13 and the ends of the cartridge supporting loop forming tongues 11 and 12 are given a preliminary substantially 90° bend downwardly and this forming is accomplished by the punch member 28 on the punch block and the die member 29 on the die block.

In the fourth forming field D, the embryo link is deflected downwardly at the juncture of the tongues 11 and 12 with the body 10 to form the V-shaped recess 30 between the transversely bent body and the bent inner ends of the tongues 11 and 12, and at the same time the body ends 10' are offset from the central portion of the body. All this formation of the link is accomplished by the punch member 31 on the punch block and the die member 32 on the die block (Figures 2, 3 and 4). The deflection 30 is such that the link body and the inner ends of the tongues 11 and 12 will be bent substantially 90° to form the first quarter of the respective link loops. The link is now ready for its final formation in the field E in which the middle portions of the tongues are bent to complete the circular link loops, and in this field, the embryo link, before the final bending, is severed from the succeeding link by cutting of the band along the tie lines 21. The severed embryo link is shown on Figure 13 and in dotted lines Figure 11.

The forming structure in the field E comprises the punch member 33 having in its front side the recesses 34 and 35 between which extends the forming wall 36 which functions in the final forming of the tongue 13 of the embryo link. In its bottom the punch 33 has the semi-circular forming recess 37 half of which is in the wall 36. When the punch member 33 moves down with the punch block the recesses 34 and 35 will receive the ends of the tongues 11 and 12 of the embryo link which follows the link which has entered the field E. The bottom of the punch member 33, back of the recesses 34 and 35, is cut away to leave the arcuate spaces 38 and 39 for receiving the offset ends 10' of the link body 10.

Referring to Figures 1, 2, 5 and 6, the punch member 33 has in its rear side the vertically extending rectangular channel 40 which is opposite the forming wall 36, the walls 41 and 42 adjacent to the channel 40 being in alignment with the recesses or channels 34 and 35 in the front side of the punch member. As shown on Figures 2, 5, 6 and 8, the punch member 33 has in its lower end the arcuate channel 43 which, in alignment with the lower ends of the walls 41 and 42, is of increased diameter to provide the arcuate forming surfaces 44 and 45 for the ends of the tongues 11 and 12 of the embryo link.

The die structure for the punch member 33 in the field E comprises the forming arbors 46 and 47 in alignment respectively with the forming channel 37, and the forming channels 44 and 45 in the punch member 33. These arbors are mounted in a supporting block 48 which is movable vertically on posts 50 secured to and extending upwardly from the die block 14. The arbor block is yieldably held in its normal position by the pressure of resistance means such as a spring, or as shown, a rubber member 51. This rubber member is shown in the form of a cylindrical block bored to receive a bar 52 secured to and depending from the die block and terminating in a head 53, an abutment washer 54 being inserted between the head and the lower end of the rubber block. An abutment washer 55 is inserted between the upper end of the rubber block and a collar 56 slidable on the bar 52. Rods 57 extend between the bottom of the arbor block and the collar 56 through guide passageways 58 in the die block. The rubber block normally holds the collar 56 up against the under side of the die block for setting of the rods 57 for holding the arbor block in its normal position. Downward movement of the arbor block is communicated through the rods and the collar to the rubber block which resists such downward movement, a clearance passageway 59 being provided in the punch press bed 16 for the resistance structure assembly below the die block. Referring to Figure 7, the forming arbor 46 is adjustably secured at its rear end in the block 48 by set screws 60 and 61, and, as shown in Figure 8, the arbor 47 is adjustably secured in the block by set screws 62 and 63.

Below the arbors, and in vertical alignment with the punch member 33, the die member 64 is mounted on the die block 14. This die member has the semi-circular forming channel or recess 65 in vertical alignment with the arbor 46 and the forming recess 37 in the punch member 33. The cooperation of these forming surfaces with the arbor 46 will bend the embryo link tongue 13 into its final circular form.

The die member 64 has the semi-circular forming surfaces 66 and 67 in vertical alignment with the arbor 47 and the forming recesses 44 and 45 in the punch member 33, these forming recesses cooperating with the arbor 47 to bend the embryo link tongues 11 and 12 into circular form. Movable vertically in the die member 64 between the forming surfaces 66 and 67 is a spacer member 68 for engaging between the tongues 11 and 12 to keep these tongues properly spaced apart while they are being bent into circular form. A spring 69 below the spacer member tends to hold it upwardly in normal position with its upper end a distance above the forming surfaces 66 and 67 so as to engage between the tongues 11 and 12 to space them and also to guide them to the surfaces 66 and 67, the spacer member in its upper and having the arcuate surface 70 for engaging the arbor 47 during final forming of the loops, as shown in Figures 6 and 8.

Figures 1 and 2 show the punch member in its upper position for feed of the stock band to bring

the embryo link from the field D into the forming field E. On Figure 5 the dotted lines show the punch member 33 in its upper position, with the embryo link extended across the arbors with its depressed part 30 extending down between the arbors and with the loop forming tongues extending laterally. The embryo link is still secured to the band by the tie lines 21, but, as the punch member 33 is moved downwardly, the link is severed from the stock band before it is engaged by the punch member. This severing of the link from the band is accomplished by a cutter 71 mounted on the forward side of the punch member 33 for cooperation with the die 72 on the die block 14. Immediately after severing of the embryo link from the stock band, the punch member 33 engages the link and bends the tongues thereof downward and partially around the arbors 46 and 47 to extend downwardly, as shown by the full lines of Figure 5. This downward pressure of the punch member 33 against the arbors to partially bend the link tongues is against the resistance of the resistance member 51 which acts against the arbor bearing block through the rods 57. As the arbor block with the partially formed link thereon continues its downward movement, the bent end of the tongue 13 is brought into engagement with the forming surface 65 on the die member 64, and the bent ends of the tongues 11 and 12 are brought into engagement with the forming surfaces 66 and 67, the spacer member 68 having been previously received between the tongues 11 and 12 to hold them properly spaced for engagement with the surfaces 66 and 67. When the punch member 33 reaches its final downward position, as shown by the full lines on Figure 6, the tongues will have been deflected around the arbors 46 and 47 to full circular form to complete the link, as shown on Figure 6.

As the tongue 13 is deflected around the middle portion of the arbor 46, the offset ends 10' of the link body 10 are received in the recesses 38 and 39 in the punch member 33 (Figure 7), and are applied by the punch member respectively against the enlargement 73 of the arbor 46 and a plate 74 on the die member 64 at the end of the arbor 46, Figures 2, 4 and 7. The enlargement 73 and the plate 74 serve also to hold the tongue 13 properly aligned transversely while it is being bent longitudinally around the arbor 46.

In order to balance the arbor supporting structure for free movement thereof during the final formation of the link, abutment studs 75 are provided on the punch block 15 for engagement with the arbor block 48 after the punch member 33 has come into engagement with the arbors for preliminary bending of the link tongues against the resistance of the member 51, the partially completed link being then held clamped by the pressure of the member 51 between the arbors and the punch member 33 while the arbor block is directly moved downwardly by the studs 75 for cooperation of the arbors with the die member 64 for final bending of the link tongues. After such completion of the link, the punch block 15 is moved upwardly by the springs 19 to follow the upward movement of the punch press head, and the resistance member 51 will return the arbor block to its normal position, shown in Figure 1, and the finished link is now ready for ejection from the arbors.

Referring to Figures 11 and 12, the embryo link in the field D is shown with the deflection 30 therein. However, referring to Figures 1 and 2, the punch member 31 in the field D does not reach the embryo link over the die member 32 for formation of the deflection 30 until the cutter 71 has severed the link in the field E from the embryo link in the field D. Before the link in field D is engaged by the punch member 31 and before the cutting operation, the ends of the link tongues 11 and 12 will project into the recesses 34 and 35 in the punch member 33 of the field E, and the end of the tongue 11 of the link in the field D will partially overlie the arbor 46, the end of the link tongue 12 being clear of the arbor by being outside of the front end of the arbor. In order that the tongue 11 of the link in field D will not be distorted by engagement therewith of the punch member 33 when the punch block 15 moves downwardly for the cutting operation, the arbor 46 is provided with the clearance recess X as shown on Figure 4, and in dotted lines on Figure 5. As the punch block now continues its downward movement for severing of the link in the field E and for engagement of the punch member 33 with the link, the tongues 11 and 12 of the link in field D will be received in the recesses 34 and 35 in the punch member and then, when the punch member 31 in field D co-operates with the die member 32, after the cutting operation in field E, the formation of the deflection 30 in the link in field D will draw the link tongues 11 and 12 in a direction away from the field E so that the tongue ends which extend into the recesses 34 and 35 of the punch member 33 will not interfere with the final movements of the punch member into co-operation with the die member 64 for the final bending into circular form of the link in the field E.

The ejector mechanism is best shown on Figures 7 to 10. It comprises the ejector rod 76 shiftable in the arbor block 48 between the arbors for engagement at its outer end with the body of the finished link. At its inner end the ejector rod is secured to a head 77 slidable in the extension 78 on the arbor blocks. A pin 79 extends from the head 77 through a slot 80 in the extension 78 and is connected by a spring 81 with the pin 82 on the arbor block, the spring tending to shift the head and the ejector rod outwardly. The operation of the rod is controlled by cam means. Secured to and depending from the punch block 15 is a bar 83. This bar extends alongside of the extension 78 on the arbor block 48 and has a triangular recess 84 extending therein from its outer edge, and within this recess a triangular cam member 85 is fulcrumed on a pin 86. A cylindrical stud 87 extends from the ejector rod head 77 for cooperation with the cam member 85 for control of the ejection of links at the proper time. At its lower end the cam member 85 has a pin 88 connected by a spring 89 with a pin 90 on the bar 83, the spring tending to hold the cam member with its lower end within the cam recess 84. The bar 83 has the slot 91 in its outer edge through which the pin 88 may travel for rocking of the cam member 85 on its fulcrum 86.

In the open position of the die structure, Figure 1, the stud 87 of the ejector is in front of the lower end of the cam member 85, the ejector being in its inner position. As the punch block 15 moves downwardly with the bar 83, the outer edge of the cam member moves past the stud 87 until the upper end of the cam member passes the stud, and by this time the punch member 33 and the studs 75 on the punch block will have

come into engagement respectively, with the arbors and the arbor block 48 so that during further downward movement of the punch block, the bar 83 and the arbor block will move downwardly together until the link is finally formed. Figures 7 and 9 show the position of the ejector head stud 87 relative to the cam structure, the upper surface 92 of the cam recess 84 holding the stud and the ejector rod inwardly against the pull of the spring 81. Now, as the punch block 15 moves upwarlly, after the final formation of a link, the cam bar 83 moves with the punch block and the arbor block is also moved upwardly with the cam bar 83 by the resistance member 51 until the arbor block has been returned to its normal position, as shown on Figure 1. As the punch block and the cam bar 83 continue their upward movement, the ejector head stud 87 is shifted by the spring 81 into the cam way between the cam surface 92 of the cam recess 84 and the upper surface 93 of the cam member 85, as shown on Figure 10, the ejector bar being thus shifted outwardly for ejection of the finished link from the arbor. During the final upward movement of the punch block and cam bar 83, the lower cam surface 94 of the cam recess 84 will cam the ejector stud 87 outwardly in the recess 84, such outward travel of the stud rocking the cam member 85 against its spring 98 until the ejector stud leaves the cam recess 84 whereupon the spring 89 returns the cam member 85 to its normal position and the stud 87 will then again be in front of the lower end of the cam member when the punch block reaches its upper position, and the ejector bar will again be in its inner position shown on Figure 9.

We thus produce a very efficient unitary die structure which can be economically manufactured and which can be readily mounted in the ordinary punch press for operation thereby without the need of a multiplicity of cams, springs, or other accessories. In our improved structure and procedure, simple die and punch sets effect the preliminary bending and forming of the links so that in the final forming field the die member and the punch member may cooperate with the resistance supported arbors to complete the bending of the link tongues into the circular loops during one downward movement of the punch block.

We have shown a practical and efficient embodiment of the various features of our invention, but we do not desire to be limited to the exact construction, arrangement and operation shown and described, as changes and modifications may be made without departing from the scope of the invention.

We claim as our invention:

1. A unitary die structure for progressively forming links of the type having a body part with a pair of cartridge receiving loops at one side thereof and a hinge loop at the other side thereof, comprising a stationary die member, a movable punch member, forming arbors, resistance means yieldably holding said arbors in normal position between said die member and punch member for receiving an embryo link, said punch member upon movement cooperating with said arbors to partially form the link loops against the pressure of said resistance means and to then carry said arbors into engagement with said stationary die member for final forming of the link loops, a spacer element, and means resiliently mounting said spacer element on said stationary die member for engaging between said cartridge receiving loops to hold them spaced apart a required distance and movable with said arbors during the final formation thereof around said arbors.

2. A unitary die structure for progressively forming links of the type described having a body part with a pair of cartridge receiving loops at one side and a hinge loop at the other side thereof, comprising a stationary die member, a movable punch member, forming arbors, resistance means yieldably holding said arbors in normal position between said die member and punch member for receiving an embryo link, said punch member adapted upon movement thereof to cooperate with said arbors to partially form the loops against the pressure of said resistance means and to then carry said arbors into engagement with said stationary die member for final forming of the link loops, a spring urged spacer member in said stationary die adapted upon downward movement of said arbors to engage between the partially formed cartridge receiving loops and to receive the arbor therefor before said partially formed loops engage with said stationary die member whereby said spacer member will guide said cartridge receiving loops during final formation thereof by said stationary die so that the cartridge receiving loops after final formation will be the required distance axially apart.

3. A unitary die structure for progressively forming links of the type described having a body part with a pair of loop tongues of circular form extending from one side and a hinge loop tongue of circular form extending from the other side, comprising a die block, a punch block, a number of die members on said die block and cooperating punch members on said punch block effective during successive movements of said punch block into engagement with said die block to cut the link blanks out of a sheet metal stock band in substantially flat form with the exception of tie lines between the hinge loop tongues of one blank and the cartridge receiving loop tongues of adjacent blanks and then to give the outer ends of all the tongues a preliminary downward bend and the link body and the adjacent inner ends of the tongues of each blank a preliminary downward bend to form the beginning of the link loops, a pair of arbors for receiving the embryo links, a resistant support on said die block for said arbors, a forming die member on said die block below said arbors and a forming punch member on the punch block above said arbors, a cutter on said punch block for cutting an embryo link along its tie lines for severance thereof from the stock band, said cutting occurring just before said form punch member engages the severed link and just before the embryo link has its body and inner ends of its tongues deflected downwardly, further downward movement of said forming punch member causing cooperation thereof with said arbors against the resistance of said support for partially bending the tongues of the received severed link blank around said arbors toward circular form, continued movement of said forming punch member moving the arbors with the partially formed link thereon downwardly into cooperation with said forming die member for final forming of the link tongues into circular loops, and a spring urged spacer member in said forming die member effective to receive the arbor which has the partially formed cartridge receiving loop tongues thereon before the loop tongues of the link engage with the forming die member whereby said catrtridge forming loop

tongues will be guided during final bending thereof into circular form to the required distance axially apart in the finished link.

4. A unitary die structure for progressively forming links of the type described, comprising a stationary die member, a movable punch member, forming arbors, a supporting block for said arbors, resistance means yieldably holding said supporting block with the arbors thereon in normal position between said die member and punch member for receiving an embryo link, said punch member upon movement thereof cooperating with said arbors to partially form the link loops against the resistance of said supporting block and to then carry said block with the arbors into engagement with said stationary die member for final forming of the link loops, an ejector member movable on said supporting block between the arbors thereon, a stud on said ejector member, a bar depending from said punch member and having a cam way therein, said ejector member being normally in an outer position, and means effective during movement of said punch member away from said die member after forming of the link for guiding said stud into said cam way for movement of said ejector member to eject the finished link from said arbors.

5. A unitary die structure for progressively forming links of the type described, comprising a stationary die member, a movable punch member, forming arbors, a supporting block for said arbors, resistance means yieldably holding said supporting block with the arbors thereon in normal position between said die member and punch member for receiving an embryo link, said punch member upon movement thereof cooperating with said arbors to partially form the link loops against the resistance of said supporting block and to then carry said block with the arbors into engagement with said stationary die member for final forming of the link loops, an ejector member movable on said supporting block between the arbors thereon, a stud on said ejector member, a bar depending from said punch member and having a cam way therein, said ejector member being normally in an outer position, and means effective upon movement of said punch member away from said die member after forming of a link for causing said stud to move first inwardly along said cam way for movement of the ejector member to eject the finished link from the arbors and then outwardly in said cam way for restoring the ejector to normal position.

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