Dec. 7, 1965 E. W. ONULAK 3,221,490

CHAIN LINK MAKING MACHINE

Original Filed Dec. 10, 1957 4 Sheets-Sheet 1

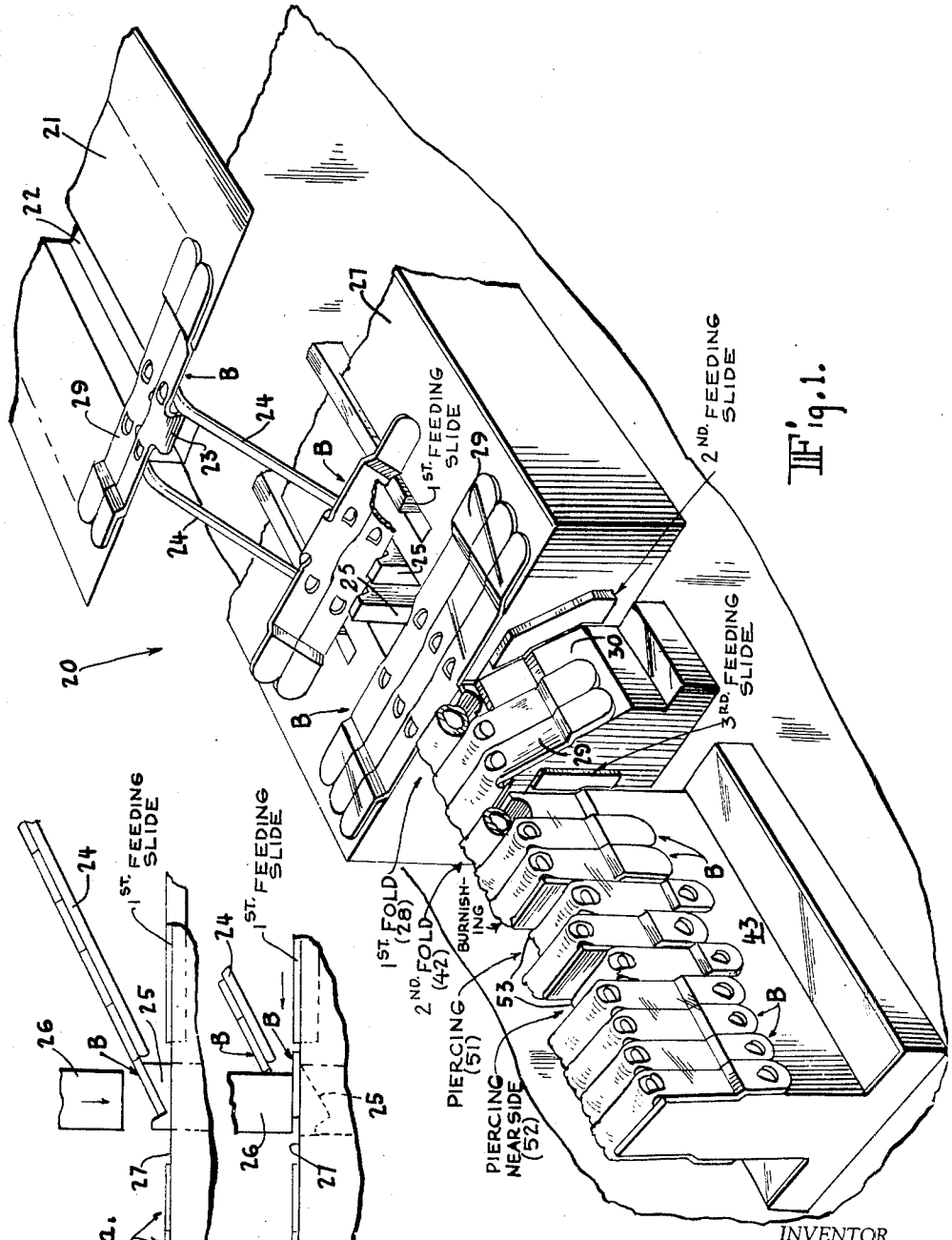

FIG. 1.

FIG. 1a.

FIG. 1b.

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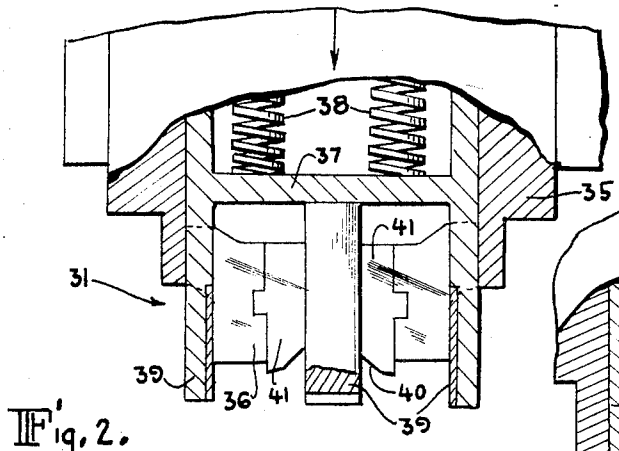

Fig. 2.

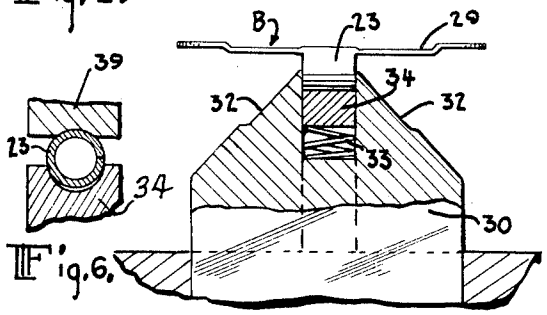

Fig. 6.

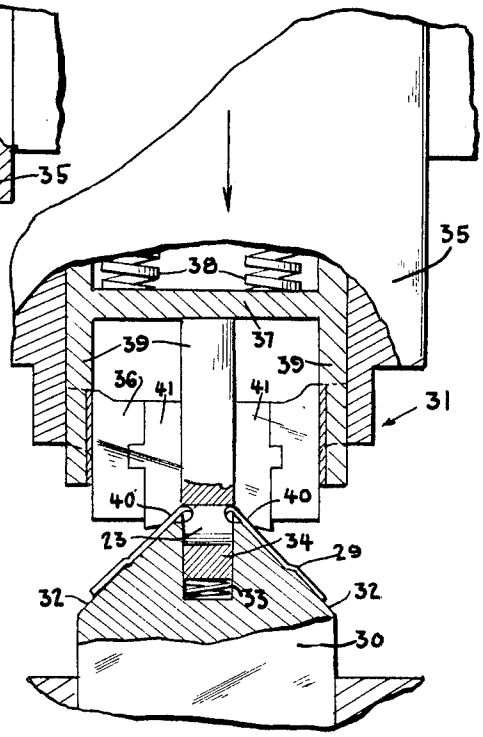

Fig. 3.

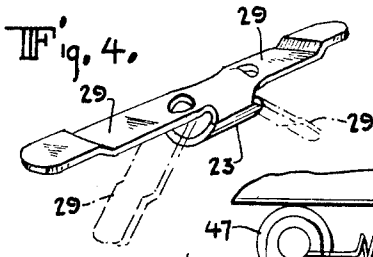

Fig. 4.

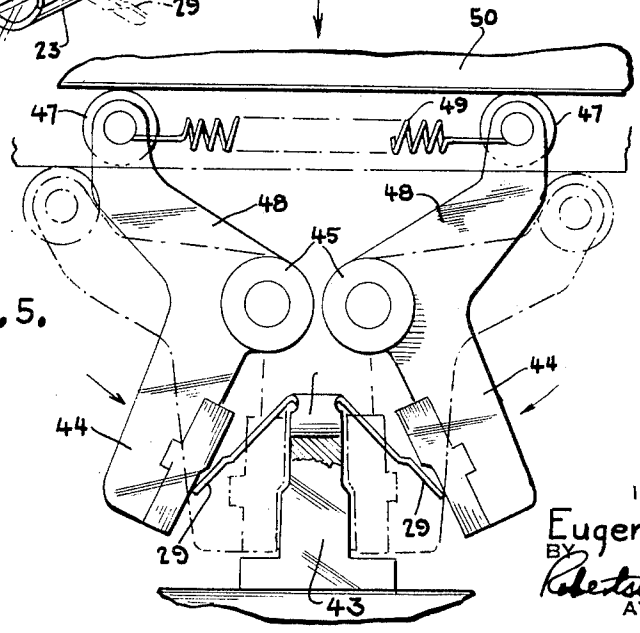

Fig. 5.

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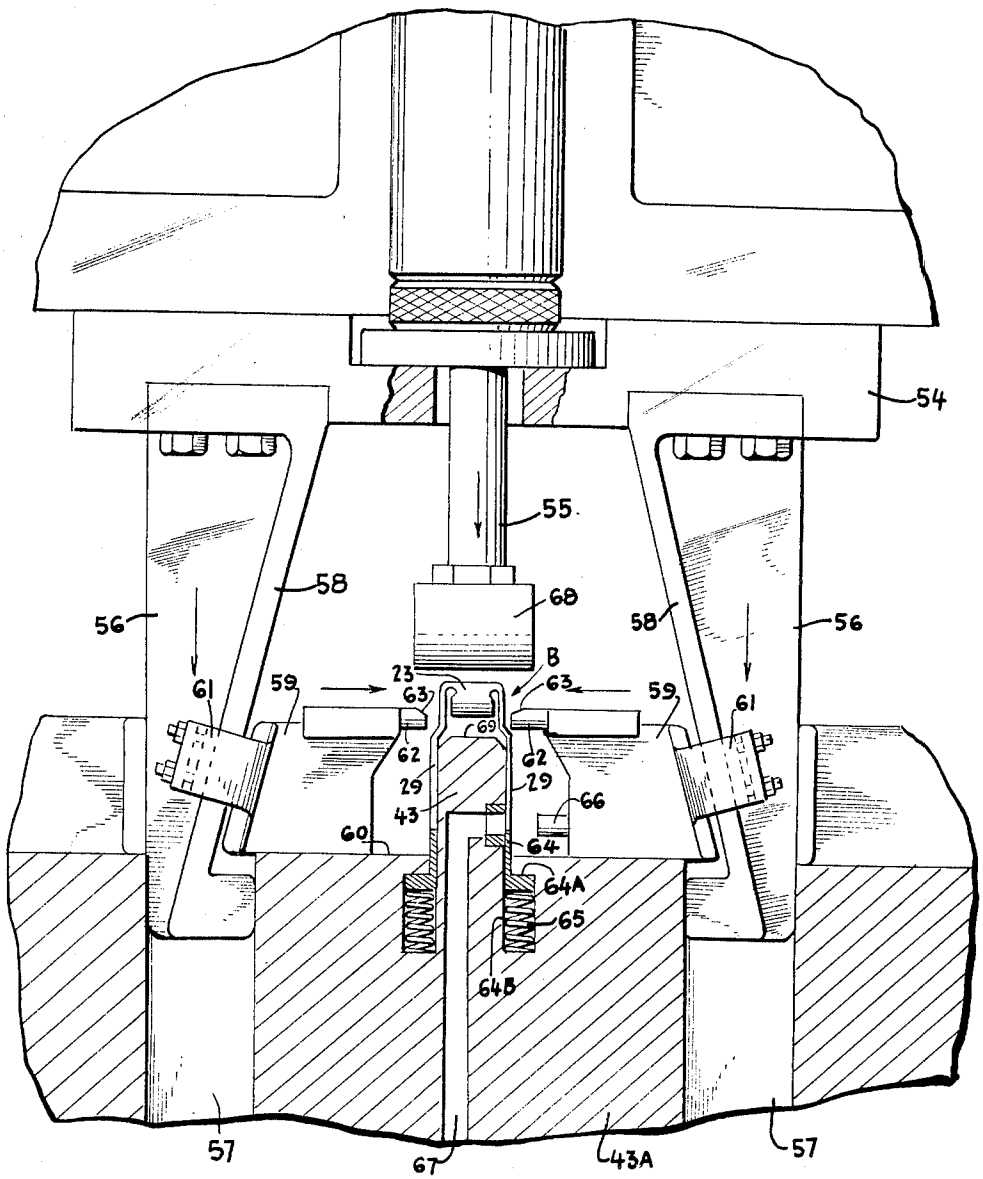

Fig. 7.

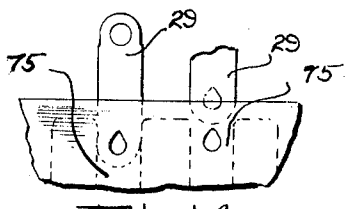

Fig 14

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CHAIN LINK MAKING MACHINE

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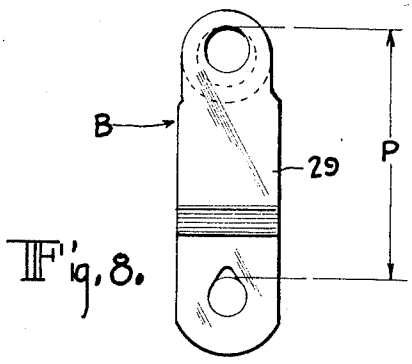

Fig. 8.

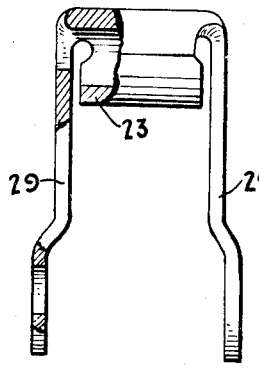

Fig. 9.

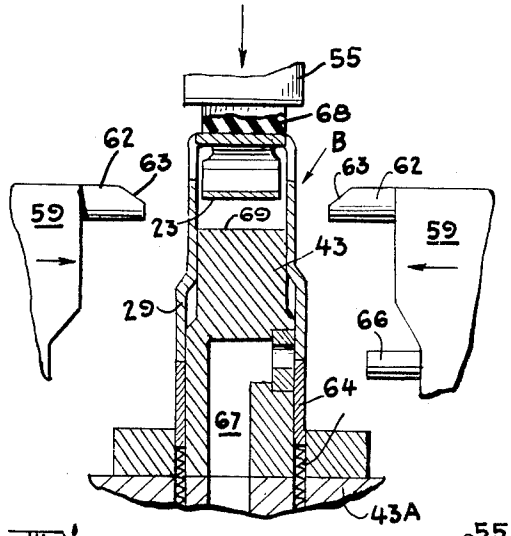

Fig. 10.

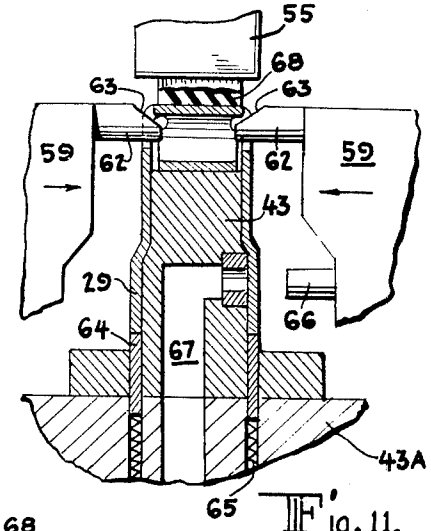

Fig. 11.

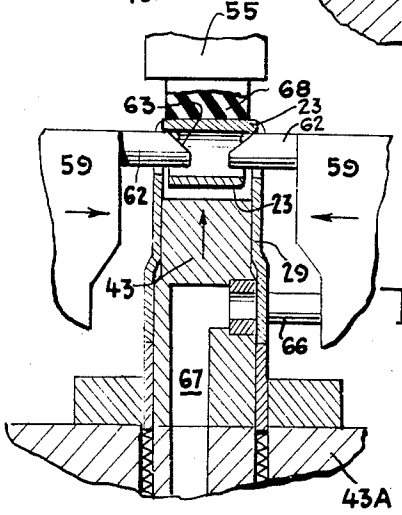

Fig. 12

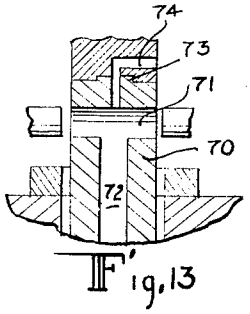

Fig. 13

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3,221,490

CHAIN LINK MAKING MACHINE

Eugene W. Onulak, Huntington, Ind., assignor to The Locke Steel Chain Company, Huntington, Ind., a corporation of Connecticut

Original application Dec. 10, 1957, Ser. No. 701,814, now Patent No. 3,063,237, dated Nov. 13, 1962. Divided and this application Apr. 6, 1962, Ser. No. 185,624

19 Claims. (Cl. 59—13)

This is a division of application Serial No. 701,814, filed December 10, 1957, now Patent No. 3,063,237 granted November 13, 1962, in the name of Eugene W. Onulak.

This invention relates to a method and an apparatus for forming integral chain links adapted to be joined together to form a conveyor or similar chain.

The invention is particularly adapted to form chain links of a type similar to those shown in United States Patent No. 2,793,536. Such a link is formed from a blank having longitudinally extending legs on either side of a cylindrically shaped hollow bushing. This bushing is formed by a separate apparatus, such as that shown in United States Patent No. 2,968,913, which may be set up so as to feed the blanks to the magazine of the instant apparatus, and thus form a single continuous machine. In bending the legs of the blank to a position where they enclose the bushing and are generally parallel to each other, it is imperative that the fold at the juncture be formed so that the metal at the fold is not weakened to any significant degree. Also, it is desirable to have a relatively sharp bend at the proper place without the bend being too sharp. It has been found that by first partially bending the legs, and then completing the bending of the legs by utilizing force which is both downward and inward, there is no material weakening of the link at the fold line and also the fold will be at the proper place.

It is also important, in the formation of integral chain links, that the distance between the axis of the cylindrical bushing and the hole which is formed in the free ends of the legs be uniform in each chain link which is formed. To accomplish this result, this invention provides a method and an apparatus for properly positioning the blank so that the hole is pierced at a predetermined distance from the axis of the bushing.

It is an object of this invention to provide a continuous machine for bending the legs of a blank to a position where the legs enclose the cylindrical bushing of the link and are perpendicular to the axis of said bushing, and for piercing holes in the free ends of the legs a predetermined distance from said bushing.

It is another object of this invention to provide a method for forming chain links in which the strength of the link adjacent the fold lines between the bushing and the legs is not materially affected.

A further object of this invention is to provide a method for positioning the blanks so that holes are pierced in the legs of all blanks an equal and predetermined distance from their respective bushings.

It is a further object of this invention to provide a mechanism for properly positioning a blank prior to the piercing of the legs thereof, so that all of the links passing through the mechanism have holes pierced in their legs an equal and predetermined distance from their respective bushings.

It is a still further object of this invention to provide a mechanism for properly positioning the blank, which mechanism first depresses the blank below its piercing position and then gradually raises the link by positioning pins, so that all the links will have their legs pierced an equal and predetermined distance from the axis of the bushing.

The apparatus for forming an integral chain link from

a blank having a cylindrical bushing thereon and legs extending outwardly from said bushing includes means for partially bending the legs adjacent their juncture with the bushing and means for bending the partially bent legs to a position perpendicular to the axis of the bushing and generally parallel to each other. Means are also provided for piercing holes in the free ends of the completely bent legs a predetermined distance from the axis of the bushing.

In a further aspect, it has been found desirable to have a continuous machine with various stations through which each blank is fed sequentially by reciprocating feeding slides, so that all of the means set forth in the paragraph above will operate simultaneously on different blanks.

The foregoing and other objects, features and advantages hereof will become apparent from the following description and drawings which are merely exemplary.

In the drawings:

FIG. 1 is an isometric schematic view of the apparatus of the invention with certain parts omitted for clarity;

FIG. 1*a* is an enlarged schematic view of the magazine feeding mechanism utilized in the invention, when in its non-feed position;

FIG. 1*b* is a view similar to FIG. 1*a* showing the parts in their feed position;

FIG. 2 is an enlarged schematic view of the parial folding mechanism prior to its operation on a chain link;

FIG. 3 is a view similar to FIG. 2 showing the parts in their position after the legs of the chain link are partially bent;

FIG. 4 is an enlarged view of a chain link of a blank of the type utilized in the apparatus of the invention;

FIG. 5 is an enlarged view of the final folding mechanism;

FIG. 6 is an enlarged view of a bushing being held in position in the folding dies of FIG. 2;

FIG. 7 is an elevational view of the positioning and piercing mechanism of the invention;

FIG. 8 is a side view of a completed chain link;

FIG. 9 is a front elevational view of the link of FIG. 8;

FIGS. 10, 11 and 12 are views showing various steps in the positioning and piercing operations of the device of FIG. 7, in which

FIG. 10 shows the mechanism prior to the depression of the link;

FIG. 11 shows the mechanism after the depression of the link; and

FIG. 12 shows the mechanism after the link is raised into proper position by the mechanism;

FIG. 13 is a fragmentary view of an arrangement wherein the piercing is performed on both legs simultaneously; and

FIG. 14 is a diagrammatic side elevational view of the positioning and piercing station.

FIG. 1 is a diagrammatic view of a preferred form of apparatus for forming chain links of the type shown in FIGS. 8 and 9 from a blank of the type shown in full lines in FIG. 4. The apparatus generally includes a feeding mechanism, shown at **20**, a first folding station, a second folding station, and two piercing stations. It may also include a sizing operation after the second folding station. The blanks B are fed step-by-step through the apparatus by feeding slides designated in FIG. 1 as the 1st, 2nd and 3rd feeding slides. All of the feeding slides reciprocate in unison so that the blanks are advanced a step at a time through the apparatus during the forward stroke of the reciprocating slides, thereby resulting in continuous operation of the entire apparatus at all times.

The feeding mechanism **20** includes a horizontal magazine or table **21** having a recessed portion **22** in which the cylindrical bushing **23** of blanks B are placed. The

magazine is mounted above the plane of the remainder of the apparatus and is spaced rearwardly from the entrance end of the apparatus. A pair of inclined rods 24 connect the forward end of the magazine to the rearward end of the apparatus so that blanks which are fed by feeding means (not shown) to the rods move downwardly by gravity. The lead or lowest blank is engaged by an upwardly urged, vertically movable stop 25. In order to feed the lead blank from the rods into the operating portion of the apparatus, a plunger 26 (FIGS. 1*a*, 1*b*) is provided which moves downwardly from its FIG. 1*a* position to its FIG. 1*b* position prior to the forward or advance stroke of the first feeding slide. The downward movement of plunger 26 forces the lead blank and stops 25 downwardly until the legs of the blank come into engagement with the surface 27. Stops 25 are then below the level of surface 27 where they will not interfere with the advancement of the lead blank when the first feeding slide moves through the advancing portion of it scycle of operation. The downward movement of the next succeeding blank is prevented by the vertical face of plunger 26. As plunger 26 moves upwardly from its FIG. 1*b* position to its FIG. 1*a* position, said next succeeding blank moves downwardly to engage stops 25 which have moved upwardly to their FIG. 1*a* position. The cycle of feeding is then repeated for the next succeeding blank. The structure just described results in the advancing of one blank B into the apparatus for each reciprocatory movement of the feeding slides.

The first feeding slide serves to move the blanks to the first folding station, shown generally at 28. As will be described hereafter, at this station, the legs 29 of the blank are bent adjacent their juncture with bushing 23 so that they are at an angle to the axis of the bushing. This angle is preferably about 45° but may be any desired angle. The angle is chosen so to result in the satisfactory first upsetting of the metal adjacent the bushing. The mechanism preferably used for performing this partial bending is best illustrated in FIGS. 2 and 3, and includes a lower die member 30 and a vertically movable press member 31.

Lower die member 30 is formed with sloping side walls 32. A block 34 mounted in a slot in die member 30 has a cavity in its upper surface for receiving bushing 23 and is spring pressed upwardly by spring 33 to engage the bottom of bushing 23 and hold legs 29 away from the top surface of die member 30 when the press member 31 is in its raised or FIG. 2 position.

Press member 31 has an outer portion 35 to which upper die member 36 is fixedly attached. Mounted slidingly within a cavity in portion 35 is a frame member 37 which is biased downwardly by springs 38. Bars or legs 39 extend downwardly from frame member 37 and are below the bottom of upper die member 36 when press member 31 is in its raised or FIG. 2 position. Press member 31 is moved down by suitable means, such as a piston arrangement (not shown).

As press member 31 moves downwardly, the bars 39 engage blank B, the center bar, which is preferably resilient, engaging bushing 23 and the outer bars engaging legs 29. Further downward movement of the press member depresses blank B and block 34 to properly position the blank and hold it in this position. The continuing downward movement of press member 31 causes frame member 37 to move relative to outer portion 35 against the action of springs 38, such being closely adjacent the bushing. This results in upper die member 36 engaging the legs 29 so that they bend the legs downwardly. In order to ensure the proper alignment of legs 29 against the sides, upper die member 36 may have downwardly inclined faces 40. Preferably these faces are formed on inserts 41 which may be replaced as needed.

The blank is then advanced from the first folding station 28 to second folding station 42 by the second feeding slide. At this station the partially bent legs 29 are bent to a position generally perpendicular to the axis of bushing 23 and enclosing the main portion of the bushing, as shown in FIG. 9. The final bending is accomplished about a lower die member 43 (FIG. 5) which has sides shaped to conform to the desired shape of the legs of the completed link. A pair of members 44, pivoted at 45, have inner faces also shaped so as to conform to the shape of the legs of the completed link. The lower die member has a cavity for receiving bushing 23 and holding the blank B in proper position. Members 44 are generally in the form of a bell crank and may have rollers 47 attached to the upper ends of legs 48. Spring 49 biases legs 48 toward each other. A suitably operated press member 50 is adapted to engage rollers 47. As press member 50 moves downwardly, legs 48 are forced away from each other against the action of spring 49. The lower legs of members 44 are moved inwardly and downwardly as the members are pivoted about pivots 45. When press member 50 reaches the lowermost portion of the stroke, the parts are in the broken line position of FIG. 5.

By first folding the legs 29 to a position where they are inclined at an angle of approximately 45° from the axis of bushing 23 with a vertically downward force, and then completing the bending of the legs by a combined downward and inward force, it has been found that the junctures between the legs and the bushing of the completed link are substantially stronger than if the legs were bent by conventional methods.

After completion of the folding of legs 29 the blanks are advanced to the piercing stations 51 and 52 by the third reciprocating feeding slide. The operations performed at each of these stations are the same, except that they are performed on different legs of blank B.

The mechanism which is preferably used to pierce holes in the free ends of legs 29 is best shown in FIG. 7. The blanks B are moved sequentially from the folding station 28, to piercing station 51 and then to piercing station 52, along lower die member 43 during the forward portion of the reciprocating stroke of the third feeding slide. At each of the piercing stations, lower die member 43 has a depression formed in its upper surface which is slightly wider than the diameter of bushing 23.

As the blank B is moved to either of the piercing stations the mechanism at the related station is actuated. This mechanism includes a vertically reciprocating head 54 upon which is secured a downwardly extending piston 55 and a pair of downwardly extending bars 56. The lower ends of bars 56 are formed so as to fit in slots 57 in the machine support. Bars 56 have flanges 58 extending perpendicularly thereto. These flanges are inclined downwardly and outwardly so as to form a cam surface. On either side of lower die member 43 there is an element 59 which is slidable on upper surface 60 of the machine support. On the outer ends of each of the elements 59 is a U-shaped extension 61 which extends over the front of its respective flange 58 so that as the bar 56 moves up and down in slot 57, it will engage either the outer or the inner leg of extensions 61 to move element 59 either outwardly or inwardly relative to the lower die member 43.

As shown in FIG. 7, both of the elements 59 have a pair of positioning pins 62 extending inwardly from an upper portion thereof. These elements have downwardly and inwardly inclined surfaces 63. Blank B is held above the top surface of the depression in the lower die member by a pair of spring pressed elements 64 which engage the lower edges of legs 29. Spring pressed elements 64 may have an extension 64A fitting in slot 64B of base element 43A, which is omitted from FIG. 1 for clarity. Elements 64 are urged upwardly by springs 65.

In the preferred form of mechanism where a hole is punched in one leg at each of the piercing stations, the appropriate element 59 has a pin 66 extending inwardly a predetermined distance below its respective pin 62. A passage 67 is formed in lower die member 43 immediately opposite pin 66. This passage provides for the disposal of the metal waste punched from leg 29 by pin 66. If the piercing is to be accomplished at a single station as seen in FIG. 13, insert 70 may be provided having cross passage 71 with vertical passage 72. The projection 73 serves as a key to prevent side motion. Air passages 74 can be used to furnish air to assist the movement of the scrap through passage 72.

The operation at the piercing stations will be described in conjunction with FIGS. 10, 11 and 12 which show the position of the operating elements at various stages in the piercing operation. As head 54 is moved downwardly by suitable means, a pad 68 on the lower portion of piston 55 engages the upper surface of bushing 23 and urges it downwardly against the upper surface 69 of the depression in lower die member 43. Pad 68 is preferably formed of a resilient material for a purpose to be described later. As head 54 continues to move downwardly, flanges 58 engage the inner legs of U-shaped members 61 and move elements 59 inwardly toward blank B. When the lower portion of bushing 23 is in engagement with surface 69, the inner surface of the upper portion of bushing 23 is below the upper surface of pins 62. As pins 62 continue their inward movement, said upper surface is engaged by inclined faces 63 and blank B is raised a small distance upwardly and pad 68 is compressed. The parts are then in the position seen in FIG. 12 where blank B is properly positioned between resilient pad 68 and the upper surface of pins 62.

Further downward movement of head 54 forces pin 66 against its cooperating leg 29 and causes pin 66 to pierce said leg and form a hole therein a predetermined distance p (FIG. 8) from the lower surface of the upper portion of bushing 23. The other leg 24 will have a hole punched in it at the second piercing station by a mechanism identical with that just described, except that pin 66 will be on the element 59 on the opposite side of lower die member 43 and the scrap passage 67 will open to the opposite side of said lower die member.

The particular mode of operation, shown in FIGS. 10, 11 and 12, of depressing the blank below the level of the positioning pins 62 and then raising the blank by the positioning pins against the action of plunger 55 and pad 68 results in the exact positioning of the hole in the lower end of all legs 29 on all blanks which pass through the machine. This accurate positioning is of extreme importance since the completed links are joined together to form a conveyor chain, and the bushing 23 of each blank must fit between legs 29, so that the hollow portion of cylindrical bushing 23 is in accurate alignment with the holes formed in the lower ends of legs 29 of the adjacent link. This permits the ready insertion of pins through the holes and the hollow portion of bushing 23, so that a chain of desired length may be readily formed.

In order to ensure the proper location of the holes relative to the sides of the legs 29, the lower die has a nest or slot 75 (FIG. 14) formed therein (for each of the positioning and piercing stations) into which the legs fit upon depression of the blank at the respective station. The slots have been omitted in FIG. 1 in the interests of clarity since this is a schematic view.

From the above detailed description it can be seen that there has been provided a continuous apparatus for forming a one-piece chain link in which the legs are bent to a position vertical to the axis of the bushing of the link, without any undue weakening of the juncture. The apparatus also results in all of the links having holes formed in the ends of the legs a predetermined distance from the axis of the bushing thereof. The apparatus described produces links having uniform characteristics, so that they may be readily formed into strong and inexpensive conveyor or drive chains.

It has been found desirable in some instances to burnish the apertures of the legs 29 preceding the positioning or piercing of the blank at the piercing station. This may be accomplished by mounting pins (not shown) of proper contour on the piercing slides at a location preceding the piercing pin locating means and after final folding, thereby shaping the bushing hole.

It is to be understood that the described exemplary embodiment is merely intended for the purpose of illustration, and that the principles of the invention are not intended to be limited thereto, except as defined in the appended claims.

What is claimed is:

1. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and legs extending outwardly from said bushing, the combination comprising first means for partially bending said legs adjacent their juncture with said bushing, second means for bending said partially bent legs adjacent said juncture to a position perpendicular to the axis of said bushing and generally parallel to each other, means for piercing holes in the free ends of said legs a predetermined distance from the axis of said bushing, and transfer means between said first and second bending means and said piercing means adapted to advance said blank successively between said bending means and piercing means.

2. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and legs extending outwardly from said bushing, the combination comprising first means for partially bending said legs adjacent their juncture with said bushing, second means for bending said partially bent legs adjacent said juncture to a position perpendicular to the axis of said bushing and generally parallel to each other, means for positioning and piercing the free end of one of said legs, means for positioning and piercing the free end of the other of said legs, and transfer means between said first and second bending means and both said piercing means adapted to advance said blank successively between said bending means and piercing means.

3. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a die member having outwardly inclined walls and an upper surface for receiving said bushing, first press means for bending said legs against said inclined walls so as to partially bend said legs adjacent their juncture with said bushing, a second die member having generally vertical walls and an upper surface for receiving said bushing, second press means for bending said partially bent legs adjacent said juncture to a position enclosing the ends of said bushing and perpendicular thereto, means for positioning and piercing the free end of one of said legs, means for positioning and piercing the free end of the other of said legs, and transfer means between said first and second press means and both said piercing means adapted to advance said blank successively between said press means and piercing means.

4. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a die member having downwardly and outwardly inclined walls and an upper surface for receiving said bushing, first press means which direct a downward force against said legs forcing said legs against said downwardly and outwardly inclined walls so as to partially bend said legs adjacent their juncture with said bushing, a second die member having generally vertical walls and an upper surface for receiving said bushing, second press means which direct a downward and inward force against said partially bent

legs forcing said legs against said vertical wall so as to bend said legs adjacent said juncture to a position enclosing the ends of said bushing and perpendicular to the axis thereof, means for positioning and piercing the free end of one of said legs, means for positioning and piercing the free ends of the other of said legs, and transfer means between said first and second press means and both said piercing means adapted to advance said blank successively between said press means and piercing means.

5. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposeite directions from the ends of said bushing, the combination comprising a die member having downwardly and outwardly inclined walls and an upper surface for receiving said bushing, vertically reciprocable die means including a first pair of press members having downwardly and outwardly inclined walls adapted to mate with said downwardly and outwardly inclined walls of said die member, said die means also including a resiliently mounted holding member having portions extending below said press members when said die means is in its upper position, so that as said die means moves downwardly said portions contact and hold said blank before said press members contact and bend said legs, a second die member having generally vertical walls and an upper surface for receiving said bushing, a pair of spaced pivoted die means having inwardly facing surfaces adapted to mate with said generally vertical walls, second press means for pivoting each of said pivoted die means inwardly so as to bend the legs to a position enclosing the ends of said bushing and perpendicular to the axis thereof, means for positioning and piercing the free end of one of said legs, means for positioning and piercing the free end of the other of said legs, and transfer means between said first and second press means and both said piercing means adapted to advance said blank successively between said press means and piercing means.

6. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and a pair of legs extending outwardly in opposite directions from said bushing, said legs having holes adjacent their juncture with said bushing, the combination comprising first means for partially bending said legs adjacent their juncture with said bushing, second means for bending said partially bent legs adjacent said juncture to a position perpendicular to the axis of said bushing and generally parallel to each other, so that the holes in said legs are in alignment with the ends of said bushing, a pair of horizontally movable pins adapted to enter said holes and having their upper surface inclined downwardly, the axis of said pins being above the axis of said bushing so that as said pins move toward each other to enter said holes the pins urge the blank upwardly to accurately position the same, means for piercing holes in the free ends of said legs a predetermined distance from the axis of said bushing, and transfer means between said first and second bending means and said piercing means adapted to advance said blank successively between said bending means and piercing means.

7. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and a pair of legs extending outwardly in opposite directions from said bushing, said legs having holes adjacent their juncture with said bushing, the combination comprising first means for partially bending said legs adjacent their juncture with said bushing, second means for bending said partially bent legs adjacent said juncture to a position perpendicular to the axis of said bushing and parallel to each other so that the holes in said legs are in alignment with the open ends of said bushing, a die member having an upper surface adapted to receive said bushing, means resiliently urging said bushing away from said upper surface, press means for forcing said bushing onto said upper surface, a pair of inwardly movable, axially aligned, horizontal pins having inwardly and downwardly inclined upper faces, the axis of said pins being above the axis of said bushing when said bushing is on said upper surface, cam means for moving said pins inwardly in response to the movement of said press means so that said inclined upper faces contact the upper surface of said bushing and force said bushing and said legs upwardly to accurately position the same on said pins, means for piercing a hole in the free end of each of said legs a predetermined distance from said axis of said bushing while said bushing is held in proper position by said pins, and transfer means between said first and second bending means and said piercing means adapted to advance said blank successively between said bending means and piercing means.

8. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and legs extending outwardly from said bushing, the combination comprising a first station having means for partially bending said legs adjacent their juncture with said bushing, a reciprocating feeding means for feeding said blanks to said first station, a second station having means for bending said partially bent legs adjacent said juncture to a position perpendicular to the axis of said bushing and generally parallel to each other, a reciprocating feeding slide which contacts said partially bent legs and advances said blank from said first station to said second station, a third station having means for positioning said blank and means for piercing a hole in the free end of one of said legs, a fourth station having means for positioning said blank and means for piercing a hole in the free end of the other of said legs, and a reciprocating feeding slide which contacts the legs of said blank and advances said blank from said second station to said third station, then to said fourth station and then advances the completed link to the discharge end of the apparatus.

9. An apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a die member having outwardly inclined side walls and an upper surface for receiving said bushing, press means for bending said legs against said inclined walls so as to partially bend said legs adjacent their juncture with said bushing, a first reciprocating feeding slide which contacts said blank and advances said blank to said die member, a second die member having generally vertical side walls and an upper surface for receiving said bushing, second press means for bending said partially bent legs adjacent said juncture to a position enclosing the ends of said bushing and perpendicular thereto, a second reciprocating feeding slide means which contacts said partially bent legs and advances said blank to said second die member, a first station having means for positioning and piercing the free end of one of said legs, a second station having means for positioning and piercing the free end of the other of said legs, and a third reciprocating feeding slide which contacts the legs of said blank and advances said blank from said second die member to said first station and thence to said second station, all of said reciprocating feeding slides operating simultaneously to move the blanks in the apparatus through a single step during each forward reciprocatory movement of the slides.

10. An apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and legs extending outwardly from said bushing, a combination comprising a blank holding magazine, a first station having means for partially bending said legs adjacent their juncture with said bushing, a first reciprocating feeding slide for transferring said blanks from said magazine to said first station in step-by-step movement, a second station having means for bending said legs adjacent their juncture with said bushing, a second recipro-

cating feeding slide for advancing said blanks from said first station to said second station in step-by-step movement, a third station having means for positioning said blank and means for piercing holes in the free ends of said legs, and a third reciprocating feeding slide which engages said bent legs and advances said blanks from said second station to said third station in step-by-step movement, all of said reciprocating feeding slides advancing through one step of operation simultaneously to move said blanks sequentially through said apparatus so that operations are performed simultaneously at each station on different blanks.

11. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a die member having outwardly inclined walls and an upper surface for receiving said bushing, first press means adjacent said die member for bending said legs against said inclined walls so as to partially bend said legs adjacent their juncture with said bushing, said press means having inclined walls formed so as to mate with the inclined walls of said die member when said press means and said die member are moved into operative position relative to each other, a second die member having generally vertical walls and an upper surface for receiving said bushing, second press means for applying a downward and inward force against said partially bent legs so as to bend said legs to a position enclosing the ends of said bushing and perpendicular thereto, and means for transferring said blank between said first and second press means.

12. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a die member having downwardly and outwardly inclined walls and an upper surface for receiving said bushing, press means above said die member having resiliently mounted portions and having a rigidly mounted die with surfaces adapted to mate with the downwardly and outwardly inclined walls of the die member, said die when said press is in its upper position being above said resiliently mounted positions so that as said press means is moved toward said die member said resiliently mounted portions engage said blank to properly position and grip the same prior to the movement of the die into operative position relative to the blank and the die member, a second die member having generally vertical walls and an upper surface for receiving said bushing, said second press means directing a downward and inward force against said partially bent legs so as to bend said legs against said vertical walls to a position enclosing the ends of said bushing and perpendicular to the axis thereof, and means for feeding said blank from said first press means to said second press means.

13. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising means for partially bending said legs adjacent their juncture with said bushing, a die member spaced from said partial bending means and having generally vertical walls and an upper surface for receiving said bushing, press means for bending said partially bent legs to a position enclosing the ends of said bushing and perpendicular to the axis thereof, said press means including a pair of spaced, pivoted bending members, means for pivoting said bending members toward said partially bent legs so that they direct an inward and downward force on said legs to bend said legs against the generally vertical side walls of the die member, thereby ensuring a strong bend at the juncture of each of said legs with said bushing, and means for advancing said blank from said partial bending means to said press means.

14. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a first station having a die member with downwardly and outwardly inclined side walls and press means above said die member including resiliently mounted portions and a rigidly mounted die, said rigidly mounted die having surfaces adapted to mate with the downwardly and outwardly inclined side walls of the die member, said die being above said resiliently mounted portions when said press means is in its upper position so that as said press means is moved toward said die member said resiliently mounted portions engage said blank to properly position and grip the same prior to the movement of the die into operative position relative to the blank and the die member to partially bend said legs, a second station spaced from said first station including a second die member having generally vertical side walls and second press means for bending said partially bent legs to a position enclosing the ends of said bushing and perpendicular to the axis thereof, said second press means including a pair of spaced pivoted bending members and means for pivoting said bending members toward said partially bent legs so as to direct an inward and downward force on said legs to bend said legs against the generally vertical side walls of said second die member, and reciprocating feeding means for advancing said blank from said first station to said second station.

15. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a lower die member having downwardly and outwardly inclined side walls and an indentation in the upper surface for receiving said bushing, and a vertically movable press means mounted above said die member, said press means including an upper die member rigidly mounted thereon and having lower surfaces adapted to mate with said downwardly and outwardly inclined side walls and resiliently mounted legs normally extending below said upper die member so that as said press means is moved downwardly toward said lower die member the blank is positioned and gripped by said legs prior to being engaged by said upper die member.

16. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing and a pair of legs extending outwardly in opposite directions from said bushing, the combination comprising a lower die member having downwardly and outwardly inclined side walls and an indentation in the upper surface for receiving said bushing, and a vertically movable press means mounted above said die member, said press means including an upper die member rigidly mounted thereon and having lower surfaces adapted to mate with said downwardly and outwardly inclined side walls, resiliently mounted legs normally extending below said upper die member, and a head mounted in said press means movable vertically relative thereto and normally urged downwardly, said legs being attached to said head for movement therewith, so that as said press means is moved downwardly toward said lower die member the blank is positioned and gripped by said legs prior to being engaged by the upper die member.

17. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and legs extending perpendicularly to the axis of said bushing and enclosing the same, the combination comprising a first station having means for positioning said blank and means for piercing a hole in the free end of one of said legs, a second station having means for positioning said blank and means for piercing a hole in the free end of the other of said legs, and a reciprocating feeding slide which contacts the legs of said blank and advances said blank from said first station to said second station.

18. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and legs extending perpendicularly to the axis of said bushing and enclosing the same, the combination comprising a first positioning and piercing station having means for positioning the free end of one of said legs relative to the axis of said bushing and means for piercing the free end of said one of said legs at a predetermined distance from said axis, a second positioning and piercing station having means for positioning the free end of the other of said legs relative to said axis and means for piercing the free end of said other of said legs at said predetermined distance from said axis, and means for transferring said blank from one station to the other.

19. In an apparatus for forming an integral chain link from a blank having a cylindrical bushing thereon and legs extending perpendicularly to the axis of said bushing and enclosing the same, the combination comprising a support for said blank, means adjacent said support normally urging said blank away from the upper surface of said support, a resilient vertically movable member adapted to engage said blank and urge it against said support, a pair of inwardly movable, axially aligned, horizontally disposed pins having inwardly and downwardly inclined upper faces, the axis of said pins being above the axis of said bushing when said bushing is against the upper surface of said die member, cam means for moving said pins inwardly in response to downward movement of said resilient member so that said inclined upper faces contact the upper surface of said bushing and force said bushing and said legs upwardly to accurately position the same on said pins, and means for piercing a hole in the free end of each of said legs a predetermined distance from the axis of said bushing while said bushing is held in position by said pins.

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