March 17, 1931. R. W. DULL 1,796,594

APPARATUS FOR CHAIN MANUFACTURE

Filed March 10, 1925 4 Sheets-Sheet 1

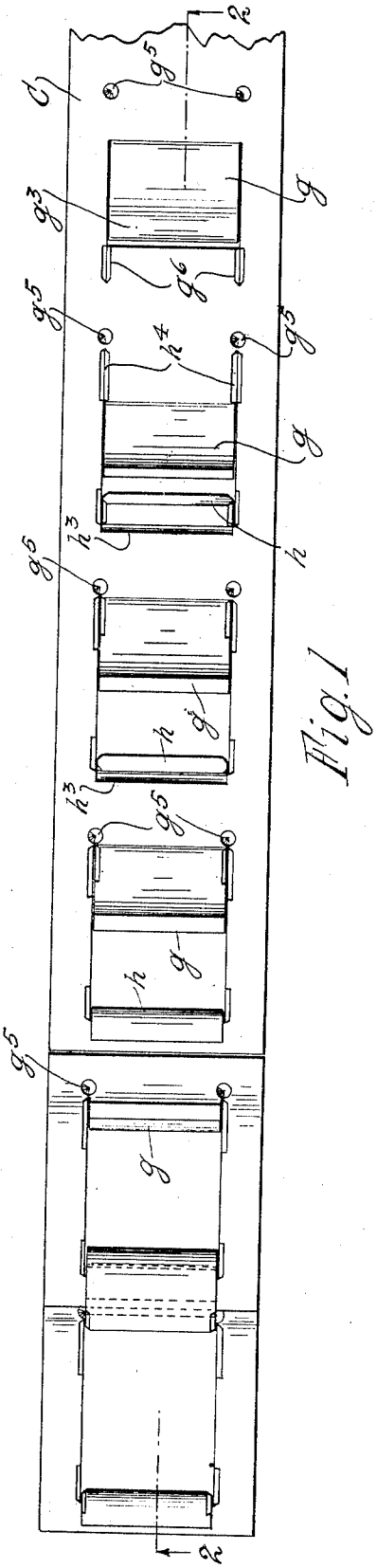


Fig. 1

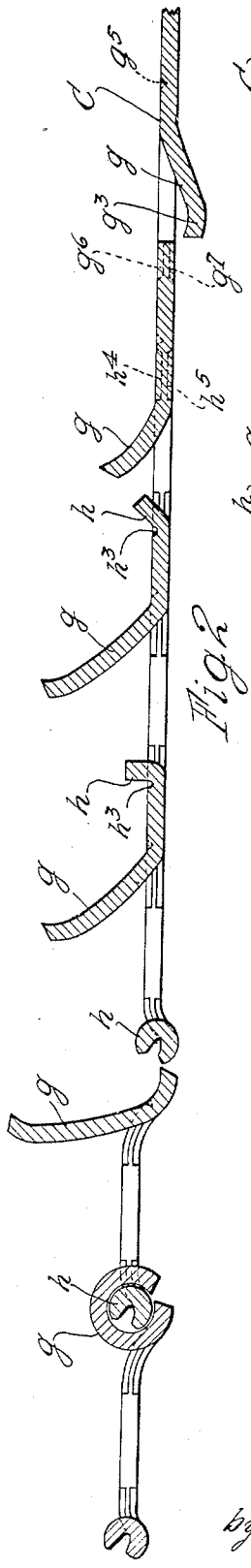


Fig. 2

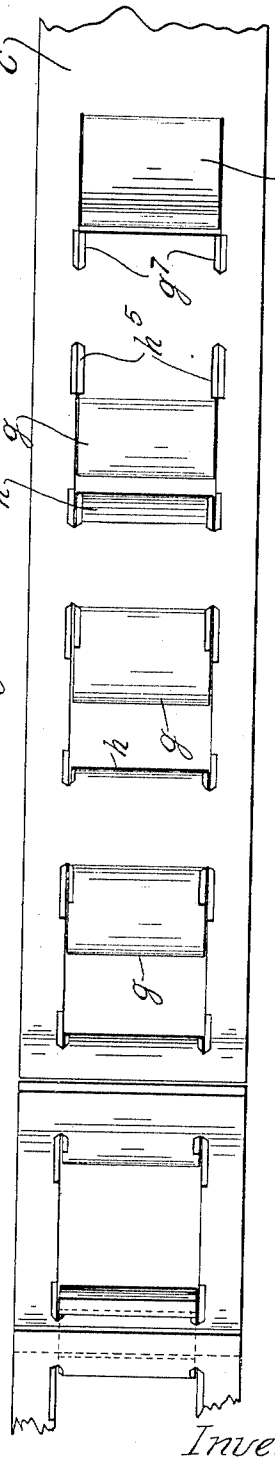


Fig. 3

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APPARATUS FOR CHAIN MANUFACTURE

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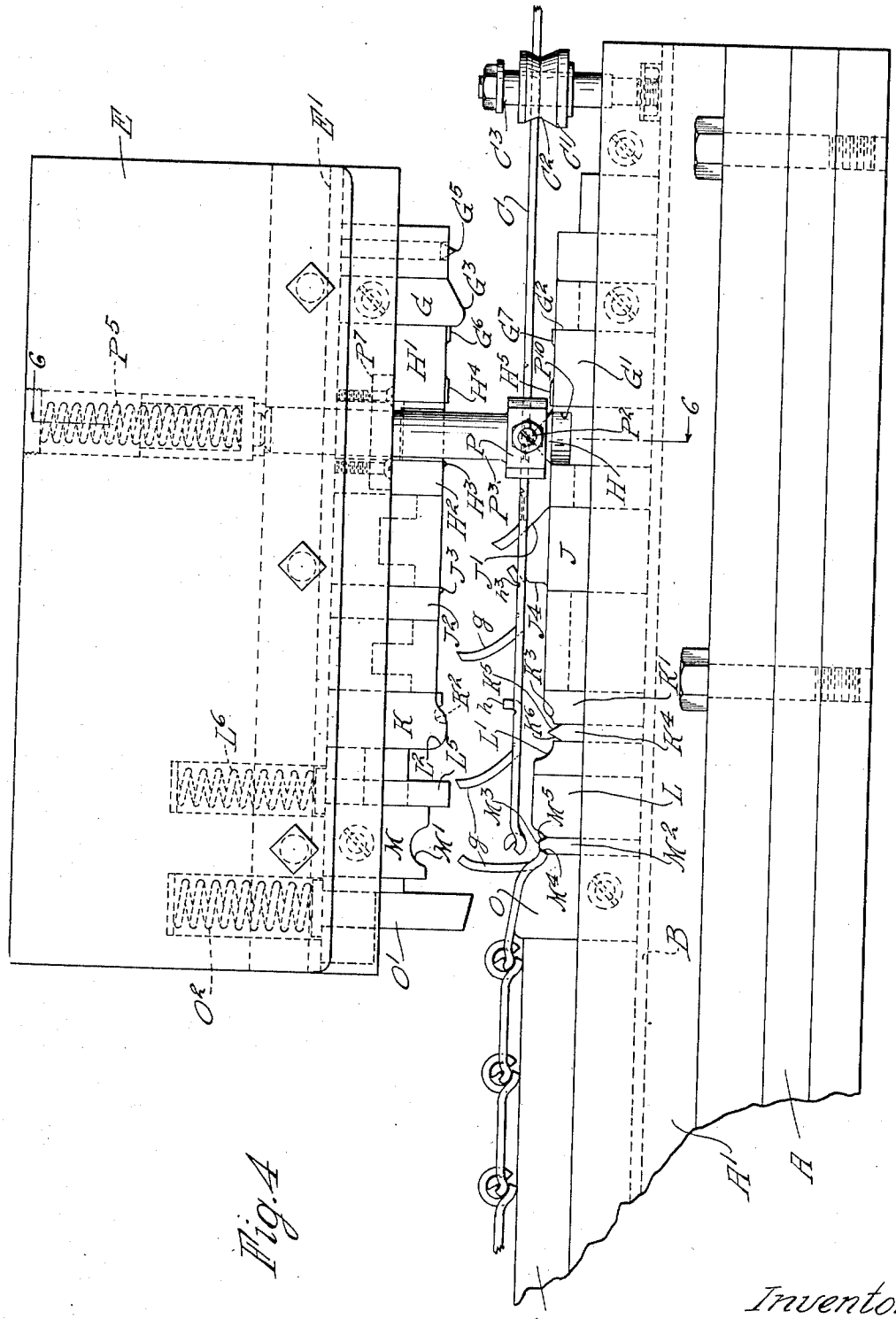


Fig. 4

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APPARATUS FOR CHAIN MANUFACTURE

Filed March 10, 1925 4 Sheets-Sheet 3

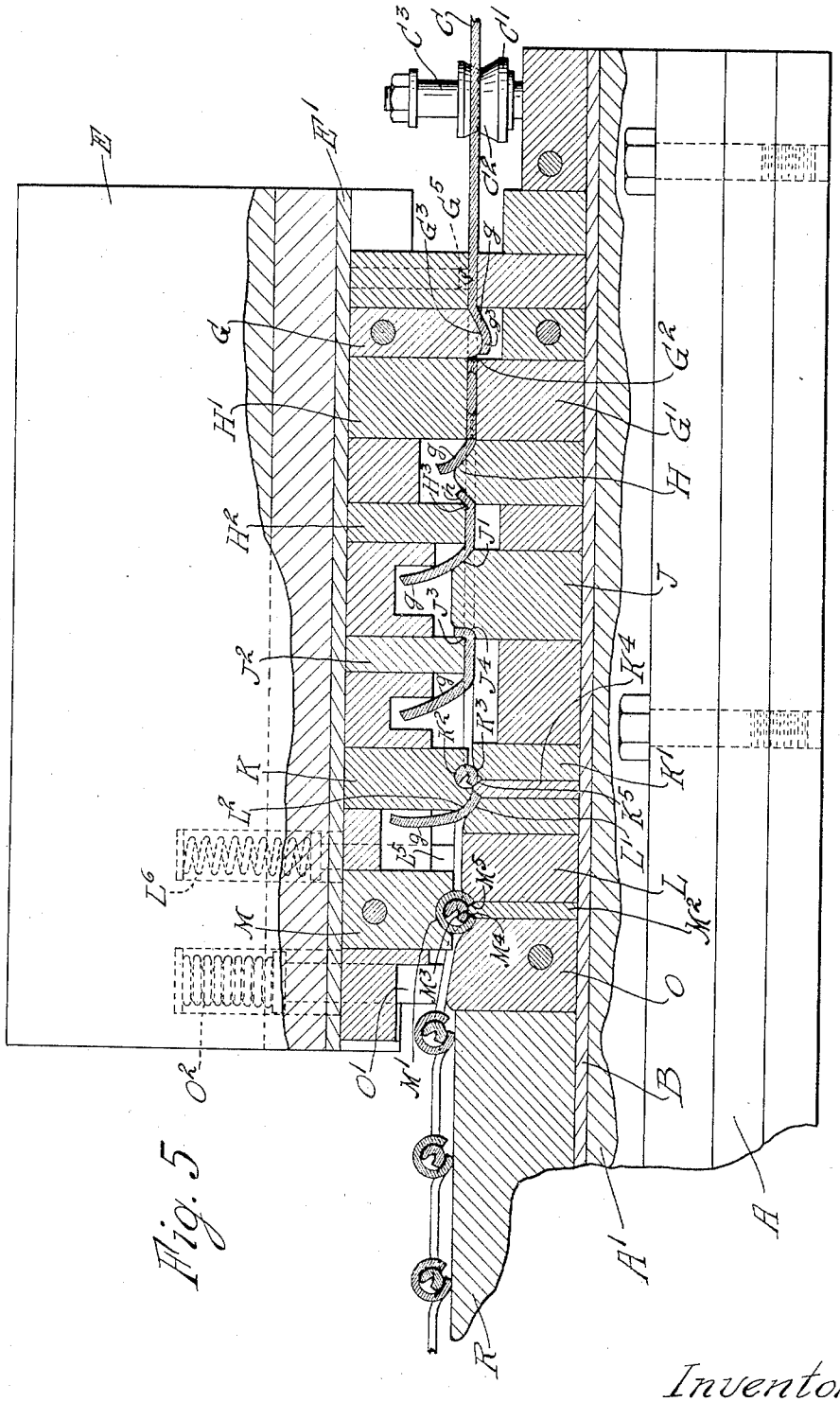


Fig. 5

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March 17, 1931. R. W. DULL 1,796,594

APPARATUS FOR CHAIN MANUFACTURE

Filed March 10, 1925 4 Sheets-Sheet 4

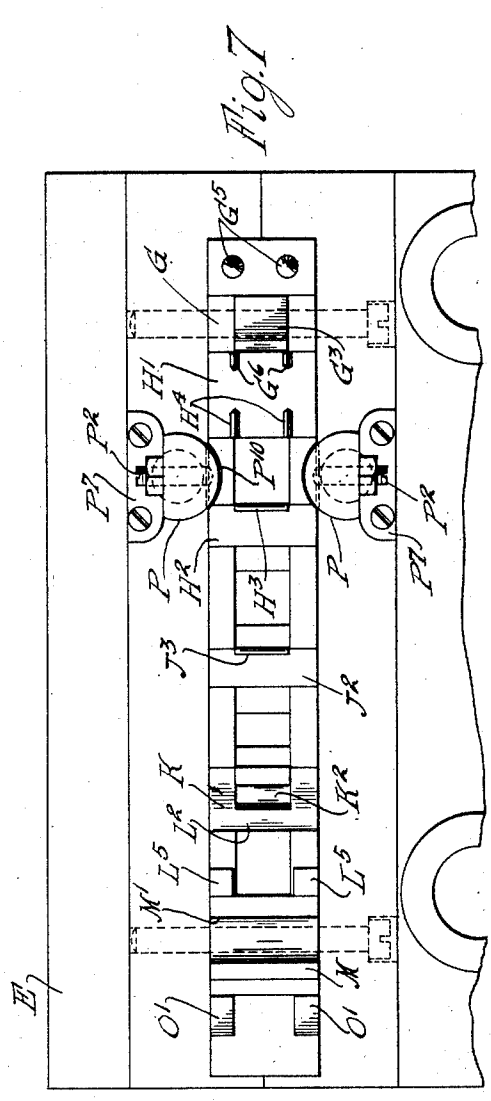


Fig. 7

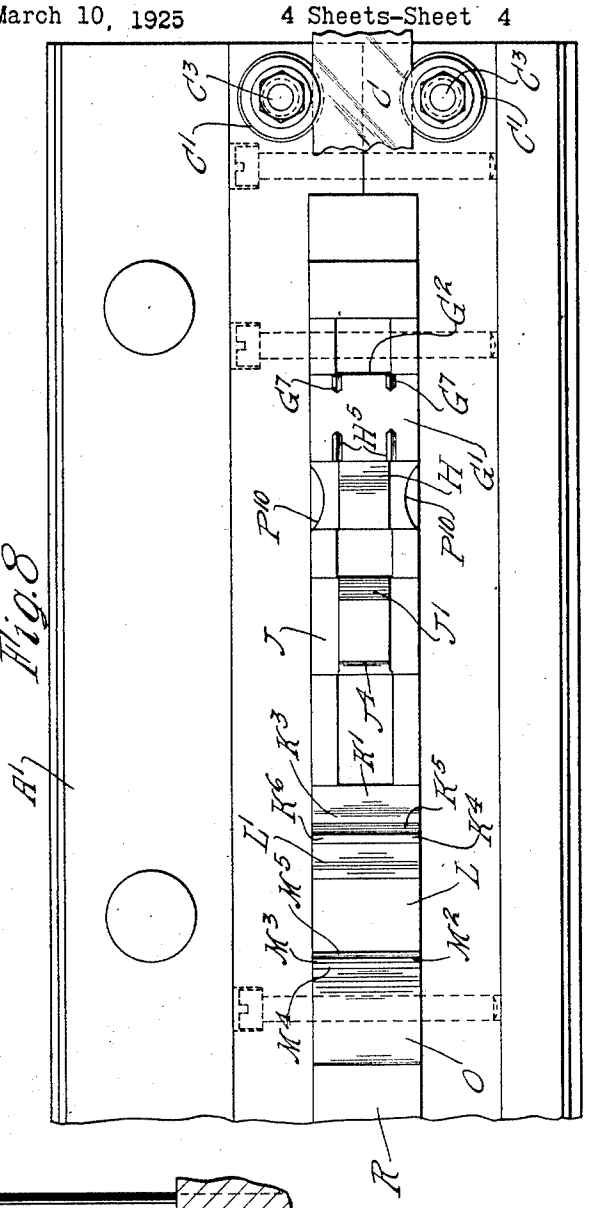


Fig. 8

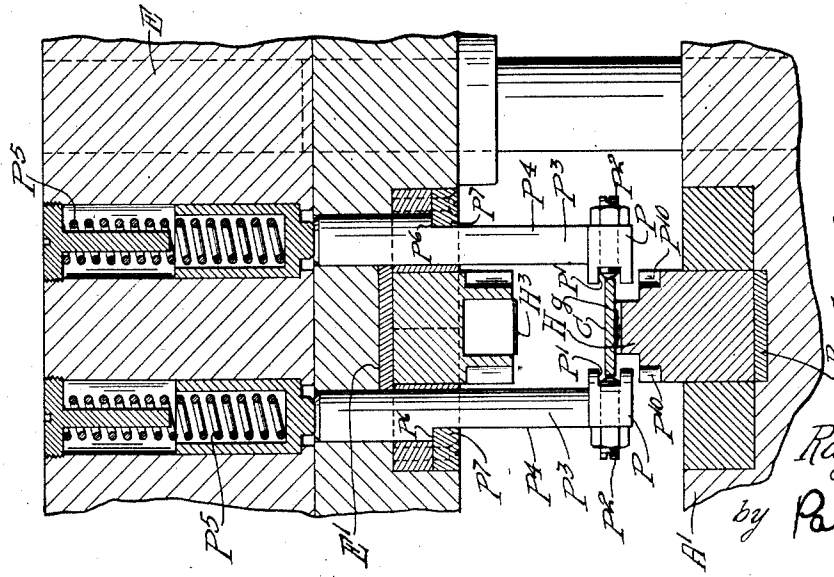


Fig. 6

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Patented Mar. 17, 1931

1,796,594

UNITED STATES PATENT OFFICE

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APPARATUS FOR CHAIN MANUFACTURE

Application filed March 10, 1925. Serial No. 14,414.

My invention relates to an apparatus for making chain from a strip of sheet metal stock, and particularly to a machine for the continuous making and automatic assembling of the links into a chain. The general object of my invention is to produce chain of the type described in which hook and pintle tongues are stamped from the center of the link blank and the hook and pintle end bars are bent to produce a chain, each link of which consists of flat side bars, a relatively cylindrical hook at the end, and a pintle at the other shaped for rotation within the hook of the link next adjacent. One object is to provide a mechanism for producing chain of the type described, with maximum cheapness and simplicity. Another object is to provide a mechanism which shall stamp the hook and pintle tongues from the center of the blank and curl them and the end bars into finished hooks and pintles with a minimum strain upon the metal of the blank, and a minimum weakening and distortion of the fibers of the metal. Another object is to provide a mechanism for producing chain of the type described in which, by scoring and by indenting each blank the tendency of the end bars to tear out shall be reduced to a minimum. Another object is to provide a mechanism for producing chain of the described type in which the length of the blank as it passes through the device shall vary as little as possible during, and be reduced as little as possible, by the successive die impacts.

Other objects will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a plan view of the strip of material operated upon;

Figure 2 is a section along the line 2—2 of Figure 1;

Figure 3 is a bottom view of the strip;

Figure 4 is a skeleton side elevation of the punch and die;

Figure 5 is a longitudinal section of the punch and die;

Figure 6 is a section on the line 6—6 of Figure 4;

Figure 7 is a plan view of the punch; and

Figure 8 is a plan view of the die.

Like parts are illustrated by like characters throughout the specification and drawings.

A is any suitable base having mounted thereupon the die block A^1, secured thereto in any suitable manner.

B is any suitable strip of relatively resistant metal, upon which rest the individual die elements which are mounted in the die block, and which are secured thereto in any suitable manner.

The passage of the metal strip C over the die block is from right to left, as shown in Figures 4 and 5. This ribbon or strip C of stock may be initially straightened and fed by any means not herein shown, being guided into the machine, for example, by the rollers C^1 channeled as at C^2, and slidably and rotatably mounted on the vertical pins C^3 positioned at either side of the die blocks.

Any suitable means may be used for feeding the stock into and for drawing the completed chain away from the space between die and punch by a step by step movement, the stock being advanced one step between each forming action of the punch, and being moved forward at each step a distance equivalent to the length of the blank or space from which the individual links are formed.

E is any suitable punch element and E^1 is a relatively resistant base or backing adapted to receive the individual punch elements which will later be described in detail.

The progressive affect of the cooperation of the punch and die elements is shown in Figures 1, 2 and 3, and for the sake of clarity the impressions on the blanks made by the individual elements will be shown in small letters corresponding to the capitals which indicate the punch or die elements making them.

At the first step the punch G shearing against the edge G^2 of the die member G^1 shears the end of the future hook tongue from the opposed edge or end of the future pintle tongue. The pintle tongue remains flat in the plane of the stock but the outer length of the hook tongue is forced downwardly therefrom, and is sheared from the side bars for approximately two-thirds of its future

length. The member G being rounded as at G^3 crimps the outer end of the hook tongue *g*, in anticipation of the final rolling operation. Meanwhile the prick punches G^5 indent the future corners of the side bars and hook bar of the completed link. The longitudinal scoring knives G^6 score the upper surface of the blank, outlining the separation between the pintle tongue and the side bar and the opposed scorning knives G^7 similarly score the bottom of the blank.

When the punch is withdrawn and the stock has moved forward another step the tongue *g* is positioned over the upwardly humped die member H. As the punch members H^1 and H^2 thrust the blank down the tongue *g* is bent upwardly from the blank and the pintle tongue *h* is severed from the side bars and bent upwardly about the creasing bead H^3 on the punch element H^2. At the same time the longitudinal scoring knives H^4 score the top of the blank and the opposed knives H^5 score the bottom of the blank to outline the separation between the unsevered portion of the hook tongue *g* and the side bars.

At the next step, the punch thrusts the blank downwardly against the die member J and its inclined forward surface J^1 completes the separation of the hook tongue, thrusting it still farther upwardly from the blank. Meanwhile the punch member J^2 with its creasing bead J^3 thrusts the pintle tongue against the forming surface J^4 of the die element J and bends it into substantial perpendicularity to the stock.

At the next step the hook tongue and the hook end of the link are not further modified but the punch member K operating against the die member K^1 at the same time rolls the pintle tongue into final position and crimps or bends the pintle cross bar downwardly from the plane of the stock. The pintle tongue and end bar are confined between and formed by the substantially arcuate forming surface K^2 on the punch K the downwardly inclined surface K^3 on the die member K^1 and the face K^5 of the severing knife K^4.

At the next step the blank is positioned upon the die member L and the hook end bar is bent or crimped against the die surface L^1 by the opposed arcuate face L^2 on the punch member K. Meanwhile the knife K^4 severs the blank from the stock, preferably without any preliminary transverse scoring between links, and the rearward surface K^6 of the knife member serve as a stop to limit the downward movement of the hook cross bar during its formation. The severed link is held firmly in position upon the die member L for example by the spring pads L^5 which engage the side bars, and which are downwardly thrust for example by the spring L^6. Preferably a pair of such pads are used, or a pad or gripping member which engages and operates against both side bars.

The pintle end bar, which at the preceding step was completely formed, is not operated on by the punch or die, but it is surrounded by the hook tongue which is rolled about it by the punch member M with its arcuate forming surface M^1. The die member M^2 is provided with a more or less flattened or slightly arcuate upper surface M^3 upon which the pintle bar rests. The inclined forward die surface M^4 of the member M^2 limits the downward or rearward movement of the hook end bar during the rolling of the hook and its rearward surface M^5 limits the movement of the end of the hook as it is formed, thus controlling the diameter of the cylinder thus produced.

At the next step the severed and partly formed link, its pintle now surrounded by the hook of the preceding link, is drawn forward with the chain, its side bars rest upon the downwardly and rearwardly inclined die member O, being held firmly in position thereon, for example by the spring pads O^1, compressed by the springs O^2. Its hook is then rolled about the pintle of the succeeding link, as above described.

In the formation of the chain, I employ opposed inwardly slotted edge gripping yokes P depending from the punch block and positioned at any suitable point along the strip. Since the side bars of the blank are not in any way crimped or deformed or severed until the pintle bar is operated on at the moment of severance of the preceding blank from the stock, it may be positioned at any point along the stock. I illustrate it herein, however, as positioned adjacent the second forming step. They are inwardly slotted as at P^1, and provided with any suitable adjusting elements, for example the adjusting screws P^2. The yokes are suspended upon or are positioned at the lower ends of the plungers P^3, herein shown as cylindrical, with cut away portions P^4. They are spring pressed by the spiral springs P^5, the ledges P^6 limiting their downward movement in engagement with the stops P^7. It will be understood that the die block is cut away as at P^{10} to receive the yokes and thus to permit the stock to lie upon the die elements and to receive the impact of the punch elements, without being disengaged from the yokes.

I provide any suitable supporting member R along which the finished chain may be drawn. I do not herein illustrate any specific feeding means, since the details of the feeding means used form no part of the present invention, but it will be realized that I may provide any suitable means for drawing the chain step by step away from the die block as the successive forming impacts take place and as the stock if forwardly fed between punch and die.

The use and operation of my invention are as follows:

I manufacture chain from a ribbon or strip of metal stock which is fed forwardly, step by step, between opposed punches and dies. The interval between the forward feeding movement need be only sufficient to permit the strip to move forwardly through the press the length of one link.

In order to prevent interference between the stock and the punch or die at the time of such forward movement, I provide means for lifting the entire strip of stock from the die and for suspending it between die and punch intermediate the forming impacts, and for giving it its forward movement when so suspended and out of contact with either punch or die.

In the form herein shown, I move the strip upwardly after each impact to a position sufficiently high above the die to enable the hook g, when downwardly turned, to clear the die member G^1 as the stock is forwardly moved. At the same time, the strip is positioned at such a distance below the punch as to permit the hook tongue g to clear all the punch elements even when it is bent to its position of maximum height above the stock. The yokes P, which engage the edges of the stock with their slots P^1 serve to lift the stock, and to hold it suspended while the stock is being forwardly fed. The adjustment screws P^2 permit of minor variations in width of stock used, and enable the yokes to be adjusted with whatever accuracy is necessary.

The strip of stock C is fed into the space between the punch and dies, for example through the rollers C^1 which are provided with a circumferential channel or groove of V-shaped cross section. The stock cannot be caught or jammed in the rollers, since the rollers rotate in response to forward movement of the stock and thus prevent any tendency of the stock to clamp between the rollers, the bottoms of the slots or channels of the rollers being preferably positioned sufficiently far apart to permit a slight clearance. The rollers are vertically movable along the pins C^3 and permit such upward and downward movement of the stock as normally takes place.

In the form of punch and die herein shown, the portions of the link which are forced out of the normal plane of the strip are all bent upwardly toward the punch, save for the initial downward movement of the tongue g^3, and the lifting movement of the yokes P need thus be relatively slight.

In the method and mechanism of chain formation herein described, the side bars of the links are not in any way deformed or bent until the step succeeding that in which the final severing of both hook tongues from the side bars is completed. This bending occurs, in the case of the pintle bar, at the step before the blank is severed, and in case of the hook bar at the step when the blank is severed. Thus throughout most of its excursion between punch and die the stock is straight edged, and can be easily and efficiently forwardly fed through the slotted yokes or guides P.

The strip of metal stock of which the links are formed is a fibrous material and, though tough and hard, is relatively yielding to impacts parallel to the grain of its fibers and is likely to tear along the line of the fibers, if weakened therealong. Thus it is necessary not only to render easy the severing of the parts which have to be severed, and to make this severing possible without a damaging distortion of the material, but also to limit the severing and to counteract the tendency for further and unintended tearing or severing, either during manufacture or during the later use of the chain. To make the severing easy, some of the parts to be severed are initially scored. To prevent unintended tearing, the lines of score are terminated by creases or indentations which modify the normal fibrous structure of the material, and which prevent the formation of lines and angles of weakness and cleavage.

The successive steps of the operation may be summarized as follows:

First step: The top of the stock is prick punched or indented at the future point of separation of the hook tongue and the side bars as at g^5. I illustrate a sharp pointed punch, but obviously a blunt or rounded punch may be used. At the same time the tongue g is sheared from the side bars and the future pintle bar and its outer end is slightly bent by the form and action of the punch G, being severed from the side bars for part, shown in the drawings as about two-thirds, of its length. The pintle bar is left in the plane of the stock and is not severed, but scored both on the top and bottom by the scores g^6 g^7 which outline the separation between the pintle bar and the side bars.

Second step: The hook tongue g is thrown upwardly from the stock, although it is not further severed from the side bars. The separation between the unsevered portion of the tongue and the side bars is outlined on the top and bottom by the scores h^4 h^5. The pintle tongue h is severed from the side bars and upwardly bent about the creasing bead H^8, forming the crease h^3 in the stock.

Third step: The hook tongue is now completely severed from the side bars, being sheared along the scores h^4 h^5 clear back to the prick punch marks g^5. The pintle tongue is thrown upwardly about the creasing bead J^3 into substantial perpendicularity to the stock.

Fourth step: At this step the hook tongue and end bar are not operated on, but the pintle tongue is bent into final position and

at the same time and by the same action the whole pintle bar is bent downwardly from the plane of the stock into its final position.

Fifth step: The blank, with its pintle end completed, is now severed from the stock. The spring pads L^5 engage the side bars and hold the blank in position. The hook end bar is bent substantially into final shape and the hook tongue is thrown still further around, or higher from the stock. The completed pintle end is surrounded by the hook tongue of the precedingly severed link.

Sixth step: At this step the uncompleted link, which was at the preceding step joined to the chain, and drawn forwardly with it, is positioned on a slightly rearwardly inclined die memmber, being clamped thereon by the spring pads C^1. The hook tongue is then rolled about the pintle of the succeeding link into its final cylindrical form, and the link is thus completed.

In the tools herein described I employ massive robust punch and die elements which are not rapidly worn and can be used for relatively long periods without replacement. Taking the members from right to left of Figure 5, the prick punch points are durable. The punch G is a massive member and exerts a shearing action against the edge G^2 of the die G^1. The die G^1 is a massive block and the shearing action is practically the easiest and least wearing type of action on the opposed elements. The die H is a massive member with no sharp edges or corners to wear off, as is the die member J. The creasing beads H^2 J^3 are not subjected to particular wear. The wear on the knife K^4 is reduced by giving it a shearing action against the opposed punch. The various arcuate forming members are not particularly subject to wear. Thus I have developed a peculiarly robust and long lived set of tools.

While I have illustrated a practical and operable set of tools it will be realized that many changes may be made in the details and arrangements of the individual elements and their relative size and location without departing from the spirit of my invention and I wish my drawings and description to be taken as in a broad sense diagrammatic or illustrative rather than as limiting me to my specific showing.

I claim:

1. In a machine for making, from a continuous strip of sheet metal stock, chain links having pintles and hooks struck from the center of the link, comprising an opposed die and punch, each having a plurality of elements positioned therealong for progressive action upon the stock passing therebetween, means for initially severing the outer end of the hook tongue from the side bars and the opposed edge of the future pintle bar, and at the same time scoring the separation between the side bars and the pintle tongue; means for bending the scored pintle tongue from the side bars and for scoring the separation between the unsevered portion of the hook tongue and the side bars; means for completing the separation of the hook tongue from the side bars; means for forming the pintle tongue and pintle end bar into final shape; means for crimping the hook end bar and substantially simultaneously severing the link from the stock and curling around its pintle the hook tongue of the precedingly severed link.

2. In a machine for making, from a continuous strip of sheet metal stock, chain links having pintles and hooks struck from the center of the link, comprising an opposed die and punch, each having a plurality of elements positioned therealong for progressive action upon the stock passing therebetween, means for initially severing the outer end of the hook tongue from the side bars and the opposed edge of the future pintle bar and for crimping the end of said hook tongue, and at the same time scoring the separation between the side bars and the pintle tongue, means for bending the scored pintle tongue from the side bars, and for creasing the inside of the bend thereby formed, and at the same time scoring the separation between the unsevered portion of the hook tongue and the side bars; means for completing the separation of the hook tongue from the side bars; means for forming the pintle tongue and pintle end bar into fianl shape; means for crimping the hook end bar and substantially simultaneously severing the link from the stock and curling around its pintle the hook tongue of the precedingly severed link.

3. In a machine for making, from a continuous strip of sheet metal stock, chain links having pintles and hooks struck from the center of the link, comprising an opposed die and punch, each having a plurality of elements positioned therealong for progressive action upon the stock passing therebetween, means for initially severing the outer end of the hook tongue from the side bars, while maintaining the rest of the hook tongue and the future pintle tongue in the plane of the link; means for bending the pintle tongue from the side bars and for scoring the separation between the unsevered portion of the hook tongue and the side bars; means for completing the separation of the hook tongue from the side bars; means for forming the pintle tongue and pintle end bar into final shape; means for substantially simultaneously severing the link from the stock and curling around its pintle the hook tongue of the precedingly severed link.

4. In a machine for making, from a continuous strip of sheet metal stock, chain links having pintles and hooks struck from the center of the link, comprising an opposed die and punch, each having a plurality of ele-

ments positioned therealong for progressive action upon the stock passing therebetween, means for initially indenting the inner corners of the hook tongue and the side bars, and scoring the lines of separation between the pintle tongue and the side bars, and bending the hook tongue from the side bars along part of its length and crimping the outer end of the hook tongue; means for separating the pintle tongue from the side bars along said scores and bending it from the link and creasing the inside of the bend thus formed, and for scoring the lines of separation between the side bars and the unsevered portion of the hook tongue; means for completing the separation of the hook tongue along said lines of score; means for forming the pintle end bar and tongue into final shape; means for crimping the hook end bar and for substantially simultaneously severing the link from the stock and curling around its pintle the hook tongue of the preceding severed link.

Signed at Chicago, county of Cook, and State of Illinois, this 6th day of March, 1925.

RAYMOND W. DULL.