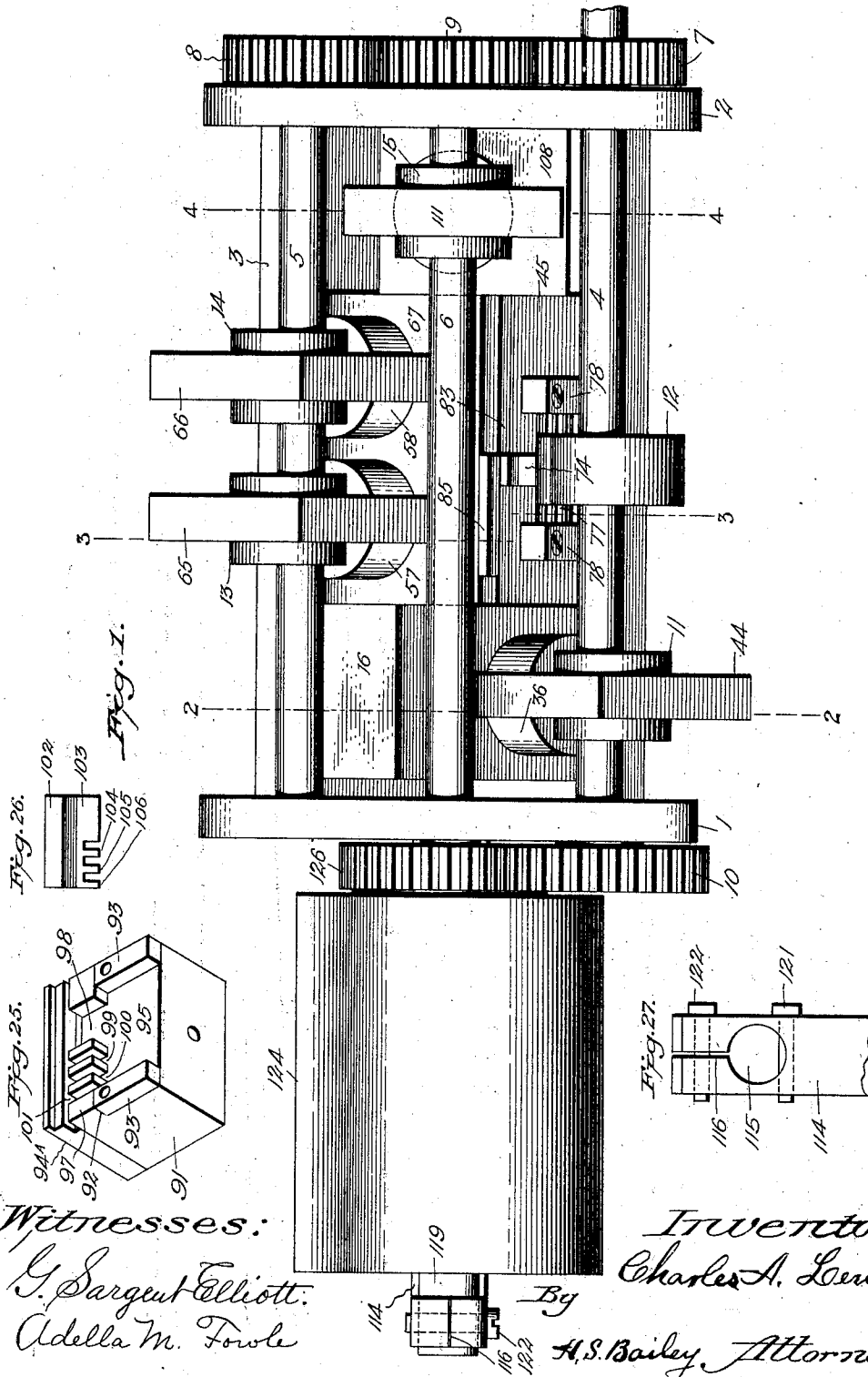


C. A. LEWIS.
MACHINE FOR MAKING WELDLESS LINK CHAINS.
APPLICATION FILED JUNE 30, 1910.

997,305.

Patented July 11, 1911.

4 SHEETS—SHEET 1.



Witnesses:

G. Sargent Elliott.
Adella M. Fowler

Inventor
Charles A. Lewis

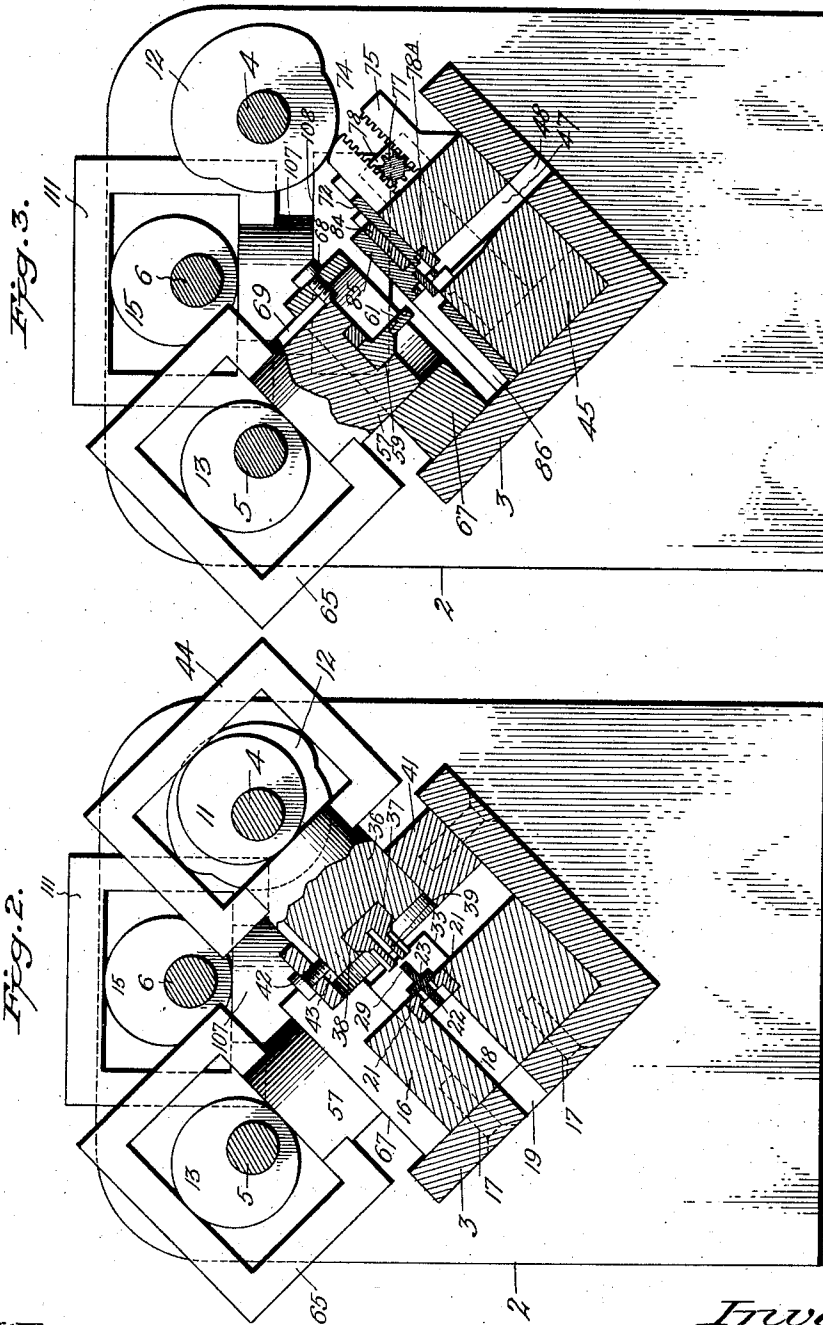
By
H. S. Bailey, Attorney

C. A. LEWIS.
MACHINE FOR MAKING WELDLESS LINK CHAINS.
APPLICATION FILED JUNE 30, 1910.

997,305.

Patented July 11, 1911.

4 SHEETS—SHEET 2.

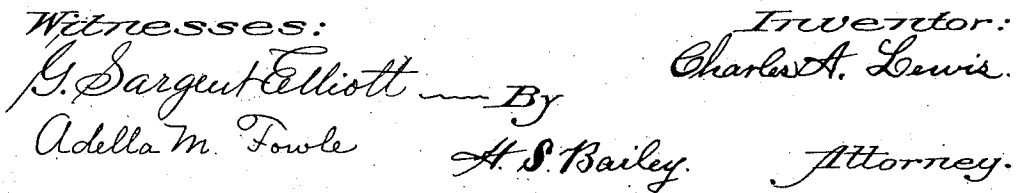


Witnesses:
G. Sargent Elliott.
Adella M. Fowle

Inventor
Charles A. Lewis.
By
H. S. Bailey. Attorney.

997,305.

4 SHEETS—SHEET 3.

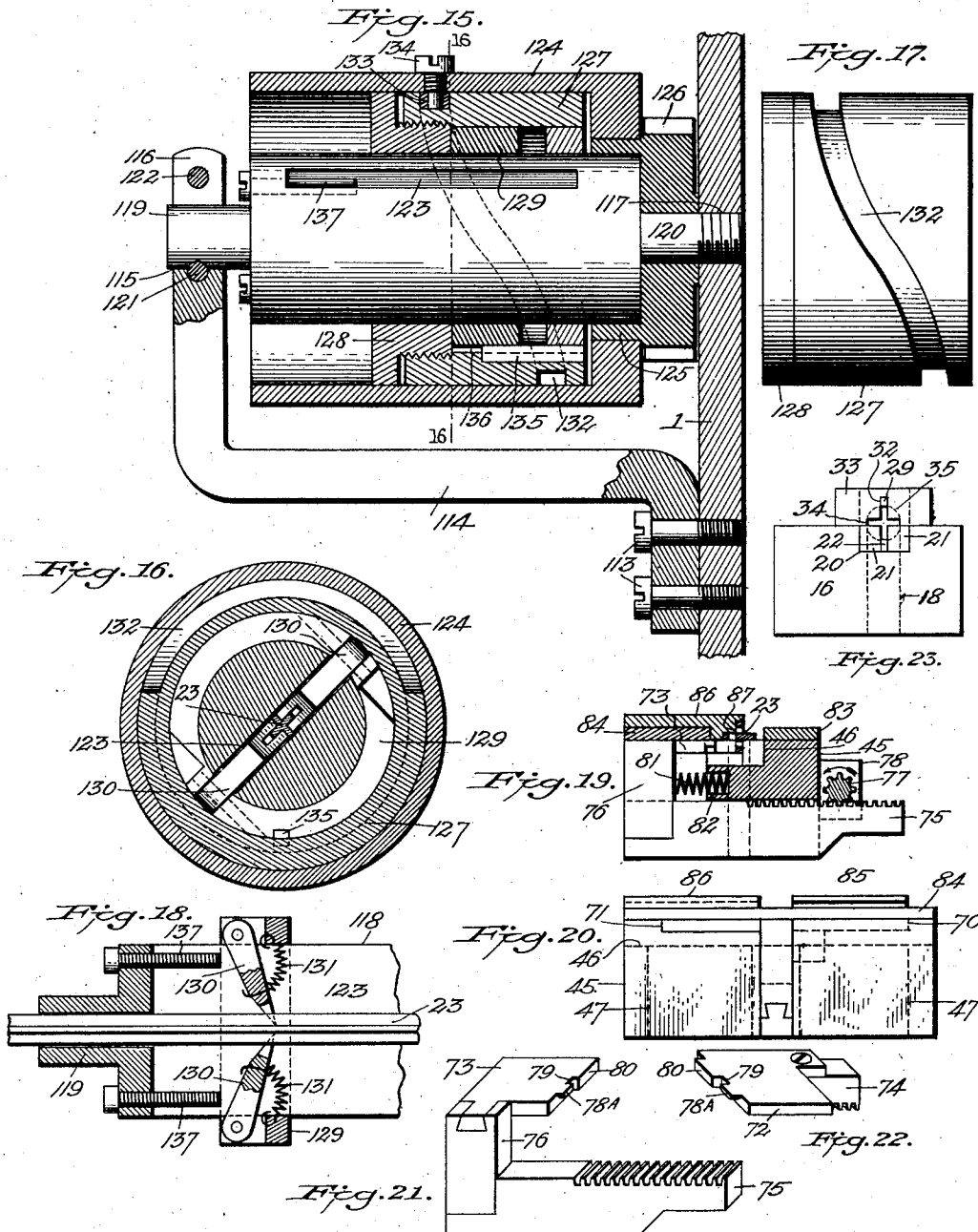


C. A. LEWIS.
MACHINE FOR MAKING WELDLESS LINK CHAINS.
APPLICATION FILED JUNE 30, 1910.

997,305.

Patented July 11, 1911.

4 SHEETS—SHEET 4.



Witnesses:

G. Sargent Elliott
Adella M. Fowle

Inventor:

By Charles A. Lewis.
H. S. Bailey, Attorney

UNITED STATES PATENT OFFICE.

CHARLES A. LEWIS, OF DENVER, COLORADO.

MACHINE FOR MAKING WELDLESS-LINK CHAINS.

997,305.

Specification of Letters Patent.

Patented July 11, 1911.

Application filed June 30, 1910. Serial No. 569,712.

To all whom it may concern:

Be it known that I, CHARLES A. LEWIS, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented a new and useful Machine for Making Weldless-Link Chains, of which the following is a specification.

This invention relates to improvements in machines for making weldless link chains.

The object of the invention is to provide a plurality of dies and punches arranged in progressive order and adapted to form individual connected links from a bar of steel or other suitable metal, which is cruciform in cross section, the dies being secured to a suitable support in which is mounted shafts carrying eccentrics by which the punches are operated; further, to provide in connection with the dies and punches an improved bar feeding device, by which the bar from which the links are formed is fed step by step between the said dies and punches at periods alternating with the operative movements of the punches. These objects are accomplished by the mechanism illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of the improved chain making machine. Fig. 2 is a vertical, transverse, sectional view on the line 2—2 of Figs. 1 and 5. Fig. 3 is a vertical, transverse, sectional view on the line 3—3 of Figs. 1 and 8. Fig. 4 is a similar view on the line 4—4 of Fig. 1. Fig. 5 is a plan view of the first die block of the series. Fig. 6 is a vertical, longitudinal, sectional view of the same. Fig. 7 is a plan view of the punch used in connection with the die shown in Figs. 5 and 6. Fig. 8 is a plan view of the second die block, which is formed with two half dies, the stripper plates used in connection therewith being omitted. Figs. 9 and 10 are plan views of the punches used in connection with the half dies shown in Fig. 8. Fig. 11 is a perspective view of a portion of a cruciform metal bar such as is used in the production of the weldless link chains. Fig. 12 is a plan view of a portion of a bar after the same has been operated upon by the first die and

punch. Fig. 13 is a plan view of the bar in a different position, the foremost link having been operated upon by both of the half dies. Fig. 14 is a perspective view of a section of chain showing the same as it appears before stock connecting the links has been removed by the last punch. Fig. 15 is a view, partly in elevation and partly in section, of the bar feeding mechanism. Fig. 16 is a transverse, sectional view thereof on the line 16—16 of Fig. 15. Fig. 17 is a side elevation of the cylindrical casing, which incloses and operates the ring carrying the dogs, which grip and move the bar from which the chain is formed. Fig. 18 is a longitudinal, sectional view through the guide block upon which the dog-carrying ring is mounted, showing the chain bar passing through the same, and the dogs in engagement therewith. Fig. 19 is a sectional view of Fig. 8, on the line 19—19. Fig. 20 is a side view of the same. Fig. 21 is a perspective view of one of the link supports used in conjunction with one of the half dies. Fig. 22 is a perspective view of the other link support. Fig. 23 is a view looking at the rear end of the guide block 16. Fig. 24 is a perspective view of one of the strippers. Fig. 25 is a perspective view of the die for separating the links, one of the strippers being removed. Fig. 26 is a view of the punch used in connection with the die shown in Fig. 25; and Fig. 27 is an end view of a portion of the bracket which supports the chain bar feeding mechanism.

Referring to the accompanying drawings, the numerals 1 and 2 refer to the end plates of the supporting structure of the improved chain making machine, which plates are connected by a horizontal member or platform 3, which is V-shaped in cross section.

Mounted in the plates 1 and 2, above the platform 3, are shafts 4, 5 and 6, the shafts 4 and 5 being on the same horizontal plane, while the shaft 6 is on a higher plane, and midway between the other shafts. These shafts extend beyond the plate 2 and are provided with intermeshing gears 7, 8 and 9 respectively. The shaft 4 may be connected in any suitable manner with a source

of power and its opposite end extends through the plate 1 and is provided with a gear wheel 10.

The shaft 4 adjacent to the plate 1 is provided with an eccentric 11 and about mid-way of its length with a cam 12. The shaft 5 is provided with eccentrics 13 and 14, which are secured upon its central portion and adjacent to each other, and the shaft 6 is provided adjacent to the plate 2 with an eccentric 15. These eccentrics are adapted to operate a series of punches, while the cam 12 operates a pair of link supports, as will be fully shown hereinafter.

The link forming dies are secured to the opposite sides of the platform 3 and the sides of this platform are at right angles to each other so that the faces of the dies incline in opposite directions and at an angle of forty-five degrees. With this arrangement of the dies the chain bar is supported with its wings at opposite angles of forty-five degrees, which provides for a more convenient arrangement and operation of the punches than could be otherwise obtained.

This machine is adapted to form a chain composed of alternating long and short links, and the dies and punches for forming these links are arranged in the following manner: The first die comprises a metal block 16, which is secured to one side of the platform 3 in any suitable manner, preferably by screws 17, which extend through the side and into the block. A slot 18 extends through the block from bottom to top and registers with an opening 19 in the side of the platform, as shown in Fig. 2. These slots form an outlet passage for the portions of metal cut from the chain bar in forming the links, as will be fully shown hereinafter. The slot 18 is intersected by a longitudinal slot 20, in the face of the block, in which are rigidly secured metal die plates 21, which are divided by a strip 22, of even thickness, with one of the wings of the chain bar. The die plates 21 are flush with the face of the block 16, but the strip 22 is of such a height relatively to the plates 21 that when one wing of the chain bar 23 rests upon the plates 21 the lower edge of the other wing thereof rests upon the strip 22, as will be seen by reference to Fig. 2.

The die plates 21 are adapted to form the short links of the chain, and to accomplish this they are provided with opposing recesses 24 adjoining the strip 22, which together correspond to the opening in the link. Adjacent to these recesses and separated therefrom by portions of stock 25, corresponding in width and curvature to the end of a link, are opposing recesses 26, which extend from the strip 22 to points corresponding to one side of a wing of the chain bar. These recesses correspond in

shape to the stock removed between two short links, and it will be noted that the curved ends 27 of these slots form one end of a short link, while the opposite ends 28 form the remaining end of the link when the chain bar is moved forward the requisite distance, as will be apparent by reference to Fig. 12.

Above the strip 22, a distance equal to the width of one of the wings of the chain bar, is a similar strip 29, which is secured at one end in a vertical slot 30 formed in a block 31 secured in the slot 20 of the block 16, while the other end of the strip 29 is secured in a vertical slot 32 formed in a block 33, secured upon the block 16. The lower face of the block 33 is also provided with a transverse slot 34, which with the slot 32 and the space between the die plates 21 form a cruciform aperture of the dimensions of the chain bar, as will be seen by reference to Fig. 23.

The block 31 is provided with a circular aperture 35 of a diameter corresponding to the width of a wing of the chain bar, and the said bar passes through this aperture and through the cruciform aperture at the opposite end of the block 16, with one of its wings resting on the die plates 21, while the edges of the other wing are engaged by the strips 22 and 29, the former of which acts as a support for the chain bar under the action of the punches, while the latter serves to hold the said bar down while the punches are withdrawn, as will be understood by reference to Fig. 2.

The punch for the first die comprises a circular block 36 having a slot 37 in its lower end, in which is secured a plate 38, from which depend a pair of punches 39, which match the recesses 24 of the die plates 21, and with other punches 40, which match the recesses 26. The block 36 is supported in a guide block 41, which is secured to the side of the platform 3, and is prevented from turning in the guide block by a set screw 42 which passes through the guide block and into a groove 43 in the block 36. Upon the upper end of the block 36 is secured an oblong, rectangular frame 44, within which works the eccentric 11 on the shaft 4, the inner width of the said frame being the same as the diameter of the eccentrics, the eccentrics being circular.

The second die forms the long links of the chain and stands at right angles to the first die, and consequently operates on the opposite wing of the chain bar from that operated upon by the first die. The second die comprises a block 45 secured to the opposite side of the platform 3 from the block 16 and formed with a longitudinal groove or recess 46 in its upper face from which extend slots 47 which register with corresponding slots 48 in the adjacent side of the

platform, which slots are adapted to carry off the portions of metal cut from the bar in forming the links.

In the forward portion of the groove 46 is secured a die plate 49, and in the opposite portion of this groove is secured a die plate 50. These plates are secured on opposite sides of the groove, and a space is left between them equal to the thickness of a wing 5 of the chain bar, wedge plates 51 being placed between the inner edges of the die plates and the side of the groove 46 to hold the said die plates in place. Each of these die plates is adapted to form the half of a link 15 longitudinally and to remove the stock between the adjacent ends of two links, and to this end they are provided with recesses 52 and 53 respectively, the opposite margins of which are curved to correspond to the one half part of the ends of two adjoining links, while the area of the two recesses is the equivalent of the area of the stock to be removed from between the two links. Separated from these recesses by tongues 54 of stock, which correspond in size and outline to the one half part of the end of a link, are recesses 55 and 56 respectively, which correspond to the opening through the link. These recesses and the recesses 52 and 53 30 open into the slots 47, which carry off the pieces of metal cut from the bar.

The punches used with the second die comprise circular blocks 57 and 58 respectively having slots 59 in their lower ends, in which are secured plates 60, from which depend punches 61 and 62 respectively corresponding to the recesses 52 and 53, and punches 63 and 64 respectively which correspond to the recesses 55 and 56. To the upper ends of the blocks 57 and 58 are secured oblong rectangular frames 65 and 66 respectively, within which work the eccentrics 13 and 14 respectively on the shaft 5, these eccentrics and frames being similar in size and shape to the eccentric 11 and frame 44. The blocks 45 57 and 58 are supported in a guide block 67 and are held against axial rotation by set screws 68 which pass through the guide block and into grooves 69 in the said blocks 57 and 58.

It will thus be seen that the second die is arranged in such a manner that each link formed by it is subjected to two operations; or, in other words, one half of the link is 55 formed in one end of the die, while the other half thereof is formed in the other end of the die, and this is for the following reason: When the chain bar is acted upon in the first die the outline of a link is formed in the wing A, and the punches 39 and 40 which straddle the other wing B of the bar remove a strip of metal from the link on each side of the wing B and also from between two links on each side of the said wing, as will 60 be understood by reference to Fig. 12. The

removal of this metal from the center of the link and from between two links in the same wing leaves the corresponding portions of the wing B unsupported and if a die and punch similar to the first die and punch 70 were employed in forming the links in the wing B the punches would push the metal down and by the time they passed through it the form of the link would be destroyed, and for this reason means must be employed 75 for supporting the central core of each link of the wing B and also for forming a shearing edge as the center of the link is removed. Therefore, two operations are required as the means for supporting the core must be inserted through an opening in the die on the opposite side thereof from where the strip is removed, which would prevent the action of the punches on that side of the die. This feature is accomplished in the following 85 manner: In the face of the block 45 opposite the die plate 49 a recess 70 is formed, which extends from the groove 46 to the adjacent side of the block and is equal in width to the length of the said die plate. A similar recess 90 71 is formed in the block opposite the die plate 50 and in these recesses are slidably mounted link supporting plates 72 and 73 respectively, to which are secured rack bars 74 and 75 respectively, which extend out beyond the upper side of the block. The rack bar 74 is secured directly to the plate 72, but the rack bar 75 has a right angled arm 76 at its inner end which connects with the plate 73. The bar 74 is toothed on its under 100 edge and the bar 75 is toothed upon its upper edge, and this bar rests against the side of the platform 3. These bars pass through suitable guide slots in the block, and their extended ends are in mesh with a pinion 77 105 which lies between them and which is journaled in bearings 78 on the side of the block. The end of the bar 74 is engaged by the cam 12 on the shaft 4, and when it is pushed in by the said cam the pinion 77 is turned in the direction of the arrow, Fig. 19, and moves the bar 75 in the opposite direction to the bar 74, and the plates 72 and 73 are drawn toward each other. The wing B of the chain bar rests upon the die plates 49 115 and 50, and the link supporting plates 72 and 73 are adapted to pass beneath the said wing far enough to form shearing edges for the punches 61, 62, 63 and 64. The inner edges of the link supporting plates are formed with projections or lugs 78^A corresponding in shape to the punches 39 which form the openings through the small links, and these lugs project a distance corresponding to the thickness of one of the wings of the chain bar and form shearing edges for the punches 61 and 62. Separated from the lugs 78^A by recesses 79 are projections 80, which are adapted to pass beneath the wing B and between two short links so as to sup- 120 125 130

port the wing B and form shearing edges for the punches 63 and 64.

The eccentric and cam 12 work in unison so that as the punches are moved toward the dies the link supports 72 and 73 are moved beneath the wing B of the chain bar in position to support the same under the action of the punches. A coil spring 81 supported in circular recess 82 in the block 45 bears against the arm 76 of the rack bar 75 and when the said rack bar is moved in by the pinion 77, the spring 81 is compressed and when the operating face of the cam passes away from the end of the bar 74 the spring throws the rack bar 75 out to its normal position, thereby reversing the pinion 77, by which the rack bar 74 is moved to its normal position simultaneously with the movement of the bar 75.

Plates 83 and 84 are screwed upon the block 45 to cover the link supports 72 and 73 and hold them in place. Upon the plates 83 and 84 are screwed stripper plates 85 and 86 respectively, the plate 85 being above the support 72 while the plate 86 is above the support 73. These strippers are of the same length as the link supports and their inner edges are stepped, as shown at 87, so as to rest upon the edge of one wing of the chain bar and upon the face of the other wing thereof and against its edge, as will be seen by reference to Fig. 3. The stripper 85 rests upon the edge of the wing A and upon one side of the wing B, while the stripper 86 rests upon the edge of the wing A and upon the opposite side of the wing B. The strippers not only hold the chain bar steady under the action of the punches but they hold the bar down when the punches are withdrawn after each operative movement. After the chain bar has passed through the first and second dies, it is in the form shown in Fig. 14; that is to say, the links are all formed as to outline and a portion of stock on each side of the longitudinal center of each link has been removed; but the short links are still connected by long strips 88 of stock which form the central core of each long link and by short lengths 89 of stock which connect the inner edges of their ends with the inner edges of the long links. The adjacent ends of the long links are also connected by short lengths 90 of stock, which form a central core within the short links. These connecting strips 88, 89 and 90 must be removed in order to produce the individual, connected links composing the chain, and in order to accomplish this a third die and punch is employed. This third die comprises a cubical block 91, which is secured to the platform 3, its upper edge being adapted to contact with and support the chain bar, the wings A and B of which straddle the said edge of the block. A portion of one of the upper sides of this

block is cut away to form a shoulder 92, near its upper edge, and strips of metal 93 of the thickness of the part removed are placed at each end of the block and extend from the shoulder 92 to the lower side of the block. A stripper plate 94 is placed over the shouldered portion of the block, and over the strips 93, and the space between the strips 93 forms a slot 95 which communicates with a slot 96 which extends through the adjacent side of the platform.

A stripper plate 94^a is secured upon the opposite upper side of the block, and the adjacent edges of these plates are stepped, as shown, so that they will rest upon the edge of one wing of the chain bar and upon one side of and against the edge of the other wing of the bar. These strippers, with the faces of the block 91, form a guideway for the chain bar and hold it securely against lateral movement in any direction.

The raised portion 97 of the block, which extends from the shoulder 92 to the upper edge of the block is provided with slots or recesses 98, 99, 100 and 101, corresponding to the connecting strips 88, the two strips 89 and the strip 90 of the incomplete chain, and these slots communicate with the slot 95, which is the outlet passage for the portions of metal removed from the chain at this point, as will be understood. The punch for the die comprises a body portion 102, from which depend punches 103, 104, 105 and 106 which match the recesses 98, 99, 100 and 101. The punch body 102 is secured in a groove in the lower end of a circular block 107, which is reciprocally mounted in a guide block 108, secured to the upright 2. The block 107 is held against turning by a screw 109, which passes through the guide block and into a groove 110 in the block 107. To the upper end of this block is secured an oblong, rectangular frame 111, in which works the eccentric 15 on the shaft 6.

The third die and punch produces the individual, connected links, and the completed chain passes out through an aperture 112 in the upright 2.

The chain bar is automatically fed through the machine a predetermined distance after each operative movement of the punches, and this movement of the bar is accomplished in the following manner: To the upright 1 is secured by bolts or screws 113 an arm or bracket 114 having an up-turned portion which is provided with a hole 115 adjacent to its end, a split 116 extending from the hole to the extremity of the up-turned portion. The upright 1 is provided with a threaded hole 117 in line with the hole 115 in the bracket and in these holes is supported a cylindrical guide block 118, which is provided with tubular stems 119 and 120, the stem 119 being supported in

the hole 115 of the bracket, while the stem 120 is threaded and screws into the hole 117 of the upright 1. The guide block is prevented from turning by a screw 121, which
 5 passes through the bracket, and through a groove in the stem 119, as will be seen by reference to Fig. 15, and a screw 122 which passes through the split upper end of the bracket serves to clamp the bracket upon the
 10 said stem 119. These tubular stems communicate with a slot 123, which extends diametrically through the guide block, the block being held in a position to give the said slot an inclination of forty-five degrees, as will appear by reference to Fig. 16.

Surrounding the guide block is a cylindrical housing 124, of much greater diameter than the block, the outer end of which is open, while the inner end is provided with an axial hole in which is rigidly secured in
 20 any suitable manner an annular rim 125, which projects from a gear wheel 126, which is thus rigidly secured to the housing. The inner end of the guide block fits in the rim 125, as shown, and the stem 120 passes through an axial hole in the said gear wheel. This wheel is in mesh with the gear wheel 10 on the driven shaft 4, as shown by Fig. 1.

Within the housing 124 and surrounding
 30 the guide block is a follower 127 comprising a cylindrical casing having an axial hole in its inner end through which the guide block passes, while a cap 128 is screwed into its outer end, as shown. The internal diameter of the follower is greater than the guide
 35 block, and a dog carrying ring or carriage 129 is housed within the follower and surrounds the guide block.

At diametrically opposite points on the carriage are pivotally mounted dogs 130, the free ends of which are bifurcated and formed with a chisel edge. The bifurcated
 40 ends of the dogs are adapted to straddle one wing of the chain bar and engage the other wing thereof, as shown by Figs. 16 and 17, so that when the carriage is moved in one direction the dogs grip the chain bar, which passes through the guide block and carry it forward, while upon the opposite movement
 45 of the carriage they release the bar and slide upon the same, the dogs being inclined at an angle that will cause them both to grip and release the bar. Springs 131 secured to the carriage and to the dogs exert a pressure upon the latter, which insures their gripping
 50 the bar.

The follower is provided with a cam groove 132, into which extends a roller 133 on the unthreaded end of a screw 134, which
 60 passes through the housing 124. Thus, when the housing is rotated by the gear wheel 10 meshing with the gear wheel 126 the follower is reciprocated, carrying with it the carriage 129. The carriage is held
 65 against rotation by the dogs extending

through the slot 123 of the guide block, and the follower is provided with a feather key 135, which extends into a groove 136 of the carriage by which the said follower is held against rotation. The cam groove 132 is of
 70 such pitch that the follower is moved a greater distance at each reciprocation than the distance the chain bar is required to be moved, but the distance between the inner end of the cap 128 of the follower and the
 75 opposite end of the follower is greater than the width of the carriage which is moved forward by the contact therewith of the cap and rearward by the contact therewith of the opposite end of the follower. Thus the carriage remains stationary for a short period at the end of each reciprocation of the follower or until the follower has traveled in a reverse direction a distance equal to the difference between the width of the carriage
 85 and the distance between the carriage operating ends of the follower and the difference between the length of movement of the follower and the lost motion of the carriage corresponds to the distance the chain is
 90 moved and this distance may be varied by adjusting the cap 128 so that the bar may always be moved a distance corresponding to the size of the links as defined by the dies. In producing a chain of the character shown
 95 in the drawings it is necessary to move the chain bar at each operation a distance corresponding to the space between the centers of two adjoining small links, and this length of movement may be accomplished and accurately maintained by properly adjusting the cap 128 so as to increase or diminish the distance between the same and the opposite end of the follower. Abutment screws 137 extend into the slot 123 from the outer end of
 105 the guide block, and these screws are for the following purpose: Normally the carriage remains stationary at the end of each reciprocation of the follower, as previously stated, while the follower is moving a short distance on the reverse stroke, and then it is engaged by one of the ends of the follower and moved forward or backward as the case may be. But if for any reason, such as the working in of a particle of grit or other foreign substance between the carriage and follower, the carriage should be moved by the follower immediately upon reversing its movement and carried thereby the screws 137 would stop it when it reached the proper position
 120 relatively to the full movement of the follower, and the follower would then continue to the limit of its movement, leaving a space between its end and the adjacent end of the carriage over which it would have to travel
 125 on the reverse movement before again contacting with the carriage.

The operation of the improved chain making machine is as follows: A metal cruciform bar of the style shown in Fig. 11 is in- 130

serted in the stem 119 and between the dogs 130 and through the stem 120 to the first die. The eccentrics 11, 13, 14 and 15 and the cam 12 are arranged to work in unison, and the chain bar is moved step by step by the dogs 130 during each upward movement of the dies. By the operation of the first die and punch a small link is partially formed in the wing A, and the stock between it and another small link is removed. The bar is then moved forward the required distance, the first small link is completed, another small link partially formed and a half link is formed in the wing B. The bar is advanced another step, the previous operations are repeated and the second half die completes the first link in the wing B, as shown by Fig. 13. The incomplete links then pass into the last die and the strips of stock connecting them, as shown in Fig. 14, are removed by the punch and a completed chain composed of individual connected links is fed out through the hole in the upright 2. The cam 12 operates the rack bar 74, whereby the pinion is turned to operate the rack bar 75, and the link supports 72 and 73 are thus operated in unison with the dies and punches which form the half links.

The dies and punches in the present application are similar in certain details to those embodied in Patent No. 895,649, which was granted to me on August 11, 1908.

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

1. In a chain making machine as specified, a die and punch for forming incomplete links from one wing of a cruciform bar; dies and punches for forming incomplete half links on opposite sides of the other wing of the bar; link supports which are adapted to pass beneath and support the wing opposite each half die; means for operating the punches and link supports; a die and punch for removing the stock not otherwise removed by the other dies and punches, thereby forming individual connected links; a gripping device for the chain bar, and means for reciprocating the gripping device.

2. In a chain making machine as specified, the combination with a die and punch for forming incomplete links in one wing of a cruciform bar; a die and punch for forming incomplete half links on one side of the opposite wing, and a die and punch for forming incomplete half links on the opposite side of said wing and beyond the opposite half link; of slidable link supports opposite the half dies; means for moving said supports toward and adjacent to the half dies simultaneously; means for operating the punches simultaneously with the movement of the link supports; a die and punch for removing the stock connecting the links,

and a gripping device for advancing the chain bar step by step.

3. In a chain making machine as specified, the combination with a support; of a die and punch adapted to form incomplete links from one wing of a cruciform bar; dies and punches for forming incomplete half links on opposite sides of the other wing of said bar, and eccentrics for operating said punches; link supporting plates adapted to operate in connection with said half dies; rack bars secured to said plates; a pinion mounted to lie between and in mesh with the rack bars; a cam for pushing one of said rack bars whereby the pinion is rotated to move the other rack bar in the opposite direction; a die and punch for removing the stock connecting the links; an eccentric for operating said latter punch, said eccentrics and cam being set to operate in unison; a gripping device, and means for operating the same to move a chain bar between said dies and punches in alternate order to the operative movement of the punches.

4. In a machine for making weldless link chains, a support; a die secured to said support for forming incomplete links from one wing of a cruciform bar, the face of said die being inclined at an angle of forty-five degrees, and a punch for said die; dies for forming incomplete half links from the other wing of the bar, said dies being inclined at an angle of forty-five degrees and at right angles to the first die, and punches for said dies; supporting plates adapted to work in conjunction with the half dies, and means for moving said plates simultaneously toward and adjacent to the half dies and beneath the opposite sides of the wing from said half dies; stripper plates on said dies opposite the half dies adapted to bear upon the chain bar; a die and punch for removing the portions of stock between two engaging links and from between the ends of two opposing links, the face of said die being on a horizontal plane; a chain bar feeding device, and means for reciprocating said device.

5. In a machine for making weldless link chains, a die for forming incomplete links from one wing of a cruciform chain bar; strips in the die for supporting the upper and lower edges of the opposite wing of the bar, and a punch for said die; dies for forming incomplete half links from opposite sides of the other wing of the bar; slidable plates positioned opposite said half dies for supporting the said wing; means for moving the plates into operative position at the proper time, and means for retracting them; punches for said dies; strippers for guiding the chain bar and for holding the same down when the punches are withdrawn; a die having recesses corresponding to the

portions of stock connecting the links after
the actions of the former dies and punches;
a punch for said die and strippers on the die
for guiding and holding the chain bar; a
5 support for the dies; shafts mounted in the
support, one of which is adapted to be con-
nected with a source of power, intermeshing
gears on said shaft; eccentrics on the shafts
for operating the punches; a link bar feed-

ing device; means for reciprocating the 10
same, and gearing connecting the recipro-
cating means with the power driven shaft.

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

CHARLES A. LEWIS.

Witnesses:

G. SARGENT ELLIOTT,
ADELLA M. FOWLE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
