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J. W. BOWEN.

MACHINE FOR MAKING CHAIN LINKS.

No. 496,773. Patented May 2, 1893.

Fig 1

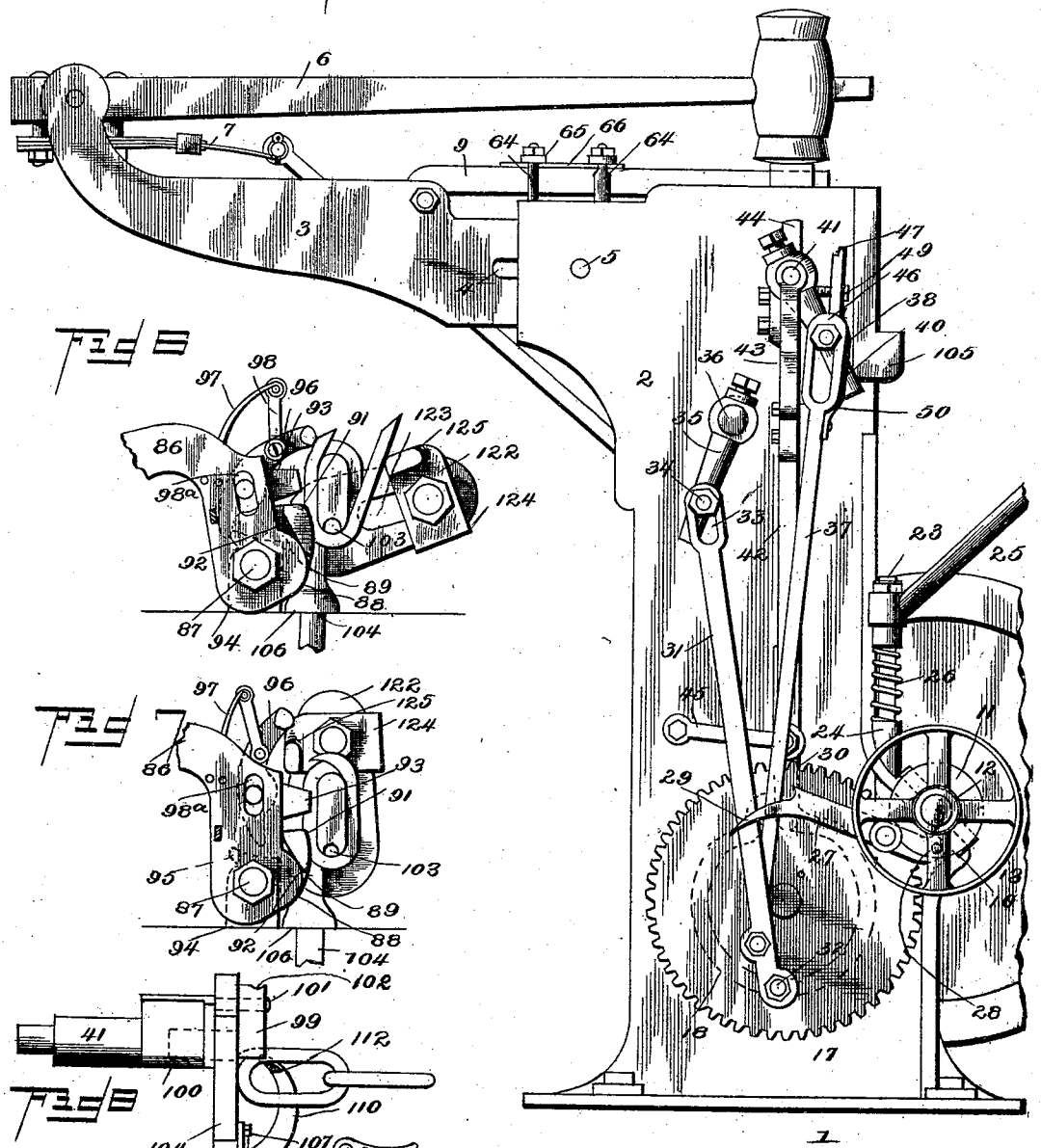

Fig 2

Fig 3

Fig 4

Witnesses

John Dewire

G. M. Lamasure

Inventor

John W. Bowen

By his Attorney

R. N. Bishop.

(No Model.) 4 Sheets—Sheet 2.

J. W. BOWEN.

MACHINE FOR MAKING CHAIN LINKS.

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Fig 11

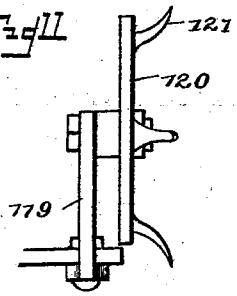


Fig 2

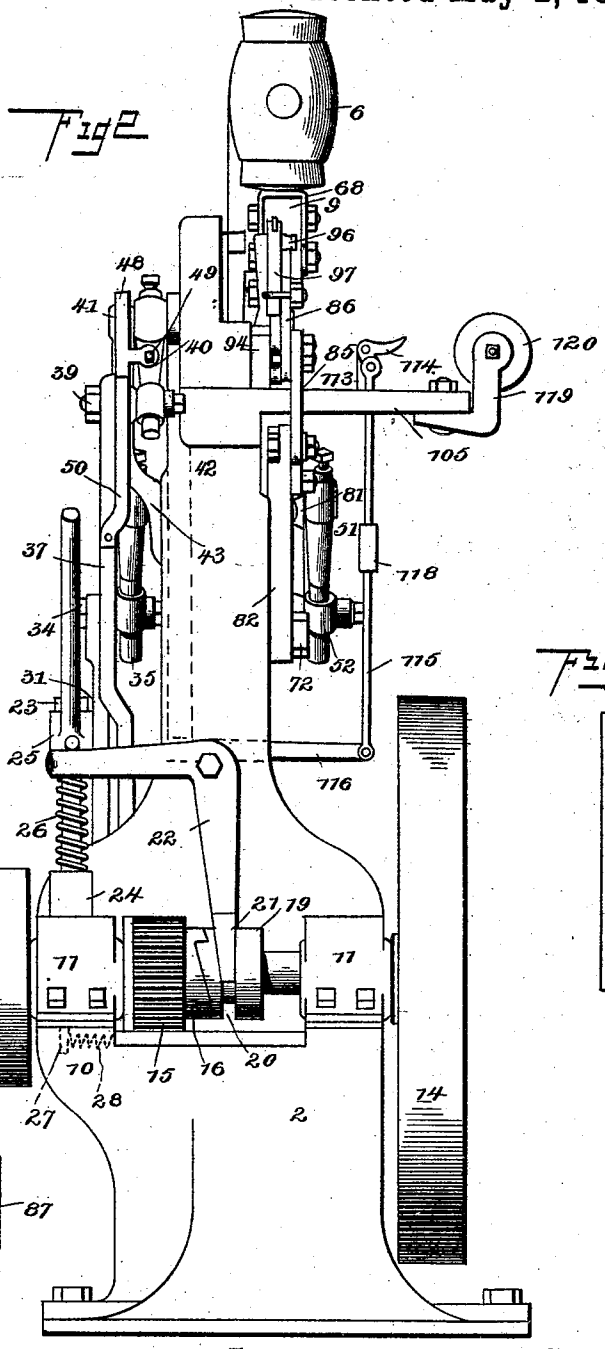


Fig 10

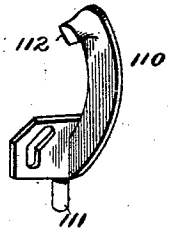


Fig 12

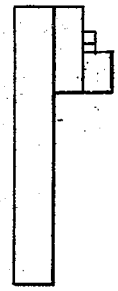
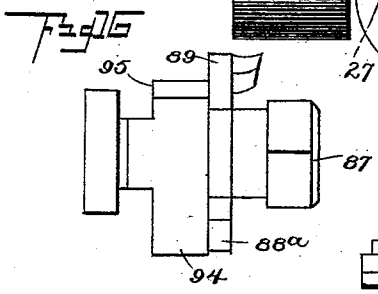


Fig 16



Witnesses

John D. Davis

G. M. Lamasure

Inventor

John W. Bowen

By his Attorney

C. W. Bishop

(No Model.) 4 Sheets—Sheet 3.

J. W. BOWEN.

MACHINE FOR MAKING CHAIN LINKS.

No. 496,773. Patented May 2, 1893.

Fig 3

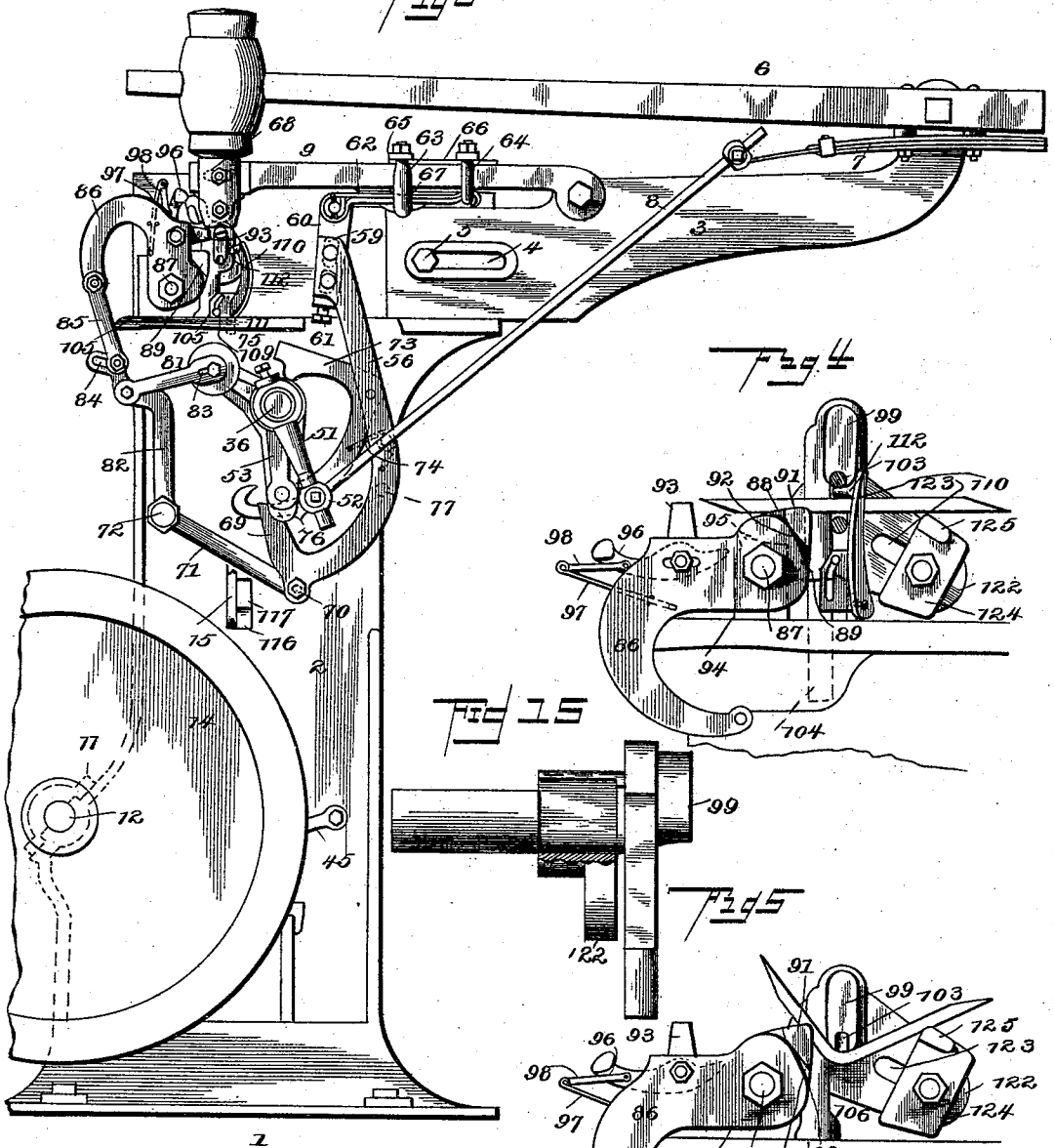


Fig 4

Fig 5

Witnesses

J. Lear Dwyer

G. M. Lamasure

Inventor

John W. Bowen

By Thos. Attorney

R. H. Bishop

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J. W. BOWEN.

MACHINE FOR MAKING CHAIN LINKS.

No. 496,773. Patented May 2, 1893.

Fig 9

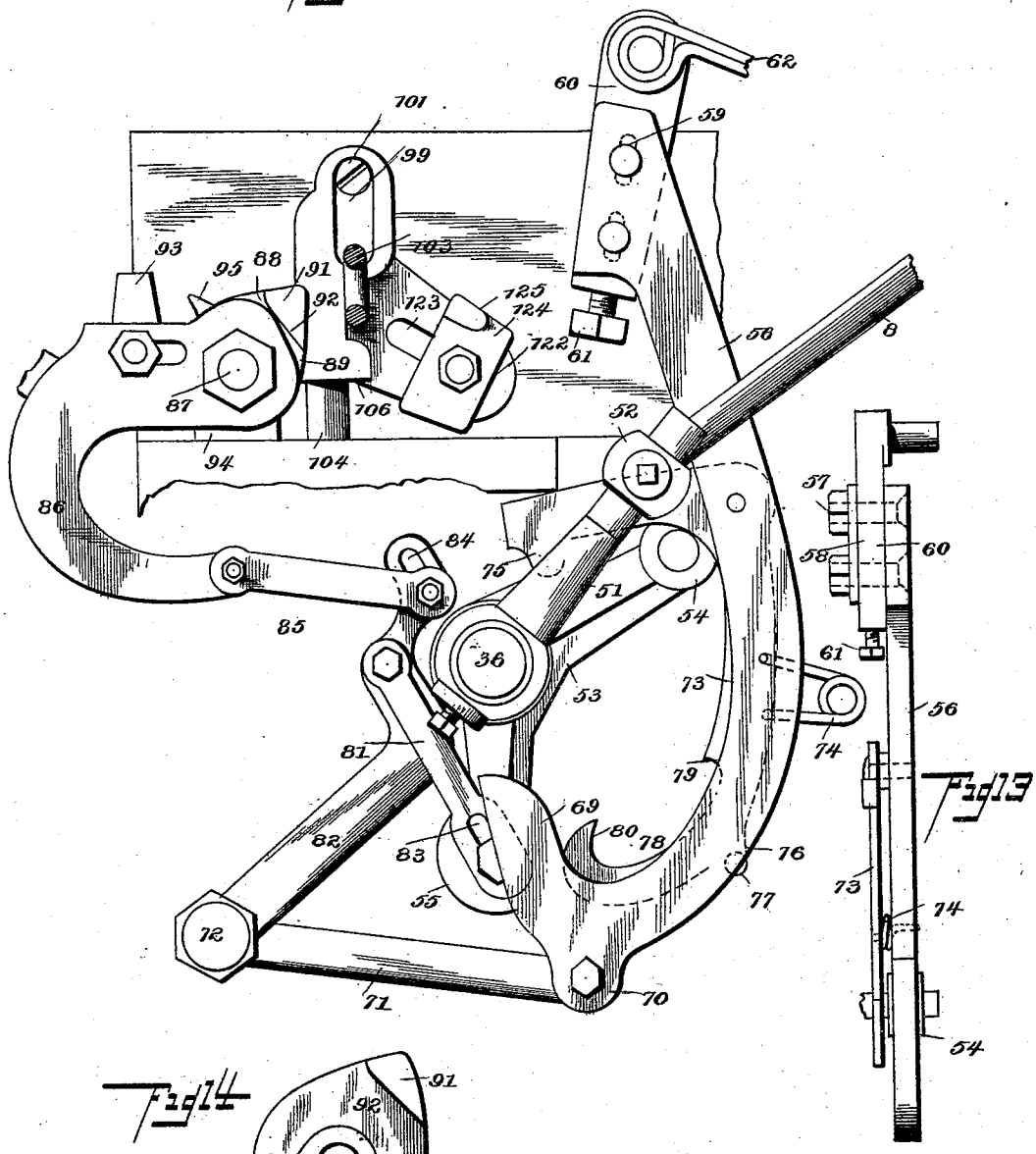
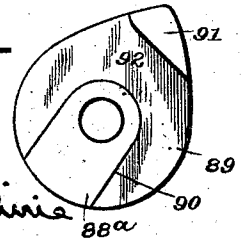


Fig 13

Fig 14



Witnesses

John Ogivie

G. M. Lamasure

Inventor

John W. Bowen

By his Attorney

R. W. Bishop

UNITED STATES PATENT OFFICE.

JOHN W. BOWEN, OF JACKSONVILLE, ILLINOIS.

MACHINE FOR MAKING CHAIN-LINKS.

SPECIFICATION forming part of Letters Patent No. 496,773, dated May 2, 1893.

Application filed June 29, 1891. Serial No. 397,832. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. BOWEN, a citizen of the United States, residing at Jacksonville, in the county of Morgan and State of Illinois, have invented certain new and useful Improvements in Machines for Making Chains; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, forming part of this specification.

My invention is an improved machine for making chains and links, or rings.

The primary object of my invention is to produce a machine by which a chain may be made with the least possible labor on the part of the attendant and in which the links will be automatically completed and added to the chain.

A further object of my invention is to accomplish the object just stated by the least possible mechanism, and to arrange that mechanism in a compact manner.

A further object of the invention is to provide an improved means for automatically throwing the machine out of operation when the link has been completed.

All these objects I accomplish by the use of the mechanism illustrated in the accompanying drawings and hereinafter described.

The invention consists in a peculiar mechanism or series of devices for bending a bar of metal into the desired shape to form a link, and in the provision of devices which act in connection with the bending devices to weld the ends of the bar together thereby completing the link, and also in devices for holding the link while the ends are being welded.

The invention further consists in the peculiar mechanism employed for operating the devices for bending and welding the link, and it also consists in means for guiding the link into position to receive the succeeding link as the chain is formed.

The invention finally consists in a peculiar mechanism whereby when the link has been formed the operation of the machine will be automatically stopped, all of which will be more particularly pointed out in the claims.

In the accompanying drawings, which fully illustrate my invention, Figure 1 is a side view of my improved machine showing the several parts in the position that they assume at the moment the link is finished. Fig. 2 is a front elevation of the machine showing the parts in the same position. Fig. 3 is a side elevation showing the side opposite that seen in Fig. 1. Figs. 4, 5, 6 and 7 are detail views of the devices for bending the link showing the successive steps by which the link is made. Fig. 8 is a detail view of a portion of the bending devices showing more especially the former, or anvil, and the devices for guiding the link and holding it in position to receive the succeeding link. Fig. 9 is a side view, on a larger scale, of the bending devices, showing them in the position they occupy just before being placed in operation. Fig. 10 is a detail perspective view of the link turner or device for guiding the link into position to receive the succeeding link. Fig. 11 is a detail view of the pulley over which the chain runs as its length increases. Fig. 12 is a detail view of the inner bending device. Fig. 13 is a detail edge view of the oscillatory cam and trip by which the swage is brought down onto the link after the ends have been brought together by the bending devices. Fig. 14 is a detail view of a portion of the front bending devices. Figs. 15 and 16 are detail sectional views.

The supporting frame of the machine consists of a base 1, a standard 2 rising from the base and formed integral therewith or rigidly secured thereto, and a supporting arm 3 which is adjustably secured to the upper end of the standard by means of a longitudinal slot 4 and a transverse bolt 5, as will be readily understood upon reference to Figs. 1 and 3. On the outer end of the arm 3 I fulcrum the power hammer 6 which is operated by means of the springs 7, the connecting rod 8 and the levers which will be hereinafter more particularly referred to. The swage-carrying lever 9 is also pivoted on the supporting arm 3 and is adapted to bring the swage down upon the ends of the link in position to be struck by the hammer 6, as will be readily understood on reference to the drawings.

The lower front portion of the standard is provided with an extension or enlargement 10, upon which I secure the journal boxes 11

in which the driving shaft 12 is mounted, a band pulley 13 and a fly wheel 14 being secured on said shaft. At an intermediate point of the driving shaft I secure the pinion 15 which is provided with a half clutch 16 on its inner side, and meshes with a gear wheel 17 which is mounted on the side of the standard and is provided with a cam groove 18 in its inner face. A sliding half clutch 19 is mounted on the driving shaft, adjacent to the half clutch 16, and is adapted to engage the same, as shown in Fig. 2. This half clutch 19 is constructed with an annular groove 20, which is engaged by the ends of a fork 21 on the lower end of the shifting lever 22 which is pivoted on the standard and has its upper arm extending laterally therefrom. A vertically disposed bar or rod 23 passes through the outer end of the lever 22 and a projection 24 on the standard, and is provided at its upper end with a handle 25 which bears on the upper side of the end of the said lever 22. A spring 26 is coiled around the said bar, between the projection 24 and the end of the lever 22, and thereby serves to normally throw the end of the said lever upward and consequently causes the lower end of the same to force the half clutch into engagement with the half clutch 16 so as to cause the machine to operate. It will be understood, however, that the form of spring is immaterial and that a leaf spring may be used, having one end secured to the standard and its other end bearing against the under side of the lever. The lower end of the bar or rod 23 is pivoted to a vibratory arm or lever 27 which is arranged on the side of the standard and has its front end bearing against the projection 10 and held in place by a spring 28, so that it will be capable of a slight vibration in a vertical plane. The rear end of this lever or arm 27 is carried slightly downward so as to present the curved tooth or surface 29 and the shoulder 30, as shown. The operation of the mechanism just described will be fully disclosed hereinafter.

A pitman 31 is pivoted at its lower end to the gear wheel 17 and the pivot or wrist pin 32 is extended slightly beyond the pitman so as to ride over the curved surface 29 at the end of the vibratory lever 27, in the operation of the machine. The upper end of the pitman 31 is provided with a slot 33 which engages a pin 34 adjustably secured on a crank arm 35 which projects from a shaft 36, which is journaled in and extends through the standard 2 near the upper end thereof.

A pitman 37 has its lower end pivoted to the pitman 31 near the wrist pin 32 and extends upward and slightly forward therefrom. The upper end of the pitman is provided with a slotted yoke 38 which fits over a pin 39, adjustably secured upon a crank arm 40 which is secured upon the shaft 41 extending through the standard. This shaft 41 is journaled in the upper end of a reciprocating rod 42 and a yoke 43, secured to the said rod, and passes through a vertical transverse key-hole slot 44 in the standard. To prevent lateral movement of this rod 42, and to reduce the friction between the same and adjacent parts, I provide the guides 45 which are pivoted at their rear ends to the standard and at their front ends to the said rod.

The yoke 38, at the upper end of the pitman 37, is provided on its inner side with a lug 46, which is adapted to be engaged by the notch 47, in the upper end of the dog 48, which is mounted on the pin 39 and may be adjusted to any desired angle by a set screw 49 mounted in the said dog 48 and bearing on the crank arm 40. This dog is normally pressed toward the crank arm 40 by a spring 50, secured to the pitman 37 and bearing on the dog. By the construction thus described the bending devices can be easily adjusted to have the proper movement required by the work being done, as will be presently more particularly pointed out.

As before stated, the shafts 36 and 41 extend through the standard, the link former being carried by the free end of the shaft 41, and a crank arm 51 being secured to the end of the shaft 36. The lower end of the connecting rod 8 is pivotally attached to the crank arm 51 by means of a pintle and a collar 52 adjustably secured on the said crank arm.

Upon the shaft 36, between the crank arm 51 and the side of the standard, I mount the angle lever 53, the ends of which are provided with rollers 54, 55, as shown most clearly in Fig. 9. These rollers, however, may be dispensed with as they are used only to reduce the friction.

In rear of the shaft 36, I arrange an elongated cam 56 which has its upper end provided with the bolts 57, connected by a plate 58 and passing through slots 59 in a connecting plate 60, whereby the upper end of the cam 56 is adjustably connected to the said plate 60. A set screw 61 is mounted in the lower end of said connecting plate and bears against the lower bolt 57 so as to secure an accurate adjustment of the cam. The upper end of this plate 60 has the front ends of the springs 62 secured thereto so that when the cam 56 is raised or lowered the swages will be operated and when the said plate is adjusted relative to the cam 56 the tension of said spring will be increased or diminished.

The springs 62, it will be readily understood, are secured to the swage carrier 9, and in order to increase the efficiency of the machine, I secure the spring to the said bar by means of clips 63, 64, which pass around the springs and the swage carrier, as plainly shown. The clip plates 65 are not placed directly on the swage carrier but bear against the plate 66 which is secured to the front clip plate and extends under the rear clip plate. The clips will thus be secured to the swage carrier in such a manner that they cannot move thereon but at the same time the front

clip will be reasonably loose. A small block or furring 67 is placed between the springs and the under side of the swage-carrier so that the spring may act in both directions and aid in raising the swage as well as in lowering the same.

To the outer end of the swage-carrier I adjustably secure the stirrup 68, in the lower end of which the swage is mounted. The lower end of the swage is provided with a groove adapted to fit the bar from which the link is made and the groove may be of any desired diameter according to the size of link required.

The lower end of the cam 56 is provided with a point 69, and a link 71 has its rear end pivoted to the cam near the said point 69, as shown at 70, and its front end pivoted on a stub shaft 72 on the side of the standard. To the inner side of the cam 56 I pivot the trip 73 which is held in its proper position relative to the cam by a spring 74 which has its ends secured to the said trip and the cam, as shown in Figs. 2 and 13. The upper end of this trip 73 extends forward and is adapted to rest on a projection on the side of the standard. In the drawings, however, I have shown the trip as provided with a lug 75 adapted to rest on the bearing or hub of the shaft 36. The lower portion of the trip extends downward and forward in a curve approximating the shape of the cam 56 and it is provided on its rear side with a tooth or projection 76 which is adapted to engage a pin 77 on the side of the standard. A recess or notch 78 is formed in the inner or upper edge of the trip near the lower end of the same thereby providing the shoulders 79 and 80 which are adapted to be engaged by the axle of the roller 54 on the angle lever 53.

The forward arm of the lever 53 is connected by a link 81 to a vibratory arm 82, the lower end of said vibratory arm being fulcrumed on the stub shaft 72, as clearly shown. The inner end of the link 81 is provided with a slot 83 which engages the pivot pin at the end of the lever 53. The upper end of the vibratory bar 82 is pivoted with a slot 84 which is engaged by a pin on the lower end of the link 85 which has its upper end pivoted to the end of the inverted U-shaped bar 86. The upper end of this bar 86 is pivoted to the side of the standard by a bolt 87 and its extremity is so shaped as to present the eccentric or cam surface 88. The bar 86 may be provided with a collar surrounding its pivot bolt, or a ring may be slipped over the pivot, and on the said pivot bolt, adjacent to said ring or collar, I mount the guide 88^a. Upon this guide I mount the folder 89 which is provided with an open-ended slot 90 to permit it to slide on the said guide and is provided at its upper inner corner with the lateral projection 91 having the inclined inner face 92, whereby when the bar 86 moves on its pivot the cam or eccentric 88 will bear against the said face 92 and will cause the said folder to slide upward against the bar and push the front end of the same toward the former.

To the bar 86, above the folder and at the inner edge of the said bar, I secure the holder 93 which projects from the said bar at substantially a right angle thereto, and is adapted to hold the wire or blank against the former while the ends are being welded to prevent the same from being bent outward by the pressure applied thereto by the rear bending devices and the swage.

Between the standard and the folder 89, I arrange a trip plate 94 which is provided at its upper end with a tooth or point 95 adapted to be struck by the lower end of the upper bending arm 96, and thereby cause the said arm to spring forward against the end of the blank and bend the same over the upper end of the former. A spring 97 is secured on the inner side of the U-shaped bar 86 and is connected with the bending arm 96 by a link or connecting bar 98. This spring serves to hold the bending arm in the proper position to engage the point 95 and also serves to throw the said arm out of the path of the rear bending device in the operation of the machine. The bar 86 is provided with a slot 98^a to permit the stroke of the bending arm 96 to be adjusted.

The bolt 87 has its head fitted in a groove or slot in the standard and has its end projecting slightly beyond the bar 86 and provided with a suitable securing nut. By turning this nut home the several parts will be prevented from moving laterally and it will thus be seen that the guide 88^a can be secured at any desired angle.

The former 99 is carried by the end of the shaft 41 and is secured thereto by means of a pin 100 at the lower end of the former, engaging a socket in the end of the shaft. A screw 101 is inserted through the upper end of the former into the end of a stanchion 104 which extends downward and fits over the pin 100 and has its lower end playing in a socket in the table or flange 105 on the standard 2. This stanchion is provided with a shoulder 106 to rest on said flange and thereby aid in supporting the former. The upper end of the former is provided with a slight groove 102, to hold the upper end of the link, and the lower end of the same is provided with a notch 103 adapted to receive and hold the end of the completed link.

The stanchion is provided, a short distance above the shoulder 106, with a pin or screw 107 which engages a cam slot 108, formed in a plate 109 at the lower end of the link turner and holder 110, which is provided at its lower end with a pin 111 engaging a socket in the flange 105, so that the said link and holder may move vertically in the operation of the machine and at the same time rotate on the said pin as a center. The link-turner and holder extends upward to a point near the lower end of the former and is provided with a tooth 112, which is adapted to engage the finished link,

as it leaves the former, and give the said link a quarter turn, so as to bring it into position to enter the notch 103 in the lower end of the former and thus receive the bar from which the succeeding link is made.

Upon the table 105, adjacent to the link-turner and holder, I mount a small post 113, to the upper end of which I pivot a tapper 114 which consists substantially of an L-shaped pawl pivoted at its angle to the upper end of the post and having the end of its shorter arm pivoted to the upper end of a pitman 115, the lower end of which is pivoted to a transverse reciprocating arm 116, which plays in a transverse slot 117 in the standard 2, and has its inner end secured to the reciprocating bar 42. This pitman 115 is constructed in two sections connected by a turn buckle 118 so that the length of the pitman can be adjusted and the stroke of the tapper 114 regulated.

At the outer end of the table 105 I secure a standard 119, at the upper end of which I journal a roller 120 provided on its rear side with the spurs or teeth 121. These spurs or teeth are arranged at a distance apart corresponding to the length of the links so that each tooth will engage a link as the chain passes over the roller, and the outer sides of the spurs or teeth are curved, as shown most clearly in Fig. 11, so that as the link strikes the tooth it will be given a slight turn and turning as the last completed link thereby aided.

The rear bending device consists of a bending arm 122 having a hub resting in the lower end of the key-hole slot 44 in the standard, and provided with a notch adapted to engage the flattened portion of the shaft 41, so that it will be rotated by the said shaft. This bending arm 122 is provided with a longitudinal slot 123 by means of which, and a suitable securing bolt, a folding iron 124 is adjustably secured to the bending arm. This folding iron 124 is provided at its front or upper end with a lug or projection 125 adapted to ride over the rear end of the metal bar and thereby fold the same over the front end thereof, thereby bringing the link into proper position for the action of the swage and hammer, as will be understood upon reference to Figs. 6 and 7.

In practice, when the machine is at rest, the bending devices will be in the position shown in Fig. 9, and the shaft 41 will be at the upper end of the slot 44. The driving shaft will be in motion at all times, so that in order to set the machine in operation it will be necessary only to press the handle 25 to one side thereby throwing the lever 27 out of engagement with the wrist pin 32, when the spring 26 will at once throw the lever 22 upward so as to cause the half clutch 19 to engage the half clutch 16, consequently causing the motion of the driving shaft to be imparted to the pinion 15, and thereby transmitted to the gear wheel 17. The bars which are made into the links are first cut the proper length with their ends beveled, as shown in Fig. 4, and after being heated are inserted in the machine so that they rest on the folder 89 and the folding arm 124 and pass below the former, as clearly shown in Fig. 4.

When the machine is in its initial position, the bar 42 and the shaft 41, which is carried thereby, will be held in their highest position by the cam groove 18 in the inner side of the gear wheel 17. When the gear wheel is set in motion, as above stated, the cam groove will be moved sufficiently to cause the shaft 41 to at once drop to the lower end of the slot 44, thereby bringing the former down onto the blank so as to bend the same, as shown in Fig. 5. This motion of the shaft causes it to engage the bending arm 122 and bring the shoulder 106, of the stanchion, down upon the table 105. The pitman 31 and 37 are set in motion simultaneously with the bar 42, so that as soon as the shalt 41 has reached the lower end of the slot 44 and is in engagement with the bending arm 122, the pitman 37 will cause the crank arm 40 to swing downward and thereby rotate the said shaft, thereby operating the bending arm 122. Meanwhile, however the pitman 31 has caused the shaft 36, to rotate, thereby causing the angle lever 53 to swing forward. The roller 54 will thus be caused to ride downward on the front edge of the cam 56, and the axle of said roller will act on the trip 73. Simultaneously with this movement, the front end of the lever 53 will cause the link 81 to push the vibratory arm 82 forward and upward so as to force the bar 86 upward and rearward into the position shown in Fig. 6. This movement of the bar 86 causes the cam surface 88 thereof to act on the roller 89 and thereby push the same toward the former, so that the front end of the blank will be forced against the side of the former. The holder 93 will also be brought up against the blank as shown in Figs. 6 and 7. As the bar 86 swings upward and forward the inner end of the upper bending arm 96 will be brought against the point or tooth 95 of the trip plate 94, as shown in Figs. 4 and 5, so that as the bar 86 continues its movement, the said trip plate will retard the lower or inner end of the bending arm 96 and thereby cause the upper end of the same to swing forward so as to force the upper end of the blank over the former, as shown in Figs. 6 and 7. Just as the said bending arm completes the operation of bending the end of the blank, the inner lower end of said arm will clear the tooth 95, and the spring 97 will then be free to act and will throw the upper end of the bending arm forward, thus removing it from the path of the rear bending arm. On the return movement of the bar 86, the lower end of the arm 93 will ride over the end of the trip plate and will be swung rearward thereby throwing the upper end of said arm forward so that as soon as the lower end of the arm has cleared the trip plate the spring 97 will re-act and throw the said arm into the posi-

tion shown in Fig. 4. While the operation thus described is being performed, the bending arm 122 is being swung upward and forward so as to force the rear end of the blank against the former, as shown in Figs. 4, 5 and 6, and the movement of the parts is so timed that just as the bending arm 96 recedes from the former, the folding arm 124 will ride over the upper end of the former and come to rest at a point in advance of the former, as shown in Fig. 7. The swage is then brought down on the ends of the blank and the hammer caused to strike a blow on the swage thereby welding the ends of the blank and finishing the link. Just as the bending arm 122 moves over the upper end of the former, the axle of the roller 54 will engage the shoulder 80 of the trip 73 and thereby swing said trip slightly forward so as to disengage it from the pin 77, after which it will be carried forward to the position shown in Fig. 3. The roller 54 will be simultaneously caused to ride upon the point 69 and thereby depress the cam 56 consequently bringing the swage down onto the ends of the blank. By this time, the crank arm 51 will have reached the lowest point of its movement and the connecting rod 8 thereby caused to draw the spring 7 downward and bring the hammer forcibly upon the swage so as to complete the welding and finish the link. The several parts then immediately start upon their reverse movement, the crank arm 51 forcing the connecting bar 8 upward and rearward, so that the spring 7 will raise the hammer. The axle of the roller 54 on the end of the lever 53 will engage the shoulder 79 and thereby carry the trip uward and rearward, and as the said trip is secured to cam 56 this movement will raise the said cam and thereby lift the swage. The upward movement of the trip will cause the upper end of the same to be carried against a projection or flange on the standard and thereby caused to swing slightly downward and rearward so as to release the said axle and again engage the pin 77, and thereby hold the cam in its initial position until the shoulder 80 is again engaged by the end of the lever 53. The shaft 41 will begin to rotate as soon as the swage leaves the upper end of the former and will thus carry the bending arm 122 backward to its initial position. At the same time, the front arm of the lever 53 will act on the vibratory arm 82, and its connections so as to return the bar 86 to its initial position. The bending devices will be moved from the former and the link left in position to be taken therefrom. At this moment, the gear-wheel 17 will have completed its revolution, and the cam groove will be brought around to the proper point to raise the bar 42 and the shaft 4 thereby lifting the former and placing the several parts in position to form another link. The weight of the chain will now draw the link from the former and the side of the link will come into contact with tooth 112 on the link-turner and holder so that the link will be given a quarter turn. As the former rises, the pin or screw 107 will act on the slot 108 so as to rotate the link-turner and holder 110 and thereby cause the same to bring the link into alignment with the notch 103. The tapper 114 will then be forced upward by the pitman 115 and will strike the outer end of the link so as to drive the same into engagement with the said notch. The bar for forming the succeeding link is then inserted through the end of the link just formed and the former operation repeated. When the wrist pin 32 approaches its highest position it will ride over the curved tooth 29, at the end of the lever 27, thereby depressing the rear end of said lever and causing the same to draw the rod 23 downward so that the lever 22 will be vibrated and will disengage the half clutch 19 from the half clutch 16 so as to stop the operation of the machine. The automatic stoppage of the machine is rendered positive by the pin 32 coming into contact with the shoulder 30 of the said lever and thereby having its further movement instantly arrested.

From the foregoing description, taken in connection with the accompanying drawings, it will be seen that I have provided an automatically operating machine by which a chain of any desired length may be manufactured without any attention on the part of the operator other than is necessary to place the heated bars in the machine, and then move the shifting lever so as to put the machine into operation. The links are inter-locked as they are made and the weight of the chain serves to draw the link from the former as it is completed, so that there will be no clogging of the machine and the operation will be rapid and positive. While I have shown and described the machine as being used for the purpose of making links and chains it is obvious that it is not confined to that use, as it can be used for making rings by simply substituting a round or circular former for the elliptical former shown in the drawings.

It will be observed that in my present machine the operating parts are connected in such a manner that they follow each other in perfect time and order, and there is no liability of any of the parts clashing and thereby injuring the machine. It will also be noticed that I connect a number of the pitmen and crank arms by slotted connections, so that each part will have a momentary period of rest while the next succeeding part is at work.

Special attention is called to the means employed for adjusting the rear bending devices. As the pitman 37 moves upward the lug 46 will ride on the dog 48 until it reaches the upper end of the same, when the spring 50 will throw the said dog into engagement with the said lug. The lower end of the slotted yoke 38 will then engage the pin 39 and will force the crank arm 40 upward. On the downward stroke of the pitman the lug 46 will force the dog 48 downward with the pitman

until the screw 49 comes into contact with the crank arm 40 when the further circular movement of the dog will be arrested and the lug 46 will be disengaged therefrom so that the said pitman 37 will drop into a position of rest and remain in that position until the next link is to be made. Now it is obvious that by adjusting the crank pin along the crank arm and by changing the angle of the dog to the crank arm, the rear bending arm can be given a long or short movement and also a fast or slow movement according to the wishes and desires of the operator and the requirements of the work being done.

It will be observed that the stanchion which extends downward from the former provides a solid support for the same and prevents it from being bent or twisted by the blow of the hammer. The table 105, which is shown most clearly in Fig. 2, prevents the scales from the iron, or the water that may be used for cooling, from falling on the work below. This table may be formed integral with the standard 2, or formed separate therefrom and secured thereto as may be preferred.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A machine for automatically making welded chains comprising a former, a series of devices for bending the blank around the former and also lapping the ends of the same, a swage arranged above the former and adapted to rest upon the lapped ends of the blank, and a hammer adapted to strike upon the swage and thereby completely weld the ends of the link blank.

2. A machine for making chains provided on one side with a lateral arm or table, and at the outer end of said arm with a roller having spurs or teeth on one side over which the finished chain passes, the said spurs or teeth having curved faces whereby the chain is partially turned as it passes thereover.

3. The combination of a driving shaft, a pinion loosely mounted on said shaft, a gear-wheel meshing with and driven by said pinion, a clutch mounted on the shaft and adapted to connect the pinion thereto, a shifting lever engaging the said clutch, a vibratory arm adapted to be depressed by the wrist pin of the driving wheel, and connections between the shifting lever and the said vibratory arm whereby when the said arm is depressed the clutch will be disengaged from the pinion.

4. The combination of the driving shaft, the pinion 15 mounted thereon and provided with a half clutch 16, the sliding half clutch 19 mounted on the driving shaft and adapted to engage the half clutch 16, the shifting lever engaging the half clutch 19, the driving wheel meshing with the pinion 15, and provided with a wrist pin 32, the vibratory arm 27 having the curved tooth 29 and the shoulder 30, a vertically reciprocating rod having its lower end pivoted to the vibratory arm 27 and provided with a handle bearing on the lever 22, and a spring acting on said lever in opposition to the handle of the reciprocating rod.

5. The combination of the supporting standard, the reciprocating bar 42, means for operating said bar, and the guides pivoted to the standard and connected to said bar.

6. The combination of the driving mechanism, a reciprocating bar driven by said mechanism, a shaft in the upper end of said bar, a crank arm on said shaft, a dog carried by the said crank arm, and a pitman adapted to drive said crank arm and be engaged by the said dog.

7. The combination of a rock shaft, a crank arm extending therefrom, a dog secured on said crank arm, a set screw mounted in said dog and adapted to impinge against the crank arm, and a pitman provided at its end with a slotted yoke passing over a wrist pin on the crank arm and provided with a lug adapted to be engaged by the upper end of the dog.

8. The combination of a vertically movable rock shaft, a former carried thereby, a rear bending arm adapted to be engaged by the said shaft and swung toward the former, and suitable front bending devices and operating mechanism.

9. In a machine for making welded chains and links, the combination of the former, the bending devices arranged in front and rear of the former, and a folder arranged near the lower end of the former and operated by the front bending devices whereby the front portion of the blank will be bent before the rear portion thereof.

10. The combination of a former, a folder provided with a front inclined face, a pivoted bar having an eccentric portion bearing against the inclined face of the folder, and suitable operating mechanism, whereby the folder will be moved against the former.

11. The combination of the former, a folder provided with an open-ended slot, means for causing the folder to move toward and away from the former, and a guide fitting in the open-ended slot of the folder.

12. The combination of the front and rear bending devices, and a holder carried by the front bending devices and adapted to hold the blank against the former while the rear bending device is at work.

13. The combination of the former, front and rear bending devices, for forcing the blank against the former, and a bending arm carried by the front bending devices and adapted to bend the upper end of the blank over the upper end of the former.

14. The combination of a former, front and rear bending devices, a bending arm carried by the front devices and adapted to bend the front end of the blank over the upper end of the former, and a spring connected to the said arm and bending devices and adapted to withdraw the said bending arm from the former before the rear bending arm acts thereon.

15. The combination of the vibrating bar

86, a bending arm carried thereby, and a trip plate arranged adjacent to the said bar and adapted to be engaged by the bending arm.

16. The combination of the vibrating bar 86, a trip plate arranged adjacent thereto and provided with an upwardly projecting point at its upper end, a bending arm having its inner end adapted to be engaged by and ride over the said point, a spring secured to the bar 86, and a link connecting said spring with the bending arm.

17. The combination of the vertically movable rock shaft 41, a former carried thereby, and a bending arm operated by the said shaft to force the rear end of the blank against the former.

18. The combination of the vertically movable rock shaft, the former carried thereby, a bending arm operated by said shaft, and a folding iron carried by the said bending arm.

19. The combination of the former, a stanchion extending downward therefrom, a link turner and holder arranged adjacent to the former and the stanchion, and connections between the stanchion and link turner and holder, whereby when the stanchion and former are raised the link turner and holder will be rotated.

20. The combination of the support, the stanchion engaging a socket in the support, the link turner and holder pivotally mounted on the support and provided at its lower end with an off-set having a cam slot, and a pin carried by the stanchion and engaging the said cam slot.

21. The combination of the vertically movable rock shaft, the former provided with a pin engaging a socket in the end of the rock shaft, a stanchion secured to the former and fitting over the said pin, and provided with supporting shoulders adapted to rest on the supporting frame whereby a solid support for the former is provided.

22. The combination of the reciprocating bar 42, the bending devices, the pivoted tapper, and connections between the said tapper and the bar 42.

23. The combination of the swage carrier, the spring secured thereto, the connecting plate having its upper end secured to the said spring, the cam for operating the swage, carrying bolts at its upper end which pass through slots in the connecting plate, and a set screw mounted in the lower end of the connecting plate and bearing against the lower bolt.

24. The combination of the swage carrier, a cam for operating the same, and a connecting plate connected with the swage carrier and adjustably secured to the upper end of the cam.

25. The combination of the swage carrier, the cam for operating the same, a trip pivoted to the cam and adapted to hold the same in its raised position, and suitable operating means for releasing the trip and thereby permitting the cam to operate.

26. The combination of the swage carrier, a cam for operating the same having an upwardly projecting point at its lower end, a trip pivoted to the cam and adapted to hold the same in its raised position and provided with shoulders 79 and 80 near its lower end, a lever adapted to engage the said shoulders and the upturned point of the cam, and suitable operating mechanism.

27. The combination of the swage carrier, a cam for operating the same, a pin, as 77, projecting from the supporting frame, a trip pivoted to the cam and adapted to engage the said pin to hold the cam in its raised position, and means for disengaging the trip from the said pin and depressing the cam.

28. The combination of the swage carrier, the cam for operating the same, a trip pivoted to the cam and adapted to hold the same in its raised position and provided at its upper end with a forwardly extending arm adapted to engage a projection on the supporting frame, and suitable operating mechanism.

29. The combination of the cam 56, the trip 73 pivoted thereto, and the spring having its ends secured respectively to the cam and the trip.

30. The combination of the supporting standard, the shaft 36 mounted therein, the bar 86 pivotally mounted thereon, the lever 53 secured to the shaft 36, the vibratory bar 82 pivoted on the supporting standard, and links connecting the said bar with the lever 53 and the bar 86.

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

JOHN W. BOWEN.

Witnesses:
R. W. BISHOP,
ALEXANDER H. BELL.