

April 17, 1928.

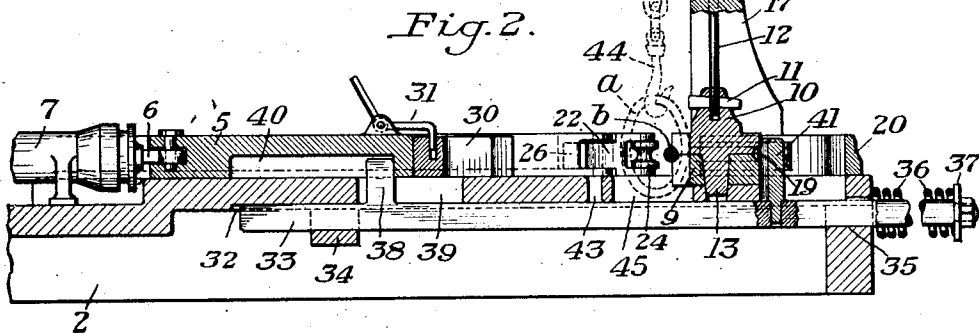
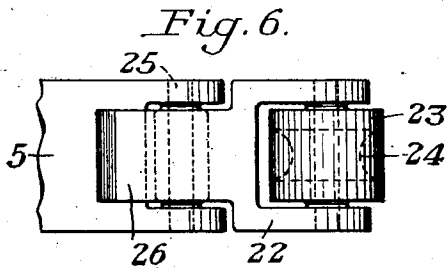
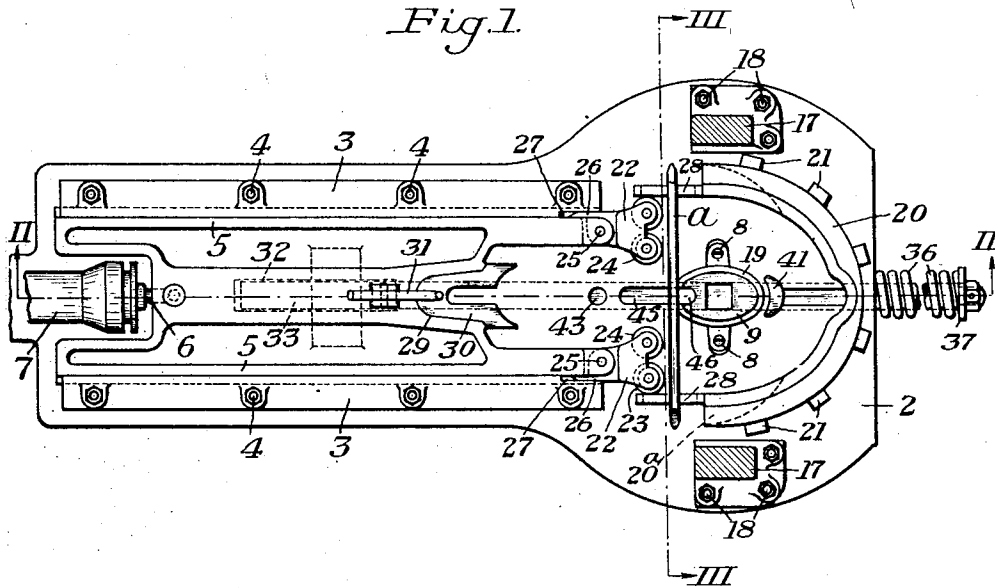
1,666,380

A. G. HEINLE

APPARATUS FOR MAKING CHAINS

Filed July 23, 1924

3 Sheets-Sheet 1



INVENTOR  
*Albert G. Heinle,*  
by *Dymis, Fellini, Parmelee,*  
*his Atty.*

April 17, 1928.

1,666,380

A. G. HEINLE

APPARATUS FOR MAKING CHAINS

Filed July 23, 1924

3 Sheets-Sheet 2

Fig. 3.

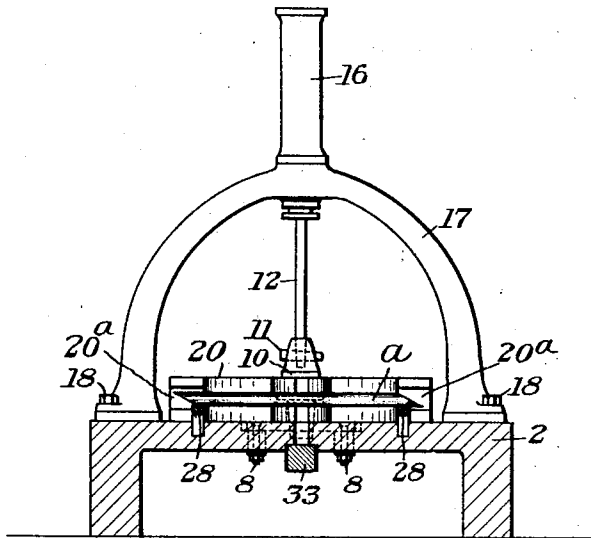


Fig. 4.

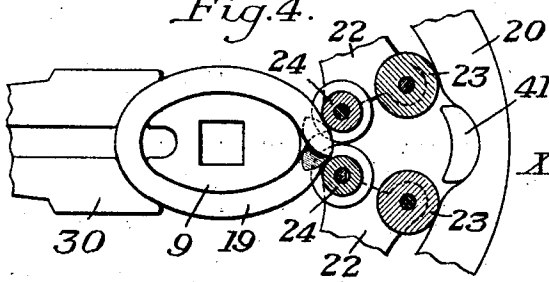


Fig. 13.

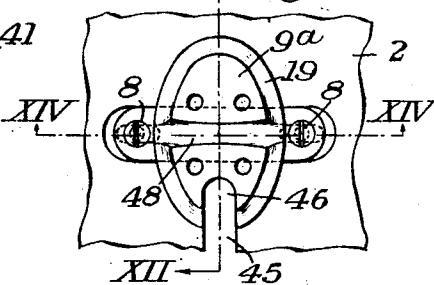


Fig. 5.

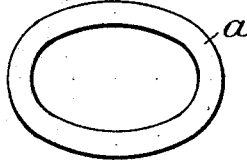


Fig. 12.

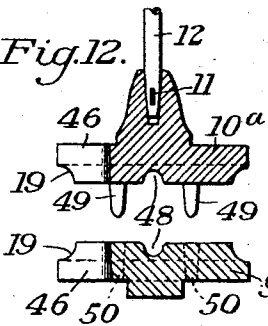


Fig. 11.

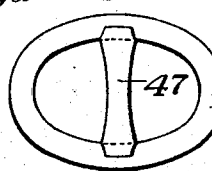
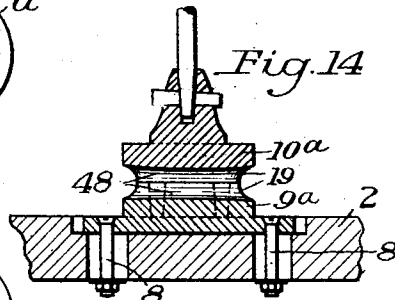


Fig. 14.



INVENTOR

Albert G. Heinle  
By *Pyman, Peckin & Barnabe*  
his attys

April 17, 1928.

1,666,380

A. G. HEINLE

APPARATUS FOR MAKING CHAINS

Filed July 23, 1924

3 Sheets-Sheet 3

Fig. 7.

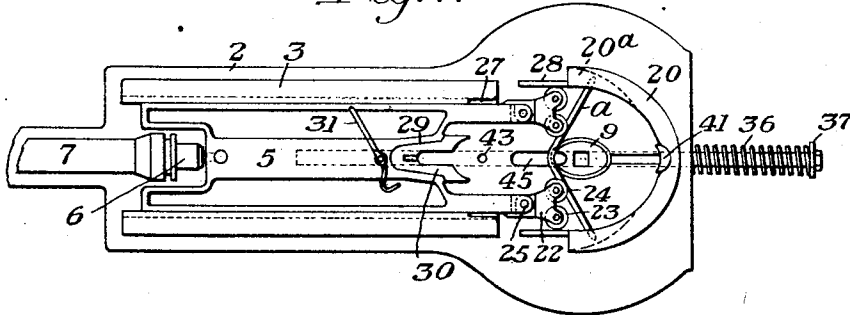


Fig. 8.

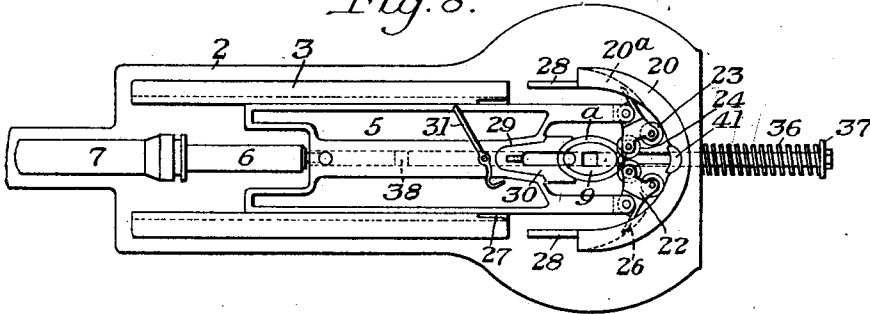


Fig. 9.

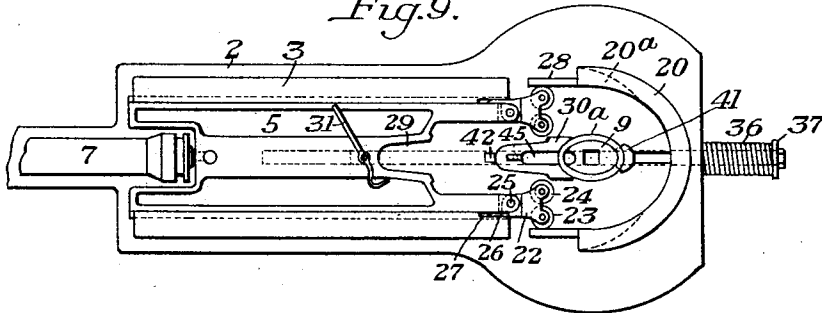
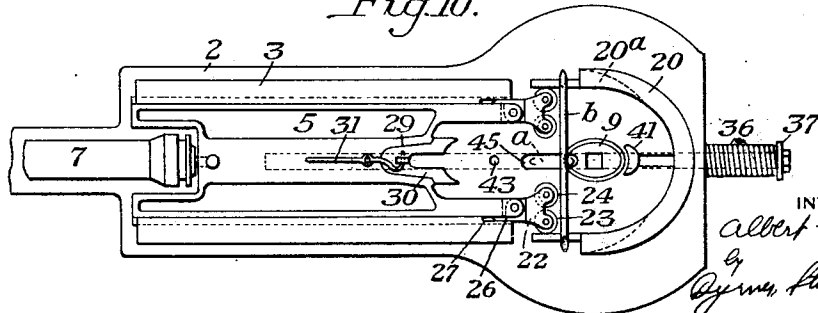


Fig. 10.



INVENTOR

Albert S. Heinle

By

Raymond H. Brown, Esq.  
his Atty.

# UNITED STATES PATENT OFFICE.

ALBERT G. HEINLE, OF CRAFTON, PENNSYLVANIA, ASSIGNOR OF THREE-EIGHTHS TO  
THOMAS A. McQUAIDE, OF PITTSBURGH, PENNSYLVANIA.

## APPARATUS FOR MAKING CHAINS.

Application filed July 23, 1924. Serial No. 727,651.

The present invention relates to chain making, and more particularly to the making of the relatively heavy links for anchor chains, towing chains, and the like. Such links usually weigh from 80 to 100 pounds, and have a length of from 15 to 20 inches, and because of their relatively great weight and size as compared with the links of ordinary chains, it has not been possible to adapt the usual chain making machines to their manufacture. Heretofore it has been customary to form open links of this character by hand methods, and then to interconnect the links and hammer and weld their ends together to complete the chain. Such methods are slow and laborious, and hence relatively costly. In accordance with the present invention, the individual links are made from bar stock by cooperating forming and bending dies, each link, as it is formed, being simultaneously permanently connected to another previously formed link. By this method it is possible to make the links much more expeditiously than by the present hand methods, and at a greatly reduced cost, because of the increased output and reduction in the amount of labor required. Furthermore, a better and more uniform product results from this method of manufacture.

In the accompanying drawings:

Figure 1 is a sectional plan view of a preferred form of link-forming apparatus embodying my invention;

Figure 2 is a longitudinal section on the line II—II of Figure 1;

Figure 3 is a transverse section on the line III—III of Figure 1;

Figure 4 is a detail view, on a larger scale, showing the final position of the bending dies in forming a link;

Figure 5 is a plan view of a completed link;

Figure 6 is a detail view, on a larger scale, of a bending die and of its connection to the die plunger;

Figures 7, 8, 9 and 10 are plan views, more or less diagrammatic, of the apparatus, illustrating certain steps in the formation of a link;

Figure 11 is a plan view of a link having a cross-brace or truss-bar for reinforcing the same, and

Figures 12, 13 and 14 are detail views

showing a modified form of forming die for making the link shown in Figure 11; Figure 12 being a section on the line XII—XII of Figure 13, and Figure 14 being a section on the line XIV—XIV of Figure 13.

Referring to Figures 1, 2 and 3, the link-forming apparatus therein shown comprises a base 2 having longitudinal guides 3 detachably mounted thereon by bolts 4. Slidably mounted on the base, between these guides, is a die plunger 5 operatively connected with the piston 6 of a fluid pressure cylinder 7, whereby the plunger is reciprocated on the base. The guides 3 have their inner longitudinal edges rabbeted to overlap the rabbeted longitudinal edges of the plunger, whereby the latter is held to the base during its reciprocatory movements.

Detachably mounted on the base by bolts 8 is the lower section 9 of a forming die. The upper section 10 of the forming die is detachably secured by a pin 11 to the lower end of a piston rod 12, and has a downwardly extending integral projection 13 adapted to fit an opening 14 in the lower section of the die. The piston rod 12 is connected to a piston 15 working in a fluid pressure cylinder 16, whereby the upper section 10 of the forming die is adapted to be raised and lowered. The cylinder 16 is carried by an arched support 17, the lower ends of which are secured to the base by bolts 18. The forming die has a peripheral semi-cylindrical groove 19 formed partly in its lower section and partly in its upper section.

Detachably mounted on the base is a templet 20 adapted to be held in correct position by a series of removable pins 21 inserted in openings in the base. This templet is provided for cooperation with bending dies 22 pivotally connected to the bifurcated forward end of the die plunger 5. Each bending die carries a roller 23 for cooperation with the templet, and a grooved bending roller 24. Each bending die is pivoted to the plunger by means of a pin 25 and has a tail piece 26 adapted to be received in a recess 27 between the outer edge of the plunger and the inner edge of the corresponding guide 3. These recesses are provided by cutting away the inner longitudinal edges of the guides adjacent their forward ends. The end of the tail piece 26 of each bending die is beveled for

cooperation with the corresponding guide 3, whereby when the die plunger is retracted, these beveled ends will engage the ends of the guides and cause the tail pieces 26 to enter the recesses 27, thereby straightening the bending dies.

In forming a link with this apparatus, a straight bar *a* having its ends oppositely beveled, as illustrated in Figures 1 and 3, is heated to the proper temperature to facilitate the bending thereof, and is then placed in the apparatus in the position shown in Figure 1. The bar is supported in this position upon supports 28 mounted on the base 2, adjacent the ends of the templet 20. Fluid is then admitted to the cylinder 7, causing the die plunger to move forwardly. As the plunger moves forwardly, the grooved bending rollers 24 engage the bar *a* and bend it into link form in the groove 19, as illustrated in Figures 7 and 8. The bending dies are guided during such forward movement of the die plunger through the cooperation of the rollers 23 with the supports 28 and the templet 20. Grooves 20<sup>a</sup> are formed in the end portions of the templet to receive the ends of the bar as it is bent into the groove 19.

Fitting in a recess 29 in the bifurcated end of the die plunger is a follower 30 adapted to be held in said recess to move with the plunger by means of a latch 31 pivoted on the plunger. In Figures 7, 8, 9 and 10 this latch is shown as swinging on a vertical axis for convenience of illustration. Obviously it can be mounted in this manner or to swing on a horizontal axis as shown in Figures 1 and 2. The follower 30 cooperates with the forming die to shape one end of the link, as clearly illustrated in Figure 8. The final position of the bending dies is shown in Figure 8, and also in the detail view of Figure 4. It will be seen that the bending rollers 24, in their final position, have bent the beveled ends of the bar into overlapping relation, but that these ends are not perfectly conformed to the forming die.

Mounted for reciprocation in a groove 32 in the lower face of the base 2 is a longitudinally extending bar 33. This bar is held in position by a strap 34 engaging the rear end portion of the bar. This bar extends through an opening 35 in the forward end of the base, and the projecting end portion of the bar is surrounded by a coil spring 36 interposed between a washer 37 on the end of the bar and the forward end of the base. Adjacent its rear end the bar has an upwardly extending lug 38 which extends through a longitudinal slot 39 in the base and into a longitudinal recess 40 in the plunger 5. It will be apparent that the spring 36 tends to maintain the lug 38 in engagement with the forward end wall of the recess 40. Adjacent its forward end the bar

carries a detachably mounted forming block 41. This block, on the forward movement of the die plunger, engages the templet 20 whereby the forward movement of the bar 33, under the influence of the spring 36, is limited.

When the parts have assumed the position shown in Figure 8, fluid is admitted to the opposite end of the cylinder 7 to retract the die plunger. After the initial rearward movement of the plunger, a pin 42 is inserted in an opening 43 in the base 2 to hold the follower 30 in engagement with the forming die and the link. Thereafter, the lug 38 is engaged by the forward end wall of the recess 40, whereby continued rearward movement of the die plunger moves the bar 33 rearwardly, compressing the spring 36. The forming block 41 is thus moved into engagement with the overlapping beveled ends of the link, and these ends are conformed thereby to the forming die, as illustrated in Figure 9. The pin 42 is then removed from the opening 43 and the die plunger 5 again moved forwardly to the position shown in Figure 8, whereupon the latch 31 is engaged with the follower 30. The die plunger 5 is then retracted, and as it moves rearwardly, fluid is admitted to the cylinder 16 to raise the upper section 10 of the forming die. A crane hook 44 may then be engaged with the formed link and the same may be carried thereby to a forge located at a convenient point near the forming apparatus. The link may have its overlapping beveled ends heated to a welding temperature in the forge, and such ends may then be welded together to form a completed link, such as is illustrated in Figure 5. After the link has been completed, it may be moved by the crane hook and placed in a vertical position in a slot 45 in the base 2, as indicated in dash lines in Figure 2. Previous to this, the upper section 10 of the forming die will have been lowered into engagement with the lower section 9 thereof. The forming die has a slot 46 in its rear end registering with the slot 45 and receiving a portion of the link when in the dash line position shown in Figure 2. A bar *b* may now be placed in position for forming the next link, and the operations described for forming the first link repeated. It will be noted by reference to Figure 2 that in placing the bar *b* in position on the supports 28, it is inserted through the previously formed link, so that when the bar *b* is formed into link form, it is permanently united with the previously formed link. In like manner each succeeding link is formed and simultaneously connected to the previously formed and connected links. As successive links are added to the chain, the crane hook 44 will be correspondingly raised.

In forming very heavy chains, it is often

desirable to reinforce each link by a cross-  
brace or truss-bar 47, as illustrated in Figure  
11. In that case, I employ a modified form  
of forming die. This die is made in upper  
5 and lower sections 9<sup>a</sup> and 10<sup>a</sup> having the  
peripheral groove 19 formed partly in each  
section. The die is provided with a trans-  
verse opening 48 to receive the cross-brace  
47, this transverse opening being formed  
10 partly in each section of the die. One sec-  
tion of the die is provided with a plurality  
of pins 49 adapted to be received in open-  
ings 50 in the other section of the die, where-  
by the two sections of the die are held in  
15 proper relation. In forming a braced link  
with this modified form of die, the cross-  
brace 47 will be placed in the transverse  
groove in the lower section of the die while  
the upper section thereof is raised, and the  
20 latter will then be lowered into position.  
The link will then be formed from a bar of  
stock material in the same manner as de-  
scribed for the unbraced link. As the bar is  
bent into link form in the peripheral groove  
25 of the forming die, it will be simultaneously  
united with the cross-brace or truss-bar 47,  
the latter having bifurcated or grooved ends  
to receive the sides of the link.

It will be noted, particularly by reference  
30 to Figure 4, that in bending a bar into link  
form, one beveled end is positioned above the  
other, so that when the overlapping beveled  
ends are welded together, the welded joint is  
in shear rather than in tension. This is  
35 important, as it provides a stronger joint  
than where the beveled ends are overlapped  
in side by side relationship.

While I have shown and described a pre-  
ferred form of apparatus embodying my in-  
40 vention, it will be understood that changes  
may be made in the details of construction  
and in the arrangement of parts without  
departing from the spirit of the invention or  
scope of the appended claims.

I claim:

1. Apparatus for forming chain links,  
comprising a fixed forming die having a pe-  
45 ripheral groove, and unitary means for bend-  
ing the bar into link form in said groove  
in a single operation.

2. Apparatus for forming chain links,  
comprising a fixed forming die having a  
peripheral groove, means for supporting a  
50 bar in the plane of said groove, and unitary  
means for bending said bar into link form in  
said groove in a single operation.

3. Apparatus for forming chain links,  
comprising a forming die having a periph-  
60 eral groove and a link receiving recess for  
receiving a part of one link while a second  
link is being formed, a plunger, means car-  
ried by said plunger for bending a bar into  
link form in said groove, and means for  
reciprocating said plunger.

4. Apparatus for forming chain links,

comprising a normally fixed forming die  
having a peripheral groove, means for sup-  
porting a bar in the plane of said groove,  
a plunger, means carried by said plunger for  
70 bending said bar into link form in said  
groove, and means for reciprocating said  
plunger.

5. Apparatus for forming chain links,  
comprising a forming die having a periph-  
75 eral groove and divided along its entire  
length in the plane of the groove, said  
groove being formed partly in each section  
of the die, means for bending a bar into  
link form in said groove, and means for  
opening and closing said die.

6. Apparatus for forming chain links,  
comprising a fixed forming die having a  
peripheral groove, unitary means for bend-  
ing a bar into link form in said groove in  
85 a single operation, and forming means for  
thereafter acting upon the ends of said link.

7. Apparatus for forming chain links,  
comprising a forming die having a periph-  
90 eral groove and a transverse opening in-  
tersecting said groove, said die being di-  
vided in the plane of said groove and said  
groove and transverse opening being formed  
partly in each section, means for bending  
a bar into link form in said groove, and  
95 means for opening and closing said die.

8. Apparatus for forming chain links,  
comprising a forming die having a periph-  
100 eral groove, a plunger having a bifur-  
cated end, a bending die pivoted to each arm  
of the bifurcated end of the plunger, each  
of said bending dies comprising a grooved  
bending roller and a guide roller, a templet  
for cooperation with said guide rollers, means  
for supporting a bar in the plane of the pe-  
105 ripheral groove in the forming die and in  
position to be engaged by said bending  
rollers and bent into link form in said pe-  
ripheral groove as said plunger is advanced,  
and means for reciprocating said plunger.

9. Apparatus for forming chain links, 110  
comprising a two-part forming die having  
a peripheral groove formed partly in each  
part thereof, a plunger, means carried by  
said plunger for bending a bar into link  
form in said groove, means for reciprocating  
115 said plunger, and operating means for  
opening and closing said die.

10. Apparatus for forming chain links,  
comprising a forming die having a periph-  
120 eral groove, a plunger, means carried by  
said plunger for bending a bar into link  
form in said groove, a templet for coopera-  
tion with said means and means for reciprocating  
said plunger, substantially as de-  
125 scribed.

11. Apparatus for forming chain links,  
comprising a forming die having a periph-  
130 eral groove, a plunger, means carried  
by said plunger for bending a bar having  
beveled ends into link form in said groove

with said beveled ends in overlapping relation, means for reciprocating said plunger, and means connected with and actuated by said plunger on the return stroke thereof for acting on said overlapping ends to conform the latter to said die.

12. Apparatus for forming chain links, comprising a forming die having a peripheral groove, a plunger, means carried by said plunger for bending a bar having beveled ends into link form in said groove with said beveled ends in overlapping relation, means for reciprocating said plunger, means actuated by said plunger on the return stroke thereof for acting on said overlapping ends to conform the latter to said die, and means movable with the plunger but separable therefrom for cooperation with the die for holding said link for the action of said second-mentioned means.

13. Apparatus for forming chain links comprising a forming die having a peripheral groove, a unitary means for bending a bar about the die into link form in said groove in a single operation, a reciprocable frame in which the bending means is carried, and forming means yieldably mounted on the carrier for thereafter acting upon the ends of the link.

14. A link forming apparatus including a bed member, a normally fixed forming die thereon, a reciprocable frame movable about the die having forming means thereon operable upon movement of the frame in one direction, end closing means on the frame movable into operative position upon reciprocation of the frame in the reverse di-

rection, and means for reciprocating the frame.

15. A link forming apparatus including a separable forming die having a peripheral groove therein, said die having a cross bar receiving cavity formed between the separable parts thereof, and forming means operable about the bar.

16. A link forming machine including a bed, a die member mounted on the bed, a reciprocable frame associated with the bed, a pair of pivotally supported members on the frame, each of said members having a pair of rollers thereon, one of which rollers travels about the die and the other of which is arranged for cooperation with a guiding template, and a template on the bed for cooperation with one of the rollers.

17. A link forming machine including a bed, a die member mounted on the bed, a reciprocable frame having a bifurcated end associated with the bed, flexibly supported bending rolls carried by the bifurcated ends of the frame, and a follower between the bifurcated ends of the carrier.

18. A link forming machine including a bed, a die member mounted on the bed, a reciprocable frame having a bifurcated end associated with the bed, flexibly supported bending rolls carried by the bifurcated ends of the frame, a follower between the bifurcated ends of the carrier, and a latch for releasably connecting the follower with the carrier.

In testimony whereof I have hereunto set my hand.

ALBERT G. HEINLE.