Oct. 8, 1940. A. E. HENRICSON 2,217,053

BENDING MACHINE

Filed Nov. 15, 1937 4 Sheets-Sheet 1

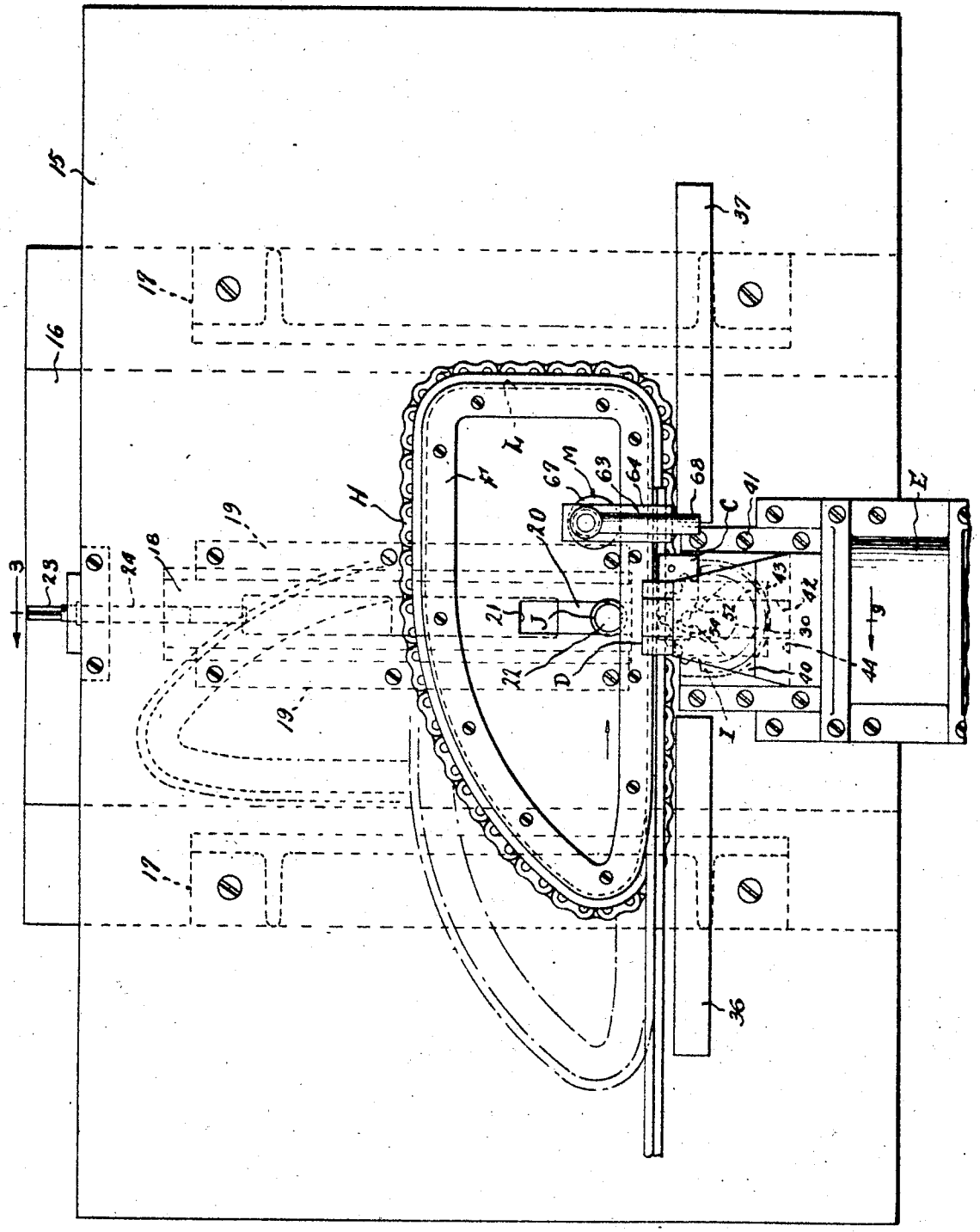


Fig. 1.

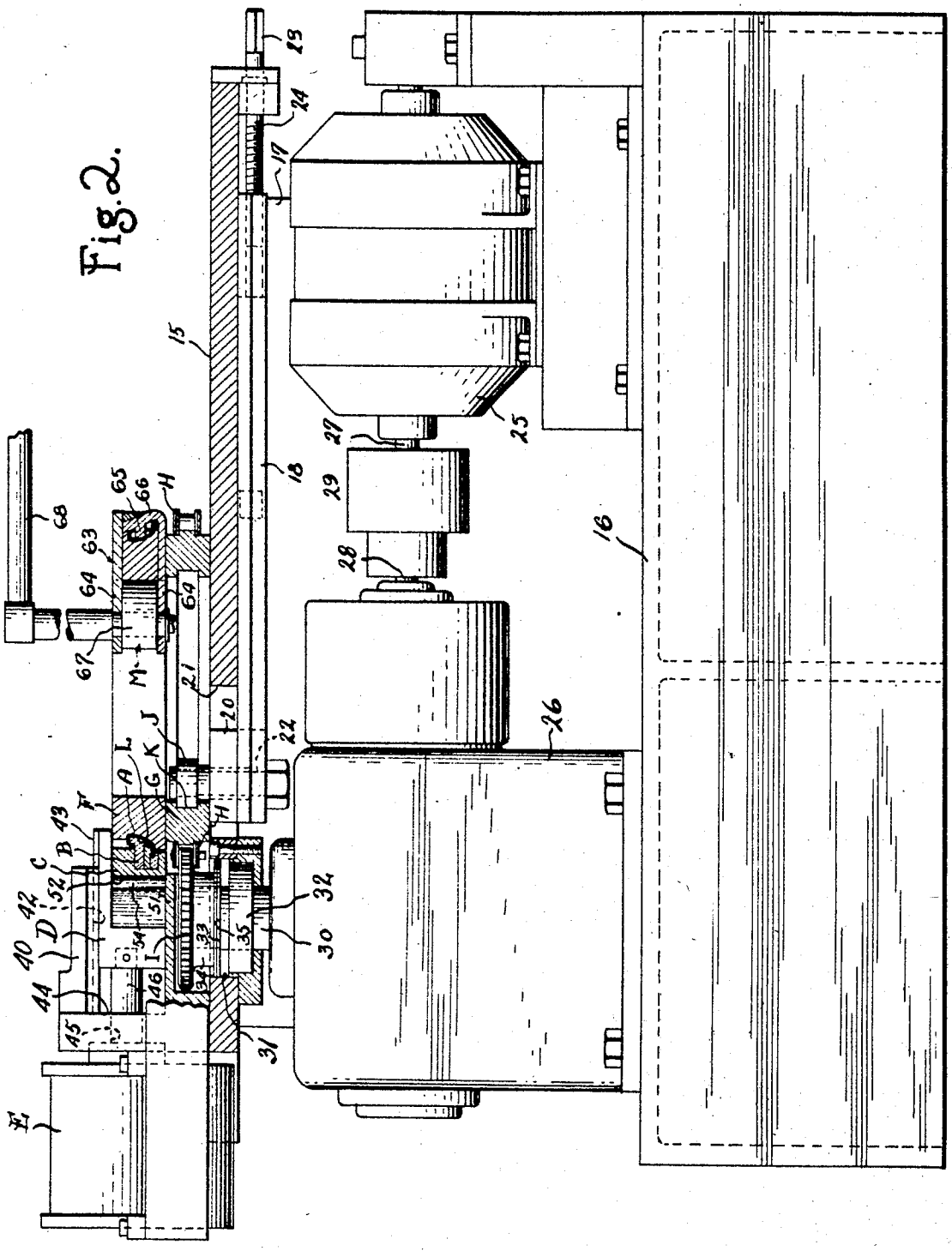
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Fig. 2.



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Fig. 3.

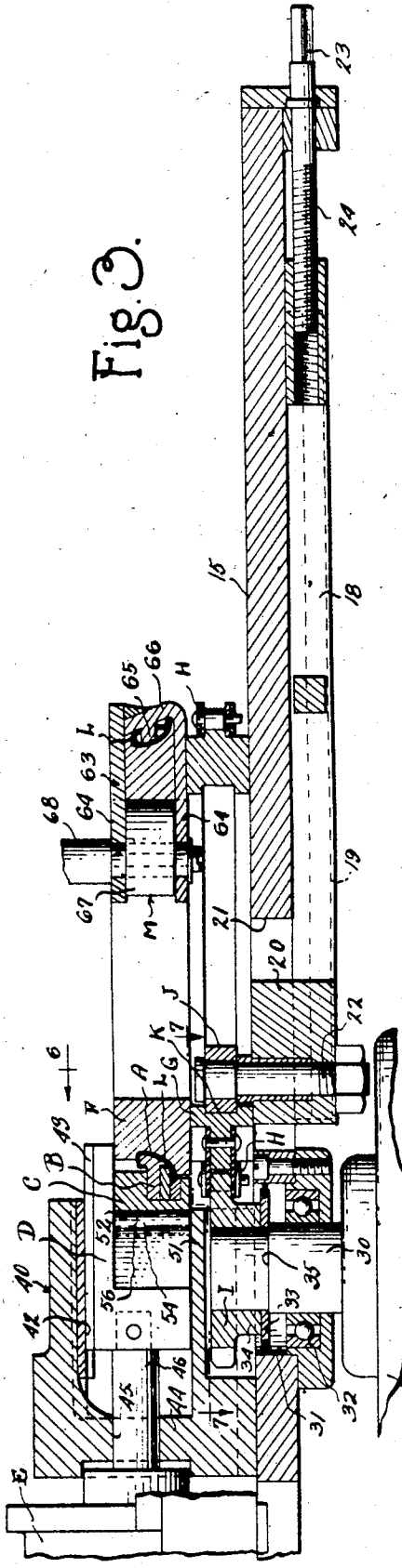


Fig. 5.

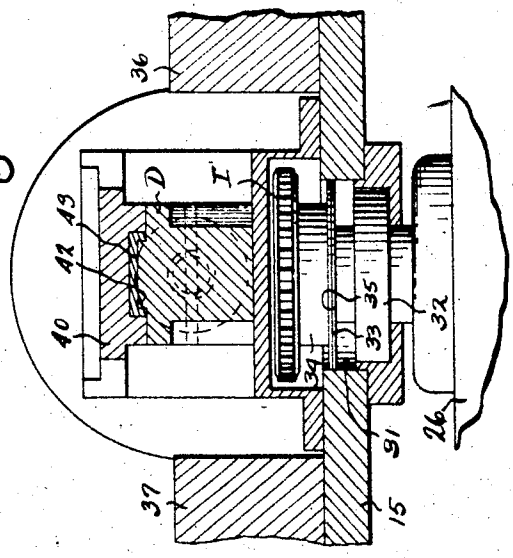
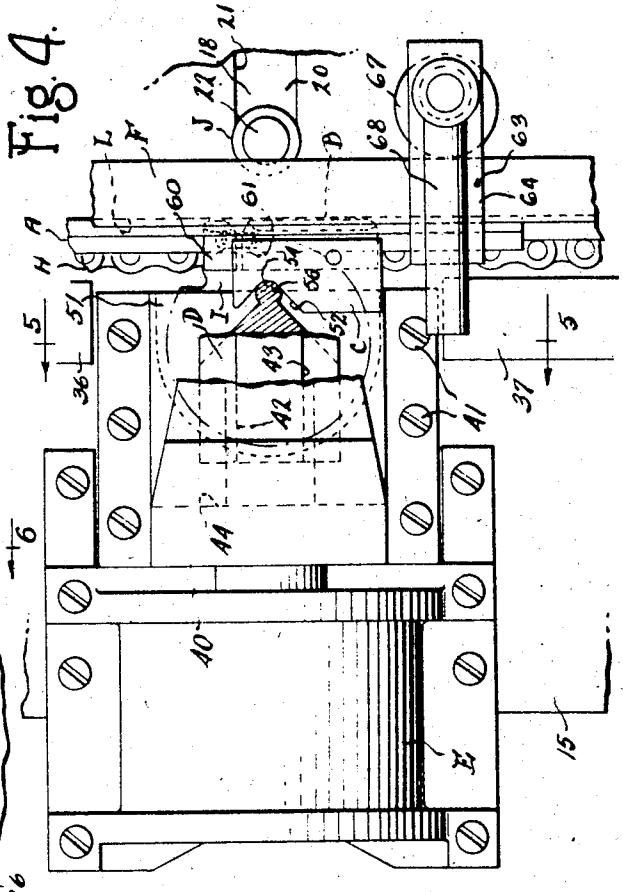


Fig. 4.



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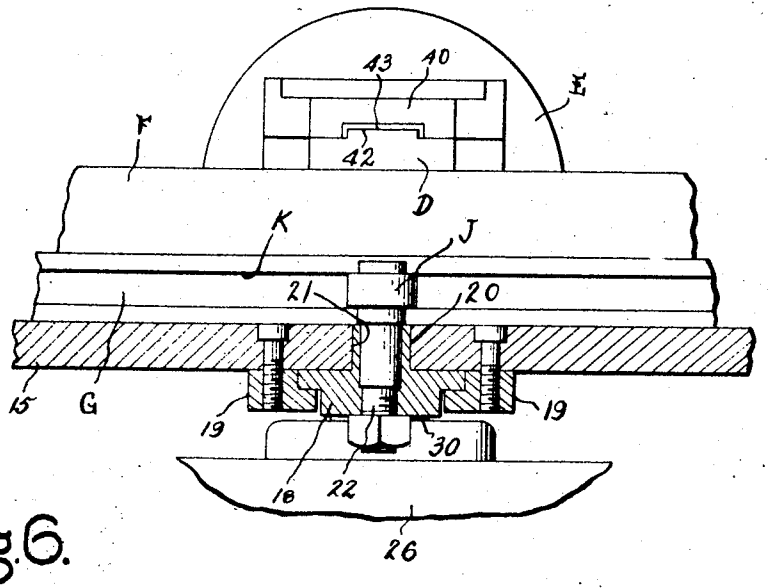


Fig. 6.

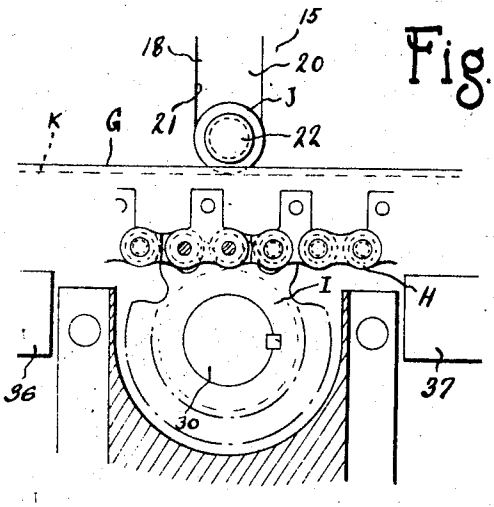


Fig. 7.

Fig. 9.



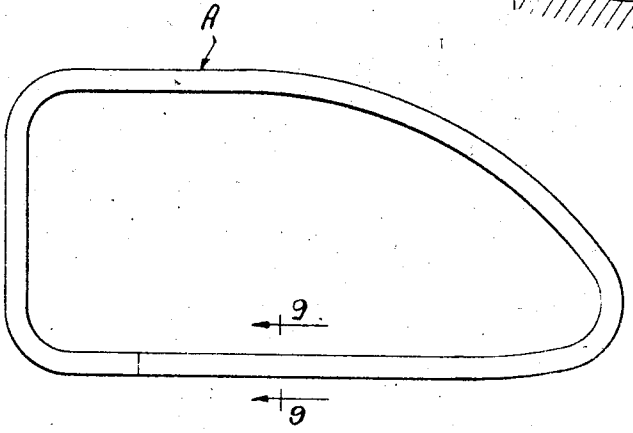


Fig. 8.

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Patented Oct. 8, 1940 2,217,053

UNITED STATES PATENT OFFICE

2,217,053

BENDING MACHINE

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Application November 15, 1937, Serial No. 174,716

4 Claims. (Cl. 153—40)

This invention relates generally to metal working machines and refers more particularly to improvements in machines for bending stock to a predetermined shape.

One of the principal objects of this invention resides in the provision of a bending machine having means for bending stock to a predetermined longitudinal contour after the latter has been fashioned to the desired cross sectional contour, without overstressing, or disturbing, the cross sectional contour of the stock. In accordance with this invention, a strip of stock prefashioned to the desired cross sectional contour may be longitudinally bent to form a complete garnish molding frame of the type commonly employed in connection with window openings in vehicle bodies, although it will, of course, be understood as this description proceeds that the invention is not limited to the production of this particular product.

Another object of this invention resides in the provision of apparatus of the type set forth capable of bending a strip of stock to its final shape with such accuracy that it renders it unnecessary to size, or otherwise reform the product. This feature is advantageous in that it simplifies the method of manufacture and appreciably increases production.

Still another object of this invention consists in a bending machine which is not only compact and relatively simple to operate, but which is capable of performing the required bending operations at a rate considerably faster than bending equipment employed in the past.

In addition to the foregoing, the invention contemplates a bending machine having forms capable of being readily interchanged so as to permit fashioning strips to various different longitudinal contours.

The foregoing, as well as other objects, will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a plan view of a bending machine constructed in accordance with this invention;

Figure 2 is a side elevational view of the machine shown in Figure 1 with certain parts broken away in section for the sake of clearness;

Figure 3 is a sectional view taken substantially on the plane indicated by the line 3—3 of Figure 1;

Figure 4 is an enlarged fragmentary plan view of a portion of the machine shown in Figure 1;

Figure 5 is a sectional view taken substantially on the plane indicated by the line 5—5 of Figure 4;

Figure 6 is a sectional view taken substantially on the plane indicated by the line 6—6 of Figure 3;

Figure 7 is a sectional view taken substantially on the plane indicated by the line 7—7 of Figure 3;

Figure 8 is an elevational view of a garnish molding frame adapted to be fashioned by the machine forming the subject matter of this invention; and

Figure 9 is a cross sectional view taken substantially on the plane indicated by the line 9—9 of Figure 8.

Although the embodiment of the bending machine selected herein for the purpose of illustration is for the purpose of fashioning garnish molding frames of the type commonly used in connection with the windows of motor vehicle bodies, nevertheless, it is to be understood that the machine is not limited to any particular shape or product and may be used to advantage in practically any case where it is desired to bend the strip stock to a predetermined longitudinal contour.

In general, a strip of metal prefashioned to the desired cross sectional contour is cut to the length required to form a garnish molding frame A of the size and cross sectional area shown in Figures 8 and 9. One end of the straight strip of metal is then assembled with the shoe B before the latter is installed in the machine. As shown in Figure 3 of the drawings, the cross sectional contour of the shoe corresponds to the cross sectional contour of the strip and the dimension of the shoe is such that the exterior surface thereof contacts with the internal surface of the strip throughout the cross sectional area of the latter. In actual practice, one end of the strip is telescoped on the shoe B and, after this is accomplished, the shoe, with its holder C, is assembled with the slide D. Referring again to Figure 3, it will be noted that the slide D is operatively connected to an air cylinder E for movement by the latter toward a form F conforming in shape to the garnish molding frame A and supported opposite the shoe B on a carriage G.

The form or templet frame F is movable relative to the shoe B throughout a continuous path of travel determined by the outline of the garnish molding frame A, and the free end of the stock adjacent the shoe is secured to the templet for movement as a unit therewith. The air cylinder E yieldably maintains the shoe B into

clamping engagement with the stock throughout movement of the templet frame, irrespective of the irregular shape of the latter. In Figure 1 of the drawings, the carriage G is shown as being in the form of a frame corresponding in shape to the templet frame, and the latter is moved throughout the path of travel aforesaid by an endless chain H surrounding the perimeter of the carriage frame. The chain is secured at spaced points to the carriage frame and is adapted to mesh with a sprocket wheel I. The sprocket wheel I is driven at a reduced speed and the chain is held in intermeshing relation therewith by means of a roller J. The roller J is supported on the machine frame directly opposite the sprocket wheel and engages in a continuous channel K formed in the inner surface of the carriage frame G. It follows from the above that rotation of the sprocket I effects a movement of the templet frame F and the strip A throughout a continuous path relative to the shoe B to form the strip of stock to the longitudinal contour of the garnish molding frame.

Upon reference to Figure 2 of the drawings, it will be noted that the outer edge of the templet frame is fashioned with a continuous recess L therein, and that this recess has a cross sectional shape which corresponds accurately to the cross sectional contour of the strip to be fashioned. In other words, the recess cooperates with the shoe B to form a cavity having a cross sectional contour exactly the same as the cross sectional contour of the strip so that during the bending operation of the strip, the walls of the latter will be effectively supported and maintained to their original predetermined contour. Attention is also directed to the fact at this time that the recess is accurately dimensioned so that when the strip is bent around the templet, the resulting product will have the required dimension.

When the end aforesaid of the straight strip of stock is telescoped with the shoe B, care is taken to extend this end beyond the shoe sufficiently to permit clamping the stock to the templet frame after the shoe is assembled with the slide D. For this purpose, the templet frame is provided with a clamp M having a portion secured to the templet frame and operable to effectively secure the end aforesaid of the strip in the recess L of the templet frame. After this is accomplished, the templet frame is moved throughout its path of travel in a direction so that the clamp M travels away from the sprocket I, and this movement is continued until the templet frame has completed one cycle of operation. Thus, it will be seen that the strip is moved relative to the shoe B as a unit with the templet frame F throughout the path of travel determined by the chain H and, as a consequence, is formed to the longitudinal contour of the templet frame. Upon completion of one cycle of operation of the templet frame, the machine is stopped and the clamp M is released. At the same time, the pressure exerted on the strip by the air cylinder E is relieved and the strip, together with the shoe, are removed from the machine. The shoe B is then merely slipped off one end of the garnish molding frame and is assembled with another straight strip of stock, whereupon the above operations are repeated.

Referring now more in detail to the particular construction of the machine, it will be noted that the same comprises a table 15 shown in Figure 2 as positioned in supporting relationship to the carriage frame G and as secured in vertical spaced relationship to the base 16 of the machine by the bracket plates 17. Mounted upon the underside of the table 15 for sliding movement toward and away from the shoe B is a slide 18 held in assembled relation with the table by means of the ways 19 secured to the underside of the table 15 at opposite sides of the slide 18. Upon reference to Figure 3, it will be noted that the end of the slide adjacent the shoe B has a portion 20 projecting upwardly from the slide into an elongated slot 21 formed in the table 15. The slot 21 is elongated in the direction of sliding movement of the slide 18, and the portion 20 carries the roller J, previously described as engaging in the continuous channel K in the carriage frame to maintain the chain H on the perimeter of the latter in intermeshing relationship with the sprocket wheel I. In this connection, it will be noted that a stud 22 extends vertically through the portion 20 of the slide, and the roller J is mounted upon the upper end of the stud in registration with the channel K in the carriage G. The roller J is maintained into frictional engagement with the carriage frame G by means of an adjustment screw 23 rotatably supported at the outer end of the table 15 and having the inner end portion 24 threaded in the adjacent end of the slide. This adjustment not only renders it possible to vary the relationship between the roller J and carriage frame G, but also permits assembling and disassembling the carriage G and associated parts. By reason of the above construction, it will also be noted that the roller J cooperates with the channel K and the carriage frame G to not only maintain the chain H in intermeshing relationship with the sprocket wheel I, but to also hold the carriage frame G on the table 15.

Supported on the base 16 of the machine beneath the table assembly is a prime mover 25 and a suitable speed reducer 26. As shown in Figure 2, the drive shaft 27 of the prime mover is connected to the driven shaft 28 of the speed reducer by means of a coupling 29, and the power take-off shaft 30 of the speed reducer extends upwardly through an opening 31 in the table 15. The power take-off shaft 30 is shown in Figure 3 as journalled in a bearing 32 secured to the underside of the table 15, and the upper end of the shaft is secured to the sprocket wheel I for driving the latter. A suitable seal 33 is located in the opening 31 above the bearing 32 and is secured between the hub 34 of the sprocket and an annular shoulder 35 on the shaft 30. The purpose of the seal is to prevent foreign matter from finding its way into the bearing 32 and interfering with the operation of the latter.

Upon reference to Figure 1, it will be noted that a pair of strips 36 and 37 are secured to the table 15 at opposite sides of the sprocket I. The purpose of these strips is to limit swinging movement of the carriage and templet frames during the bending operation. More particularly, the strip 36 forms a stop for limiting swinging movement when the templet employed is adapted to form garnish molding frames for the left-hand side of the vehicle body, and the strip 37 functions as a stop when the machine is utilized to form garnish molding frames for the right-hand side of the vehicle body. In detail, it will be noted from Figure 1 that when the carriage frame is moved from the dotted line position to the dot-dash line position, the free end of the frame is prevented from swinging beyond the path of travel by engagement with the stop 36 and the latter is of sufficient length to guide the carriage frame

from the dot-dash line position of the same to the full line position, also illustrated in Figure 1. When, however, the machine is employed to form a garnish molding frame for the right-hand side of the vehicle body, the carriage frame is moved throughout its path of travel in the opposite direction so that in this case the stop 37 functions to perform the same results pointed out above in connection with the stop 36.

Referring now more in detail to the particular means provided herein for effectively clamping the strip between the shoe B and templet frame F during the bending operation, attention is called to Figures 3 to 6, inclusive. In these figures, the slide D is shown as slidably supported in a bracket 40 secured to the table 15 by means of the fastener elements 41 and having a channel 42 formed in the underside of the top wall thereof for receiving a portion 43 extending upwardly from the slide. The channel 42 extends in the direction of sliding movement of the slide D and cooperates with the projection 43 on the latter to effectively guide the same. Upon particular reference to Figure 3, it will be noted that the outer wall 44 of the bracket 40 is formed with an opening 45 therethrough for receiving a coupling pin 46 having one end secured to the piston of the air cylinder E and having the opposite end secured to the slide. With this construction, it will be noted that when air is admitted in the cylinder at the outer side of the piston and exhausted from the cylinder at the inner side of the piston, the slide D is moved inwardly to clamp the stock between the shoe B and the templet frame F. The reverse operation of the air cylinder E, of course, causes the slide D to move outwardly and permits the garnish molding frame and shoe B to be removed.

The shoe B is secured in a holder C adapted to be supported on the portion 51 of the bracket 40 and having a V-shaped recess 52 on the outer side thereof for receiving a correspondingly shaped projection 54 extending inwardly from the slide. The bottom 56 of the recess is formed on a radius and the outer end of the projection 54 is fashioned with an arcuate head portion engageable with the bottom 56 of the recess in the shoe holder to provide for limited swinging movement of the shoe B in the plane of the templet frame F. This rocking movement of the shoe holder is desirable in order to insure effectively clamping the strip between the shoe and templet frame during the intervals the templet frame is moved angularly to form the bends in the strip. In this connection, it will be noted that the shoe has a section 60 which is pivotally connected to the remaining portion of the shoe through the medium of a link 61, and this link permits the section 60 to assume a position in angular relationship to the remaining portion of the shoe. The purpose of the section 60 is to effectively support the strip during the intervals the latter is bent around the form and, by reason of this construction, substantially right angle bends may be formed in the strip without overstressing or interfering with the predetermined cross sectional contour of the strip.

Mention has been made above to the fact that the strip is clamped to the templet frame or form F by means of a releasable clamp M. As shown in Figure 3, the clamp M comprises a U-shaped member 63 having the leg portions 64 thereof spaced from each other a sufficient distance to receive a portion of the templet frame therebetween and having a projection 65 on the base portion 66 which is adapted to engage the strip to clamp the latter against the adjacent surface of the templet. The clamping action is effected by an eccentric 67 rotatably supported between the leg portions 64 of the U-shaped member and adapted to engage the inner side of the templet frame to draw the projection 65 into engagement with the strip of stock. The eccentric 67 is rotated by means of a suitable control handle 68 which extends above the templet and is located for convenient manipulation by the operator.

Thus, from the foregoing, it will be observed that I have provided a relatively simple, inexpensive bending machine capable of expediently bending strip stock to the desired longitudinal contour. It will also be noted that provision is made in the machine for bending stock having a predetermined cross sectional contour and for preserving this cross sectional contour during the bending operation.

What I claim as my invention is:

1. In a machine for bending strip stock to a predetermined longitudinal contour, a closed frame member having an outer surface corresponding in shape to said longitudinal contour, a flexible continuous driving member surrounding the outer surface of the frame and secured to the latter, means engageable with the driving member and effective to move the frame throughout a path of travel determined by the shape of the flexible continuous driving member, a templet frame also corresponding in shape to the predetermined longitudinal contour and movable with the first mentioned frame, a shoe supported opposite the templet frame for movement toward and away from the latter and effective to clamp the strip stock between the templet frame and shoe, and means for clamping the strip stock to the templet frame.

2. In a machine for bending strip stock having a prefashioned cross sectional contour to form a closed frame having a predetermined longitudinal contour, a templet frame corresponding in shape to said predetermined longitudinal contour and having a continuous recess in the outer surface thereof provided with a cross sectional contour determined to engage the outer surface of the strip of stock substantially throughout the cross sectional area of the latter, a shoe having a portion engageable with the inner surface of the strip of stock substantially throughout the cross sectional area of the latter and normally yieldably urged in a direction toward the templet frame, an endless chain confined to a shape corresponding to the predetermined longitudinal contour aforesaid and operatively connected to the templet frame, and a rotatable sprocket wheel engageable with the chain.

3. In a machine for bending strip stock to a predetermined longitudinal contour, a carriage frame corresponding in shape to the predetermined longitudinal contour and having a continuous channel in the inner surface thereof, an endless chain surrounding the outer surface of the carriage frame and secured to the latter, a rotatable sprocket connected to the frame for moving the latter throughout a path of travel determined by the shape of the chain, means supported opposite the sprocket and engageable in the channel to maintain the chain in intermeshing relationship with the sprocket, a form connected to the carriage frame and corresponding in shape to the predetermined longitudinal contour aforesaid, means for clamping one end portion of a strip of stock to the form, and

means cooperating with the form upon movement thereof throughout said path of travel to bend the strip of stock around the form.

4. In a machine for bending a strip of stock to form a closed frame having a predetermined longitudinal contour, a supporting table, a carriage frame mounted on the supporting table and having inner and outer surfaces corresponding to the predetermined longitudinal contour aforesaid, a continuous chain extending along one of the surfaces aforesaid of the carriage frame and secured to the latter, a revoluble sprocket engaging the chain, a guide roller engageable within a continuous recess formed in the opposite surface of the carriage frame to maintain the carriage frame on said table and to hold the chain against the sprocket, means for rotating the sprocket to effect movement of the carriage frame throughout a path determined by the longitudinal contour of the continuous chain, a templet frame having an outer surface corresponding in shape to the longitudinal contour aforesaid and movable by the carriage frame throughout a corresponding path of travel, and means cooperating with the surface aforesaid of the templet frame to bend a strip of stock around said surface.

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