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METAL WORKING MACHINE

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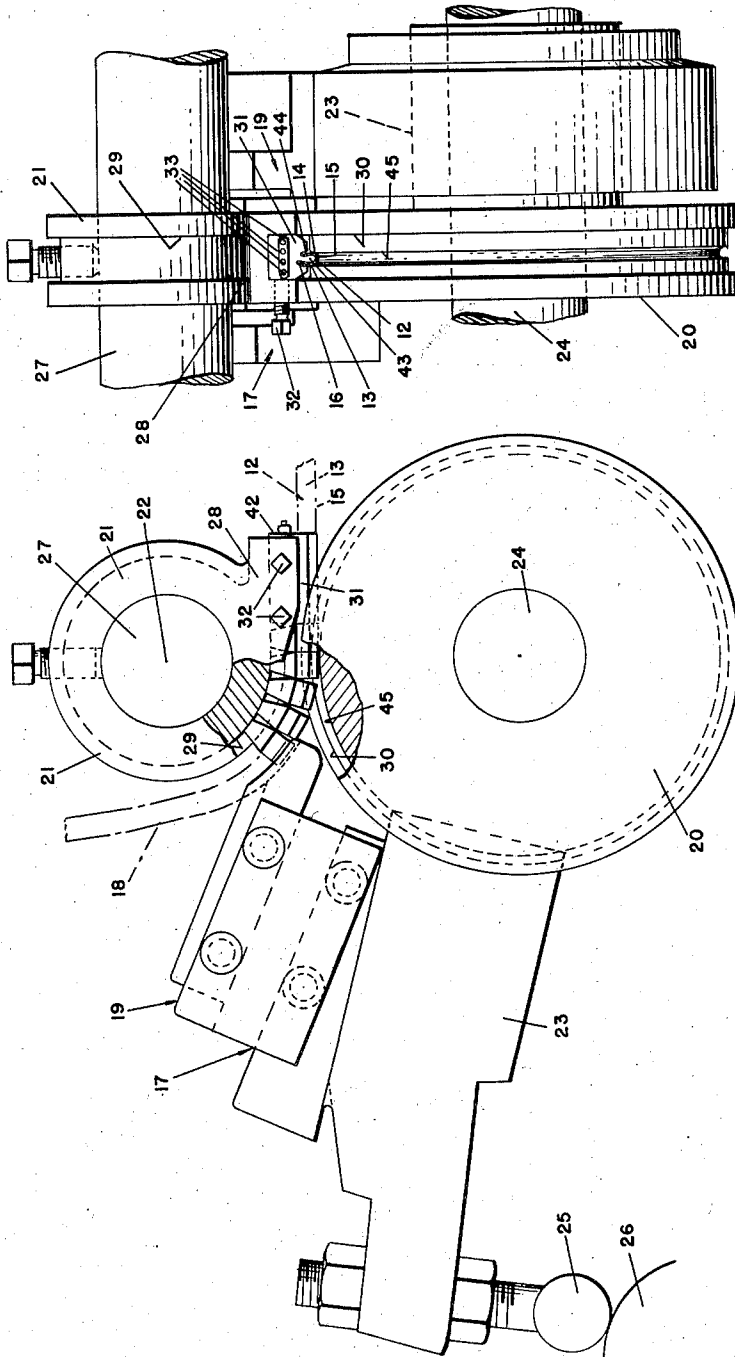


FIG. 3.

FIG. 2.

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METAL WORKING MACHINE

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This invention relates generally to metal working machines and refers more particularly to apparatus for forming a strip of stock of predetermined cross sectional contour into an arcuate section.

One of the principal objects of this invention resides in the provision of apparatus of the character set forth embodying means for effecting a relatively small radius bend in a prefashioned strip without the danger of deforming, buckling or otherwise interfering with the cross sectional contour of the strip.

Another advantageous feature of this invention resides in the provision of a metal working machine having means for forming a strip of flat stock to a predetermined cross sectional contour and having means at the delivery end thereof for bending the strip to form a relatively small curve in the same without interfering with the cross sectional contour thereof. In accordance with this invention, the cross sectional contour of the strip is maintained during bending of the strip by an articulated shoe having portions providing a form corresponding in cross section to the transverse contour of the strip and extending into the latter during the bending operation and having other portions at opposite sides of the form for holding the strip against the latter sides of the form as the strip is being bent.

The above, 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 semi-diagrammatic side elevational view of a portion of a metal working machine equipped with the present invention;

Figure 2 is an enlarged fragmentary side elevational view, partly in section, of the means at the delivery end of the metal working machine for bending the strip of stock;

Figure 3 is a sectional view taken substantially on the plane indicated by the line 3—3 of Figure 2;

Figure 4 is a perspective of the underside of the articulated shoe showing a strip of prefashioned stock in operative relation thereto;

Figure 5 is an enlarged plan view of the shoe shown in Figure 4;

Figure 6 is a cross sectional view taken substantially on the plane indicated by the line 6—6 of Figure 5; and

Figure 7 is a cross sectional view through a prefashioned strip of stock.

Referring now more in detail to the drawings, it will be noted that there is diagrammatically

illustrated in Figure 1, a portion of a rolling machine 10 comprising a plurality of sets of forming rolls 11 cooperating with each other to form a strip of flat stock to a predetermined cross sectional contour. For the purpose of illustration, the rolls 11 may be considered to possess the configuration required to progressively form the strip of stock to the cross sectional contour illustrated in Figure 7, although it is to be understood that this contour may vary materially without departing from the spirit and scope of this invention.

The particular strip selected herein for the purpose of illustrating this invention is designated in Figure 7 by the reference character 12 and is in the form of a frame bead fashioned of relatively light gauge sheet metal and having opposed side walls 13 and 14 spaced laterally from each other. In the present instance, the side walls are integrally connected by means of an arcuate base portion 15 and the free longitudinal edge of the side wall 13 projects beyond the corresponding edge of the side wall 14 and is bent upon itself as indicated by the reference character 16.

The strip 12 is formed to the cross sectional contour shown in Figure 7 by the rolling machine 10 with the channel of the strip opening in an upward direction and the machine is equipped with bending means 17 at the delivery end thereof for imparting the relatively sharp bend in the strip 12, designated in Figure 2 by the dot and dash lines 18. Upon reference to this latter figure, it will be noted that the bending means 17 comprises a fixture 19 supported for oscillation about the axis of a guide roll 20 at the delivery end of the machine and adapted to cooperate with a fixed form 21 to bend the strip about the center or axis 22 of the form.

In detail, the fixture 19 comprises an arm 23 having the inner end journaled on the guide roll shaft 24 and having an adjustable follower 25 at the outer end thereof adapted to engage a rotatable cam 26. The cam 26 is driven in any suitable manner from the source of power employed to operate the machine and the development of the cam is predetermined to oscillate the fixture 19 in a direction to effect a bending of the strip about the axis of the form 21.

In the present instance, the form 21 is secured to a shaft 27 supported above the guide roll 20 with the axis 22 thereof in a common vertical plane with the axis of the guide roll shaft 24. As shown in Figure 2, the form 21 is annular with the exception of the lower portion 28 thereof

which extends tangentially from the periphery of the form or, in other words, extends in a straight line toward the entrant end of the rolling machine. The outer surface of the form is provided with a channel 29 extending from the end of the portion 28 around the entire form and cooperates with a groove 30 of similar width formed in the periphery of the guide roll 20 to receive an articulated elongated shoe 31.

Upon reference to Figure 3, it will be noted that the shoe 31 is removably secured in the channel 29 by means of the fastener elements 32 threadedly mounted in one side of the portion 28 of the form 21. The shoe 31 is formed of a plurality of sections supported in juxtaposition to each other by means of a plurality of spring wire strands 33 extending through aligned openings 34 in the sections and secured against accidental disengagement. The spring wire strands serve to permanently secure the several sections of the articulated shoe in assembled relationship and possess sufficient resiliency to permit the shoe to be bent around the form 21 by the fixture 19 in the manner clearly shown in Figure 2. In this connection, it may be pointed out that the adjacent surfaces of the sections above the wire strands 33 are tapered or relieved as at 35 to provide the clearance required to permit the necessary bending of the shoe.

Upon reference to Figure 6, it will be noted that each of the sections of the articulated shoe are formed with four openings 34 therethrough and that these openings are spaced laterally from each other in a common plane. As shown in Figure 5, one strip of wire 36 is threaded through the aligned openings 37 in the several sections of the shoes and is returned through the aligned openings 38 in these sections. Another strip of wire 39 is threaded through the aligned openings 40 in the sections and is returned through the openings 41. The free ends of the wire strands beyond the end section of the shoe may be united together by brazing or welding. It will be noted from Figure 2 that the section 42 at the end of the shoe remote from the bending fixture 19 is longer than the remaining sections and this section forms a pilot for guiding the strip 12 into engagement with the following sections as the strip is advanced through the machine.

The cross sectional contour of each of the sections of the articulated shoe is substantially identical and, in the present instance, is illustrated in Figures 3 and 6. In detail, each of the sections of the shoe are formed with a depending tongue or form 43 corresponding in cross section to the cross sectional area of the strip 12 and dimensioned in such a manner as to be snugly received by the strip 12 as it is advanced along its path of travel. In order to insure aligning of the tongue portions on the several sections of the articulated shoe, the diameter of the openings 34 is greater than the diameter of the wire strands projecting through these openings so as to permit a limited degree of lateral shifting movement of the sections relative to each other. This permits the tongues on the several sections to cooperate with each other to provide, in effect, a continuous form throughout the length of the shoe and each of the sections of the latter are undercut on opposite sides of the tongue to form continuous recesses 44 for receiving the free edge portions of the strip 12. In this connection, attention is called to the fact that the width of the recesses 44 at opposite sides of the tongues is such as to urge the side walls of the strip into

intimate contacting relation with the tongue or form so that the strip will be positively held to its prefashioned cross sectional contour during the operation of the fixture 19 to bend this strip in the manner shown in Figure 2. It will also be noted from Figure 5 that the tongue on the pilot section 42 is tapered slightly to facilitate guiding the strip into engagement with the tongues on the following sections of the shoe.

Operation

As the strip leaves the last set of forming rolls 11 in the apparatus, the same assumes a cross sectional contour shown in Figure 7 and continued advancement thereof along its path of travel effects a telescoping engagement of the strip with the depending form or tongue on the pilot section 42 of the articulated shoe 31. The pilot 42 guides the strip into successive engagement with the tongues on the following sections of the articulated shoe and the strip is forced into intimate contacting relation with the tongues of the articulated sections of the shoe by means of the guide roll 20. In this connection, attention is called to Figure 3 wherein it will be noted that the guide roll 20 is formed with an annular recess 45 therein adapted to receive the form or tongue 43 and affording a clearance with the latter approximating the gauge or thickness of the metal forming the strip 12. Consequently, as the strip is advanced between the guide roll 20 and the tongue 43 on the articulated shoe, the strip is forced over the tongue and the side walls of the strip are effectively braced by means of the walls of the recesses 44 opposite the tongue. As the strip continues to advance along its path of travel in telescoping relation with the tongue 43 on the articulated shoe, the arm 23 is actuated by the cam 26 to bring the bending fixture 19 into engagement with the outer end portion of the shoe. In this connection, attention is called to the fact that the fixture 19 straddles the strip so that continued movement of the fixture by the cam 26 exerts a pressure on the shoe to bend the latter and portion of the strip associated therewith out of the path of travel. This causes the shoe to assume the arc of the adjacent portion of the form 21 and produces the desired bend in the strip. It follows from the foregoing that during this bending operation, the strip is prevented from buckling or otherwise changing in cross sectional contour by reason of the several sections of the articulated shoe.

What I claim as my invention is:

1. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, an elongated articulated shoe supported in the path of travel of the strip and having portions embracing the strip as it is advanced relative to the shoe, and a bending fixture engageable with the shoe and operable during advancement of the strip relative to the shoe for bending the strip out of the path of travel aforesaid.

2. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, a shoe supported in said path of travel and having a portion frictionally received by the strip as the latter is advanced relative to the shoe, and bending means acting upon the shoe during advancement of the strip relative thereto for bending the strip out of its path of travel.

3. In a metal working machine, means for advancing a strip of stock of predetermined cross

sectional contour along a path of travel, an elongated articulated shoe supported in said path of travel having a portion conforming in cross sectional contour to the cross sectional contour of the strip and frictionally received by the strip as the latter is advanced along said path of travel, and bending means acting upon the shoe for bending the strip out of its path of travel during advancement of the strip relative to the shoe.

4. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, an elongated articulated shoe supported in said path of travel having a portion received by the strip as it is advanced along said path of travel and having portions at opposite sides of the strip frictionally engaging the side walls of the latter to maintain the latter into engagement with the portion aforesaid of the shoe, and means for bending the shoe with the portion of the strip engaged thereby out of said path of travel.

5. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, an elongated articulated shoe supported in said path of travel having a portion conforming in cross sectional contour to the cross sectional contour of the strip and received by the strip as it is advanced along said path of travel, said shoe having other portions at opposite sides of the portion aforesaid engageable with the sides of the strip to maintain the same in frictional contact with the first named portion of the shoe, and means acting on the shoe for bending the strip out of its path of travel.

6. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, an elongated articulated shoe supported in the path of travel and having a longitudinally extending portion adapted to be received by the strip as it is advanced along said path of travel, a roll journaled at one side of the path of travel and cooperating with the portion aforesaid of the shoe to roll the strip into intimate contacting relation with said portion, and means for subsequently bending the strip out of its path of travel.

7. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, an elongated articulated shoe supported in said path of travel having a longitudinally extending portion conforming in cross sectional contour to the cross sectional contour of the strip and frictionally received by the strip as the latter is advanced along said path of travel, means for rolling the strip into intimate contacting relation with the portion aforesaid of the shoe, and means acting upon the shoe for bending the strip out of its path of travel.

8. In a metal working machine, an elongated articulated shoe having a longitudinally extending portion corresponding in cross sectional contour to the cross sectional contour of the strip to be worked, means for advancing the strip relative to the shoe, a pilot forming a section of the shoe and operable to guide the strip into telescopic engagement with the portion aforesaid of the shoe, and means acting upon the shoe for bending the strip out of its path of travel.

9. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, a form positioned to one side of the path of travel and having an arcuate surface, an elongated articulated shoe supported in the path of travel of the

strip and having a longitudinally extending portion corresponding in cross sectional contour to the strip and adapted to be received by the strip as it is advanced along the path of travel, means at the side of the path of travel opposite the form for rolling the strip into intimate contacting relation with the longitudinally extending portion aforesaid of the shoe, and means acting upon the articulated shoe for bending the same out of the path of travel of the strip against the arcuate surface of the form.

10. In a metal working machine, means for advancing a strip of stock along a path of travel, an articulated shoe supported in said path of travel and having a portion received by the strip as it is advanced along the path of travel, a roller located to one side of the path of travel and cooperating with the shoe to support opposite sides of the strip substantially throughout its cross sectional area, and means effective upon continued advancement of the strip between the roller and shoe to bend the portion of the strip engaged by the shoe out of the path of travel.

11. In a metal working machine, means for advancing a strip of stock along a path of travel, an articulated shoe supported in said path of travel and having a portion received by the strip as it is advanced along said path, a roller supported to one side of the path of travel and having a peripheral surface contoured to cooperate with the shoe in supporting the strip throughout the cross sectional area thereof, a form located at the opposite side of the path of travel of the strip, and means supported in said path of travel beyond the form and effective upon continued advancement of the strip to bend the portion of the latter engaged by the shoe over said form.

12. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, a shoe supported in said path of travel and having portions embracing the strip as it is advanced relative to the shoe, and means effective during advancement of the strip relative to the shoe to engage said shoe and bend the strip out of the path of travel aforesaid.

13. In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, a roll positioned to one side of the path of travel and having a peripheral surface contoured to engage a portion of the outer surface of the strip of stock as it is advanced along said path of travel, an elongated articulated shoe supported opposite the roll in the path of travel and having a portion received by the strip as it is advanced along said path of travel, said shoe further having portions at opposite sides of the strip cooperating with the contoured surface of the roll to frictionally engage the side walls of the strip substantially throughout the cross sectional area of the latter, and means for bending the strip out of its path of travel as the strip is advanced between the roll and shoe.

14. In a metal working machine, an elongated articulated shoe having a longitudinally extending rib of predetermined cross sectional contour, a member positioned opposite the rib and having a recess within which the rib extends, means for advancing a strip of stock of a cross sectional contour corresponding to the cross sectional contour of the rib between the shoe and member in a manner to telescope the stock with the rib, and means effective upon advancement of the stock

between the member and shoe to bend the shoe with the stock out of the path of travel.

15 In a metal working machine, means for advancing a strip of stock of predetermined cross sectional contour along a path of travel, an elongated articulated shoe supported in the path of travel of the strip and having a longitudinally extending rib corresponding in cross sectional contour to the cross sectional contour of the strip and adapted to be telescoped by the strip as it is advanced along said path of travel, and a member positioned opposite the shoe and engageable with the strip to maintain the latter in frictional engagement with the rib on the shoe, and means acting upon the articulated shoe for bending the strip out of the path of travel thereof.

16 In a metal working machine, means for advancing a strip of stock of substantially U-shaped cross sectional contour along a predetermined path of travel, an elongated articulated shoe having a longitudinally extending rib positioned in the path of travel of the strip and corresponding in cross sectional contour to the cross

sectional contour of the strip so as to be received by the strip as the latter is advanced along said path of travel, and bending means effective during advancement of the strip relative to the shoe for bending the shoe with the strip out of its path of travel.

17 In a metal working machine, means for advancing a strip of stock of substantially U-shaped cross sectional contour along a predetermined path of travel, an elongated articulated shoe having a longitudinally extending rib located in the path of travel of the strip and having a cross sectional contour corresponding to the cross sectional contour of the strip to be received by the strip as it is advanced along said path of travel, said shoe further having undercut recesses on opposite sides of the rib to receive the free longitudinal edge portions of the strip as it is advanced along said path of travel, and bending means acting upon the shoe during advancement of the strip relative to the shoe for bending the strip out of its path of travel.

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