Aug. 21, 1956 L. H. KNOST 2,759,514

CONE ROLLING APPARATUS

Filed Jan. 8, 1952 2 Sheets-Sheet 1

Fig. 1.

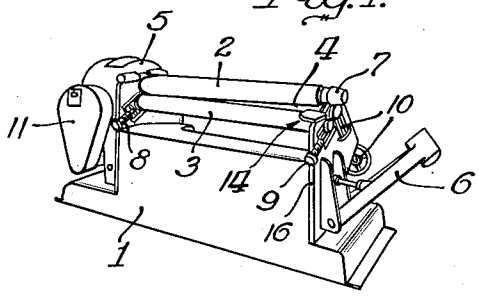


Fig. 2.

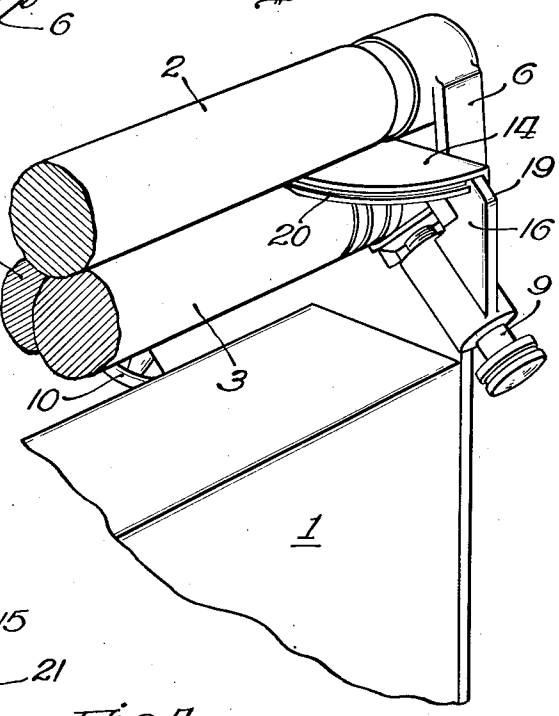


Fig. 3.

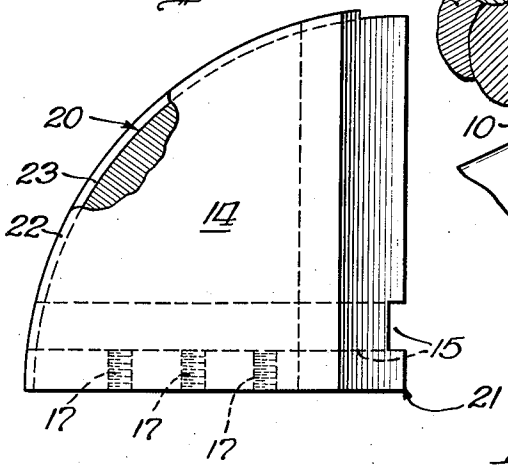


Fig. 4.

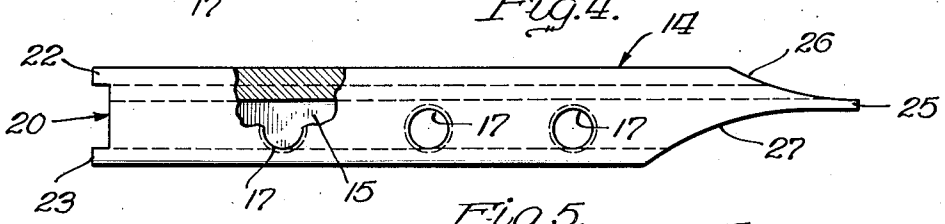
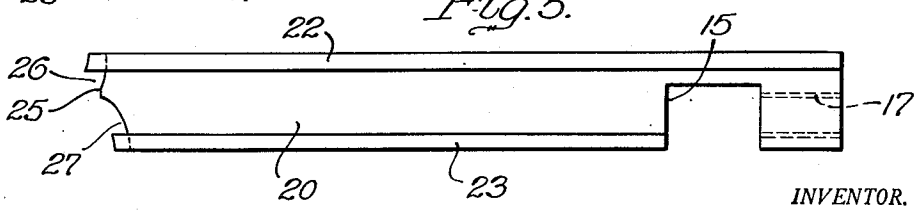


Fig. 5.



INVENTOR.
Lloyd H. Knost
BY
Eberhard C. Wattley
Atty.

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Fig. 6.

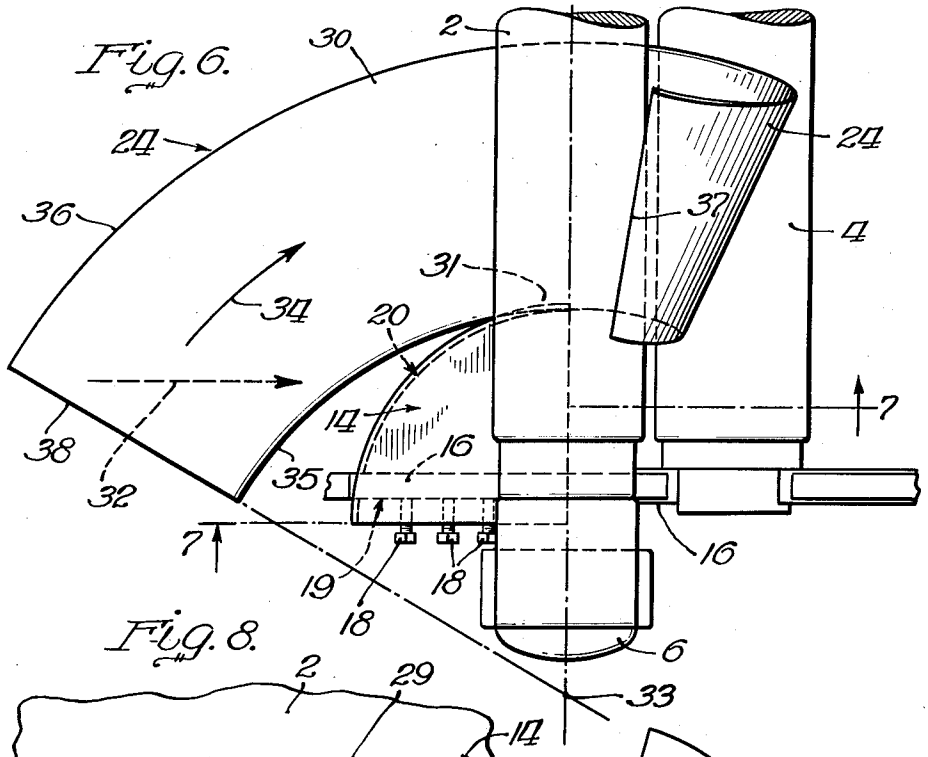


Fig. 8.

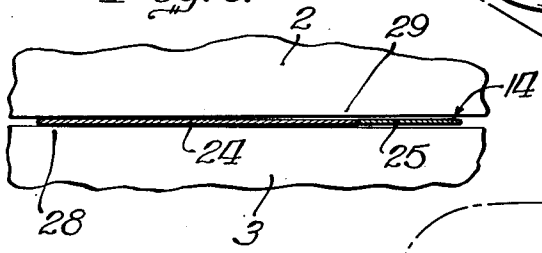


Fig. 7.

INVENTOR.
Lloyd H. Knost
BY
Eberhard E. Goldsby
Atty.

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CONE ROLLING APPARATUS

Lloyd H. Knost, Carthage, Mo.

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15 Claims. (Cl. 153—54)

This invention relates to an apparatus for rolling cones from flat metal stock comprising a blank of predetermined configuration.

More specifically the present invention is directed to a guide unit used in conjunction with a slip roll forming machine whereby segmental stock blanks can be guided through the machine for the purpose of rolling conical structures.

It is one of the main objects of the present invention to provide a means in the form of a camming guide which can be attached in predetermined relation with respect to the forming rolls of a material forming machine and which will function to turn arcuately shaped blanks into the forming rolls of a conventional machine ahead of the pinch rolls or feed rolls of that machine. This guided turning feed of a flat blank of arcuate configuration causes the blank to follow a generally circular path as the blank enters the tangency area between the feed rolls of the machine.

Under normal conditions any metal blank will be fed in a straight line direction and normal to the axes of the rolls of that machine. With the present attachment and the disposition thereof in a location wherein a part of the attachment is arranged for cooperative contact with the blank, such blank will not follow through in the straight line direction mentioned but will be turned in its plane about such attachment to thereby produce a conical structure from the blank.

It is a further object of the present invention to provide such an attachment in the form of a heavy block having a curved camming surface for disposition in the path of the blank, and this block terminates in a feather edge flanked by composite curvatures which fit the cylindrical surfaces of the feed rolls with the feather edge terminating generally at the point of tangency of such rolls.

It is a further object of the present invention to provide such a guide in the form of an easily attachable and detachable unit arranged for quick adjustment and securement to a machine to convert the latter into a cone rolling structure. The attachment may be made as a guide member that is easily replaceable by similar structures having different camming surfaces to meet other conditions of operation.

It is still a further object of this invention to provide such a guide member with retaining means which will maintain the blank in cooperative coplanar relationship with the curved camming edge of the guide while such blank is being drawn through the forming rolls of the machine.

In a pinch roll machine of the character herein described, at least one of the cooperative feed rolls is swingable angularly with respect to the other feed roll and can be readily secured into cooperative position by means of a swingable bearing head. This swingable head permits the release of formed metal stocks endwise off of the upper pinch roll. It is also possible in a machine of this type to adjust one of the pinch rolls angularly with respect to the other to provide an exact fit commensurate with

the thickness of the metal blank to be rolled to firmly grip the blank toward the remote area thereof in relation to the cone rolling attachment, and to provide a slight frictional clearance area between the rolls adjacent the inner area portion of the blank that normally passes about the attachment structure. The object of this arrangement in conjunction with the use of the cone rolling attachment provides a feed that will positively move the outer greater curved portion of the stock blank through the rolls but which will permit a certain amount of self adjustment of the inner edge of the blank adjacent the camming attachment member to provide a more efficient and accurate rolling of the conical structure in an organization of elements of this type.

All other objects and advantages relating to the present invention shall hereinafter appear in the following detailed description having reference to the accompanying drawings forming a part of this specification.

In the drawings:

Fig. 1 is a perspective view of the metal forming machine commonly termed a slip roll former incorporating the cone rolling attachment of the present invention;

Fig. 2 is a fragmentary perspective view of the right hand portion of the machine illustrated in Fig. 1 to better show the location and position of the cone rolling attachment as seen from a different angle than that shown in Fig. 1;

Fig. 3 is a plan view of the guide structure comprising the cone rolling attachment of the present invention;

Fig. 4 is an edge view of the cone rolling attachment as seen from the bottom edge in Fig. 3;

Fig. 5 is another edge elevational view of the cone rolling attachment as seen from the left hand side in Fig. 3;

Fig. 6 is a fragmentary plan view of the machine illustrated in Fig. 1 showing that portion of the machine which incorporates the cone rolling attachment and the manner of use thereof in feeding a stock blank through the forming rolls of a machine;

Fig. 7 is a diagrammatic vertical cross sectional view taken substantially along the line 7—7 in Fig. 6 to further illustrate the cone rolling attachment and its use in operation; and

Fig. 8 is a diagrammatic view looking into the feeding side of the upper and lower feed rolls to illustrate in exaggerated form the angular positioning of these rolls in regard to a blank and the cone rolling attachment.

Referring more specifically to Figs. 1 and 2, the slip roll forming machine is indicated at **1** and employs upper and lower slip rolls **2** and **3** supplemented by a rearwardly positioned forming roll **4** which, together, can be relatively adjusted to provide a definite arrangement for forming a predetermined metal shape from a blank passing through the rolls. The upper feed or pinch roll **2** is arranged for automatic separation through swinging within the driving head **5** of the machine **1** upon removal of a swingable head **6** from the bearing end **7** of such roll. This action permits removal of the stock that is bent and normally curled about the roll **2**. The bottom feed or pinch roll **3** can be adjusted by suitable adjustment units **8** and **9** into a predetermined chosen position with respect to the upper roll **2**. The rear roll **4** may be adjusted relative to both of the rolls **2** and **3** by adjustable means, one of which is shown at **10** in Fig. 1. And one or more of the rolls **2**, **3** and **4** may be driven through the motor drive arrangement **11** through suitable power transmission means in the head **5**.

The normal arrangement of the rolls as best seen in Fig. 7 comprises the more or less fixed position of the upper roll **2** with rolls **3** and **4** being adjustable along the dot and dash lines **12** and **13** respectively by the cooperative adjusting means associated with each of these rolls respectively.

The cone rolling attachment comprises the guide 14 which may be fixed in any suitable fashion to the frame or to any other standard connected with the frame of the machine 1. This guide is preferably provided with a slot 15 formed in the under side thereof for the purpose of engaging over the upper edge of a wall 16 of the machine 1. A plurality of threadsd bores 17 are formed through the edge portion of the guide 14 for the reception of a plurality of set screws 18 which can be threaded through the bores 17 for engagement with the outer surface 19 of the wall 16.

The attachment, as best seen in Figs. 3, 4 and 5, incorporates a camming surface 20 preferably comprising a circular edge generated about the point 21 of the attachment member. This camming surface 20 is flanked by upper and lower ridges 22 and 23 which provide retaining means for the blank 24 shown in Figs. 6 and 7, whereby this blank is held in coplanar relationship with the general plane of the guide 14. The guide 14 is completed by means of a feather edge 25 which is flanked by the upper and lower curved surfaces 26 and 27 that conform to the cylindrical contours of the pinch rolls 2 and 3 respectively. Furthermore, the feather edge 25 is arranged to extend substantially to the point of tangency between the pinch or feed rolls 2 and 3 to thereby provide a continuous guide for the stock blank 24 up to and including the point of tangency of such rolls 2 and 3.

Obviously, rolls 2 and 3 will require other adjustments when various thicknesses of stock blanks are being rolled by the apparatus of the present invention. It is for this purpose that the guide 14 can be removed and replaced by other similar guides but wherein the only real change will be in the thickness of the feather edge 25 employed. Suffice it to say that the feather edge shown in Fig. 4 may accommodate various thicknesses of metal blanks if so desired. If heavier stock is to be rolled, it is also possible in some instances to slightly retract the guide away from the point of tangency between the rolls 2 and 3. It is preferable, however, to replace the guide as illustrated in Figs. 3 to 5 with a guide having a different thickness of feather edge 25 to accommodate a given thickness of stock blanks.

In using the attachment or guide 14, it is preferable to adjust the rolls 2 and 3 to obtain a slight taper therebetween somewhat as diagrammatically illustrated in Fig. 8. Here the rolls 2 and 3 are adjusted to the thickness of the metal blank 24 at the location 28, while slight frictional clearance is provided at the location 29 across the width of the blank 24. This produces a positive feed or pull of the outer area portion 30 of the blank as shown in Fig. 6, while providing a certain amount of adjustable slippage at the point 31 along the inner area portion of the blank 24. With this particular arrangement of the rolls in conjunction with the guide 14, the conical metal blank will better adjust itself while being bent into the conical form illustrated in Figs. 6 and 7.

Under normal conditions of operation, a blank such as 24 would be drawn directly through the rolls of the machine in the direction of the broken arrow 32 as indicated in Fig. 6. This is normal to the axes of the rolls. However, with the embodiment of the guide structure 14 which is disposed in the path of a portion of the blank 24, this guide causes the blank to turn generally about its virtual center of curvature 33 or generally in the direction of the arrow 34. Furthermore, the curvature of the camming surface 20 of the guide 14 may be equal to the smaller curvature 35 of the blank 24 or preferably at some curvature less or sharper than the curvature 35 and, for example, having an arcuate contour substantially as best illustrated in Fig. 6. Normally, the outer curved edge 36 of the blank is concentrically formed with the curvature of the edge 35 and the terminal end portions 37 and 38 of the blank 24 are arranged radially to the virtual center of curvature 33.

Therefore, through the use of the cone rolling attachment supported in fixed relation in a path for partial contact with a movement of the blank through the forming rolls of this machine, this blank is turned or skittered through the feed rolls and properly formed into a conical structure of predetermined dimensions. Feeding like size blanks in a like manner produces a plurality of cones having the same physical characteristics with reference to shape and dimensions.

The foregoing description is directed to a preferred embodiment of the present invention and is given by way of example only. Other changes and modifications are contemplated in the particular arrangement and combination of elements herein shown. All permissible changes and deviations in the fundamental concept of this invention shall be governed by the breadth and scope of the subject matter defined and set forth in the appended claims directed to the device of this invention.

What I claim is:

1. An apparatus for rolling conical structures from stock comprising rolls to form said stock, at least two of the rolls comprising means to feed the stock between said forming rolls, a guide means disposed at the entrance side and ahead of said two feed rolls and in the path of the stock for operative engagement with a portion of said stock, said two feed rolls functioning to draw said stock therebetween and toward said guide, said guide having one edge acting to continuously turn said stock ahead of said feed rolls, and said guide extending from ahead of said rolls and from the stock feed side thereof to the point of tangency between said feed rolls for effective guiding contact with the stock to such point.

2. An apparatus for rolling conical structure from stock comprising rolls to form said stock, at least two of the rolls comprising means to feed the stock between said forming rolls, a guide means disposed at the entrance side of said two feed rolls and in the path of the stock for operative engagement with a portion of said stock, said two feed rolls functioning to draw said stock therebetween and toward said guide, said guide having one edge acting to continuously turn said stock ahead of said feed rolls, and said guide extending to the point of tangency of said feed rolls for effective guiding contact with the stock to such point, and said one edge of said guide having retaining means thereon to maintain said stock in coacting operative engagement with said guide.

3. An apparatus for rolling conical structures from stock comprising rolls to form said stock, at least two of the rolls comprising means to feed the stock between said forming rolls, a guide means disposed at the entrance side of said two feed rolls and in the path of the stock for operative engagement with a portion of said stock, said two feed rolls functioning to draw said stock therebetween and toward said guide, said guide having one edge acting to continuously turn said stock ahead of said feed rolls, and said guide extending to the point of tangency of said feed rolls for effective guiding contact with the stock to such point, and said one edge of said guide having retaining means thereon to maintain said stock in coacting operative engagement with said guide, said retaining means being arranged along the stock receiving edge of said guide and terminating adjacent the peripheral surface portions of said two feed rolls.

4. An apparatus for rolling conical structures from stock comprising rolls to form said stock, at least two of the rolls comprising means to feed the stock between said forming rolls, a guide means disposed at the entrance side of said two feed rolls and in the path of the stock for operative engagement with a portion of said stock, said two feed rolls functioning to draw said stock therebetween and toward said guide, said guide having one edge acting to continuously turn said stock ahead of said feed rolls, and said guide extending to the point of tangency of said feed rolls for effective guiding contact with the stock to such point, said portion of said guide disposed ad-

jacent the point of tangency of said feed rolls being less in thickness than the thickness of said stock.

5. In an apparatus to roll conical structures from circular segmental stock blanks having curved outer and inner edges, said apparatus comprising rolls to form said blanks, a guide for said blanks, two of said rolls acting to feed said blank between the rolls in one direction, said guide being arranged in advance of said rolls and at the blank entrance side thereof and in the path of a portion of said blank to bodily turn said blank ahead of said feed rolls, and said guide having a curved surface to engage said blank, and said curved surface extending to the point of tangency and between said feed rolls whereby said guide control of said blank is effective from ahead of the blank feed side of said rolls to the point of tangency between said feed rolls.

6. In an apparatus to roll conical structures from circular segmental stock blanks having curved outer and inner edges, and terminating in ends disposed generally radially from the virtual generation center of said curved edges, said apparatus comprising a plurality of rolls to form said blanks, a guide for said blanks, two of said rolls acting to feed the blank between the rolls and in the general direction of said guide, said guide being arranged in the path of a portion of said blank to bodily turn said blank in radial increments ahead of said feed rolls, and said guide comprising an abutment member having a curved surface for camming said blank into said feed rolls, said curved surface terminating in a feather edge adjacent the point of tangency of said feed rolls, and retaining means for said blank cooperating with said curved surface of said abutment member to maintain the blank in active registry with said blank camming surface of said guide.

7. A cone rolling machine comprising forming mechanism to bend a cone blank, said mechanism including at least two coacting rolls arranged for swinging movement toward and away from each other, said two rolls providing feed means to move the blank between the rolls, a guide disposed in the path of said rolls and terminating in a position in between said rolls to cam said blank into a predetermined path of entry ahead of and between said feed rolls, adjustment means for said feed rolls to regulate the angularity of said rolls with respect to each other and at least to separate said rolls to the thickness of the blank at the edge thereof located remotely from said guide, and with slight frictional clearance between said two rolls at the edge of said blank disposed adjacent said guide.

8. A cone rolling machine comprising forming mechanism to bend a cone blank, said mechanism including at least two coacting rolls arranged for swinging movement toward and away from each other, said two rolls providing feed means to move the blank between the rolls, a guide disposed in the path of said rolls and terminating in a position in between said rolls to cam said blank into a predetermined path of entry ahead of and between said feed rolls, adjustment means for said feed rolls to regulate the angularity of said rolls with respect to each other and at least to separate said rolls to the thickness of the blank at the edge thereof located remotely from said guide, and with slight frictional clearance between said two rolls at the edge of said blank disposed adjacent said guide, said guide having a camming edge arranged for operative coaction in the path of said blank with said edge terminating adjacent the point of tangency of said feed rolls.

9. A cone rolling attachment to coact with one pair of rolls of a metal working machine of the character that includes a plurality of forming rolls constructed and arranged to produce elongated curved members from flat sheet-like cone blank stock, said attachment comprising a cam member, fastening means to support said member from said machine and in a predetermined relation with respect thereto, said cam member having a stock guiding surface arranged for direct contact with an edge of the stock, said member having one side thereof formed into a feather edge to extend between said one pair of rolls of said machine, and said stock guiding surface being contiguous with a portion of said feather edge.

10. A cone rolling attachment to coact with one pair of rolls of a metal working machine of the character that includes a plurality of forming rolls constructed and arranged to produce elongated curved members from flat sheet-like cone blank stock, said attachment comprising a cam member, fastening means to support said member from said machine and in a predetermined relation with respect thereto, and said cam member comprising a segmental body defined by an outer curved edge and two radially disposed edges, said outer curved edge comprising cam means arranged for operative contact with one portion of a cone blank, and one of said radial edges including top and bottom concavities to form a feather edge along said radial edge to extend between said one pair of rolls of said machine.

11. A cone rolling attachment to coact with one pair of rolls of a metal working machine of the character that includes a plurality of forming rolls constructed and arranged to produced elongated curved members from flat sheet-like cone blank stock, said attachment comprising a cam member, fastening means to support said member from said machine and in a predetermined relation with respect thereto, and said cam member comprising a segmental body defined by an outer curved edge and two radially disposed edges, said outer curved edge comprising cam means arranged for operative contact with one portion of a cone blank, and one of said radial edges including top and bottom concavities to form a feather edge along said radial edge to extend between said one pair of rolls of said machine, and retaining means connected with said outer curved edge to hold the cone blank in operative registry with the aforesaid edge.

12. A cone rolling attachment for use in conjunction with the rolls of a metal forming machine of the character adapted to produce elongated curved members from flat sheet-like stock members, said attachment comprising a segmental body, supporting means on said machine for said body, said body having at least two radially disposed end walls and a curved outer edge generated from a pivot point at the meeting juncture of said radial walls, said curved outer edge providing operative cam means to guide a metal blank circularly between said rolls, and one of said radial walls including parallel upper and lower concavities together providing a feather edge for insertion between said rolls and to a point adjacent the tangency thereof.

13. A cone rolling attachment for use in conjunction with the rolls of a metal forming machine of the character adapted to produce elongated curved members from flat sheet-like stock members, said attachment comprising a segmental body having at least two radially disposed end walls and a curved outer edge generated from a pivot point at the meeting juncture of said radial walls, said curved outer edge providing operative cam means to guide a metal blank circularly between said rolls, and one of said radial walls including parallel upper and lower concavities together providing a feather edge for insertion between said rolls and to a point adjacent the tangency thereof, and clamp means to secure said body to the machine comprising a slot in said body and along the other wall thereof and at a predetermined angle with respect to said feather edge with clamp screw means carried adjacent the slot.

14. In a metal forming machine having at least two forming rolls and arranged to produce curved units from generally flat stock members each comprising segmental sheets having outer and inner curved edges generated from a remote virtual center point and extending between radially disposed front and back edges radiating outwardly from said center point, an attachment to guide

said sheets through said rolls and to frictionally retard the motion of a sheet at one curved edge in relation to the roll feed speed of the other curved edge, said sheet being initially fed into the rolls by aligning one radial edge of the sheet with the tangency line of said rolls, and said attachment comprising a segment block positioned in advance of said rolls and having one straight edge disposed coincident with the line of tangency of said rolls, and said block having an outer curved peripheral portion leading to said one straight edge thereof and adapted to engage said stock sheet at the inner curved edge thereof, said curved peripheral portion of said segment block having a smaller radius than the radius of said inner curved edge of said stock sheet.

15. In a metal forming machine attachment as set forth in claim 14, but wherein said curved peripheral sheet guiding portion of said block is generated by said smaller radius from a virtual center point disposed upon a line coincident with the line of tangency as established by said forming rolls.

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