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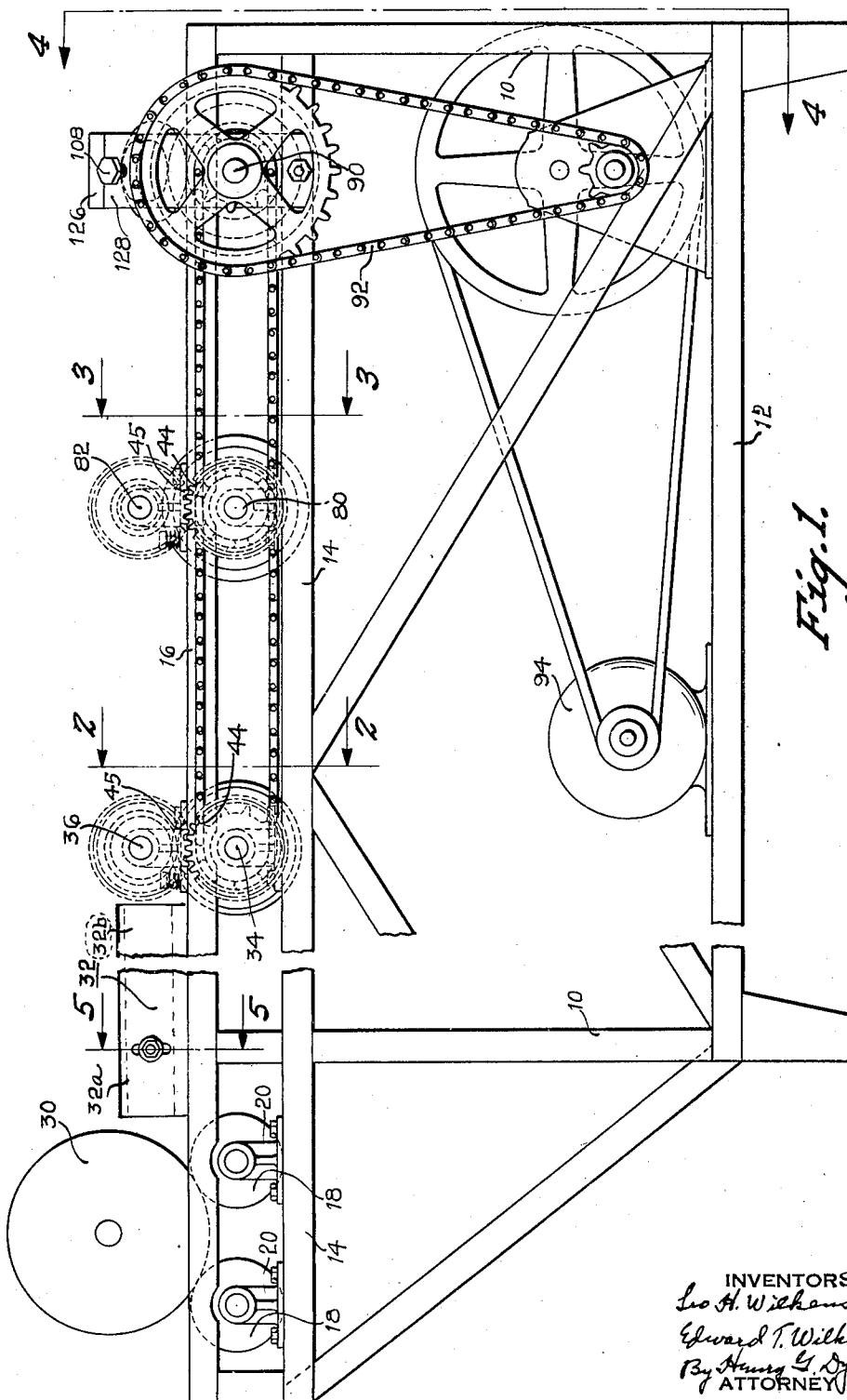
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2,294,324

ROOFING MACHINE

Filed Sept. 12, 1940

2 Sheets-Sheet 1



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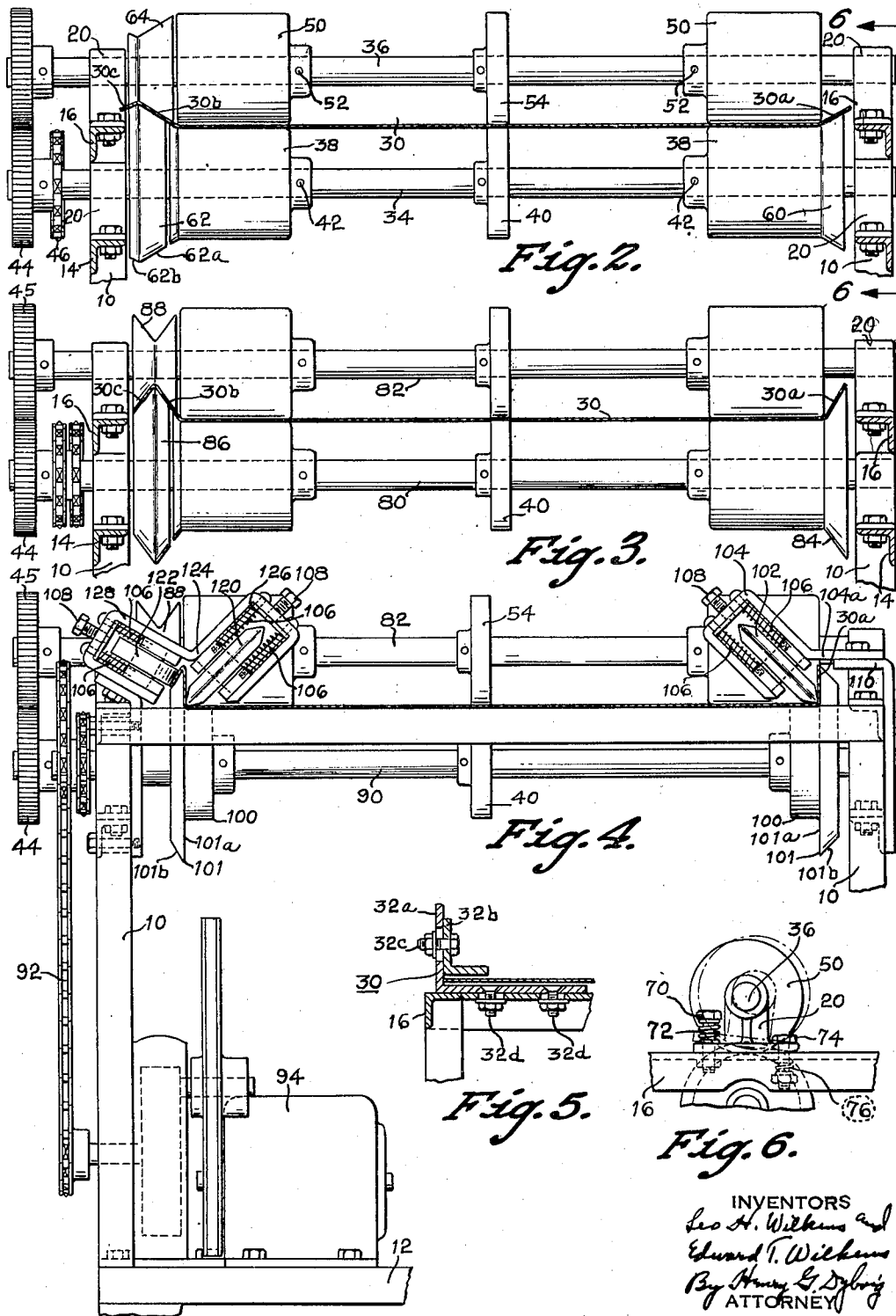
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UNITED STATES PATENT OFFICE

2,294,324

ROOFING MACHINE

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2 Claims. (Cl. 153—28)

This invention relates to a metal forming machine and more particularly to a machine for fabricating continuous length strips of sheet metal into predetermined formation.

An object of this invention is to provide a machine having a plurality of feed rollers for gripping the sheet metal and feeding the same through a series of forming rollers, so as to progressively form the sheet metal into the desired formation.

Another object of this invention is to provide forming rollers driven by contacting the edges of the metal that is being formed.

Another object of this invention is to provide rollers for feeding sheet metal through a forming device, which rollers function both as pulling and pushing type rollers.

Another object of this invention is to provide a metal forming device particularly adaptable for forming fabricated roofing material, which device is dependable, accurate, easily constructed, available at a low price and at the same time efficient.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

Referring to the drawings, Figure 1 represents a side elevation of the metal forming machine, adaptable to form continuous length sheets into any suitable cross sectional area such as required by roofing material and other sheet metal usages.

Figure 2 is a fragmentary cross sectional view of the feeding and forming rollers comprising the first forming stage. This sectional view is taken substantially on the line 2—2 of Figure 1.

Figure 3 is a cross sectional view of the feeding and forming rollers comprising the second stage. This sectional view is taken substantially on the line 3—3 of Figure 1.

Figure 4 is an end view showing the forming rollers of the final stage, as seen in the direction of the arrow 4—4 in Figure 1. In this view some of the frame has been broken away.

Figure 5 is a fragmentary cross sectional view taken substantially on the line 5—5 of Figure 1, so as to show the adjustable guiding mechanism.

Figure 6 is an end view showing the flexible mounting of the feed rollers to permit a transverse seam to be passed through the machine.

Although various attempts have been made to provide a portable metal forming machine for forming roofing material into the desired shape, the majority of metallic roofing material that is laid on buildings such as farm buildings and the

like is either formed at the factory and shipped in predetermined lengths to the destination where it is to be used, or the sheet metal is formed manually on the job. In some sections of the country, most sheet metal roofing material is purchased in rolls and then formed on the job by the use of hand tongs.

Attempts have been made in the past to produce machines that will form sheet metal with the proper flanges, V-notches or grooves. Illustrations of one type of machine that has been attempted is shown in the patent to Reynolds No. 104,647. However, in this machine the forming rollers are integral with the feed rollers. Utilizing some types of metal, this may prove satisfactory; but the present day alloys used in roofing material have been made to withstand corrosion and have only sufficient tensile strength to hold the sheets in position. Such sheet metal is generally protected by a coating of galvanizing material that must be gently handled. Otherwise, the galvanizing material is abraded or scraped off in spots, defeating the purpose of the galvanizing coating. The machines shown in the past, as illustrated by the above referred-to patent, fail to meet present day requirements.

In the drawings, the base of the machine includes a plurality of legs 10 held in suitable spaced relation by spacing members 12 and supporting horizontal angle iron frame members 14 and 16. The frame structure may be braced in any suitable manner, depending entirely upon the requirements of the device. The frame members are preferably made from angle iron, so as to provide a light frame structure, having sufficient strength. The angle frame members 14 support a pair of bearing brackets 20, having journaled therein suitable supporting rollers 18 which are freely rotatable. These rollers are adapted to support a roll of sheet metal 30. The sheet metal from the roll 30 advances between a pair of parallel guides 32, one on each side of the sheet metal, which guide the sheet metal through a well defined path to the feed rollers.

Each of the guides 32 includes an angle bar 32a adjustably mounted upon frame members 16, as clearly shown in Figure 5. This angle bar 32a supports a second angle bar 32b. The angle bar 32b is smaller than the angle bar 32a and is adjustably attached thereto by a bolt 32c. If a narrower or wider sheet of metal is used, the angle bar 32a held in position by the bolts 32d may be adjusted either in the slots or elongated holes shown for the bolts 32d, or these bolts may be inserted in other holes (not shown) provided

therefor, so as to provide the proper spacing between the guides. If the gauge of the metal is changed or for any other reason it is found desirable to raise or lower angle bar 32b, this may be done through the medium of the bolt 32c extending through a suitable slot. By this arrangement, the same machine may be used for forming various widths of sheet metal and various thicknesses of sheet metal. These guides extend from the proximity of the roll 30 to the first stage of the operating mechanism. In the drawings, the frame has been cut for the sake of economy of space, so as to show the whole machine on one sheet. The guides are quite long, so as to accurately align the sheet metal before it reaches the first operating stage. After the sheet metal leaves the guides 32, it passes through several operating stages, progressively forming the sheet metal. The first stage begins the formation. This may be followed by an intermediate stage and a final stage. The number of stages is dependent upon the type of seam to be produced. The first of these stages will now be described.

First stage

The sheet advances through the guides 32 to a plurality of pairs of feed rollers mounted upon shafts 34 and 36. The lower shaft 34 has keyed thereto a pair of end feed rollers 38 and a supporting roller 40. The feed rollers 38 are mounted for axial adjustment on the shaft 34 and keyed in position by suitable set screws 42. The ends of the shaft 34 are journaled in a pair of bearing brackets 20, one adjacent each end. One end of the shaft 34 projects beyond the frame and supports a gear 44 and a sprocket wheel 46. The sprocket wheel is driven from a source of power which will be described more fully later. The upper shaft 36 supports a pair of feed rollers 50 near each end thereof, which rollers are also adjustably mounted and held in position by suitable set screws 52. In addition thereto, the shaft 36 near the center thereof supports a supporting roller 54, preventing the center of the sheet from sagging or bulging. The rollers 50 cooperate with the rollers 38, as do the supporting rollers 54 and 40, to grip the sheet 30 and pull the sheet from the roll of sheet metal and advance it through the machine.

As viewed in Figure 2, the right end of the shaft 34 supports an idle forming roller 60 provided with a bevelled surface and the left end supports a second idle forming roller 62 provided with oppositely disposed conical surfaces 62a and 62b. Rollers 60 and 62 are free to rotate independently of the shaft 34 and independently of the rollers 38. These idle rollers 60 and 62 constitute forming rollers, deflecting the edges of the sheet metal. As may be seen to the right of Figure 2, the edge on the right side of the sheet metal 30 is deflected upwardly slightly and as seen to the left of Figure 2, the left edge of the sheet metal is formed into a slight V-shaped formation. The roller 62, shown to the left, cooperates with an idle forming roller 64, mounted for free rotation upon the shaft 36, to form the left edge of the sheet metal, as viewed in Figure 2. The forming rollers 60, 62 and 64 are rotated by frictionally engaging the edges of the metal. If these rollers were fixedly attached to the drive shafts 34 and 36, the peripheral speed of the bevelled surface of the forming rollers 60 and 62 would be greater than the peripheral speed of the feed rollers 38 and 50.

If the forming rollers were keyed to the shafts, the forming rollers would exert a marginal pull upon the sheet metal, tending to warp, twist, break and mutilate the edges of the sheet metal. Before constructing the machine disclosed herein, a machine having the forming rollers keyed to the shaft and integral with the feed rollers, similar to the disclosure in the patent to Reynolds No. 104,647 was constructed. This machine, with the forming rollers positively driven in unison with the feed rollers, so distorted the metal that it was unfit for use as roofing material. Furthermore, the forming rollers positively driven with the feed rollers destroyed the effectiveness of the galvanized surface of the sheet metal. That being the case, it was found to be absolutely unsatisfactory to use a machine wherein the forming rollers were integral with the feed rollers. This objection was overcome by using idle rollers as forming rollers, which idle rollers are driven by the friction of the sheet metal in the process of formation.

The upper shaft 36 is mounted in bearing brackets 20. These bearing brackets are resiliently mounted upon the angle frame brackets 16. As may be best seen by referring to Figure 6, both ends of the bracket 20 are resiliently mounted upon the frame 16. The left hand end of the bracket 20, as viewed in Figure 6, is held in position by means of a bolt 70 passing through the frame member 16. The head of this bolt 70 cooperates with a spring 72 to urge the bracket 20 into contact with the frame member 16. The opposite end of the bracket is held in position by a bolt 74 cooperating with a spring 76, to resiliently urge this end of the bracket into engagement with the frame 16. This provides a resilient mounting for the shaft 36 and the feed rollers 50.

When all of the metal on the roll 30 has been used, a new roll 30 is placed upon the supporting rollers 18. The ends of the sheet metal 30 are joined by an interlocking seam, as is well known to those skilled in the art. This seam may be four or five times as thick as the average thickness of the metal. As this seam approaches the feed rollers, the springs 74 and 76 yield, so as to permit the feed rollers 50 to spread away from the feed rollers 38, to allow the seam to be fed through the feed rollers. As the feed rollers 50 raise with respect to the feed rollers 38, the idle roller 64 carried upon the end of the shaft 36 is also raised, so as to permit the margin of the sheet metal to pass through the machine and be deflected and formed the same as the balance of the sheet metal.

Second stage

The sheet metal advances from the first stage to a succeeding operating stage. In the second operating stage the mechanism is similar to the parts in the first stage. The forming rollers differ in degree. The mechanism for the second operating stage includes a pair of shafts 80 and 82 supporting feed rollers 38 and 50 and the supporting rollers 40 and 54 identical to those already described. The shaft 80 supports idle rollers 84 and 86, similar to idle rollers 60 and 62; but provided with a larger or steeper forming surface. The upper shaft 82 supports a grooved forming roller 88. The forming rollers 84, 86 and 88 are mounted for free rotation upon their respective shafts. The ends of the shafts 80 and 82 are provided with suitable gears 44 and 45, which are driven in a manner similar to that de-

scribed in connection with the shafts 34 and 36. As the sheet passes through the second stage of operation, the flange to the left of the sheet is formed through an angle of substantially 60° with respect to the main body of the sheet. Likewise, the margin to the left of the sheet has been formed into a more abrupt angle. It is desirable to have the margin 30a on the right hand side of the sheet formed into a flange extending normal to the main body portion of the sheet. Likewise, the portion 30b should extend in a direction normal to the main body of the sheet and the portion 30c should form a reentrant flange. The final operation of the sheet is performed in a third stage by a mechanism now to be described.

Third stage

In the third stage there are no feed rollers corresponding to the rollers 38 and 50. This third stage includes a driven shaft 90, driven from a suitable chain 92 from an electric motor 94. This motor supplies power to all the stages through suitable chain drives, as clearly shown in Figure 1. In the third stage no top shaft, corresponding to the shafts 36 and 82 in the other stages, has been used. The lower shaft 90 has keyed thereto forming rollers 100 which are provided with flanges 101. These flanges 101 are provided with a radially disposed surface 101a forming a right angle corner with respect to the peripheral surface of the main body portion of the rollers 100. This forms an abrupt corner, so that when the metal is forced into this corner a flange is formed normal to the main body portion of the metal. The flanges 101 have also been provided with a bevelled surface 101b. For the particular type of seam formed on the sheet metal shown herein, the bevelled surface 101b of the roller shown to the right of Figure 1 has no particular utility. However, for the sake of economy in production, the rollers 100 located on the left hand side and to the right hand side are identical. The forming roller 100 and its flange 101 located on the right hand side of the machine, as viewed in Figure 4, cooperates with a forming wheel or roller 102 provided with a pair of bevelled surfaces forming a right angle with respect to each other to form the flange 30a in a direction normal to the main body portion of the sheet. This forming wheel 102 is driven by the frictional contact with the sheet that is pushed through the third stage by the feed rollers described in connection with the first and second stages. The forming wheel 102 is mounted so that its axis of rotation forms an angle of approximately 45° with respect to the axis of rotation of the shaft 90. This forming wheel 102 is mounted in a yoke 104 and biased into the corner of the sheet metal by a pair of springs 106, tensioned by a suitable set screw 108. One fork of the yoke 104 is provided with an extension 104a mounted upon a bracket 110 attached to the side of the angle frame members 14 and 16. If additional pressure is required to properly form the flange 30a, this set screw 108 is tightened. If the roller 102 exerts too great a pressure so as to tend to mutilate the surface of the metal or too much force is required to feed the metal through the third stage, the tension upon the roller 102 may be eased by loosening the screw 108.

The forming roller 100, located on the left hand side of Figure 4, cooperates with a pair of idle forming rollers or wheels 120 and 122 to form the left hand margin of the sheet metal into the proper formation. The forming rollers 120 and

122 are supported in a supporting member 124 having a pair of yoke portions 126 and 128. The yoke portion 126 corresponds to the yoke 104 as far as its forming wheel is concerned. A pair of helical springs 106 biases the forming roller 120 into a corner of the sheet metal 30. The tension of these springs may be adjusted by a suitable set screw 108, substantially identical to the one already described in connection with the forming roller 102. The contour of the forming roller 120 is substantially identical to the contour of the forming roller 102 in that the forming roller 120 has been provided with a pair of bevelled edges extending at right angles to each other. The forming roller 122 is also biased against the bevelled surface 101a by a pair of springs 106, the tension of which is adjusted by a set screw 108. The contacting surface of the roller 122 is flat, in that the contacting surface of this roller is parallel to the longitudinal axis of rotation of the roller 122.

As the sheet metal passes out of the forming machine, it is preferably cut into proper lengths. The machine is well suited for forming a sheet passing rapidly through the machine. In one machine that has been constructed, forty to fifty feet advances through the machine per minute. This production could undoubtedly be speeded up for some types of work. In the first two stages the idle rollers rotate about an axis common to the axis of rotation of the feed rollers. In the third stage some of the forming rollers rotate about an axis parallel to the axis of rotation of the feed rollers and the forming rollers on the opposite side of the sheet are mounted for rotation about an axis forming acute angles with respect to the first mentioned axis.

By a slight modification and rearrangement of the rolls, the device disclosed herein could be utilized in manufacturing other articles from sheet metal, as for example, spouts for gutters or eave-troughs. The rollers then, of course, would be adjusted so as to operate upon a narrower strip, so that the finished product would simulate conventional eave-troughs. Furthermore, the device may be modified to produce other shapes and dimensions, without departing from the principles disclosed herein.

Although the preferred modification of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described our invention, we claim:

1. A sheet metal forming machine for forming a metal strip with complementary parts of a standing seam for sheet metal roofing, said machine including a frame, means mounted in the frame for supporting a roll of continuous length sheet metal and three stages of sheet metal forming means mounted on said frame, each of two of said stages including a pair of parallel shafts, a pair of sheet metal feed rollers fixedly mounted on each shaft, the pair of feed rollers on one shaft cooperating with a like pair of feed rollers mounted on the other shaft of the same pair of shafts, and idly mounted forming rollers mounted for rotation on certain of said shafts adjacent the feed rollers and cooperating therewith to partially form the aforesaid complementary parts of the seam, the third stage including a driven shaft

parallel to said parallel shafts, a pair of driven flanged forming rollers fixedly secured to said shaft, said forming rollers being positioned on one side of the sheet, idle forming rollers located on the other side of the sheet, means for supporting said idly mounted forming rollers upon axes of rotation forming acute angles with the axis of rotation of the driven forming rollers and in cooperating relationship with one of the flanged rollers to form one part of the complementary parts of the seam, and a third idle forming roller, means for mounting said third idle forming roller at an angle with respect to the axis of rotation of the driven forming rollers, said idle forming rollers cooperating with the bevelled edge of the flanged portion of the other driven forming roller to finish the forming operation of the other part of the complementary part of the seam prior to the laying of the roofing.

2. A forming machine for forming a strip of sheet metal with complementary parts of a standing seam, said formed sheet having a standing flange along one edge and an inverted V-portion along the opposite edge, said machine including two pairs of parallel shafts, means for driving said shafts, a pair of sheet metal feed

rollers fixedly mounted on each shaft, the pair of feed rollers on one shaft cooperating with a like pair of feed rollers mounted on the other shaft of the same pair of shafts, and idly mounted forming rollers mounted for rotation on certain of said shafts adjacent the feed rollers and cooperating therewith to partially form the aforesaid complementary parts of the seam, finishing means including a pair of rollers having flanges, a shaft for supporting said rollers having flanges, means for driving said shaft and the rollers having flanges, one of said flanges being bevelled, idle forming rollers cooperating with said roller having a bevelled flange, means for supporting said idle forming rollers at an angle of approximately 45° with respect to the axis of rotation of the rollers having flanges and in a manner to cooperate with said bevelled flange to form the V-portion of the standing seam, a third idle roller cooperating with the other roller having a flange to form the standing flange on the opposite edge of the sheet, and means for supporting said third roller in contact with the standing flange abutting the adjacent roller having a flange.

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