APPARATUS FOR MAKING STRUCTURAL SHAPES

FIG. 1.

FIG. 2.

INVENTOR:
DAVID L. MERCER,

BY:
John E. Jackson
his Attorney.
APPARATUS FOR MAKING STRUCTURAL SHAPES

D. L. MERCER

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FIG. 3

FIG. 4

INVENTOR:

DAVID L. MERCER,

BY

John E. Jackson

his Attorney.
FIG. 7.

FIG. 8.

INVENTOR:

DAVID L. MERCER,

BY:

JOHN E. JACKSON

his Attorney.
This invention relates to apparatus for cold forming steel plate or strips and the like into structural shapes and more particularly to apparatus which will form channels, angles, and Z's.

Various apparatus comprising a series of roll stands for cold forming steel plate or strips into structural shapes has heretofore been proposed. However, such prior art apparatus has been limited on its use as different sets of rolls have been required to form different shapes, and the design thereof was such that an undue amount of time was required to adjust the apparatus to accommodate plates of strips of different gauge and to change the apparatus to form different shapes or sections. Such apparatus was also subject to rapid wear because of slippage between the forming members and the strip, which slippage also resulted in undesirable marking of the product while being formed.

It is accordingly amongst the objects of the present invention to provide apparatus which is simple in design, economical to operate and which has increased roll life together with improved surface finish on the formed product.

It is a further object of the present invention to provide forming apparatus which can by simple adjustments be adapted to form channels, angles or Z's with the same rolls.

The foregoing and further objects will be apparent from the following specification and drawings, wherein:

Figure 1 is a schematic showing of a cold forming mill of the type to which my invention is applicable;
Figure 2 is a front elevation of a preliminary bending stand for channels;
Figure 3 is a front elevation of a preliminary bending stand for angles;
Figure 4 is a front elevation of preliminary bending stand for Z's.

Figure 5 is a front elevation of forming stand for channels;
Figure 6 is a front elevation of forming stand for angles;
Figure 7 is a front elevation of forming stand for Z's;
Figure 8 is a side view of Figure 7 showing the idler roll mounting;
Figure 9 is a development of the formation of angles;
Figure 10 is a view similar to Figure 9 but showing the development of channels; and
Figure 11 is a view similar to Figures 8 and 10 but showing the development of Z's.

Referring more particularly to the drawings, the numeral 2 designates a series of closely disposed and longitudinally aligned roll stands composed of oppositely disposed, vertical housing members 4 mounted on a suitable foundation 5.

Reciprocally mounted between each pair of housing members 4 are two bearing blocks 8 which are vertically adjustable by conventional screw-downs 16 and separating threads 15 suitably journaled in the bearing blocks 8 and extending between blocks in the oppositely disposed housing members are power-driven roll shafts 14.

In the arrangement shown, the first three stands as shown in Figures 2, 3 and 4 are preliminary bending stands in which the passes and roll members are formed as follows. The roll shafts 14 have shoulders 16 adjacent the inner side of one of the housings and are provided with screw-threaded jam nuts 18 adjacent the inner face of the opposite housing. The roll members are formed of roll segments A having a work contacting face A1, which is parallel to the axis of rotation and an obliquely disposed work contacting face A2, which diverges toward the roll shaft, the contained angle between the two faces being an obtuse angle. Roll segments B which have an oblique work contacting face which is complementary to the angle of face A2 and segments C which have a work contacting face C1, which is parallel to the axis of rotation. The roll segments are properly spaced by spacers D, the outer diameter of which is slightly less than that of segments C and faces A1 of segments A. These roll assemblies are positioned intermediate the shoulders 16 and jam nuts 18 by U-shaped spacer collars E. Lateral adjustment of the assembly may be secured by U-shaped shims F. Roll segments A, B and C, and spacers D and E are preferably keyed to the shaft to insure rotation thereof, as indicated by the numeral 20.

A preliminary bending assembly for forming channels is shown in Figure 2. This comprises two each of segments B and C on the lower shaft, and two segments A on the upper shaft. In this as well as in the following assemblies, it is of course understood that the relative positions of the segments could be reversed, that is the segments on the lower shaft could be on the upper shaft and vice versa. An assembly for preliminary bending of angles is shown in Figure 3. This is similar to the foregoing except that the right hand segment B has been removed from the lower shaft. In Figure 4 there is shown an assembly for preliminary forming of Z's. This is similar to the assembly for forming channels ex-
cept that the right hand segments B and C have been moved to the upper shaft in place of the upper right hand segment A which has been moved to the lower shaft.

It is apparent from the foregoing figures that there is a difference in speed relationship in such assemblies between faces A1 and C, A2 and B. That is to say, since each segment rotates at the same speed the oblique faces will have a different surface speed than the faces which are parallel to the axis of rotation. This must be compensated for by relative slippage between the work contacting faces and the workpiece which causes increased wear of the work contacting faces and marking of the workpiece. However, this is not sufficient to be appreciable so long as the angle $\phi$, that is the angle formed by faces A1 and B with respect to the axis of rotation, is not over about 50°. In the arrangement shown, the first three stands are assembled in the foregoing manner with the angle $\phi$ increased somewhat in each stand. The number of stands and passes required for such preliminary bending and complete forming will very depend on the gauge and material being formed.

Due to the foregoing effect of the change in relative speed relationship as the angle $\phi$ increases, a different assembly is used for the remainder of the forming stands as shown in Figure 5. These are generally similar to the preliminary bending stands in that roll segments A and spacers D and E are used. No segments B and C are used since each of the assemblies has two pairs of the A segments. Faces A1 cooperate with opposing faces A2 to act as pinch rolls and feed the workpiece forwardly and idler rollers H are selectively positioned against the upper or lower faces A1 in accordance with the shape desired. The faces of the rollers H are normal to the faces A1 with which they cooperate.

A preferred manner of positioning the rollers H is shown in Figures 5, 6, 7 and 8. Two channel bars 22 are bolted as at 24, or otherwise secured to adjacent housings 4 and extend across the width of the roll stands. The channel bars have their flat faces in opposed relationship and have T-shaped slots 26 opening into the flat faces adjacent each corner. Brackets 28 composed of two pairs of V-shaped legs 30 connected at the open end by bars 22 are carried by the channel bars 22 by bolts 36, the heads of which are slidable contained in the slots 26 adjacent each side of a stand. Thus, the V-shaped legs straddle a roll shaft 14 and the idler roller H rotatably mounted thereon adjacent the closed end of the legs is thereby properly positioned to cooperate with the adjacent face A1. Further adjustment and provision for thrust is obtained by screws 34 extending through housing members 4 into engagement with the brackets 28. The brackets and rollers H are so designed that they may be mounted on either the upper or the lower channel bars 22. When mounted on the upper channel bar, the roller H cooperates with the lower roll face A1, and when mounted on the lower channel bar, the roller H is placed in cooperative relationship with the face A1 of the upper roll segment. Thus it is seen that by merely changing the location of the rollers H or removing them, a change in shape is effected. Figure 5 shows both rollers mounted on the lower bars to adjust the rolls for forming channels. Figure 6 shows the stand assembled with only one roller to form angles and Figure 7 is similar to Figure 5 except that the right hand roller has been moved to the upper bar to adapt the stand to form Z's.

From the foregoing, it is seen that I have provided apparatus for forming structural shapes which is simple in design, easy to adjust for various sizes and which permits the same rolls to be used for forming channels, angles, or Z's by merely changing the position of an idler roll in each stand.

While I have shown and described one specific embodiment of my invention, it will be understood that this embodiment is merely for the purpose of illustration and description and that various other forms may be devised within the scope of my invention, as defined in the appended claims.

I claim:

1. The combination with a pair of forming rolls having shafts journaled in a pair of housings, at least one of which is power driven, said rolls having cooperative work engaging faces constructed and arranged to advance a workpiece and oppositely disposed diverging oblique faces at each end of each of said rolls, each of said faces diverging towards its respective shaft to form a V-shaped opening therebetween and idler rolls mounted intermediate said shafts adapted to cooperate with said oblique faces to form a workpiece as it is advanced by said work engaging faces and means for mounting said last named rolls to selectively place them in cooperative relationship with the oblique face of either the upper or lower forming rolls to bend the outer flange portion of a workpiece upwardly or downwardly to form angles, channels or Z's as desired.

2. A roll stand comprising a pair of housings, a pair of roll shafts journaled in said housings and extending therebetween, a pair of roll segments mounted on each of said shafts and aligned with the segments on the other shaft, each of said segments having a face portion which is parallel to the face portion of the oppositely disposed segment on the other shaft and an oblique end face which extends toward its respective shaft oppositely disposed to the oblique face of the opposing segment, said oblique faces diverging to form a V-shaped opening between the outer ends of the oppositely disposed roll segments, an idler roll disposed at either end of said pair of segments with a working face substantially normal to one of said oblique faces and means for mounting said idler rolls intermediate said roll shafts to cooperate with either the oblique face of the upper or lower roll segment to bend the outer flange portion of a workpiece upwardly or downwardly to form angles, channels or Z's as desired.

3. A roll stand comprising a pair of housings, a pair of roll shafts journaled in said housings and extending therebetween, a pair of roll segments mounted on each of said shafts and aligned with the segments on the other shaft, each of said segments having a face portion which is parallel to the face portion of the oppositely disposed segment on the other shaft and an oblique end face which extends toward its respective shaft oppositely disposed to the oblique face of the opposing segment, said oblique faces diverging to form a V-shaped opening between the outer ends of the oppositely disposed roll segments, an idler roll disposed at either end of said pair of segments with a working face substantially normal to one of said oblique faces and means for mounting said idler rolls intermediate said roll shafts and cooperating with either the oblique face of the upper or lower roll segment to bend the outer flange portion of a workpiece upwardly or downwardly to form angles, channels or Z's as desired.
said roll shafts to cooperate with either the oblique face of the upper or lower roll segment to bend the outer flange portion of a workpiece upwardly or downwardly to form angles, channels or Z's as desired, said last named means comprising a pair of oppositely disposed bars mounted on each side of said housings and extending therebetween and a bracket carrying said idler roll adapted to be mounted on the two upper channel bars or the two lower channel bars.

4. Apparatus for forming metal stock comprising a plurality of aligned roll stands, each of said stands comprising a pair of housings, a pair of roll shafts journaled in said housings and extending therebetween, a pair of roll segments mounted on each of said shafts and aligned with the segments on the other shaft, each of said segments having a face portion which is parallel to the face portion of the oppositely disposed segment on the other shaft and an oblique face portion defining a V-shaped opening between the outer ends of the oppositely disposed roll segments, an idler roll disposed at either end of said pair of segments with a working face substantially normal to one of said oblique faces and means for mounting said idler rolls to cooperate with either the oblique face of the upper or lower roll segment to bend the outer flange portion of a workpiece upwardly or downwardly as desired, said last named means comprising a pair of oppositely disposed channel bars extending between the opposing faces of adjacent roll stands and connected thereto and a V-shaped bracket carrying said idler roll adapted to straddle a roll shaft adjustably mounted on the upper or lower channel bars connected to the opposite sides of the housing in which said shaft is mounted.

DAVID L. MERCER.

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