

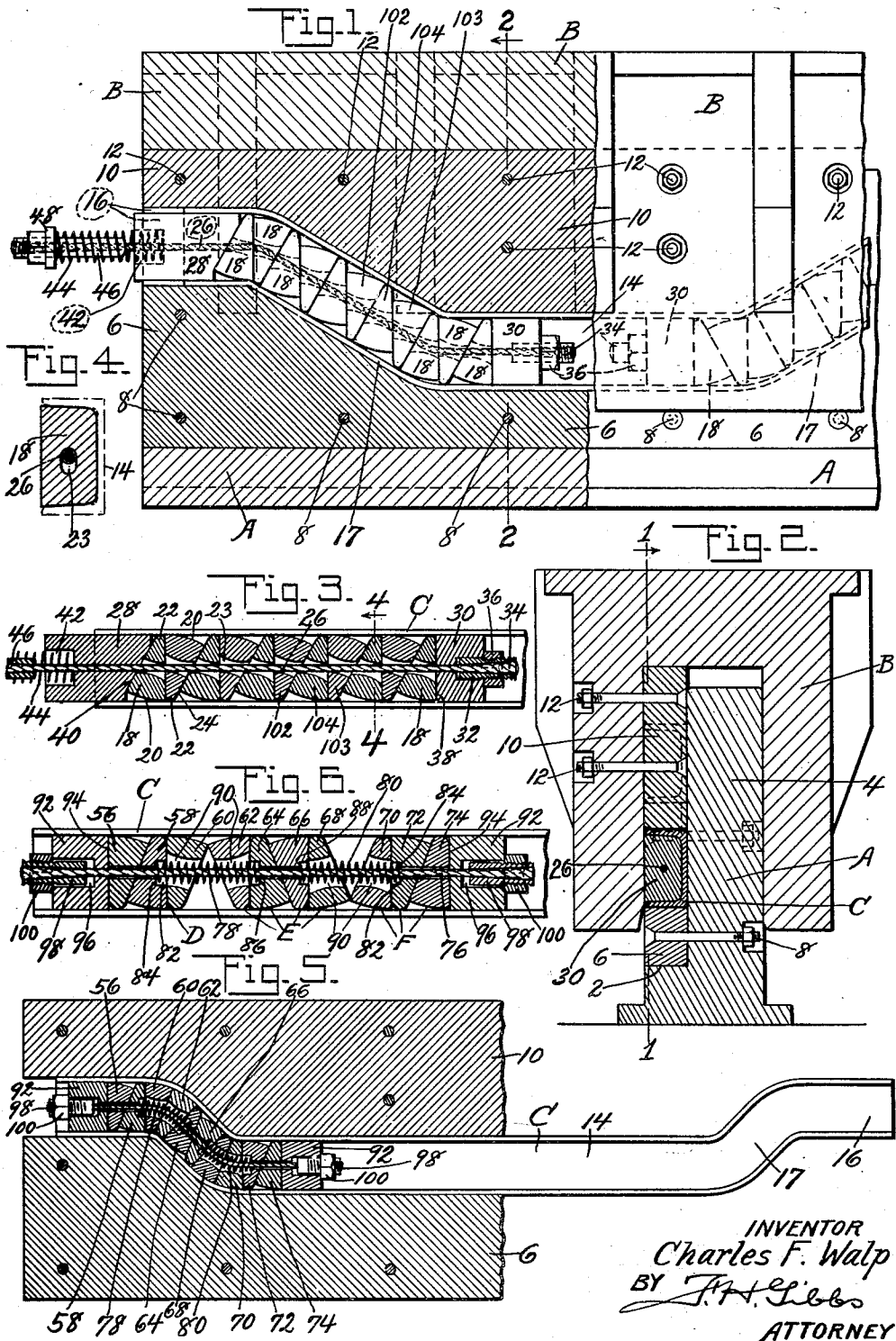
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FLEXIBLE MANDREL

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FLEXIBLE MANDREL

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This invention relates generally to bending metal channels into predetermined form, and has particular reference to a mandrel or former to be inserted into a metallic channel to reinforce the latter from within to prevent buckling or distortion thereof while it is being bent.

One object of the invention is to provide a flexible mandrel of the type or character referred to, in which a substantially continuous smooth surface is provided which will contact with the flanges and web of the channel during the bending operation.

Another object of the invention is the provision of a flexible mandrel or former for reinforcing or bracing the flanges and web of a channel while the latter is being bent into predetermined form, in which the elements thereof will contact with the oppositely arranged flanges of the channel at all times during the pressing operation, whereby to prevent distortion of the channel.

A further object of the invention is the provision of a flexible mandrel or former for reinforcing or bracing the flanges and web of a channel while the latter is subjected to the action of pressing or forming dies; which mandrel is formed of a plurality of separate and independent relatively movable elements in the form of blocks normally arranged in spaced series each comprising a plurality of said blocks.

A still further object of the invention is the provision of a mandrel formed of spaced series of blocks which are relatively movable within a channel when the latter is subjected to the action of forming dies to position said series adjacent each other and in conformity with the shape of the finished channel.

Still another object of the invention is the provision of a flexible mandrel of the character and for the purpose indicated, which is formed of a plurality of alternately arranged blocks loosely mounted on a flexible element whereby when a channel in which the mandrel is seated is subjected to the action of pressing or forming dies, said blocks move relatively to each other to conform to the shape of the finished channel during

pressing and sustain the channel against distortion.

Other objects and advantages of this invention will be apparent from the following description, taken in conjunction with the accompanying drawings in which:

Fig. 1 is a view partly in front elevation and partly in vertical section, showing the forming dies and the flexible mandrel, the sectional portion of the figure being taken on the line 1—1 of Fig. 2;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a front elevation of a channel, before bending, showing the flexible mandrel positioned therein in section;

Fig. 4 is a sectional view of the channel and mandrel, taken on the line 4—4 of Fig. 3, the channel being shown in broken lines;

Fig. 5 is a side elevation of a bent channel showing the forming dies, and a modified form of flexible mandrel in section; and

Fig. 6 is a side elevation of a channel before bending showing in section the mandrel shown in Fig. 5.

Referring now more particularly to the drawings in which similar characters of reference designate similar parts in the several views, the device of the present invention is employed in association with forming dies comprising a stationary male die block A and a movable female die block B between which blocks A and B the channel C to be bent is placed.

The metal die block A is so formed as to provide a seat or base 2 and a backing plate 4, the base 2 supporting a variable die 6 which is secured against displacement by suitable means such as the bolts 8 having their ends countersunk in the backing plate 4 and die 6, as clearly shown. The other variable die is shown at 10, and the same is secured to the female die block B by bolts 12 or the like to move therewith to bend the channel C into predetermined form. In the instance shown, the article to be formed is a channel side piece or cross bar for a truck frame, and the formed channel comprises the main portion 14 having the offset end portions 16 connected by the bends 17 and the variable dies are

correspondingly shaped to effect this structure, as will be apparent.

In the forming of channels of the type shown, it is desirable to reinforce the same to prevent distortion during pressing, especially at the bends 17 and the offset ends 16, and to effect this, I provide flexible mandrels of the type shown more clearly in Figs. 3 and 6 to be inserted in the ends of the channels.

Referring now to the mandrel shown in Figs. 1 and 3, the same comprises substantially a plurality of blocks 18 which are generally triangular or wedge shaped in form, each thereof having arcuate base and top portions 20 and 22 respectively and straight sides 24. As shown in the drawings, the blocks are alternately arranged, that is, the base 20 of one block is arranged adjacent the top 22 of the next adjacent block and so on. The blocks are each provided with enlarged openings 23 therethrough by which they may be mounted on a flexible cable 26, the ends of which cable extend through sizing heads 28 and 30 respectively. The sizing head 30 is provided with a recess in the outer face thereof in which the inner end of a keeper 32 is positioned. The keeper 32 is tubular being provided with an opening therethrough which tapers from the outer end towards the inner end, and one end of the cable 26 extends through the aperture as clearly shown; said end being swelled or enlarged at 34 in any suitable manner whereby to prevent the cable being withdrawn from the keeper. The outer end of the keeper is externally threaded to secure an adjusting nut 36 adapted to bear against the outer face of the sizing head 30 for an obvious purpose, the sizing head being provided with a vertically arranged inner face 38 against which the end block 18 bears.

Referring now to the sizing head 28, it can be seen in Fig. 3 that the inner face thereof is undercut at an acute angle to the vertical as shown at 40 to bear against the side of the adjacent end block 18, and in this connection, it can be seen that when the flexible mandrel is arranged in the channel before the latter is bent, the several blocks 18 incline slightly at an acute angle to the vertical; the angle of inclination being determined not only by the relative size of the base and top portions of the blocks but also by the inner face of the sizing head 30, and the shape of the inner face of the sizing head 28 is determined in accordance therewith. It will be apparent, therefore, that the angular inclination of the blocks with respect to the vertical plane therethrough is susceptible of many variations.

The outer face of the sizing head 28 is recessed as at 42 to provide a seat for a spring 44 which surrounds a socket 46 through which and to which the opposite end of the cable 26 extends and is secured. The socket is provided with a nut 48 forming a spring seat, as will be obvious.

Referring now to the type of mandrel shown in Figs. 5 and 6, it can be seen that the same comprises series of blocks indicated at D, E and F; D and F being end series and E an intermediate series.

Each end series, in the instance shown herein, includes three alternately arranged blocks of triangular or wedge shaped form arranged side by side, and the end series D and F are arranged at an angle inclined to the vertical plane through the blocks while the intermediate series E is composed of four blocks arranged at substantially the same angle of inclination but in a reverse direction, as clearly shown in Fig. 6.

The blocks forming the several series have been designated as 56, 58, 60, 62, 64, 66, 68 and 70, 72 and 74, and all of them are mounted on a flexible cable 76 and retained thereon as hereinafter described. The several series are retained in spaced relation by means of coil springs 78 and 80 interposed between series D and E, and E and F respectively, and through them the cable 76 extends. In order to mount the blocks on the cable, the blocks are provided with openings and to permit the springs 78 and 80 to be seated, the middle block of each end series is provided with a recess 82 to define a spring seat 84, and the blocks 64 and 66 are also provided with recesses to define spring seats 86 and 88 respectively; springs 78 and 80 being positioned between series D and E and E and F respectively by means of the spring seats and in such a manner as to retain said series in spaced relation. The mandrel is adapted to flex as shown in Fig. 5 and therefore the adjacent blocks of each series are provided with enlarged openings 90 for an obvious purpose.

Sizing heads 92 are provided for retaining the several parts of the mandrel in assembled relation, the heads having straight or vertical inner faces 94 against which the end blocks 56 and 74 bear, said heads being of such size as to fit within the channel and engage the flanges or chords thereof. Each head 92 is provided with a recess 96 which takes one end of a tubular socket 98 in which the ends of the cable are secured, and adjusting nuts 100 engage the outer threaded ends of the sockets 98 and bind against the outer faces of the heads 92 for an obvious purpose.

In forming channels of the type shown in Fig. 5, it is desirable that during the pressing operation, the flanges or chords of the channel be reinforced at all points to prevent distortion, and the use of the mandrels shown in Figs. 3 and 6 permits the flanges to be engaged during the pressing operation to reinforce or brace the flanges against distortion; the mandrels providing a substantially continuous surface with which the flanges are engaged. By this I do not mean to infer that the entire inner surface of the

chords of the channel are always engaged during the pressing operation for such an arrangement has been found unnecessary, and in fact a continuous engagement of all portions of the inner surfaces of the flanges is not desirable as it may strain the metal of the flanges. I do mean, however, that during the pressing operation, the flanges are continuously reinforced by the mandrel of the present invention in such a manner as to prevent distortion thereof. More particularly the flanges or chords of the channel are subjected to the bracing influence of the working surfaces of the blocks, that is, the tops and bases of the several blocks as each working surface during the pressing operation is contacted by the flanges at successive points, as will be apparent.

In the use of the mandrel shown in Fig. 3, the same is inserted in the channel as shown in said figure, the parts assuming the position clearly illustrated. When the channel is arranged between the dies and the latter brought together to press the channel to the desired form, the blocks 18 will move vertically relative to each other during the pressing operation until the channel assumes the desired form. It can be seen that during the pressing operation, the material of the channel will always be in contact with the arcuate ends of the blocks 18 thereby bracing the channel against distortion. For example, and to clearly show the operation of the blocks during the pressing of the channel, certain of the blocks have been designated as 102, 103 and 104. Before the channel is bent, the blocks 102, 103 and 104 contact with the upper and lower chords of the channel in a manner and at points clearly shown in Fig. 3, and the top of the block 104 extends beyond the non-contacting portion of the base of the adjacent block 102, and the top of block 102 extends downwardly below the non-contacting portion of the base of block 104. As can be seen in the drawings, the entire working surfaces of the several blocks 18 do not engage the chords of the channel for the reason that they are arcuate in shape, and due to the angular inclination of the several blocks, as before pointed out, the mandrel when inserted in a channel to be bent assumes the position shown in Fig. 3, with only a portion of the bases of the several blocks in engagement with the opposite chords of the channel; certain portions of the bases being shown in non-contacting relation with the chords. The top of each block 18 extends beyond the non-contacting portion of the bases of the adjacent block, with the exception of the two adjacent blocks arranged next to the sizing head 28. This construction can be clearly seen when the blocks 102 and 104 are viewed. Now, upon pressing of the dies, the flanges of the channel will be bent upwardly around the bases and tops of the sev-

eral blocks, thereby moving these blocks vertically relative to each other. Inasmuch as the blocks in cross-section are frusto-conical, and in fact, wedge shaped, the relative movement of the several blocks with respect to each other will cause an expansion or extension of the flexible mandrel due to the fact that the operation is in effect a wedging apart of two spaced blocks by means of an intermediate block. This will accord with the length of the finished channel, as will be apparent. More particularly illustrating this operation, when the dies are brought together, to bend the channel to the form shown in Fig. 1, the upper and lower flanges of the channels will be bent around the bases of the blocks 102 and 103 tending to force them downwardly, while at the same time the lower flanges of the channel will be bent around the base of the block 104 urging the same upwardly in a wedging manner between the straight sides of the blocks 102 and 103, thereby separating the blocks 102 and 103 in an obvious manner. The operation just described is really a series of successive steps, inasmuch as during the bending the block 103 is first acted upon, then the block 104 and finally the block 102, but the action is such that a wedging of the several blocks results. Continuation of the pressing by the dies causes the blocks to assume the position shown in Fig. 1; the blocks contacting with the channel flanges or chords, in the last instance, at points opposite the points shown in Fig. 3, and it will be apparent that those portions of the bases of the blocks which in the first instance were out of contact with the chords, are, at the completion of the pressing operation, in contact with the chords. The blocks during the pressing operation shift successively vertically relative to each other; the operation being, in effect, a bending of the channel, and more particularly the chords thereof, over the working surfaces of the blocks.

During the pressing of a channel in which the mandrel shown in Fig. 6 is employed for reinforcing purposes, the several blocks of the said mandrel shift vertically relative to each other and the several series forming the mandrel will shift horizontally relative to each other until they assume the position shown in Fig. 5. During the pressing operation, the series E will shift radially as well as laterally until the adjacent surfaces of the blocks 60 and 62, and 68 and 70 are arranged in abutting relation; in other words, with the mandrel shown in Fig. 6, the several series shift laterally with respect to each other, the blocks of each series shift vertically and laterally relative to each other, and the intermediate series of blocks E shift radially as a series, and the individual blocks of said series E shift both laterally and vertically relative to each other.

It is believed that the description and operation of the present invention will be fully apparent to those skilled in the art to which it appertains, but it is to be understood that the drawings herein are merely by way of example and that I am not restricted to the specific form shown therein; it being apparent that various changes in the form and proportions of the device may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A flexible mandrel for insertion in a piece of work to reinforce the latter during bending comprising a plurality of blocks formed to provide wide work contacting surfaces arranged in staggered relation with respect to each other, and means retaining the blocks in assembled position at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel, said blocks being shiftable relative to each other during bending of the work whereby the latter successively contacts with various points on the contacting surfaces.

2. A flexible mandrel for insertion in a piece of work to reinforce the latter during bending comprising a plurality of blocks formed to provide wide and narrow work contacting surfaces arranged in staggered relation with respect to each other, and means retaining the blocks in assembled position at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel, said blocks being shiftable relative to each other during bending of the work whereby the latter successively contacts with various points on the contacting surfaces.

3. A flexible mandrel for insertion in a piece of work to reinforce the latter during bending comprising a plurality of blocks alternately arranged to provide wide work contacting surfaces arranged in staggered relation with respect to each other, and means normally retaining the blocks in assembled relation at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel, said blocks being successively shiftable relative to each other during bending of the work.

4. A flexible mandrel for insertion in a piece of work to reinforce the latter during bending comprising a plurality of blocks arranged to provide wide work contacting surfaces arranged in staggered relation with respect to each other, and means retaining the blocks in assembled relation at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel, said blocks being successively shiftable relative to each other during bending of the work whereby each contacting area provides a plurality of points with which the work successively contacts.

5. In a flexible former, a plurality of blocks of triangular cross section arranged to pre-

sent a plurality of oppositely disposed wide contacting areas arranged in staggered relation with respect to each other, said blocks being normally arranged at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel.

6. A mandrel for the purpose described comprising wedge shaped blocks arranged to present oppositely disposed work contacting areas arranged in staggered relation with respect to each other, a flexible element on which the blocks are mounted, a sizing head at one end of the flexible element and provided with an inner face against which one side of one end block is adapted to rest whereby the same is positioned at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel, a sizing head at the other end of the flexible element provided with an inclined inner face complementary to the inclined side of the adjacent end block, and means urging the last named sizing head into contact with the adjacent end block.

7. A flexible mandrel for insertion in a channel to reinforce the flanges thereof during bending, comprising a plurality of wedge-shaped blocks arranged to present oppositely disposed work contacting surfaces arranged in staggered relation with respect to each other and positioned at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel, and means retaining said blocks in assembled position, said blocks being so mounted as to permit relative vertical and horizontal shifting thereof in the channel whereby some point of the working surfaces thereof is in contact with channel flanges at all times during the bending operation.

8. A flexible mandrel comprising end series of blocks arranged at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel, an intermediate series of blocks inclined in a direction opposite the direction of inclination of the end series, and means normally spacing said series of blocks, all of said blocks being so formed as to be capable of relative shifting.

9. A flexible mandrel for insertion in a piece of work to reinforce the latter during bending comprising a plurality of series of oppositely disposed wedge-shaped blocks arranged at an angle inclined to a plane perpendicular to the longitudinal axis of the mandrel through the work.

10. In a flexible former, a plurality of blocks of triangular cross section arranged to present a plurality of oppositely disposed wide contacting areas arranged in staggered relation with respect to each other, and means for normally retaining said blocks at an angle inclined to a plane perpendicular to the longitudinal axis through the mandrel.

11. A flexible mandrel comprising spaced series of inclined blocks, a series of blocks

intermediate the before mentioned spaced series and inclined in a direction opposite that of said spaced series, and means normally retaining the several series of blocks in spaced relation.

12. A flexible mandrel comprising a plurality of wedge shaped blocks having the larger ends thereof arranged adjacent the smaller ends of the next successive blocks, a flexible element on which said blocks are mounted, and means at the ends of said flexible element for retaining the blocks in assembled relation and at an angle inclined to a plane perpendicular to the longitudinal axis through the mandrel.

In witness whereof I have hereunto set my hand.

CHARLES F. WALP.