

Aug. 25, 1964

D. L. SPRUNG ETAL

3,145,758

APPARATUS FOR CONTINUOUS FORMING OF METAL SHAPES

Filed Jan. 23, 1961

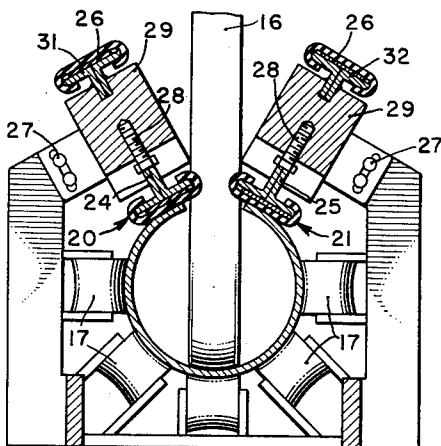
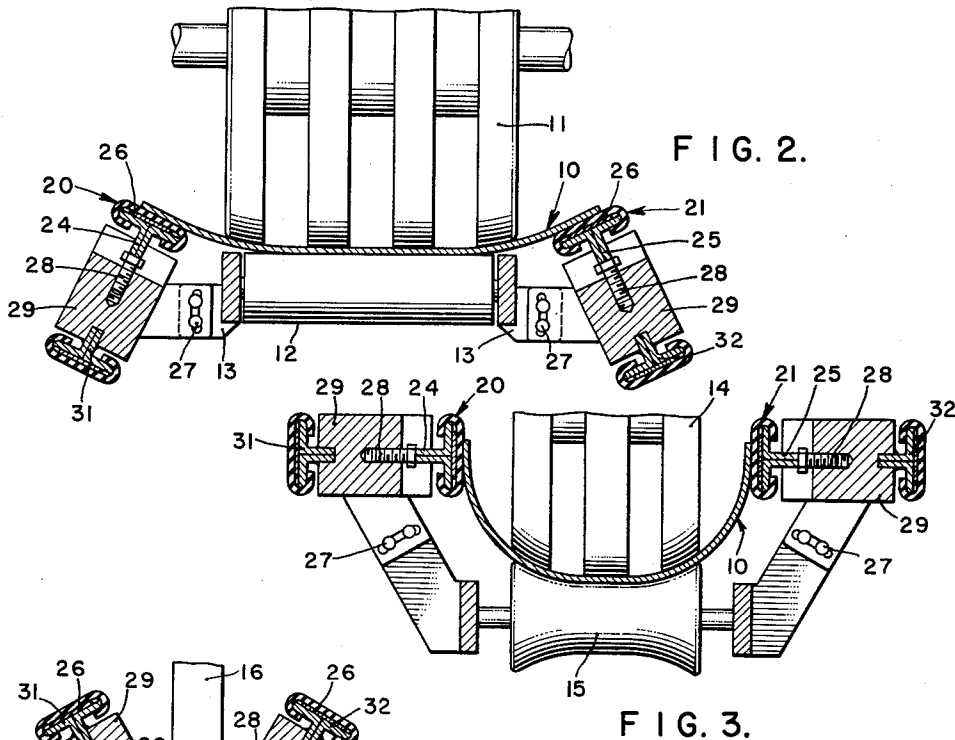
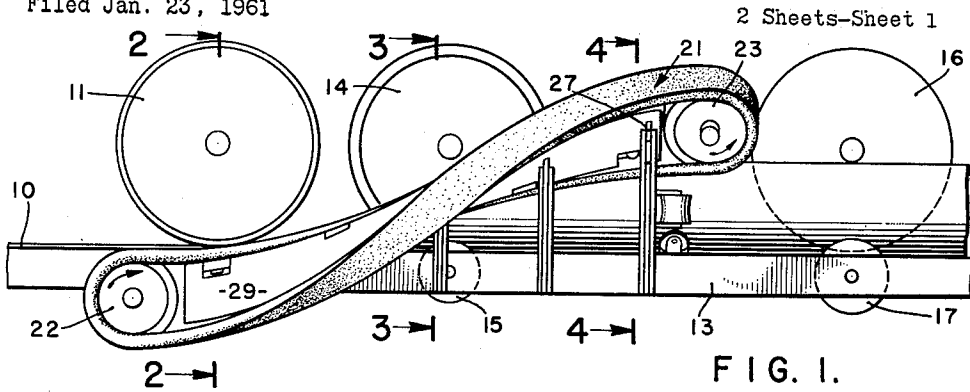


FIG. 4.

INVENTORS.
DOUGLAS L. SPRUNG
CLYDE W. VASSAR
BY
Lyon H. Lyon
ATTORNEYS.

Aug. 25, 1964

D. L. SPRUNG ETAL

3,145,758

APPARATUS FOR CONTINUOUS FORMING OF METAL SHAPES

Filed Jan. 23, 1961

2 Sheets-Sheet 2

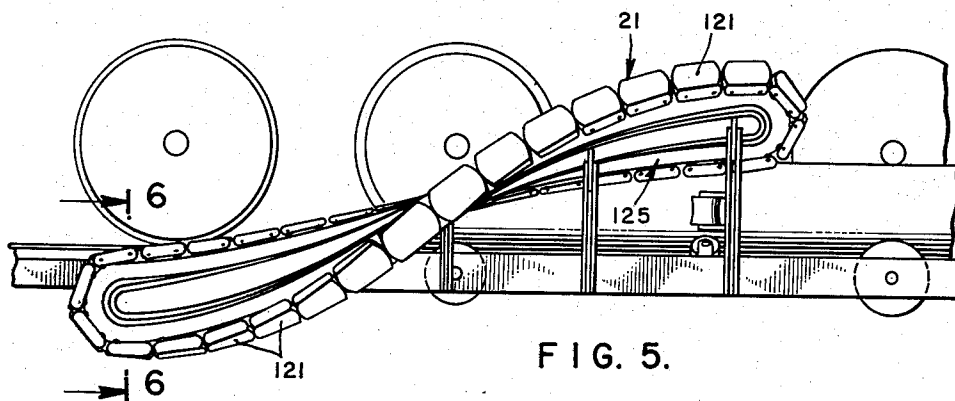


FIG. 5.

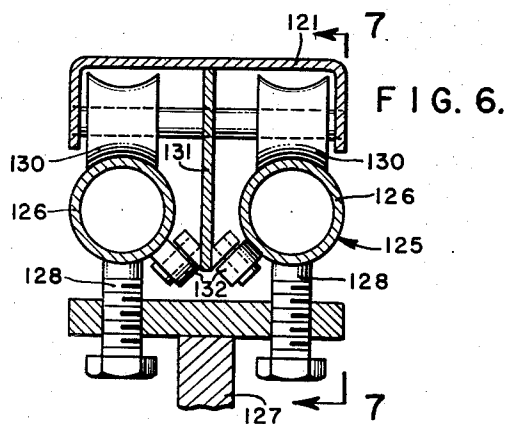


FIG. 6.

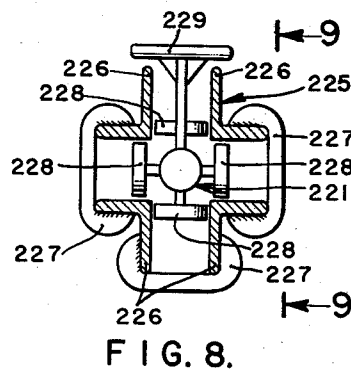


FIG. 8.

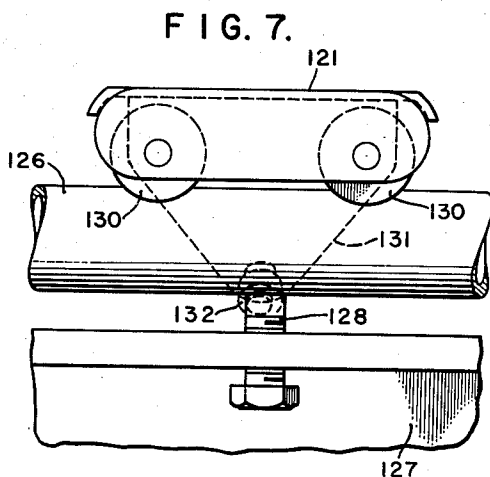


FIG. 7.

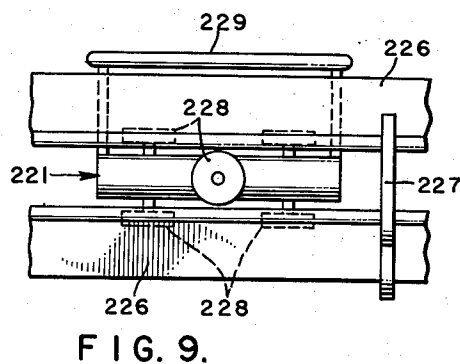


FIG. 9.

INVENTORS.
DOUGLAS L. SPRUNG
CLYDE W. VASSAR

BY

Lyon & Lyon
ATTORNEYS.

1

3,145,758

APPARATUS FOR CONTINUOUS FORMING OF METAL SHAPES

Douglas L. Sprung, Brea, and Clyde W. Vassar, Whittier,
Calif., assignors to Mobile Pipe Corporation, Whittier,
Calif., a corporation of California

Filed Jan. 23, 1961, Ser. No. 84,337

6 Claims. (Cl. 153—54)

This invention relates to apparatus for continuous forming of metal strip or skelp to form elongated metal shapes of any desired cross section. This invention will be described in connection with apparatus for accomplishing the transition of flat skelp to a generally tubular shape for the purpose of making welded pipe or tubing, but this by way of illustration only and not by way of limitation.

The principal object of this invention is to provide an improved apparatus for gradually changing the cross-section shape of a metal strip as it passes through the apparatus, for the purpose of preserving surface smoothness and preventing formation of marks or blemishes.

Another object is to provide such a device in which endless forming elements move with (not relative to) the skelp as it passes through the apparatus, so that the forming elements have substantially no relative movement, either sliding or rolling, with respect to the skelp.

Another object of this invention is to provide such a device which is particularly suited for continuous cold forming of metal strip on a quantity production basis.

In the co-pending application of Clyde W. Vassar, Serial No. 21,389, filed April 11, 1960, and entitled "Mobile Pipe-Forming Apparatus," now Patent No. 3,014,118, there is disclosed a device for making continuous welded pipe from flat strip or skelp, and the device includes apparatus for changing the cross-section shape gradually from the flat cross-section of the pipe. In that application, the change of cross-section shape is accomplished by means of rollers which contact the inner and outer surfaces of the metal and causes it to assume a tubular shape as it passes through the device. The rollers constitute the forming elements and they have rolling contact with the metal as it passes through the rollers. The present invention constitutes an improvement over that device and uses forming elements which travel continuously with the metal strip rather than having rolling contact with it.

Other and more detailed objects and advantages of this invention will appear hereinafter.

In the drawings:

FIGURE 1 is a side elevation in diagrammatic form showing a preferred embodiment of this invention.

FIGURES 2, 3 and 4 are sectional details taken substantially on the lines 2—2, 3—3 and 4—4, respectively, as shown in FIGURE 1.

FIGURE 5 is a view similar to FIGURE 1 showing a modified form of this invention.

FIGURE 6 is a sectional detail taken substantially on the lines 6—6 as shown in FIGURE 5.

FIGURE 7 is a side elevation, partly broken away, taken in the direction 7—7 as shown on FIGURE 6.

FIGURE 8 is a view similar to FIGURE 6 showing a second modification.

FIGURE 9 is a side elevation, forming partly broken

2

away, taken substantially in the direction 9—9 as shown in FIGURE 8.

Referring to the drawings, the skelp 10 passes from a supply coil through straightening rolls (not shown) and passes between the first forming roll 11 and the backup roll 12. These rolls 11 and 12 are mounted on a suitable framework 13. The skelp 10 then passes between the second forming roll 14 and its backup roll 15 and then between the third forming roll 16 and its backup roll 17. All of these rolls are mounted on a framework 13 and the forming rolls 11, 14 and 16 are preferably power driven by suitable means, not shown. Power driven feed rolls (not shown) engage the tubular strip material at a location downstream from the forming roll 16.

In accordance with this invention, forming means are provided for engaging a surface of the skelp 10 near its side edges to control the transition to the approximately cylindrical shape to which it is converted. In the preferred form of the device as shown in FIGURES 1—4, of the drawings, endless forming elements or belts 20 and 21 are trained over pulleys 22 and 23 and are guided between the pulleys on continuous curved rails or tracks 24 and 25, respectively. The portions of the belts contacting the skelp are thus continuously supported by the curved rails or tracks. The pulleys 22 and 23 and the curved tracks are all supported on the framework 13. The endless forming elements 20 and 21 move with the skelp 10, contacting the margin portions thereof and the inclined and curved path defined by the tracks 24 and 25 cause the moving elements 20 and 21 to bend and shape the metal skelp 10 in a continuous manner through the steps depicted in FIGURES 2, 3 and 4. The travelling movement of the forming elements 20 and 21 may be compared to the movement of the hand-rail on a conventional moving stairway assembly.

The endless forming elements 20 and 21 are substantially duplicates and each is formed of reinforced rubber construction, substantially C shaped in cross-section. The rails or tracks 24 and 25 are substantially duplicates except one is twisted in a right-hand direction and the other in a left-hand direction. Each rail may be formed of a pair of metal angle irons placed back-to-back. A Teflon strip 26 is interposed between each rail and the moving, forming element 20 or 21. These strips 26 serve to reduce friction between the travelling forming elements and the stationary rails or tracks.

The position of the tracks or rails may be adjusted within limits by means of the clamping elements 27 and the threaded members 28 mounted on the track supports 29. The position of the pulley 22 is such that the endless forming elements 20 and 21 first contact the skelp 10 at a location slightly in advance of the bite between the first forming roll 11 and its backup roll 12. The rails or tracks 24 and 25 each curve and twist so that the upper runs which are above the pulleys 22 are below the pulleys 23, with the result that the pulleys 22 rotate in one direction and the pulleys 23 rotate in the other direction. The return path or idle runs of the endless forming elements 20 and 21 takes place on the curved tracks 31 and 32, respectively.

It will be observed that the side edge or margin portions of the skelp 10 are contacted continuously by the endless forming elements 21 and 20 which move with the skelp in the transition zone between the pulleys 22

and pulleys 23. The frictional contact between the rubber elements 20 and 21 and the steel skelp causes the forming elements to move along their respective rails or tracks 24 and 25. If desired, the pulleys 22 or the pulleys 23 may be power driven to assist in moving the forming elements 20 and 21 at the same surface speed as the skelp 10. This movement of the forming elements 20 and 21 in synchronism and in continuous contact with the side portions of the skelp promotes smooth, uniform action in the transition zone and minimizes scuffing and marking of the outer surface of the material. Distortion and wrinkling of the edges of the skelp are prevented. Sharp transitions are avoided and instead the skelp is shaped gradually and positively without local deformations.

In the modified form of this invention, shown in FIGURES 5, 6 and 7, the forming belts 20 and 21 are replaced by an endless series of small shoes 121 which roll on elongated continuous curved tracks 125. The shoes which are in contact with the skelp are thus continuously supported by the curved tracks. The tracks comprise parallel, tubular rails 126 carried by suitable support structure 127 on the framework of the machine. Threaded members 128 provide for adjustment. Each shoe 121 has a plurality of rollers 130 which are curved to conform to the outer surface of the tubular rails 126. The shoes 121 may be connected together like cars in a train or, as shown in the drawings, may simply contact each other fore and aft so that each shoe 121 is pushed along by the shoe behind it. Each shoe 121 is provided with a retainer means to prevent it from leaving the track 125 on the return or inactive run and as shown in the drawings this retainer means may include a central web 131 carrying retainer rollers 132 which engage the outer surface of the tubular track elements 126.

The device shown in FIGURES 5, 6 and 7 operates in substantially the same fashion as that previously described.

In the modified form of the invention shown in FIGURES 8 and 9, the continuous curved tracks 225 replace the tracks 125 and the cars 221 replace the shoes 121. The tracks 225 each comprise four generally parallel angle irons 226 held in spaced relation by C members 227 placed at intervals along the length of the track 225. Each of the cars 221 in the endless series has spaced rollers 228 mounted between and contacting parallel side surfaces of the track elements 226. Each car 221 is also provided with a work-contacting element 229 which travels outside the enclosure defined by the configuration of the track elements 226. The cars 221 in contact with the skelp are thus continuously supported by the curved tracks. The elements 229 contact the skelp 10 in the manner previously described. The individual cars 221 may be connected together end-to-end in a manner of a train, or may simply contact each other fore and aft in the manner illustrated by the shoes 121 in FIGURE 5.

The operation of the modified form of the invention shown in FIGURES 8 and 9 is substantially the same as that previously described.

While we have shown and described only two forming elements 21, or two series of shoes 121 or cars 221 acting on the metal strip, it is obvious that additional such forming elements or series of shoes or cars can be used, and in such event such additional apparatus could replace certain of the backup rolls 17.

Any of the described embodiments of this invention may be employed to form U-sections or W-sections or other shapes, instead of tubular pipe.

Having fully described our invention, it is to be understood that we are not to be limited to the details herein set forth, but that our invention is of the full scope of the appended claims.

We claim:

1. For use with transition apparatus for continuously forming flat strip material to change it to generally cylindrical tubular shape, the improvement comprising, in com-

bination: continuous stationary tracks extending in a direction generally longitudinally of the length of the strip material and each curved to follow an inclined and curved path corresponding to the path of one of the margins of the strip material in changing from a flat cross-section to a generally cylindrical tubular shape, and forming means guided for movement along said tracks and each adapted to contact and move with a margin of the strip material and without relative movement therebetween, said forming means being continuously supported by said tracks along the length thereof.

2. For use with transition apparatus for continuously forming flat strip material to change it to generally cylindrical tubular shape, the improvement comprising, in combination: continuous stationary tracks extending in a direction generally longitudinally of the length of the strip material and each curved to follow an inclined and curved path corresponding to the path of one of the margins of the strip material in changing from a flat cross-section to a generally cylindrical tubular shape, and a pair of endless forming means, one guided for movement along each track and adapted to contact and move with a margin of the strip material and without relative movement therebetween, said forming means being continuously supported by said tracks along the length thereof.

3. Apparatus for continuously forming flat metal strip material into generally cylindrical tubular shape as it passes longitudinally through a transition zone, comprising: a pair of stationary continuous tracks each extending in a general longitudinal direction and each curving in an inclined path corresponding to the path of one of the margins of the strip passing through the transition zone, forming means continuously supported by said tracks and guided for movement along each of said tracks, respectively, said forming means moving with and continuously contacting a marginal edge surface of the strip without relative movement therebetween as the strip passes through the transition zone, and internal and external forming rolls positioned between the ends of said tracks and contacting both surfaces of the strip, said forming rolls and said forming means cooperating to change the shape of substantially the entire width of the strip gradually as it passes through the transition zone.

4. The combination set forth in claim 3 wherein rollers are provided between the forming means and the stationary tracks.

5. Apparatus for continuously forming flat metal strip material into generally cylindrical tubular shape as it passes longitudinally through a transition zone, comprising: a pair of stationary continuous tracks each extending in a general longitudinal direction and each curving in an inclined path corresponding to the path of one of the margins of the strip passing through the transition zone, an endless forming belt on each of said tracks and continuously supported thereby and guided for movement along each of said tracks, respectively, each of said endless forming belts moving with and continuously contacting a marginal edge surface of the strip without relative movement therebetween as the strip passes through the transition zone, and internal and external forming rolls positioned between the ends of said tracks and contacting both surfaces of the strip, said forming rolls and said endless belts cooperating to change the shape of substantially the entire width of the strip gradually as it passes through the transition zone.

6. Apparatus for continuously forming flat metal strip material into generally cylindrical tubular shape as it passes longitudinally through a transition zone, comprising: a pair of stationary continuous tracks each extending in a general longitudinal direction and each curving in an inclined path corresponding to the path of one of the margins of the strip passing through the transition zone, an endless forming belt on each of said tracks and continuously supported thereby and guided for movement along each of said tracks, respectively, each of said endless forming belts moving with and continuously contact-

ing a marginal edge surface of the strip at all times as the strip passes through the transition zone, and longitudinally spaced internal and external forming rolls positioned between the ends of said tracks and contacting both surfaces of the strip, the outer surfaces of said forming rolls being respectively shaped to conform to the curvature of the surface of the strip at the location of the forming rolls, said forming rolls and said endless belts cooperating to change the shape of substantially the entire width of the strip gradually as it passes through the transition zone.

5

10

1,404,830
1,939,581
1,980,308
2,007,284

8,656

References Cited in the file of this patent

UNITED STATES PATENTS

Sjobring ----- Jan. 31, 1922
Tesmer ----- Dec. 12, 1933
Adams ----- Nov. 13, 1934
Rafter ----- July 9, 1935

FOREIGN PATENTS

Japan ----- Sept. 17, 1958