March 17, 1970 D. J. WHEELER ET AL 3,500,673

TURRET HEAD ROLL FORMER

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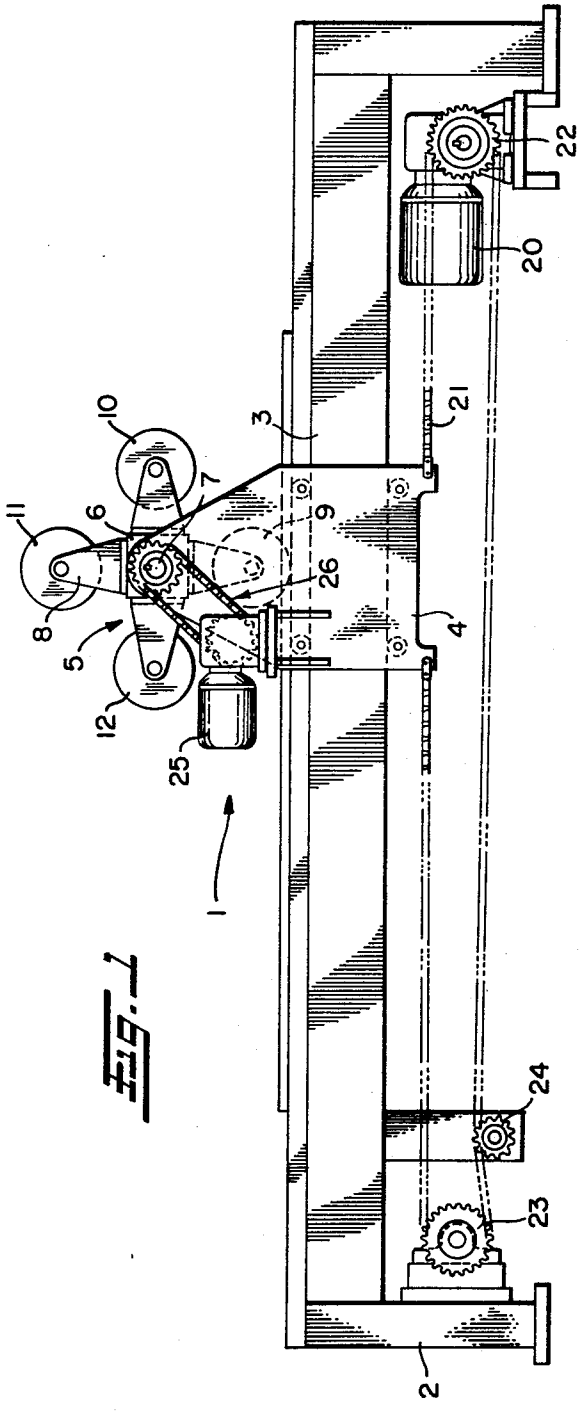


FIG. 1

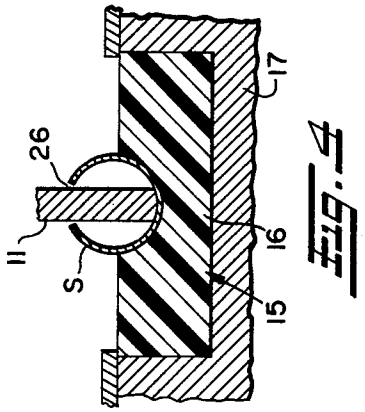


FIG. 3

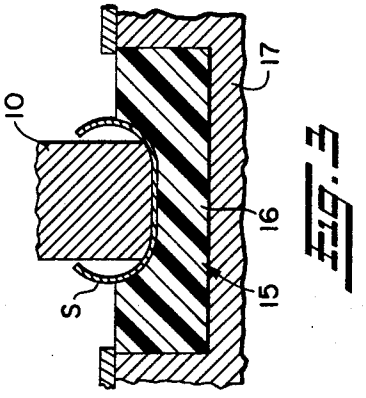


FIG. 4

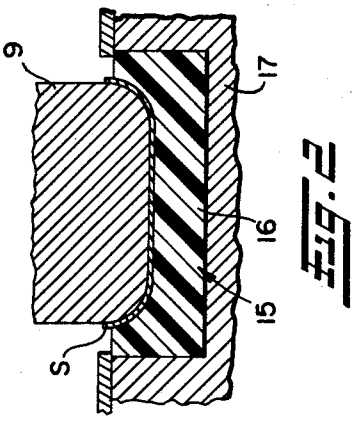


FIG. 2

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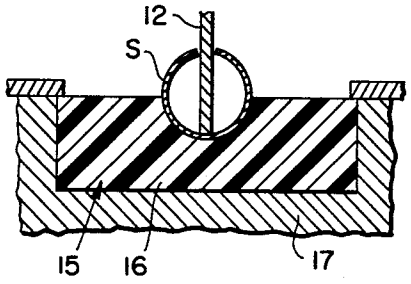


Fig. 5

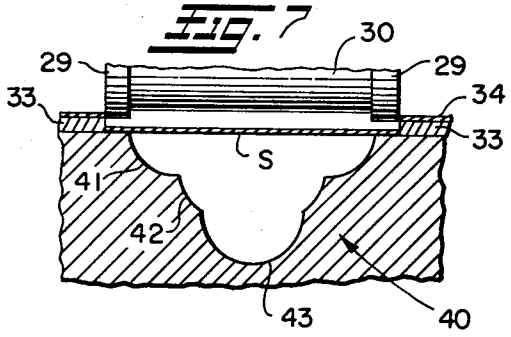


Fig. 7

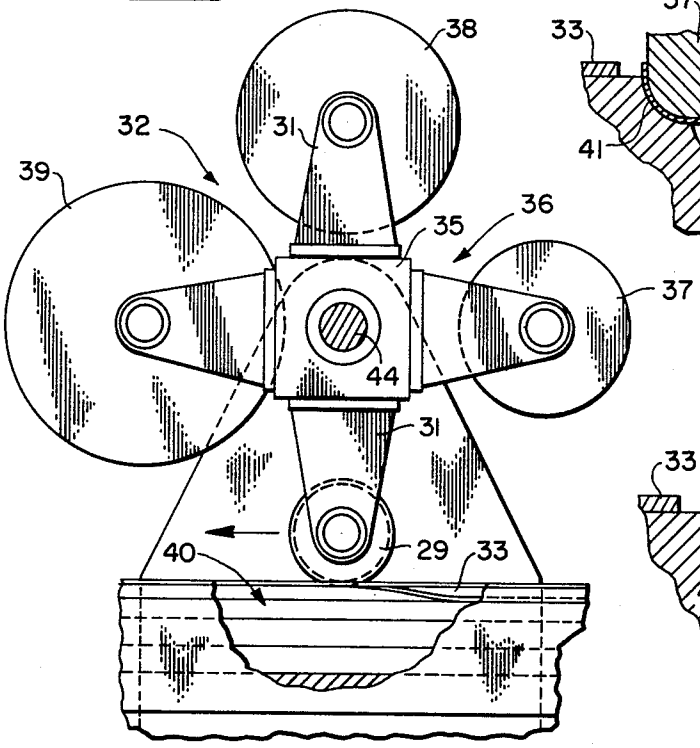


Fig. 6

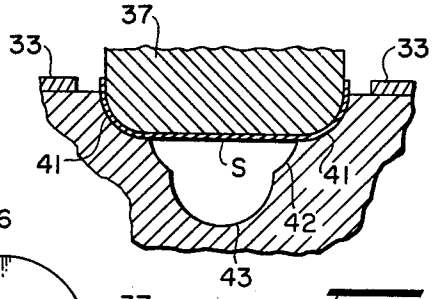


Fig. 8

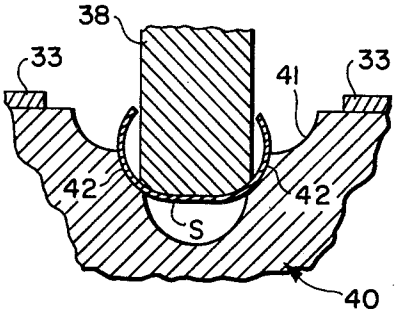


Fig. 9

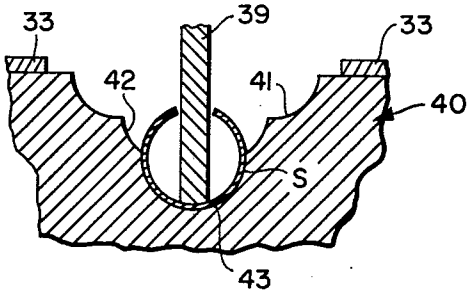


Fig. 10

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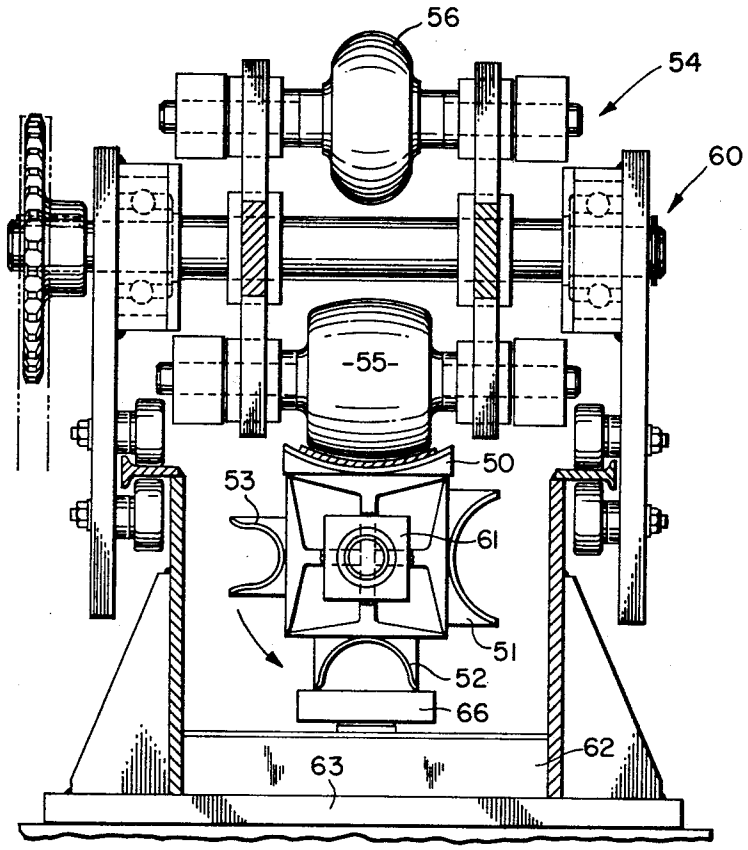
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Fig. 11



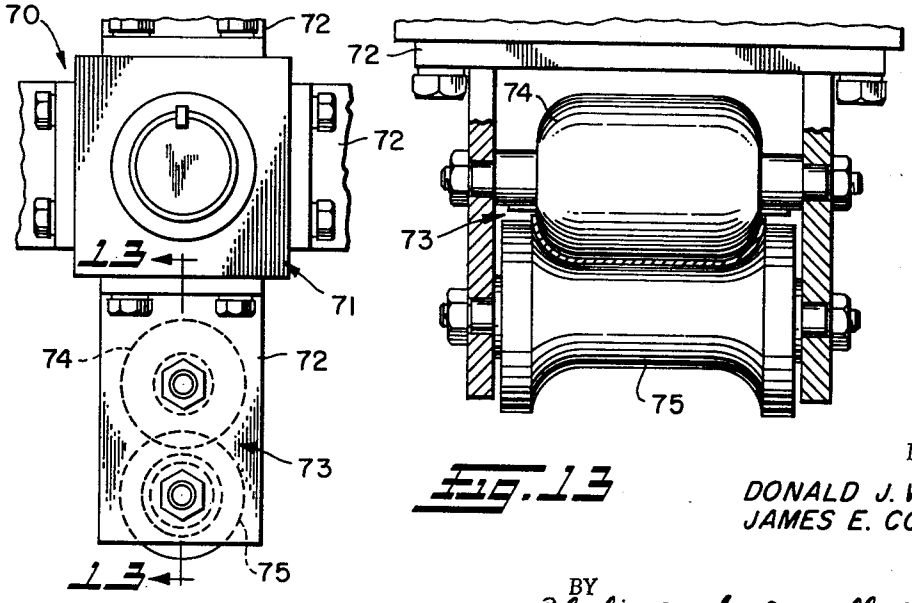


Fig. 12

Fig. 13

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United States Patent Office 3,500,673
Patented Mar. 17, 1970

3,500,673

TURRET HEAD ROLL FORMER

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Filed Dec. 6, 1967, Ser. No. 688,529
Int. Cl. B21d 5/08
U.S. Cl. 72—220 11 Claims

ABSTRACT OF THE DISCLOSURE

A turret head roll former including a turret head having a series of progressive forming rolls mounted thereon, such turret head being pivotally supported on a movable carriage permitting indexing of the forming rolls between each pass of the carriage over strip or sheet material to progressively form strip or sheet material into the desired shape.

BACKGROUND OF THE INVENTION

This invention relates generally as indicated to a turret head roll former and more particularly to a carriage supported roll forming apparatus including a series of progressive forming rolls mounted on a turret head and arranged in the proper sequence for progressively roll forming sheet or strip material by indexing the turret head before each pass of the carriage over the material.

A typical roll forming machine usually consists of a series of pairs of rolls disposed in a line, each pair being spaced a substantial distance apart and arranged in the proper sequence to form sheet and strip material continuously into a variety of shapes at high speeds. If lengths of over twelve feet are needed and the production requirements are quite high, roll forming is likely to be the most economical way to produce the product, provided of course that it is capable of being roll formed.

Shorter pieces in smaller quantities are usually better produced on a press brake, and more economically too, because of the lower cost of a press brake as compared to a roll forming machine and the additional equipment often required to operate a roll forming machine. To operate a standard pipe mill, for example, there must be included an uncoiler, peeler, leveler, and edge trimmer. A substantially smaller amount of floor space is also occupied by a press brake, which is another distinct advantage.

If a part can be made in a single forming operation, very good production can be obtained with a press brake. However, the production rate is substantially diminished where the part must be formed in several stages since that necessitates changing of the dies before each stage of forming, and the tooling-up time is considerable.

SUMMARY OF THE INVENTION

With the foregoing in mind, it is a principal object of this invention to provide a metal forming apparatus which has substantially the same advantages as a press brake over a conventional roll forming apparatus for single die forming operations of small pieces and short runs, and is equally well suited for high production precision forming of pieces in stages.

Another object is to provide such an apparatus in which the formed section can be precisely controlled and sized in such a manner as to permit welding in the same forming dies or subsequently removed for welding in a separate operation.

These and other objects of the present invention are achieved by providing a forming apparatus of the type described with multiple forming rolls mounted on a turret head for controlled indexing of the forming rolls between each stage of the forming operation. After indexing, the turret head is moved relative to the sheet or strip material during which the selected forming roll cooperates with a mating die to form the material.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

BRIEF DESCRIPTION OF THE DRAWINGS

In the annexed drawings:

FIG. 1 is a schematic side elevation view of a preferred embodiment of turret head roll former constructed in accordance with this invention;

FIGS. 2–5 are schematic fragmentary sections through the various pairs of sequence dies which comprise the apparatus of FIG. 1;

FIG. 6 is a fragmentary schematic side elevation view of another form of apparatus in accordance with this invention, a portion of the main support frame having been broken away to show the location of the stationary dies with respect to the turret head;

FIGS. 7 through 10 are schematic fragmentary sections through the various pairs of shears and sequence dies which comprise the apparatus of FIG. 6;

FIG. 11 is a schematic end elevation view of still another forming apparatus constructed in accordance with this invention;

FIG. 12 is a fragmentary schematic side elevation view of yet another form of apparatus pursuant to this invention; and

FIG. 13 is a transverse section through one of the pairs of forming rolls which comprise the apparatus of FIG. 12, taken on the plane of the line **13—13** thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in detail to the drawings and first especially to FIG. 1, there is illustrated by way of example one form of turret head roll forming apparatus **1** in accordance with this invention, generally comprising a main support frame **2** having a pair of guideways **3** thereon for supporting a movable carriage **4**. Rotatably mounted on the carriage **4** is a multiple die turret head **5** including a central hub portion **6** having a shaft **7** extending therethrough with its ends journalled in the movable carriage **4**, and a plurality of circumferentially spaced support arms **8** extending radially outwardly from the central hub portion **6**.

On the outer ends of each of the support arms **8** there is mounted one of a plurality of dies **9–12**. Each of the dies **9–12** may be in the form of progressive shaping rolls having male or female die shapes on their outer peripheries which when indexed cooperate with one or more elongated stationary mating dies **15** during movement of the carriage **4** along its length. As shown in FIGS. 2–5, the roller dies **9–12** are male dies which are progressively narrower in section and cooperate with a single elongated stationary die **15** of polyurethane foam **16** or other resiliently deformable material to progressively deform the strip or sheet material S into tubular shape. However, it should be understood that many irregular shapes can be formed equally well simply by changing the dies **9–12**.

The polyurethane foam **16** is supported on a bed plate **17** carried by the main support frame **2** intermediate the guideway **3**. Movement of the carriage **4** and multiple die turret head **5** carried thereby along the guideways **3** may be accomplished as by means of a reversible drive

notor **20** disposed at one end of the main support frame ; and connected to the carriage **4** by a chain **21** in driving ngagement with the drive sprocket **22** for the motor **20**. uitable idler and slack takeup sprockets **23** and **24** may e located wherever required.

The strip S, which may be of various different metals, lastic, or paper-like material, is initially centered on the tationary die **15** with its ends suitably clamped to hold he strip against longitudinal and transverse movements luring the various die forming stages. On the first pass f the turret head **5** along the length of the strip S, the ie **9** merely deforms the edges of the strip to the conguration shown in FIG. 2, after which the turret head **5** s indexed to bring the next roller die **10** into operative osition for further forming of the strip S into C shape luring the return pass (see FIG. 3). Indexing of the urret head **5** may be accomplished by actuation of an ndexing motor **25** mounted on the carriage **4** and having chain drive connection **26** with the turret head.

Now the turret head **5** is again indexed to bring the ext roller die **11** into operative position and the turret ead is caused to make a second pass along the strip, leforming the strip into substantially tubular form but vith a wide gap **26** between the edges thereof as shown in IG. 4. Before returning, the turret head **5** is indexed nce more to bring the roller die **12** into operative posiion for reducing the gap to within approximately 10% f the diameter of the tube as illustrated in FIG. 5. uxiliary side guides and shoes of conventional type may e provided as required to assist in guiding and forming he strip material during each pass of the turret head.

The strip material S for the apparatus **1** is desirably recut to the prescribed length and width to facilitate andling and proper placement on the stationary die **15**, vhich may be accomplished by hand or by an automatic trip loader, not shown. However, should strip material ot be available in the desired widths, a pair of laterally paced roller shears **29** having a spacer element **30** therebetween may be mounted on one of the support arms **31** f the turret head roll forming apparatus **32** illustrated n FIGS. 6–10 for cooperation with a pair of stationary hear knives **33** to shear the strip S from the leading end 4 of a coil. The other support arms **31** which project rom the central hub portion **35** of the turret head **36** arry progressive roller dies **37**, **38**, and **39** which may be uccessively brought into operative position by indexing he turret head **36** prior to each pass and return pass of he carriage **4'** over the strip to progressively form the trip into the desired shape, similar to the operation of he apparatus of the FIGS. 1–5 embodiment.

Likewise, the stationary die member **40**, rather than eing made of a resiliently deformable material such as olyurethane foam, may be a hardened steel die having a omposite shape providing different contours **41**, **42** and 3 each adapted to cooperate with a different one of the oller dies **37** through **39**. In FIG. 8, the roller die **37** is hown in operative position deforming the edges of the trip into engagement with the die surfaces **41**, whereas n FIGS. 9 and 10 the roller dies **38** and **39** are in posiion deforming the strip into engagement with the die urfaces **42** and **43**, respectively. Since the die surfaces 1–43 are progressively further from the rotating shaft 4 of the turret head **36** and are progressively narrower, he roller dies **37–39** must be of progressively increasing liameters and narrower widths to mate properly with their espective die surfaces. While only three such roller dies 7–39 are shown, it will be apparent that the number f dies used may be varied in accordance with the numer of stages required to form a particular shape.

In place of the single stationary die **15** or **40** of the IGS. 1 and 6 embodiments, a plurality of elongated lies **50**, **51**, **52**, and **53** may be provided, one for each of he roller dies carried by the rotatable turret head **54**, nly two of such roller dies **55**, **56** being shown in the urret head roll forming apparatus **60** of the FIG. 11

embodiment. The elongated dies **50–53** may consist of rolled or multiple sections precisely machined for mating engagement with their respective roller dies, each mounted on a different face of a rotatable support beam **61** supported on trunnions above the bed plate **62** of the main support frame **63**. Thus, before each stage of forming, both the turret head **54** and support beam **61** must be indexed to bring the proper dies into operative position. Strip lifting and clamping arms or the like, not shown, may be provided at each end of the strip for elevating the strip after the carriage **65** has moved beyond one or the other of its ends to permit indexing of the upper and lower dies, after which the clamping arms are lowered to bring the strip into engagement with the lower die. The material lifting and clamping arms may also be used for ejecting the strip from the dies when the part is completely formed. A hydraulically actuated clamping block **66** may be located on the bed plate **62** for movement into engagement with the lower dies **50–53** to support the same during each forming operation.

Still another form of turret head roll forming apparatus **70** in accordance with this invention is shown in FIGS. 12 and 13, comprising a rotatable turret head **71** having a plurality of support arms **72** projecting therefrom on which are mounted a series of pairs of roller dies **73**, only one pair being shown. One of the roller dies **74** of each pair has a male die shape for mating engagement with a female die shape on the other roller die **75**. Through proper selection of the number of pairs of roller dies of varying contours, the strip S may be smoothly formed into the desired shape by successive passes of the strip between the roller pairs. Indexing of the turret head **76** occurs at the end of each pass with the carriage located beyond the strip end.

After the last forming stage has been completed, the edges of the tubular shell may be welded in place while on the turret head roll forming apparatus, or the shell may be removed and subsequently welded by passing the same through welder electrodes which may themselves be revolving rolls, shaped to the contour of the shell. Where square or rectangular shapes are desired, the various dies of the turret head roll forming apparatus disclosed herein may be changed to further deform the round shell into square or rectangular sections.

With the apparatus of the present invention, it is estimated that it will be possible to produce approximately 10 pieces per hour, approximately twenty-four feet long, 8⅝ inches wide, and .5 inch thick, which far exceeds the production capabilities of a press brake, especially when the pieces must be formed in stages which requires the dies of the press brake to be changed between each stage of forming.

The changeover time for the upper and lower dies of the roll forming apparatus of the present invention is approximately one hour, thereby permitting various different shaped pieces to be formed on the same apparatus in a relatively short time. This makes it possible to produce several short runs with the apparatus of the present invention about as fast as they can be produced on a continuous multiple-operation roll forming apparatus of conventional type, and the investment and space requirements are much less.

Although in general the apparatus of the present invention includes sufficient dies to form a complete piece at a single forming station, it will be apparent that several such apparatus could be positioned side by side at different forming stations each performing different operations on the same piece as it is indexed from one station to the other.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

We, therefore, particularly point out and distinctly claim as our invention:

1. A turret head roll forming apparatus comprising a frame, a carriage, means mounting said carriage on said frame for movement along the length of a forming station, and a turret head rotatably mounted on said carriage, said turret head including a plurality of shaping rolls, and means for rotating said turret head to selectively bring said shaping rolls into operative position for continuously roll forming a strip located at such forming station during movement of said carriage along the length of the strip.

2. The apparatus of claim 1 wherein there are progressive shaping rolls on said turret head which are successively brought into operative position prior to each pass or return pass of said carriage along the length of the strip, whereby the strip is formed in stages.

3. The apparatus of claim 1 further comprising an elongated die means located at such forming station which is adapted to cooperate with each of said shaping rolls to form the strip during each pass or return pass of said carriage along the strip.

4. The apparatus of claim 3 wherein said elongated die means is of a resiliently deformable material which readily adapts to the configuration of said shaping rolls.

5. The apparatus of claim 3 wherein said elongated die means is of a metal having a composite shape providing different contours for each of said shaping rolls.

6. The apparatus of claim 1 further comprising a roller shear on said turret head adapted to be moved into operative position for shearing the strip during movement of said carriage along the length thereof.

7. The apparatus of claim 1 further comprising a plurality of elongated die means located at such forming station, one for each of said shaping rolls, and means mounting said elongated die means for selective movement into operative position for cooperation with its associated shaping roll to form the strip during movement of the carriage along the length thereof as aforesaid.

8. The apparatus of claim 7 wherein said elongated die means are mounted on different faces of a rotatable

support beam, whereby rotation of said support beam will bring said elongated die means into operative position.

9. The apparatus of claim 8 further comprising means for releasably supporting said elongated support beam intermediate its ends during forming of the strip.

10. The apparatus of claim 1 wherein there are a plurality of pairs of said shaping rolls carried by said turret head, each pair being adapted to receive the strip therebetween when moved into operative position for progressively forming the strip during movement of said carriage along its length.

11. A turret head roll forming apparatus comprising a frame, a carriage, means mounting said carriage on said frame for movement along the length of a forming station, a turret head rotatably mounted on said carriage, said turret head including a central hub portion having a shaft extending therethrough with its ends journalled in said carriage, a plurality of circumferentially spaced support arms extending radially outwardly from said central hub portion, progressive shaping rolls carried by the outer ends of said support arms, elongated die means located at such forming station for cooperation with said shaping rolls when moved into operative position to form the strip during movement of said carriage along the length thereof, and means for rotating said turret head to selectively bring said shaping rolls into operative position prior to movement of said carriage along the length of such strip.

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U.S. Cl. X.R.

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