United States Patent

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[54] **ROLL FORMING APPARATUS FOR SHEET METAL**
7 Claims, 1 Drawing Fig.

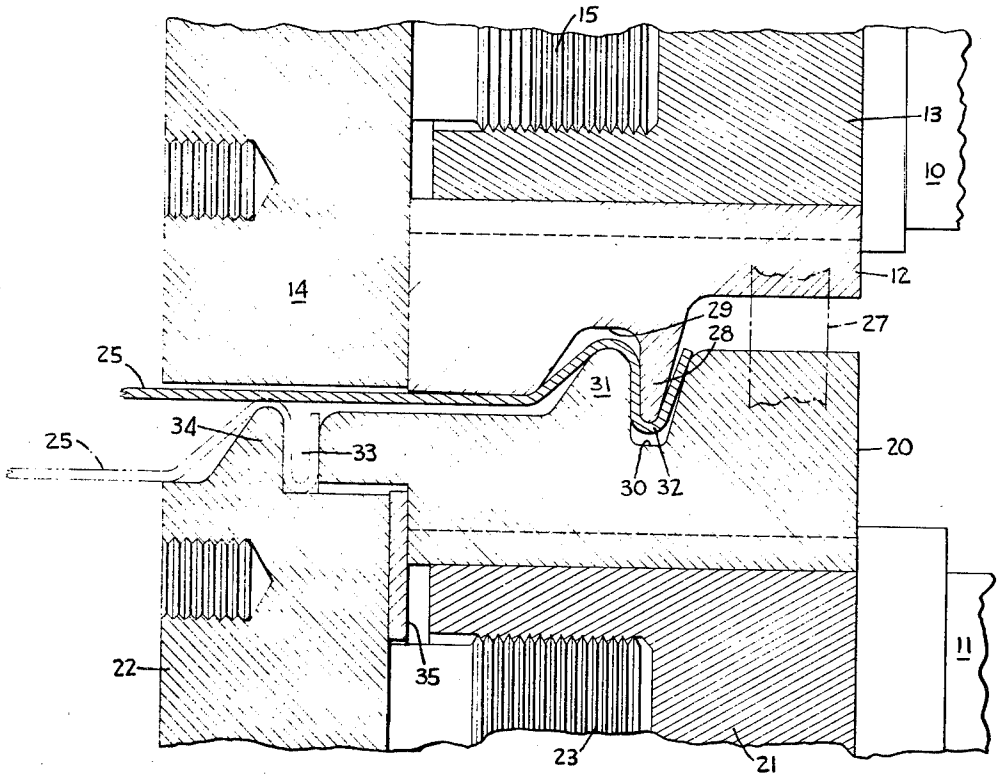
[52] **U.S. Cl.** **72/105,** 29/454, 72/370
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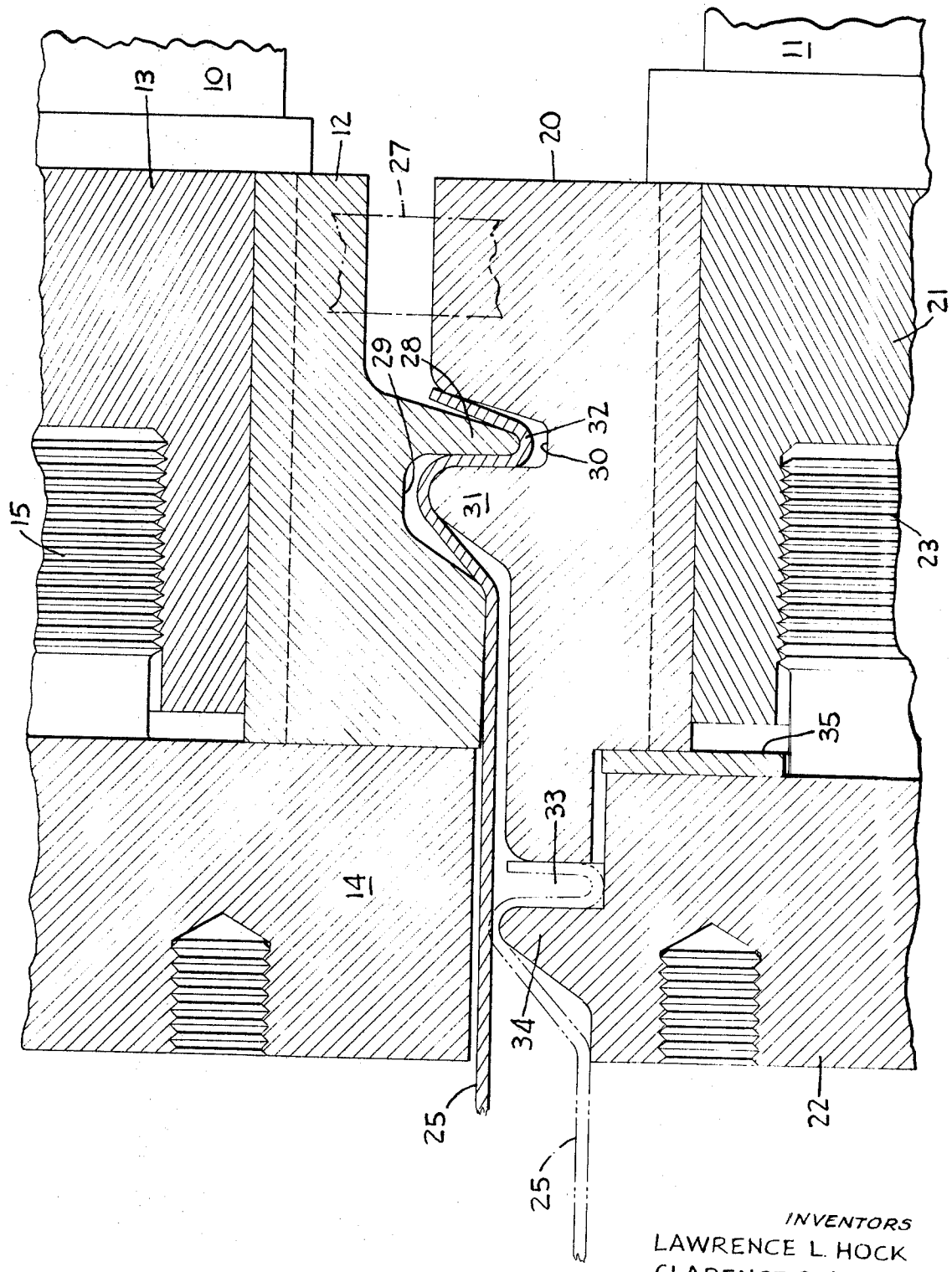
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ABSTRACT: A pair of forming rolls for forming an outwardly opening return bent channel formation at an end of a cylindrical sheet metal workpiece such as a duct. The channel is formed in two operations. The workpiece is first inserted between the forming rolls to full depth against a gauge, the rolls are closed, and a relatively open V-shaped formation is formed. The rolls are then released and the workpiece is partially withdrawn until the apex of the V-shaped formation registers with a narrow annular groove in one roll and the rolls are again closed, whereby a plain cylindrical formation on the other roll engages the outer ends of the V formation and forces the same into the annular groove to complete a relatively narrow U-shaped return bent formation.



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ROLL FORMING APPARATUS FOR SHEET METAL

BACKGROUND OF THE INVENTION

This invention relates to rolls for forming sheet metal and, more particularly, to a pair of cooperating rolls for forming return bent annular flanges at the ends of cylindrical sheet metal duct members and the like.

In fabricating sheet metal duct work and like sheet metal structures, it is commonly required to produce return bent flange formations at the ends of cylindrical sheet metal duct members. Since the return bent flange formations are commonly for the purpose of interfitting with sheet metal portions of connecting duct work the required space between the return bent flanges approximates the thickness of the sheet metal used in the duct work and is accordingly too narrow to admit a male forming member of practicable thickness in the final formation of such return bent flanges.

It is accordingly necessary, in prior art roll forming methods, to produce such return bent flange formations in a succession of forming steps employing different sets of forming rolls. In order to do this it is either necessary to set up two or more roll forming machines with successively employed sets of forming rolls or, where several roll forming machines are not available, it is necessary to perform a first forming operation with a given set of forming rolls on a number of workpieces, and then remove the first forming rolls and install second forming rolls to perform the second forming operation on the succession of workpieces.

SUMMARY OF THE INVENTION

The present invention provides a pair of forming rolls which are so contoured that a workman may introduce a sheet metal cylindrical or other structure between the forming rolls and against a stop, the forming rolls being then open or separated in a manner well known in this art, then close the rolls and rotate the same to form a relatively open V-shaped formation at an end of the sheet metal structure. The rolls are then opened to release the workpiece which is then partially withdrawn by the workman to place it in such position that the relatively open V-shaped formation rests partially in or against a narrow channel formation in one of the rolls.

The rolls are then again closed and the registering periphery of the other roll forces a beginning portion of the apex of the open V-shaped formation into the relatively narrow annular channel to close such portion and thus form a return bent formation having a relatively narrow space between the adjacent flanges of the return bent formation. The rolls are then rotated in the usual manner whereby successive portions of the V-shaped channel formation are progressively forced into the relatively narrow groove formation in the aforesaid forming roll to complete the return bent formation at the end of the workpiece.

The contour of the mating rolls of the present invention is such that the two successive forming operations just described may be successively effected, each without interference from portions of the forming rolls employed in effecting the other of the forming operations.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE of the drawing is an enlarged vertical longitudinal section through one form of a pair of forming rolls constructed according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing the numerals **10** and **11** designate the upper and lower roll shafts of a conventional roll forming machine. In such machines one of the roll shafts, usually the upper one, may be swung upwardly to separate the rolls for introducing workpieces therebetween and removing them when a roll forming operation has been effected.

The principal roll component of the upper forming roll is designated **12** and is mounted on a reduced extension **13** of upper roll shaft **10**. A cylindrical member **14** forms an axial extension of upper forming roll **12** and has a reduced threaded portion **15** which threads into the outer end of reduced shaft extension **13** to retain principal upper roll component **12** on extension **13**. As will appear later herein, upper roll component **12** comprises a first form roller and cylindrical extension **14** comprises a second form roller.

The first form component of the lower forming roll is designated **20** and is mounted on a reduced extension **21** of lower roll shaft **11**. A second form component of the lower forming roll is designated **22** and has a reduced threaded extension **23** which threads into the outer end of lower shaft **11** and thus retains the first form component **20** thereon. A shim **24** is interposed between the facing end surfaces of roll components **20** and **22** for a purpose which will appear later herein.

The workpiece prior to being formed by the novel roll-forming combination of the present invention comprises a sheet metal cylinder having a plain end. The cylindrical workpiece is designated **25** in the full and dotted line showings in the drawing. The full line showing illustrates the end of the cylinder after the first forming operation and the dot and dash line showing illustrates the final form thereof. With the rolls separated, that is, with the upper roll shaft **10** and its appurtenances raised from the lower roll shaft and its appurtenances, the plain end of the cylinder is brought into abutment with what is known as an apron gauge **27**.

The upper first forming roll **12** has an annular flange **28** and an adjacent annular groove **29**. The lower first forming roll **20** is formed with a complementary annular groove **30** and an annular flange **31**. Accordingly, when upper roll shaft **10** is lowered the engaged or beginning portion of the cylindrical workpiece **25** is brought to the form illustrated in full lines in the drawing. As the roll shafts **10** and **11** are then rotated, either by power or manual means, the illustrated cross section shown in full lines is formed about the entire end of cylinder **25**.

The rolls are then again separated and the workman merely withdraws the workpiece partially until the interior bead formation **32** of the workpiece registers with an annular recess **33** which is formed by the outer end of roll component **20** and a flange **34** formed on the second form component **22** of the lower forming roll. When roll shaft **10** is again lowered to working position the bead formation **32** is forced into recess **33** and assumes the form illustrated in dot and dash lines wherein a U-shaped formation with parallel sidewalls is produced, this being the desired final shape of the end of the cylindrical sheet metal workpiece.

This U-shaped formation is required in various widths due to varying guages of the sheet metal workpiece and varying thicknesses of the related duct work with which the U-shaped formation is to be engaged. Accordingly, various shims such as the one illustrated at **35** in the drawing engage between first form roll component **20** and second form roll component **22** and by varying the thickness of shim **35** the width of recess **33** may be correspondingly varied.

It will be noted in the drawing that roll **14** will assume a lower position in the second form operation than in the illustrated first form operation since roll **14**, in the second form, will approach within a metal thickness of the outer periphery of flange **34**. It will further be noted that the general diameter of the cylindrical workpiece **25** is nearly the same as the internal diameter of the return bent formation so that the effective general internal area of cylinder **25** is not reduced by the return bent formation. Accordingly, the workpiece tapers inwardly from the radius which is formed over flange **31** to the general diameter of the main body of the cylindrical workpiece.

A preferred embodiment of the present invention has been described and illustrated herein but it is to be understood that numerous modifications may be made without departing from the spirit and scope of the invention.

We claim:

1. A pair of forming rolls for effecting successive roll forming operations along an edge of a sheet metal workpiece, said rolls being rotatably supported at one end thereof, one of said rolls being movable away from the other for introducing the edge of a workpiece therebetween, said rolls having first and second pass peripheral formations with the first pass formations toward the supported ends of the rolls and the second pass formations outwardly thereof, said first pass formations comprising a relatively open annular groove in one of said rolls and a complementary annular flange on the other roll to produce an open return bent formation along the edge of the workpiece, the second pass formations of said grooved roll comprising a narrower U-shaped annular groove, a peripheral portion of the flanged roll being adapted to engage the outer ends of the return bent formation of the workpiece and force the same into said U-shaped groove to produce a return bent formation with a relatively narrow space between the walls thereof.

2. A pair of forming rolls in accordance with claim 1 wherein the relatively open annular groove and the complementary annular flange are generally V-shaped.

3. A pair of forming rolls in accordance with claim 1 wherein said open return bent formation has an external radius approximately one-half the width of said V-shaped annular groove.

4. A pair of forming rolls in accordance with claim 2 wherein said open return bent formation has an external radius approximately one-half the width of said V-shaped annular groove.

5. A pair of forming rolls in accordance with claim 1 wherein said one roll has a reduced diameter portion outwardly of said annular groove and said other roll has an increased diameter portion outwardly of said annular flange whereby said workpiece is provided with a tapering enlargement between the workpiece proper and the return bent formation at the end thereof.

6. A pair of forming rolls in accordance with claim 2 wherein said one roll has a reduced diameter portion outwardly of said annular groove and said other roll has an increased diameter portion outwardly of said annular flange whereby said workpiece is provided with a tapering enlargement between the workpiece proper and the return bent formation at the end thereof.

7. A pair of forming rolls in accordance with claim 5 wherein said U-shaped groove is formed in the reduced diameter portion of said one roll and the increased diameter portion of said other roll engages the return bent formation of the workpiece to force the same into said U-shaped groove.