ROLL FORMED SHEET METAL BEAM CONSTRUCTION

Filed March 12, 1962 3 Sheets-Sheet 1

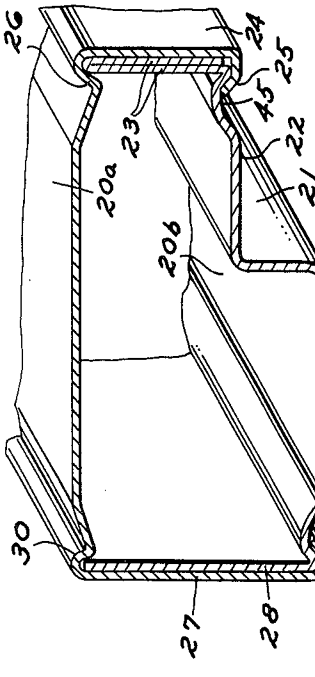

FIG. 1

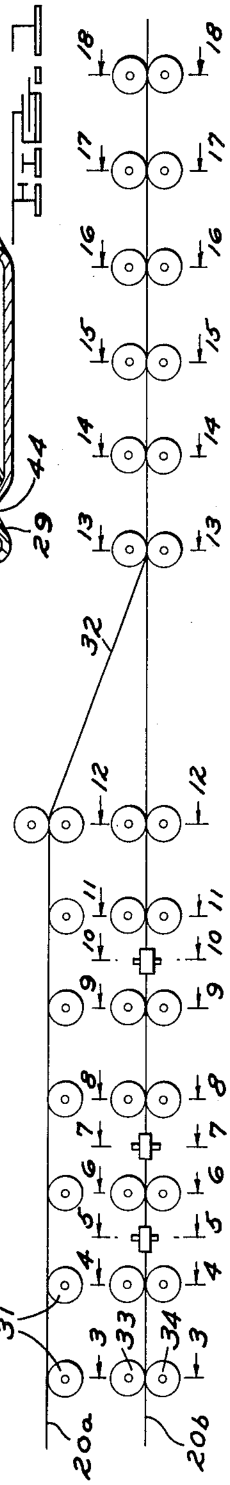

FIG. 2

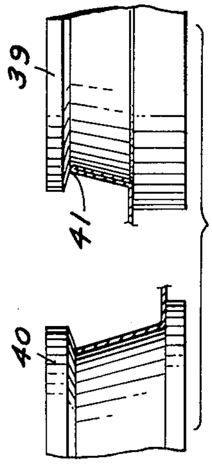

FIG. 10

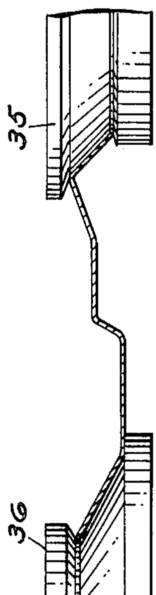

FIG. 5

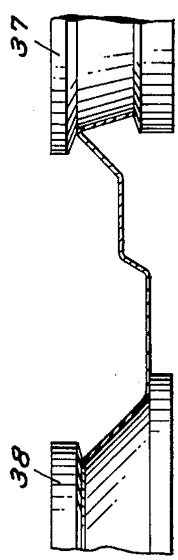

FIG. 7

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ROLL FORMED SHEET METAL BEAM CONSTRUCTION

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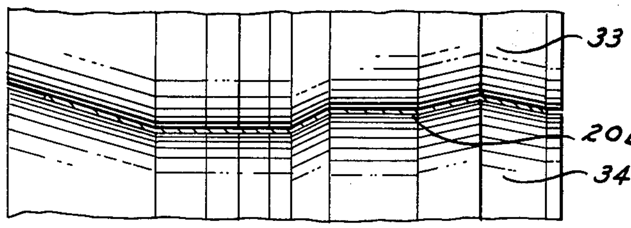

FIG. 3

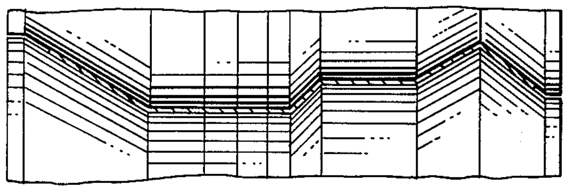

FIG. 4

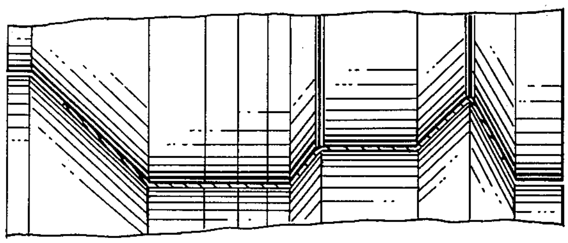

FIG. 6

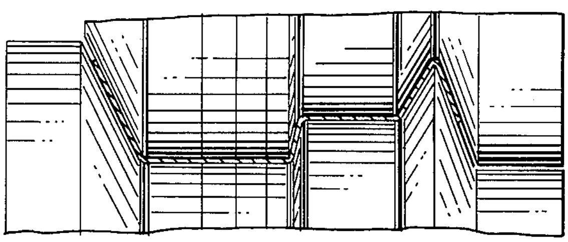

FIG. 8

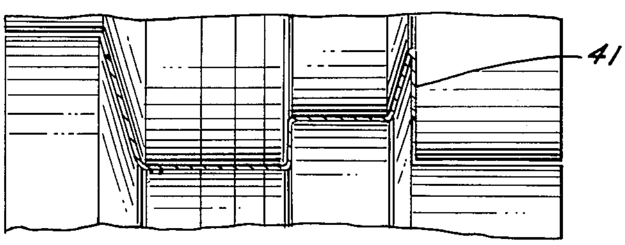

FIG. 9

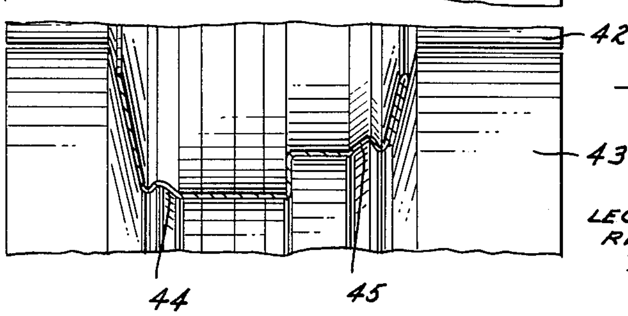

FIG. 11

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ROLL FORMED SHEET METAL BEAM CONSTRUCTION

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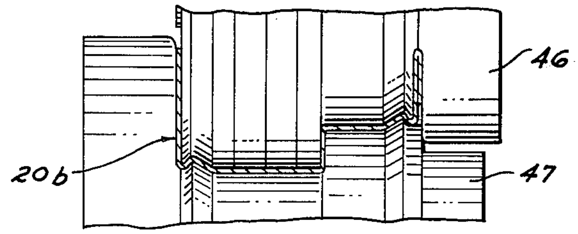

FIG. 12

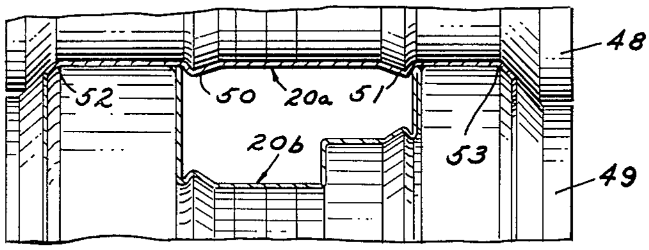

FIG. 13

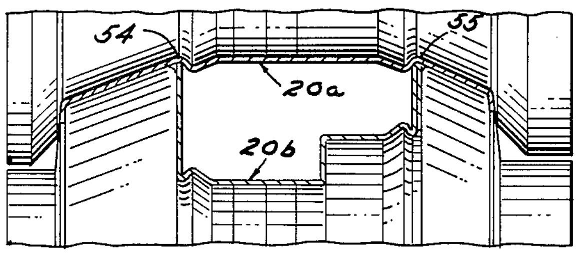

FIG. 14

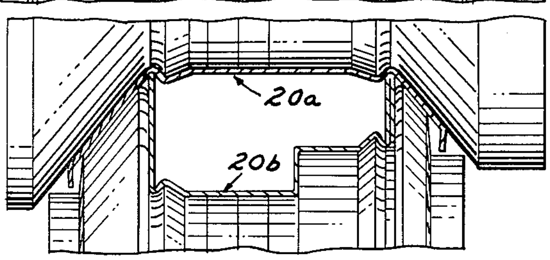

FIG. 15

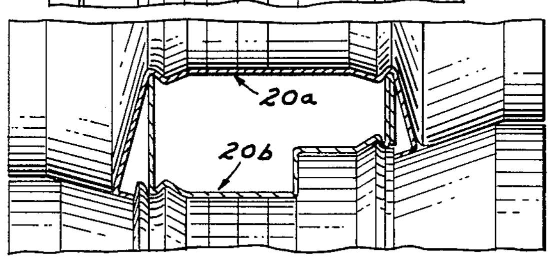

FIG. 16

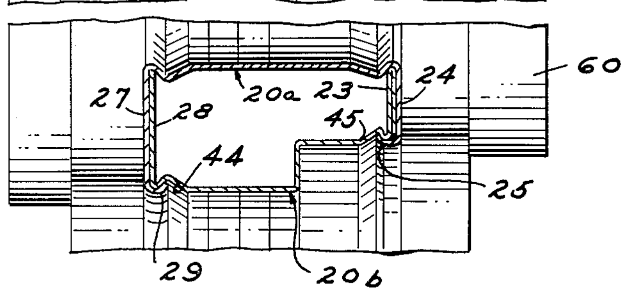

FIG. 17 & 18

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ROLL FORMED SHEET METAL BEAM CONSTRUCTION

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Filed Mar. 12, 1962, Ser. No. 179,088

9 Claims. (Cl. 52—731)

This invention relates to a structural beam or rail construction and more particularly to a box section rail having unequal upper and lower widths fabricated from sheet metal which is roll formed to provide substantially uniform strength in the upper and lower extremities.

In the construction of beam sections suitable for shelving units such as load supporting rails for storage racks, it may be desirable to provide a ledge integrally formed at the top of the rail to receive and support the marginal perimeter of shelving, and when a box rail construction is employed, the width of the upper extremity is substantially reduced in comparison with the lower width so that when formed of uniform gauge sheet metal, as is conventionally the practice, the upper wall of the box section becomes more highly stressed forming a limiting factor on the load capacity of the rail.

The present invention is directed to provide a roll formed sheet metal construction wherein the upper and lower main load bearing walls are provided respectively with three and two layers of sheet metal to enhance and substantially equalize the strength characteristics as well as to provide an extremely economical construction from a material and fabricating cost standpoint.

These and other objects of the invention can best be understood by reference to drawings illustrating a preferred embodiment of the finished product and the roll forming apparatus utilized in fabrication wherein:

FIG. 1 is an isometric fragmentary sectional view of the finished roll formed sheet metal rail;

FIG. 2 is a schematic side elevation of the roll form stands employed identifying the location of the various roll passes illustrated in the remaining views;

FIGS. 3, 4, 6, 8, 9, 11 and 12–18 are transverse sectional views of the various roll passes operating in the horizontal plane with transverse axis rolls as schematically identified in FIG. 2; and

FIGS. 5, 7 and 10 are similar sectional views of guide rolls operating in a vertical plane with rolls having vertical axes as schematically indicated in FIG. 2.

Referring to FIG. 1, the finished box beam or rail comprises two sheet metal elements **20***a* and **20***b*, each being formed to inter-engage in a composite box section which in this view is oriented to correspond to its position as formed on the roll stands of FIG. 2. When the beam is used as a load supporting member it would be turned 90° so that the single thickness side walls extend vertically and the multiple thickness side walls are horizontal, the narrower multiple thickness wall ordinarily being uppermost. A ledge **21** is formed in the inner sheet metal element **20***b*, having a vertical wall **22** terminating in a relatively narrow doubled-over upper flange **23** retained by the overlapping opposed flange **24** of the element **20***a* crimped at the end **25** and side **26** to form a solidly locked three-ply upper box wall. At their lower ends the respective sheet metal elements are formed similarly with overlapping flanges, the lowermost **27** being crimped over the inner flange **28** at the end **29** and side **30** to form a tightly locked double-ply lower rail wall. Since the ledge **21** occupies approximately one-third of the width of the rail, the extra ply at the top provides approximately equal cross-sectional area with the double-ply bottom section resulting in substantially equal load stresses at the top and bottom extremities.

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Starting with two flat sheet metal strips, the composite ledged box rail is entirely formed and the two sheet metal elements joined by roll forming operations illustrated in the remaining figures. With reference to FIG. 2 the inner ledged element **20***b* is completely formed in a first series of roll passes the progressive forming stages of which are illustrated in FIGS. 3–12. The outer sheet metal element **20***a* rides above this first series of rolls on a group of idler rolls **31** at the end of which it is caused to converge as shown at **32** into a second series of roll stands where the forming of element **20***a* including attachment to element **20***b* is effected progressively in the stages illustrated in FIGS. 13–18.

At the first roll stand illustrated in FIG. 3, contoured matching upper and lower rolls **33** and **34** impart five initial bends to the surface of the flat sheet metal element **20***b* corresponding to the five main corners of such element in the finished rail. The forming rolls of the stands illustrated in FIGS. 4–9 progressively increase the angle of such bends, while intermediate guide rolls **35** and **36** (as illustrated in FIG. 5) and rolls **37** and **38** (as illustrated in FIG. 7) on vertical axes serve as lateral guides for maintaining proper orientation through the forming rolls. The vertical axis rolls **39** and **40** illustrated in FIG. 10 serve to completely close the reverse bend **41** as well as to laterally guide the formed element, the rolls **42** and **43** illustrated in FIG. 11 add retaining recesses **44** and **45**, while rolls **46** and **47** shown in FIG. 12 complete the forming of the element **20***b*.

With reference to FIG. 13 the outer sheet metal element **20***a* which passes in flat strip condition on idler rolls **31** over the forming stands for element **20***b*, is initially formed by rolls **48** and **49** with retaining recesses **50** and **51** and with initial bends **52** and **53** at the ends. Corner bends **54** and **55** are initiated in the next pass illustrated in FIG. 14 and thereafter progressively increased as illustrated in FIGS. 15 and 16. The last two passes, which are substantially identical and therefore illustrated in a common FIGS. 17 and 18, serve to complete the corner bends and crimp the ends **25** and **29** over the adjacent corners of the inner box element **20***b* into the respective recesses **45** and **44** formed therein, thereby securely locking the flanges **23** and **28** of the inner element within the corresponding flanges **24** and **27** of the outer element **20***a*.

In this second series of roll stands of FIGS. 13–18, the previously formed element **20***b* is gradually shifted from a pocket in the lower roll **49** (FIG. 13) to a pocket in the upper roll **60** (FIG. 17) and portions of the element **20***b* are employed as forming die or roll surfaces for defining the configuration of element **20***a*. After leaving the last roll forming stage the completed rail is cut to desired length by a flying shear (not illustrated) in accordance with conventional practice.

As compared with prior practice in which a uniform thickness ledged box rail, roll formed from a sheet metal strip, has abutting edges welded after final roll forming, the present construction provides a number of advantages. In addition to elimination of the welding operation, the respective three and two thickness construction of the upper and lower extremities provides a substantially equalized multiple strength factor where beam stresses are at a maximum, permitting the use of substantially lighter gauge sheet metal for rails of equal strength and thereby providing a substantial material saving. Also, forming of such lighter gauge material without a welding operation can take place at a substantially higher rolling rate with greater roll life thereby further reducing fabrication costs.

While a particular preferred ledged box section rail and roll forming apparatus for fabricating same have been illustrated and described above in detail it will be understood that numerous modifications might be resorted to without departing from the scope of this invention as defined in the following claims.

We claim:

1. A composite sheet metal box section rail characterized by two individual sheet metal component elements each having a side wall portion and transversely extending upper and lower flanges, both flanges of one of said elements lying inside the corresponding flanges of the other element, the edges of the inner flanges terminating at the side wall of the outer flanged element, and means for interlocking said sheet metal elements together with the flanges thereof in overlapping abutting relation comprising inwardly directed recesses in the side wall portion of the outer flanged element which overlap and engage the said edges of the inner flanges, and similarly directed recesses in the side wall portion of the inner flanged element, the edges of the outer flanges each being formed into interlocking engagement with one of said similar recesses.

2. A box section rail as set forth in claim 1 wherein said sheet metal elements are each formed with a corresponding one of their upper and lower flanges substantially narrower than the other of said flanges, said narrower flange of one of the sheet metal elements being doubled over to form two plys resulting in a three ply section thickness at the narrower flange and a two ply section thickness at the wider flange.

3. A box section rail as set forth in claim 1 wherein one of said sheet metal elements is provided with a step forming a ledge in its upper side wall, the upper flange of said element being substantially narrower than the lower flange.

4. A box section rail as set forth in claim 3 wherein one of the upper flanges is doubled over to form two plys resulting in a three-ply section thickness at the top of said rail.

5. A box section rail as set forth in claim 4 wherein the element containing said ledge also has said doubled-over flange.

6. A box section rail as set forth in claim 5 wherein the element containing said ledge comprises the inner flanged element.

7. A composite sheet metal box section rail comprising two individual sheet metal component elements each having transversely extending upper and lower flanges, corresponding flanges of the respective sheet metal elements lying in adjacent overlapping opposed relationship, both flanges of one of said elements lying inside the corresponding flanges of the other element, the edges of the inner flanges terminating at the side wall of the outer flanged element, the outer flanges extending around the side wall corners of the inner flanged element to hold the respective elements in assembled relation, and said sheet metal elements each being formed with a corresponding one of their upper and lower flanges substantially narrower than the other of said flanges, said narrower flange of one of the sheet metal elements being doubled over to form at least two plys whereby said box section rail is provided with a greater sectional thickness at the narrow flange thereof than at the wider flange and the strength characteristics of the upper and lower flanges of said rail are substantially equalized.

8. A ledged box section rail comprising two inter-locked sheet metal elements, one of said elements having a side wall with laterally extending upper and lower flanges, the other said elements having a ledge-stepped side wall with laterally extending upper and lower flanges directed oppositely to the flanges of said first element and lying in adjacent internal relationship relative thereto, the upper flange of said other element being doubled over to provide a two-ply metal thickness, the combined upper and lower flanges of said sheet metal elements respectively forming a three-ply and a two-ply metal thickness whereby the strength characteristics of the upper and lower flanges of said rail are substantially equalized, and the edges of said outer flanges being formed around the corners where the inner flanges extend from the ledged side wall to hold the respective elements in assembled relation.

9. A ledged box section rail as set forth in claim 8 wherein the side walls of the respective elements are recessed inwardly at the top and bottom, the recesses in the side wall of the outer flanged element inter-engaging with the edges of the inner flanges to lock the same against separation from the outer flanges, and the edges of the outer flanges being formed to inter-engage with the recesses of the inner flanged element to lock said edges against separation from the inner flanges.

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