Jan. 24, 1967 H. HARRISON 3,299,985

STEPLADDER CONSTRUCTION

Filed Nov. 7, 1962

Fig. 1

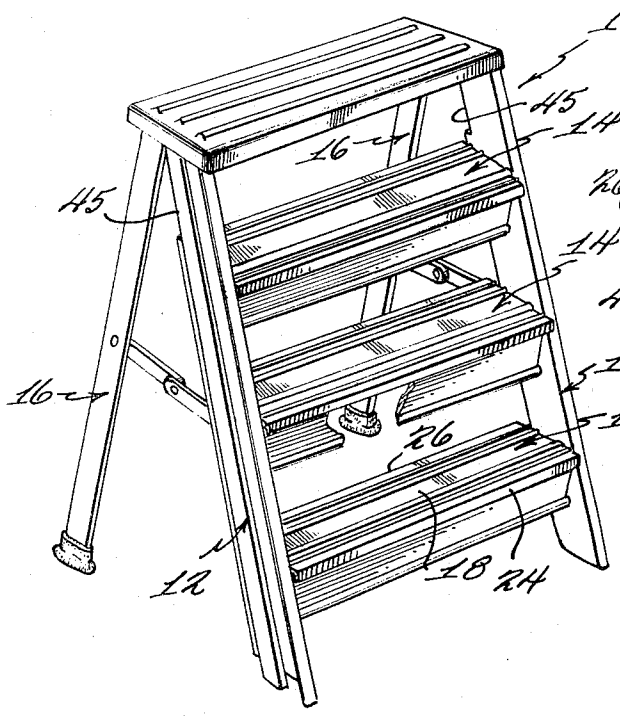


Fig. 3

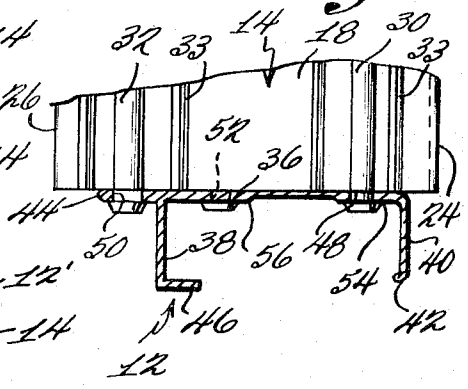


Fig. 2

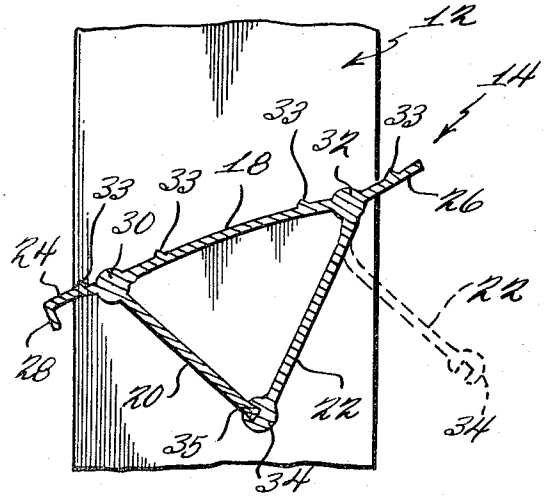
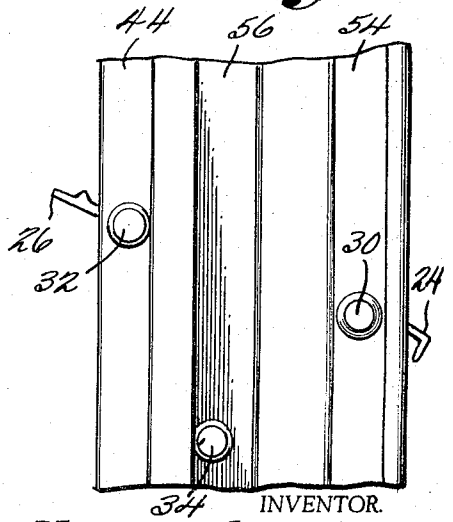


Fig. 4



INVENTOR.
HENRY HARRISON
BY
Cushman, Darby & Cushman
ATTORNEYS

United States Patent Office 3,299,985 Patented Jan. 24, 1967

3,299,985

STEPLADDER CONSTRUCTION

Henry Harrison, Frost Creek Drive, Locust Valley, N.Y. 11560

Filed Nov. 7, 1962, Ser. No. 236,031
19 Claims. (Cl. 182—194)

This invention has reference to a stepladder construction and has particular reference to a new and improved method and structure for forming the steps, and the joint between the steps and the opposed side rails.

This invention contemplates the provision of a step construction for stepladders and the like, the steps initially being extruded as a one-piece section in the general cross-sectional configuration of a pie-shape. After this extrusion is completed, one of the legs is bent toward the other and the two legs are joined together via a cleat connection at their lower free ends formed during extrusion. Thus, when the step is joined to the opposed side rails the cross-sectional configuration assumes a closed triangular, tubular configuration with a three-point stud connection to each side rail.

By virtue of this arrangement the extrusion die does not require a solid core as would be necessary in the extrusion of such hollow shapes as pipe tubing. As is well-known in the art, extrusion of hollow shapes is more expensive than open shapes, and such an extrusion of open shapes allows for easier control of the material thickness, longer die life, and lower extrusion temperatures. Thus, a hollow triangular step is formed of superior strength and characterized by extreme lightness. Moreover, the ladder steps are characterized by a high degree of torsional rigidity, and due to the three-point connection to each side rail, the shear resistance is substantial, and the requirement for separate corner braces is effectively obviated.

Further, objects of this invention include: (a) a step having a new and improved configuration, together with novel means for forming a closed, hollow step and joining the same to the opposed side rails; (b) a stepladder having generally C-shaped side rails constructed and arranged to receive step-studs which are generously spaced apart in triangular relationship for purposes of structural rigidity; (c) a new and improved method and means for forming steps by continuous extrusion techniques; (d) a stepladder of inexpensive, durable, and lightweight construction.

These and still further objects, advantages, and novel features of the present invention will become evident in the specification and claims, taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a perspective view of a stepladder constructed according to the principles of the present invention;

FIGURE 2 is a sectional view of a step when the ladder is in its folded or collapsed position, with broken lines showing the initial configuration of one depending leg during extrusion;

FIGURE 3 is a view taken along line 3—3 in FIGURE 1; and

FIGURE 4 is a side elevation view of a portion of a side rail.

Referring now to the drawings, there is shown a stepladder **10** having opposed side rails **12, 12'** and spaced apart steps **14**, disposed in parallel relationship between

the side rails **12, 12'**. Suitable rearwardly extending side rails **16, 16'** are joined to the upper end of the ladder **10** in pivotal fashion so as to provide a stable support for the ladder when in use. This linkage joining the rear rails **16, 16'** to the ladder **10** forms no part of the present invention; however, this overall construction may, for example, assume that disclosed in my copending application, Serial No. 835,796, filed August 24, 1959.

Referring now to FIGURE 2, a typical step **14** is shown. The step includes an upper base **18**, together with spaced apart front and rear depending tapered legs **20** and **22**, which extend from a point inwardly of the front and rear ends **24** and **26**, respectively, of the base **18**.

The base **18** has a depending flange **28** along its front end **24**, and enlarged circular portions **30** and **32** define the intersecting joint between the base **18** and the respective depending legs **20** and **22**. For purposes of preventing slipping during use of the stepladder **10**, the base also has upstanding triangular beads **33** spaced in parallel relationship along the step base **18**, two such beads being positioned on each side of, and extending above, the circular portions **30** and **32**.

The rear depending leg **22** has an integral cleat **34** along its lower free end, this cleat having a slot **35** arranged to receive the bottom free end of the leg **20**, thereby forming a triangular, hollow step, when so bent. The exterior configuration of the cleat **34** is preferably circular as with the portions **30** and **32** for ease of assembly as will become evident. However, other configurations will be acceptable. The advantage of providing a circular configuration resides in that the side rails **12, 12'** may be punched with circular holes corresponding to the spacing of the elements **30, 32** and **34**, as will become evident.

During initial continuous extrusion of the step **14**, which may be aluminum, the rear leg **22** extends outwardly and spaced from the leg **20**, as shown in broken lines in FIGURE 2. This avoids the requirement for core-type extrusion as necessary in forming pipe, and the problems attendant with core-type extrusion techniques. After the form is extruded, the leg **22** is then bent into engagement at its lower end with the lower end of the leg **20**, via the slotted cleat **34**.

The side rails **12** and **12'** are of identical construction, the side rail **12** being shown in FIGURES 3 and 4. The side rail **12** (and **12'**) has a generally C-shaped configuration in plan, there being provided a flat web **36** which is adapted to abut the end of the step **14**. A first flange **38** and a second flange **40** extend laterally outward from the web **36**, the flange **40** constituting the forward part of the side rail **12**. This flange **40** has a small rearwardly extending smooth bead **42** at its outer extremity. This bead configuration provides smoothness of appearance and the like.

The flange **38** is spaced inwardly from the rearward end of the web **36** so that the web **36** has a lip **44** therealong. Conveniently, the lip **44** is sheared off above the upper step, at **45**, for ease of gripping. The flange **38** terminates at its outer end in a forwardly extending flange portion **46** for purposes of structural rigidity. Both the flanges **38** and **40** are conveniently disposed at right angles to the web **36** and this structural shape may be formed with conventional techniques.

The side rail **12** is provided with holes **48, 50, 52** corresponding to the axis of the circular portions **30, 32**, and **34**, respectively, which define a triangle in their as-

sembled position. As will become evident, these circular portions **30**, **32**, and **34** are adapted to form studs during the manufacturing process. That is to say, if a continuous extrusion is made of the open step shape, the step lengths will be cut and material will cut away from the end of the step lengths so that the circular portions **30**, **32**, **34**, form studs. Moreover, the side rails **12**, **12'** are formed with extra thickness in the web **36** along the exterior surface which is joined to the steps **14** via the punched holes **48**, **50**, and **52**, respectively. These areas of increased thickness are designated by numerals **54**, and **56**, respectively. The thickened web portion **54** extends along the lengths of the side rail **12** in the area carrying the punched holes **48**, while the thickened web portion **56** traverses both the lip **44** (carrying the punched holes **50**) and the area carrying the punched holes **52**. The arrangement of the holes in the side rail **36** is such that access may be had thereto in an axial direction for ease of assembly. Thus, the bead **42** and the flanges **46** are of such a length so as not to interfere with the assembly operations through the holes **48**, **50**, and **52**, respectively.

During the manufacturing operation, a continuous extrusion is made of the cross-sectional flange configuration shown in FIGURE 2 wherein the rear leg **22** is initially formed relative to the remainder of the step **14** in the broken line shape here shown. This is an open extrusion so that extrusion temperatures may be lower and the necessity for a core is eliminated. After the continuous extrusion is formed, the leg **22** is bent to the full line shape shown in FIGURE 2 so that its cleat **34** engages the bottom end of the front leg **20** via the slot **36**. This may be a continuous operation, with a bending station in cooperative alignment with the extrusion outlet. The angle of the bend is consistent with structural considerations, depending upon the thickness of the material and the actual material used for the step structure.

Steps **14** are cut from this bent extrusion. The studs **30**, **32**, and **34** are formed from the cut ends of the steps **14** by any of various different types of cutting operations. For example, the material forming the base **18** and the legs **20**, **22** in the ends of the flange may be sheared or milled away or these web portions may be pinched out with a rule die consisting of a pattern of knife edges working against a plain inner mandral surface which conforms to the interior configuration of the step **14**. Another convenient method for forming these studs is to mill them with specially designed hollow milling cutters conforming to the configuration of the stud ends. This method most accurately locates finished studs and permits them to be formed with any desired taper or chamfer. Those skilled in the art will recognize numerous alternative ways for forming the stud ends from the circular portions **30**, **32**, and **34** of the step **14**.

The opposed stud ends of the step **14** are then assembled in the aligned holes **48**, **50**, **52** of the side rails **12**, **12'** and are joined by conventional techniques. Preferably, the stud ends are peened to the side rail web **36** or crushed so as to complete the assembly. No separate rivets or other fasteners are then required and axial access to the stud ends are not obstructed by the configuration of the side rails **12**, **12'**.

Preferably, the stepladder **10** is formed of aluminum due to its ease of extrusion and lightness, together with its structural qualities. However, other alloys and materials will be apparent to those skilled in the art.

From the foregoing description of the various embodiments of this invention, it is evident that the objects of this invention, together with many practical advantages are successfully achieved. While preferred embodiments of my invention have been described, numerous further modifications may be made without departing from the scope of this invention.

Therefore, it is to be understood that all matters herein set forth or shown in the accompanying drawings are to be interpreted in an illustrative, and not in a limiting sense.

What is claimed is:

1. In a stepladder, spaced apart side rails and vertically spaced steps joined to their opposite ends to said side rails, each of said steps including a base portion, transversely extending legs integrally formed with said base and joined to one another at their free ends to thereby form a closed and hollow triangular configuration defined by the intersection of said legs with said base portion and with one another, each of said steps also including integral studs formed at the opposite ends of said steps, said studs being positioned at the intersection of said legs with said base portion and with one another, said opposed side rails having cooperatively spaced apart holes therein for receiving said integral studs.

2. Stepladder defined in claim **1** wherein said legs depend from said base portion at locations inwardly of the edges of said base portion whereby said base portion forms a ladder tread of substantial width.

3. Stepladder defined in claim **1** wherein one of said depending legs includes an integral cleat at its lower end, said cleat having a longitudinally extending slot constructed and arranged to receive the lowermost end of the other depending leg.

4. Stepladder defined in claim **1** wherein the intersection of the depending legs with said base member and the free end of one of said legs are of circular configuration, the studs thereby being of circular cross-sectional configuration.

5. Stepladder defined in claim **4** including a peened joint connecting said studs to said opposed side rails.

6. Stepladder defined in claim **1** wherein said opposed side rails including a web portion constructed and arranged to abut the base and depending legs of said steps, and spaced apart, outwardly extending flanges integrally formed with said web portions, one of said flanges including a transversely extending flange portion at its free end, said flanges and said flange portions arranged to provide aligned access to said holes in said side rail.

7. Stepladder defined in claim **15** wherein said steps and said side rails have a front and a rear end, one of said outwardly extending flanges adjacent the front end of said steps having a rearwardly extending bead along its free end and said other flange is spaced forwardly of the rearward end of said web, to define a lip, one of said studs in a step being joined to said web along said lip, the other studs being joined to said web intermediate said flanges.

8. Stepladder defined in claim **7** wherein said transverse flange portion extends towards the front of said side rails and said steps.

9. Stepladder defined in claim **6** wherein said web portion is of enlarged sectional configuration in the region of said holes.

10. Stepladder defined in claim **1** wherein said base portion is uppermost and the region of said base portion intersecting said depending legs is enlarged in the plane of said base portion relative to the remainder thereof.

11. Stepladder defined in claim **10** including longitudinally extending upward bead treads in said base portion extending above said enlarged portions.

12. Stepladder defined in claim **10** including a depending longitudinal flange along the front of said step.

13. Stepladder defined in claim **10** wherein said legs are spaced inwardly of the front and rear end of said step.

14. Method of forming a ladder comprising the steps of: extruding an open shape in the form of an upper base and two integral spaced apart depending legs; bending one of the legs into engagement with and joining it to the other leg to form a closed triangular shape defined by the points of intersection of the legs with the base and with one another; cutting the shape in a transverse direction to form individual steps; and joining the ends of said steps at each of said three points of intersection to opposed side rails in spaced apart relationship.

15. Method as in claim **14** wherein only one leg is

bent, the other leg being maintained at a constant angle to said base.

16. Method defined in claim 14 including the step of forming a stud at each point of the triangular shape by cutting away portions of said individual steps at opposed ends along the legs and base; forming holes in said side rails corresponding to said studs, and joining said steps to said side rails by fixing said studs in said holes.

17. Method defined in claim 16 including the step of forming the shape during extrusion with a circular configuration at said intersections and forming therewith circular studs by said cutting-away step.

18. Method defined in claim 14 wherein said extruded shape is formed of aluminum.

19. Method of forming a ladder structure including spaced apart first and second supporting members and a third member joined at its opposed ends to said first and second members comprising the steps of: extruding said third member in an open cross-sectional shape to form a base portion and spaced apart legs transversely intersecting said base portion, then bending one of said legs into engagement with the other leg and joining the legs together to form a closed, hollow shape in section; cutting away a part of the base portion and a part of the legs at least one end of said third member and forming thereby

studs at the intersection of said legs with said base member and with one another; and joining said third member to one of said first and second members via said studs.

References Cited by the Examiner

UNITED STATES PATENTS

901,755	10/1908	Tiepolt	182—194
1,503,880	8/1924	Broman	182—228
1,891,740	12/1932	Westerman	182—230
2,127,035	8/1938	Kirlin	182—228
2,957,543	10/1960	Larson	182—228
2,959,245	11/1960	O'Keefe	182—228
3,004,625	10/1961	Arnold	182—228
3,016,976	1/1962	Munson	182—228
3,031,028	4/1962	Harrison	182—228
3,181,651	5/1965	Larson	182—228

FOREIGN PATENTS

607,239	12/1961	Belgium.
1,163,204	4/1958	France.
570,931	12/1957	Italy.

REINALDO P. MACHADO, *Primary Examiner.*