Sept. 6, 1960 H. B. RICH 2,951,550

LADDER CONSTRUCTION

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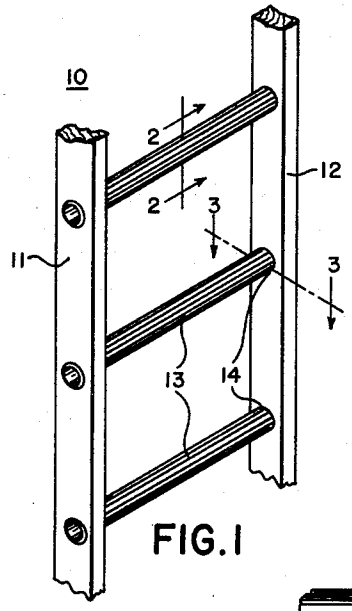

FIG. 1

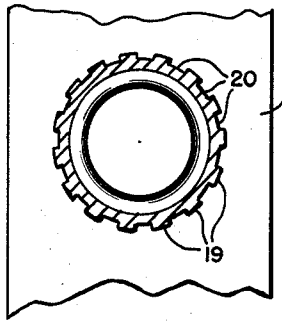

FIG. 2

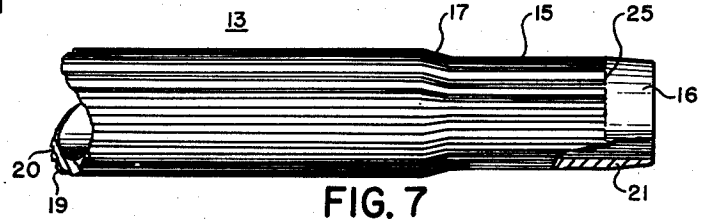

FIG. 7

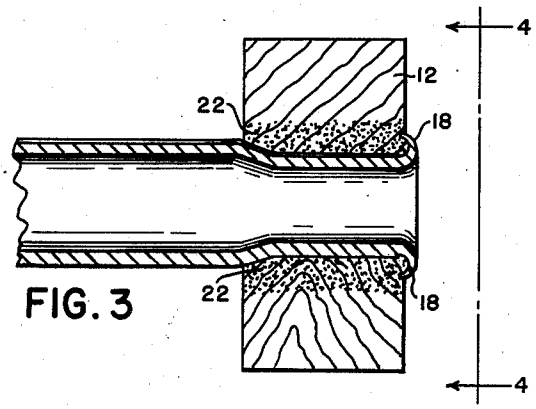

FIG. 3

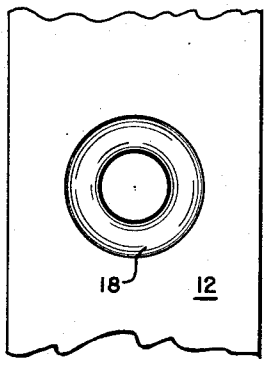

FIG. 4

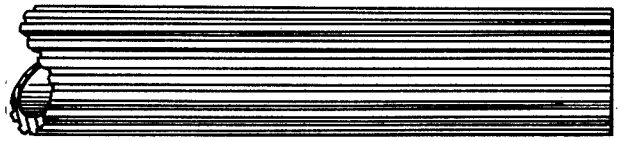

FIG. 5

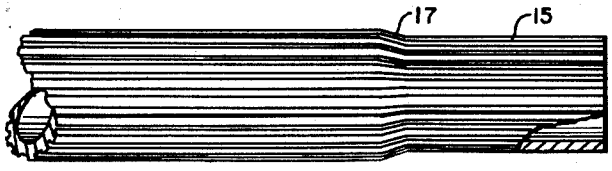

FIG. 6

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LADDER CONSTRUCTION

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1 Claim. (Cl. 182—194)

This invention relates to improvements in ladders, and in their construction, and in particular, to a novel and improved method and means of attaching the rungs firmly to side members or rails.

An object of the invention is to provide a simple, expeditious and efficient method for assembling metal rungs and rails of ladders.

Another object is to provide a ladder assembly wherein the deterioration of the ladder incident to water seepage at the junction of the rung and the rail is minimized.

Another object is to attain a rigid and effective gripping or locking of the rung and the rail upon one another in assembled relation, whereby each is fixedly secured to each other.

These and other objects are attained by the means and method described herein and disclosed in the accompanying drawings, in which:

Figure 1 is a perspective view of a ladder fragment embodying the invention.

Fig. 2 is a fragmental cross-sectional view taken on line 2—2 in Fig. 1.

Fig. 3 is a fragmental sectional view on line 3—3 of Fig. 1.

Fig. 4 is a side view of an assembled rung and rail taken along line 4—4 of Fig. 3.

Fig. 5 is a view showing a corrugated or fluted rung, in its initial or original shape, preparatory to forming of parts thereof for assembly with a rail.

Fig. 6 is a fragmental view of one end of the rung shown in Fig. 5, after forming a reduced end and an abutment or shoulder at one end portion of the rung.

Fig. 7 is a fragmental view of one end of the rung shown in Fig. 6, after the end of the rung has been developed into a tapered formation, decreasing in cross-sectional thickness toward the extreme end thereof.

The ladder fragment 10, shown in Fig. 1, illustrates an embodiment of the invention as applied to an extension ladder comprising wood side members or rails 11 and 12 and corrugated or fluted rungs 13. The invention is adaptable to other types of ladders, for example, step ladders, and also to ladders comprising metal side members or rails. The description will be confined to extension ladders comprising wood rails and will be understood as being applicable to other types of ladders.

The ladder 10 comprises a pair of side rails 11 and 12, and a plurality of rungs 13 extending fixedly between and joining the rails 11 and 12. Along the length of each of rails 11 and 12 are spaced bores 14 of substantially uniform diameter and extending transversely through the rails. Into and through each of the bores there is inserted and disposed a reduced end portion 15 of a rung 13. Thereupon, the extreme end 16 of the rung is formed or turned outwardly and then, back toward and into the rail to clamp and seize the rail between shoulder 17 which merges with one end of the reduced portion 15 of the rung, and the formed radially enlarged, inturned portion or flange 18 of the rung (see Figs. 3 and 7).

The construction at each side rail is identical, wherefore, the description herein is confined to the construction at one end of the rung.

The said rails 11 and 12, conform with side rails in common use in prior ladders in that circular bores 14 are of uniform diameter through their lengths. After the wooden rails are perforated to provide the bores, a suitable preservative is applied throughout the bores. The preservative permeates the wood for some distance around the bore.

Each rung is of metal of a corrugated or fluted, hollow or tubular, formation, and may be of aluminum content affording adequate strength and rigidity, yet capable of being formed into a reduced diameter by forcing the rung end into a suitable reducing die or chuck. The rung in its original form (Fig. 5) is provided with upstanding ribs 19 extending lengthwise of the rung and between which are grooves 20, coextensive with the ribs 19 (Figs. 2 and 5), thereby forming corrugations. The ends of the rung are reduced to a uniform diameter such that the diametrical distance between the lowermost or innermost surfaces of the grooves 20 disposed at opposite sides of the rung, approximate the diameter of the bores in the rails. The ribs 19 project outwardly from the rungs and extend in excess of the diameters of the walls of the bores 14 and therefore resist entry of the rung ends into the bores. The extreme ends 16 of the rungs are then tapered or gradually reduced on their outer faces, as at 21 in Fig. 7, to a diameter at the end of the rung, slightly less than the diameter of the bores in the rails. Thus, the reduced and tapered ends 16 of the rungs function as leading ends, guiding the rungs into the bores in the assembling operation.

The rungs are assembled with the rails by pressing or forcing the rungs into the rails until the shoulders 17 engage the inner faces of the rails, and the ribs and shoulder formations are thereby forced into the material of the rails. Thereby, the ribs on the rungs are embedded in the rails and are firmly secured and retained from rotation in the bores. The reduced portion 15 of the rung is of a length such that when the shoulder 17 is embedded in the rail, portion 15 extends from shoulder 17 for a distance to wholly confine said reduced portion within the rail, and the tapered end 16 of the rung will project from the bore at the opposite or outside face of the rail.

The tapered end 16 of the rung is then curled or turned outwardly and back toward the adjacent rail face, until the extreme end of the rung is brought into contact with and to a small degree pressed into or embedded in the material of the rail, as shown at 18 in Fig. 3.

The shoulder 17 is preferably somewhat more abrupt than is shown in the drawings, in order to attain a maximum abutment effect between the shoulder and the rail.

The taper formation at the extreme end of the rung permits rearward forming of that portion of the rung into a flange without splitting or tearing of the rung end or flange.

The preservative extending about the bore, as indicated at 22 in Fig. 3, will vary as the preservative permeates the rail to varying degree in all directions from the bore.

In assembling a ladder, the rails, with rungs in alignment with the bores, are forced toward one another by a suitable press (not shown), thereby driving or forcing the ribs on the rungs into the material of the rails, until shoulder 17 engages and abuts the inner face of the rail. The leading ends 16 of the rungs are projected beyond the rails and by a subsequent operation, the leading ends or peripheral edges of the rungs are flared or turned outwardly and back into annular flanges having fixed or gripping engagement upon and being embedded in the outer faces of the rails in the assembled ladder, thereby

completing the method by which the rungs are assembled to the side members or rails of the ladders.

The ribs formed on the outer faces of the reduced end portions of the rungs are spaced at their bases or junction with the central core of the rung by the arcuate outer faces formed on or projecting radially outwardly from or defining the periphery or outer circumference of the central core of the rungs intermediate the ribs. Those arcuate outer faces on the cores of the reduced end portions of the rung intermediate the ribs, are formed or formulated on approximately the same diameter as the diameter of the annular perforations in the rails. By so relating the size of the perforations or bores in the rails to the diameter of the rung outer faces intermediate the radially extending ribs on the reduced portions of the rungs, there is assured a snug fit and any slight oversize of the rung portions or central core will be compensated by an appropriate compression or deformation of rail material, without impairing the snug fit that is sought in the assembly.

By central core of the rung is meant the approximately hollow round portion of the rung, defined in part by the arcuately aligned outer faces of the grooves **20** and including so much of the rung material as extends centerward from the base or foot of each rib. By ribs is meant such portions of the rung as radiate outwardly from a circular line coinciding with the outer faces of the grooves and disposed and continuing between adjacent grooves at the base of each of the ribs, the ribs on the reduced end portions continuing with and from the ribs on the central portion of the rung. The core of the rung is continuous throughout the length of the rung notwithstanding the reduction in diameter thereof in the reduced end portions and the tapering reduction in thickness thereof at the free, terminal or extreme ends of the rung.

The rung comprises stepped sections or portions, each of uniform configuration, the core of the central portion being of the maximum diameter, the cores of the reduced end portions adapted to repose in the perforations in the rails being of a smaller or intermediate diameter, and the cores of the extreme ends being tapered, or gradually reduced and in the leading parts thereof, being of the smallest diameter which smallest diameter is somewhat smaller than the diameter of the perforations or bores in the rails.

The leading ends **25** of the ribs on the intermediate core portion function as cutting elements which form seats in the rail to accommodate the ribs on the reduced

end portions of the rung. The same seat forming action of the leading rib ends, is availed of in assembling ladders having metal rails.

The invention may be adapted to assemblies comprising metal rungs and metal rails, and in such instance, the relative characteristics of the metal rung and metal rib should be such that ribs **19** of the metal rung will cut their own seats into the material forming the metal rail. Obviously, in all metal ladders, the metal of which the rungs and ribs thereof are composed, must be a composition adapted to cut or form seats in the somewhat softer metal of the rails.

It is to be understood that various modifications and changes may be made in the physical embodiment of the invention heretofore described without departing from the spirit and scope of the invention.

What is claimed as new and patentable is:

In a ladder having wooden side rails and metal rungs the combination comprising a wooden side rail having an aperture extending therethrough, an elongate cylindrical rung the exterior of which is longitudinally grooved to provide radial ribs, the tread portion of said rung being of constant dimensions, and spacing and joining side rail engaging portions, each side rail engaging portion having a main substantially cylindrical portion of smaller diameter than the tread portion and joined thereto by a frusto-conic portion, said tread ribs continuing upon the exterior of said frusto-conic and main portions of said side rail engaging portion received in the aperture in said wooden side rail in interlocking wood compressing relation and a flange portion flaring outwardly from the main rail engaging portion and curving to a peripheral edge embedded in the face of said side rail remote from the tread portion of said rung whereby said frusto-conic and flange portions are retained in tight pressed relation to said side rail to provide a rigid joint in which the end grain of said side rail adjacent said rung is shielded from water.

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