

May 15, 1951

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2,552,630

METAL LADDER

Filed Aug. 6, 1947

3 Sheets-Sheet 1

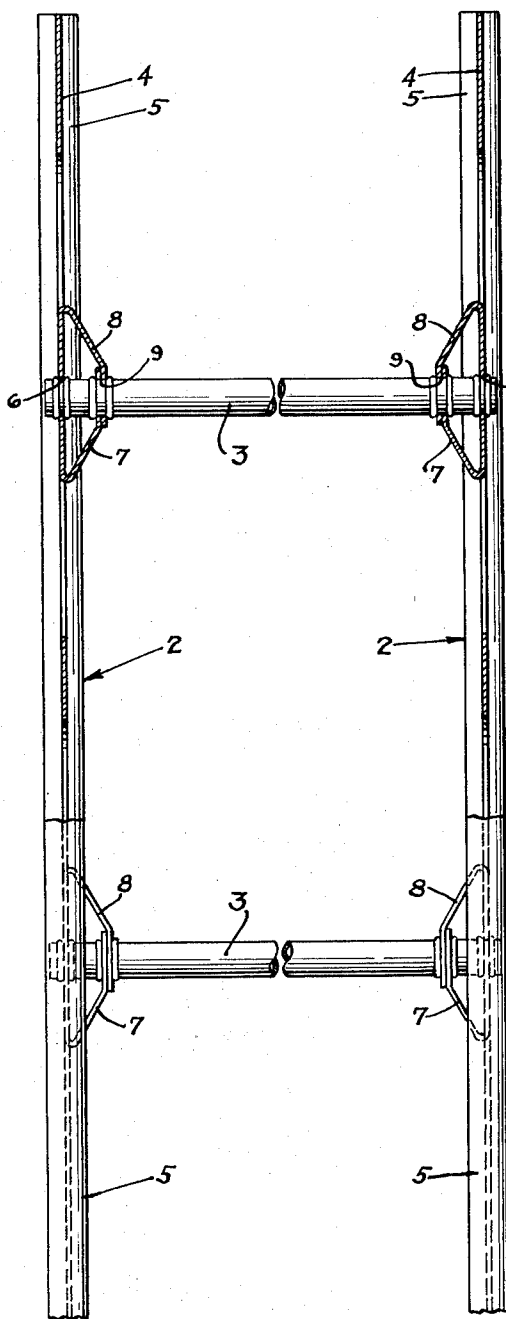


FIG. 1

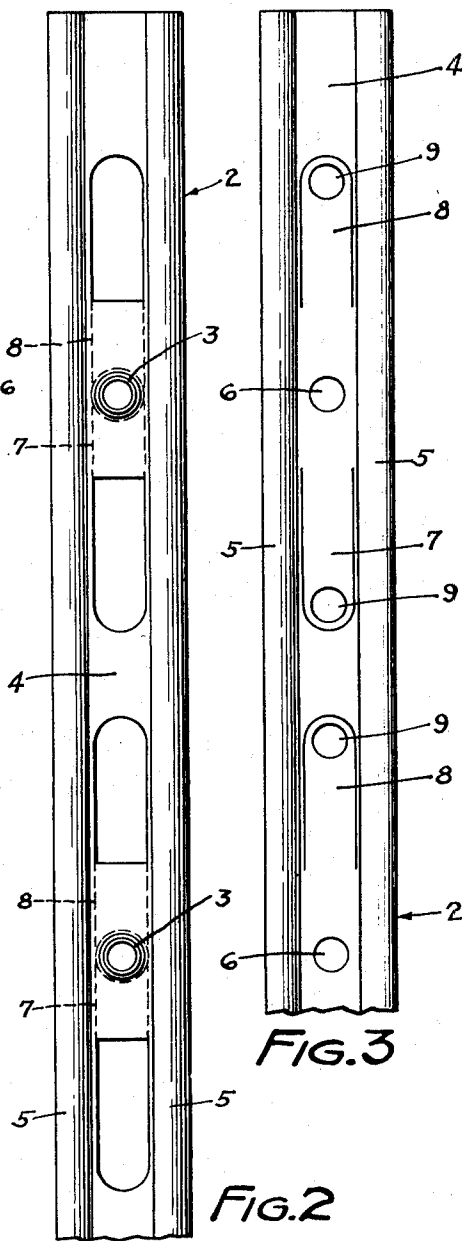


FIG. 3

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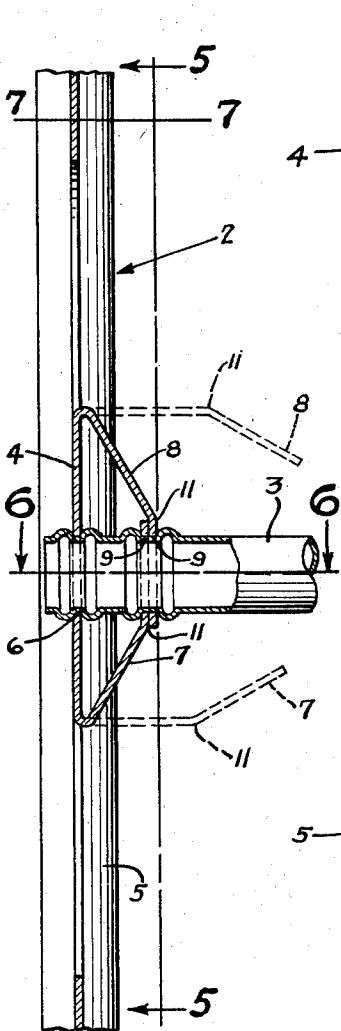


FIG. 4

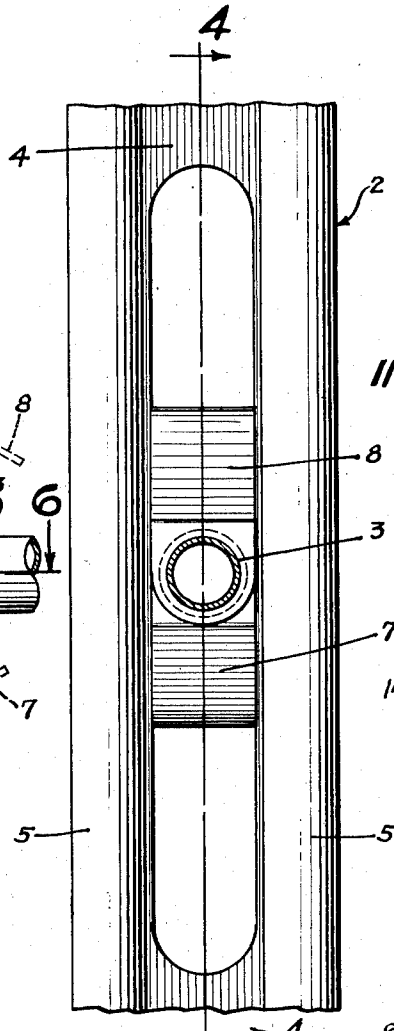


FIG. 5

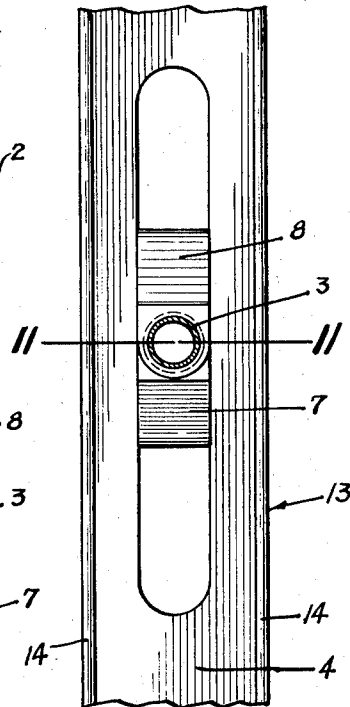


FIG. 10

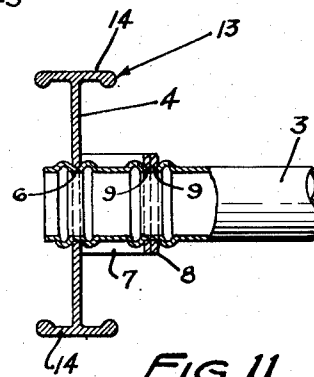


FIG. 11

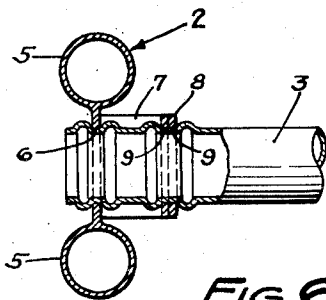


FIG. 6

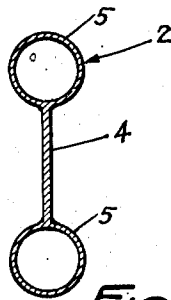


FIG. 7

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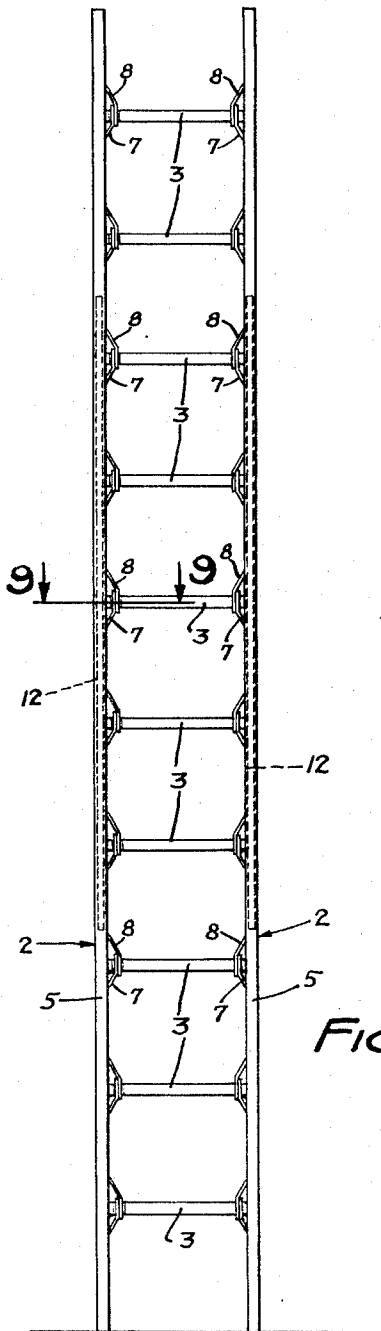


FIG. 8

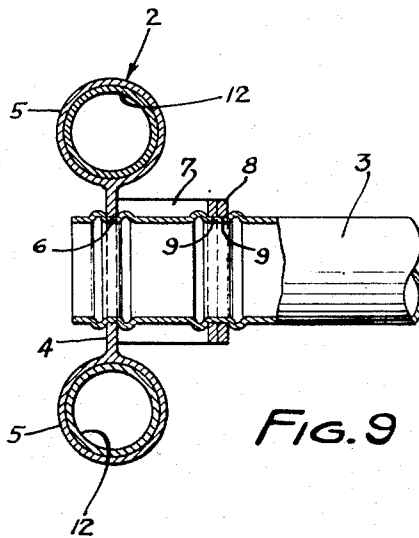


FIG. 9

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METAL LADDER

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6 Claims. (Cl. 228-56)

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This invention relates to new and useful improvements in ladders and more particularly to ladders constructed of a suitable lightweight metal such as aluminum.

During the past few years, aluminum has become very popular in the manufacturing industry, primarily because of the improvements made in the production of the metal, and also because of the improvements made in the metal itself, it now being possible to obtain aluminum alloys of almost any desired hardness without sacrificing lightness, whereby the use of aluminum in the industrial field has become very popular and widespread, in that it may be used in the manufacture of a great many articles with most desirable and practical results, ladders being one such use.

It has also been found, in the manufacture and production of aluminum, that such metal may readily be formed into long bars of almost any desired cross section by the usual rolling and drawing method, and, in addition, it readily lends itself to the extrusion method of forming longitudinal rails or bars, whereby portions of such rails or bars may be made tubular or otherwise shaped cross sectionally, in a very expeditious manner.

The present invention is directed more particularly to the provision of an all metal ladder constructed of a lightweight metal such as aluminum, and wherein the usual rungs of the ladder have their end portions suitably interlocked with the side rails of the ladder to provide, in effect, an integral structure having great strength and durability, and which is extremely light in weight, whereby it may readily be transported from one place to another with a minimum of effort, a highly desirable attribute in a device of this general character.

A further object of the invention is to provide a ladder having spaced side rails, each comprising a longitudinally extending web, which are suitably reinforced along their opposed edges to strengthen the rails against lateral deflection, when subjected to a load, and said webs having longitudinally spaced apertures therein adapted to receive the ends of tubular rungs, portions of the walls of said rungs at each side of the rail webs being formed with outwardly projecting annular beads, whereby the rung ends are so interlocked with the side rails as to provide, in effect, an integral ladder structure having great strength, and which is extremely light in weight.

A further and more specific object is to provide an aluminum ladder including spaced side rails,

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each comprising a longitudinally extending web having its opposed edges formed with suitable enlargements to reinforce said rails against lateral deflection, when the ladder is subjected to a load, and a plurality of longitudinally spaced apertures being provided in the web of each side rail, and suitable tongues being struck from said webs at each side of each aperture, and the tongues adjacent to each aperture being bent inwardly and having their end portions disposed in overlapping relation, and suitable apertures being provided in said overlapping tongue portions which apertures are axially aligned with their respective apertures in said webs, and a plurality of tubular rungs having their end portions inserted through the aligned apertures in said overlapped tongues and in the adjacent apertures in the rail webs, after which the walls of said rungs are formed with outwardly projecting annular beads at the sides of said tongue portions, and adjacent to the webs, and whereby the ends of the rungs may be firmly secured to the ladder side rails to form, in effect, an integral structure.

A further object of the invention resides in the novel way in which the ends of the rungs are secured to the side rails whereby the ladder, when completed, is greatly reinforced against lateral swaying, the cross-sectional shape of the side rails being such as to provide the utmost in strength and resistance to lateral deflection, when the ladder is subjected to a load, and whereby the invention is particularly applicable to extension ladders, and the like, which require great strength and durability.

Other objects of the invention reside in the novel construction of the overlapping tongues which, because of their inherent construction, cooperate with the web of each side rail to provide elongated bearings for the ends of the rungs, whereby when the rungs are secured to the side rails, as herein disclosed, the ends of the rungs become firmly united with the side rails thereby to eliminate play in the joints, a highly desirable attribute in a structure of this general type, particularly in the construction of relatively long extension ladder sections.

Other objects of the invention will appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to

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the exact features shown, as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a view showing a section of a ladder and illustrating the preferred manner of securing the rungs to the ladder side rails;

Figure 2 is a side view of a portion of a ladder showing the tongues struck from the web to provide means for anchoring the ends of the rungs to the side rails;

Figure 3 is a side view of a portion of a side rail showing the rung receiving holes formed therein and also the punching of the tongues prior to bending them into the form shown in Figure 1;

Figure 4 is an enlarged longitudinal sectional view on the line 4—4 of Figure 5;

Figure 5 is a vertical sectional view on the line 5—5 of Figure 4;

Figure 6 is a detail sectional view on the line 6—6 of Figure 4;

Figure 7 is a cross sectional view on the line 7—7 of Figure 4;

Figure 8 is a view showing a completed ladder having its side rails provided with suitable reinforcing inserts;

Figure 9 is an enlarged detail sectional view on the line 8—8 of Figure 8, showing the tubular reinforcing elements inserted into the longitudinally extending tubular portions of the side rails;

Figure 10 is a view showing a side rail of slightly modified construction wherein the opposed edges of each side rail are T-shaped in cross-section; and

Figure 11 is a detail sectional view on the line 11—11 of Figure 10.

The novel ladder herein disclosed is shown comprising a pair of side rails, generally designated by the numeral 2, secured together in spaced relation by suitable rungs 3, preferably tubular in cross section, as illustrated in the drawings. Each side rail 2 is shown comprising a longitudinally extending web 4 provided at its opposed edges with suitable reinforcing portions, preferably in the form of tubular, substantially cylindrical elements 5, which serve to adequately strengthen the webs against lateral and edge-wise deflection, when the ladder is subjected to a load.

Because of the advancement made in the production of aluminum bars in the past few years, it is now possible to obtain aluminum bars of considerable length formed with integral tubular side reinforcing members 5, as shown in Figure 7. Rails of such cross section readily lend themselves for use in the construction of ladders, particularly extension ladders, because of being extremely light in weight in proportion to their strength. The particular cross section shown in Figure 7 also provides a very convenient grip whereby an individual may readily grasp the side rails of the ladder with a firm grip and without danger of his hands slipping therefrom when moving the ladder about from one place to another.

One of the important features of the present invention resides in the novel manner employed for securing the rungs 3 to the side rails 2 of the ladder, whereby looseness in the connections between the rungs and the side rails is completely and positively eliminated so that the rungs and side rails become, in effect, an integral structure

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which will provide the utmost in strength and stability in proportion to its size and weight.

To thus secure the ends of the rungs to the side rails, the web 4 of each side rail is formed with a plurality of apertures 6 which are spaced apart lengthwise of the rails corresponding to the spacing between the rungs, as shown in Figures 1 and 8. Suitable tongues 7 and 8 are struck from the web 4, below and above, respectively, of each aperture 6, and each tongue is formed with a suitable aperture 9, as clearly illustrated in Figure 3. The diameters of the apertures 6 and 9 correspond substantially to the outside diameter of the rungs 3.

After the tongues have been struck or sheared from the web 4, as indicated in Figure 3, each pair of tongues 7 and 8 are bent laterally from the web to the dotted line positions shown in Figure 4, and simultaneously have their outer apertured end portions bent as indicated at 11 in Figure 4. Each pair of tongues are then further inwardly bent towards one another until their end portions are disposed in overlapping relation, and in such manner that the apertures 9 therein are axially aligned with one another and also with the adjacent aperture 6 provided in the web 4.

When the tongues of each pair of tongues of the two rails have thus been bent into overlapping relation, the cylindrical end portions of the rungs 3 are inserted through the aligned apertures in each pair of tongues and their respective webs 4. The walls of the rungs are then outwardly beaded, as best illustrated in Figure 4, at opposite sides of the tongues and also at opposite sides of the web 4, whereby the rungs become firmly secured to the side rails in a manner to eliminate any possibility of play between the parts, and also whereby the connections between the ends of the rungs and the side rails will form, in effect, substantially an integral structure.

Because of the lateral spacing of the overlapped ends of the tongues 7 and 8 and their respective rail webs 4, and further because of the outward beading of the walls of the rungs, as hereinbefore described, the connections between the rungs and the rails are of sufficient length to provide a very rugged and substantial structure which is highly resistant to side sway, when subjected to a load, as will readily be understood. At the same time, the tubular edge portions 5 of the side rails 2 minimize deflection of the side rails in the median planes thereof, thereby resulting in the production of a ladder section which presents the utmost in strength and ruggedness in proportion to its weight, which are highly desirable features in a structure of this general type.

Another feature of the invention resides in the production of a lightweight ladder so constructed that its side rails may be readily and conveniently reinforced against excessive deflection at any portion of the length of the ladder, which is particularly desirable in extension ladder sections which, at times, may be quite long.

To thus reinforce the side rails of the ladder, tubular inserts, generally designated by the numeral 12, may be inserted into the tubular side portions 5 of the rails 2, as shown in full lines in Figure 9 and dotted lines in Figure 8. These inserts may be of any desired length depending upon the length of the ladder section, and may be located at any particular location lengthwise of the side rails. In Figure 8 it will be noted that they are located at the intermediate portion of

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the ladder which is usually subjected to the maximum deflection, when the ladder is under a load.

If desired, the reinforcing elements 12 may be removably supported within both tubular portions 5 of each side rail, or but one such reinforcing element may be employed in each side rail, depending upon the load to be carried by the ladder. If the ladder is found to have adequate strength without additional reinforcement, the inserts 12 may be dispensed with.

Figures 10 and 11 show a side rail, generally designated by the numeral 13, whose side edges are T-shaped in cross section, as indicated at 14 in Figure 11. The method of securing the rungs 3 of the webs 4 of the side rails 13, is identically the same as shown and described with reference to the previous figures, and the parts thereof will therefore be identified by like numerals.

I have herein referred to the ladder as constructed of aluminum, but it is to be understood that it may be constructed of any other lightweight metals or metal alloys suitable for the purpose, aluminum having been found as a very practical metal for such use. The novel ladder herein disclosed provides the utmost in strength in that the particular manner of securing the ends of the rungs to the side rails so connects together the rungs and side rails that it is practically impossible for any play or looseness to develop in the connections therebetween. In Figure 4 it will be noted that the walls of the rungs have been outwardly annularly beaded at opposite sides of the overlapping tongue ends, and also at opposite sides of the rail webs 4. In some instances, it may be possible to eliminate some of the beading, but when beaded as herein disclosed, the rungs are positively locked against relative movement in the side rails. It will also be noted that the rungs are secured to the side rails without separate securing elements or welding, the beading shown and described constituting a very practical operation which may readily be performed with suitable tools, well known in the art.

It will be apparent to those skilled in the art that I have accomplished at least the principal objects of my invention, and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that my invention is not limited thereto.

I claim as my invention:

1. In a ladder, spaced side rails each comprising a longitudinally extending web, the opposed edges of said webs being formed with integral enlargements extending outwardly from the median plane of each web to reinforce said rails against lateral deflection, a plurality of apertures in each rail web spaced apart longitudinally of the rails, rung securing members struck from said webs adjacent to the apertures provided in each rail web, and a plurality of rungs interposed between said rails and having their end portions received in said apertures and engaged with said struck out rung securing members, thereby to secure the rungs to the rails in fixed spaced relation.

2. In an all-metal ladder, spaced side rails each comprising a longitudinally extending web, the opposed edges of said webs being formed with integral enlargements of tubular cross-section extending outwardly from the median plane of

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each web to reinforce said rails against lateral deflection, when said rails are subjected to a load, spaced apertures in said webs, a plurality of rungs each having their opposed ends received in corresponding apertures in said webs, laterally projecting means on said rungs adjacent the ends thereof for engaging opposite sides of each side rail web to prevent relative axial movement of the rungs in the side rails, and tongue-like members struck from the rail webs and extending inwardly and engaging said rungs at points spaced inwardly from said webs and cooperating with said beaded rung portions to secure the rungs to the rail webs.

3. In an all-metal ladder, spaced side rails, each side rail comprising a longitudinally extending web, the opposed edges of said webs being formed with suitable reinforcing elements to resist lateral strains imposed on said rails, a plurality of tubular rungs, rung-receiving apertures in the webs of said side rails, an elongated tongue struck from the web of each side rail adjacent to each rung-receiving aperture, said tongues being bent laterally from their respective rail webs and having their end portions disposed in substantially parallel relation thereto, and each tongue having a rung-receiving aperture axially aligned with an aperture in the rail web, the aligned apertures in the rail webs and their respective tongues receiving the end portions of said rungs, and means for fixedly securing the end portions of the rungs in said apertures to complete the formation of the ladder.

4. In an all-metal ladder, spaced side rails, each side rail comprising a longitudinally extending web, the opposed edges of said webs being formed with suitable reinforcing elements to resist lateral strains imposed on said rails, a plurality of tubular rungs, rung-receiving apertures in the webs of said side rails, a pair of elongated tongues struck from the web of each side rail adjacent to each rung-receiving aperture, and the end portions of each pair of tongues being bent laterally from their respective rail webs and having their end portions disposed in overlapping relation, rung-receiving apertures in said overlapped tongue portions axially aligned with their complemental apertures in the rail webs, the aligned apertures in the rail webs and their respective tongues receiving the end portions of said rungs, and means for fixedly securing the end portions of the rungs in said apertures to complete the formation of the ladder.

5. In an all-metal ladder, spaced upright side rails, each side rail comprising spaced parallel tubular portions secured together by an integral web, a plurality of apertures formed in the web of each side rail and spaced apart lengthwise thereof, longitudinally disposed tongues struck from said webs and arranged in pairs, one tongue at each side of each of said apertures, the end portions of each pair of said tongues being bent inwardly and towards one another and disposed in overlapping relation, the overlapped ends of each pair of said tongues having apertures therein axially aligned with their complemental web apertures, and a plurality of rungs having cylindrical end portions fitted into and secured in the aligned apertures in each pair of complemental tongues and the adjacent web portions, thereby to complete the formation of the ladder.

6. In an all-metal ladder, spaced upright side rails, each side rail comprising spaced parallel

tubular portions secured together by an integral web, a plurality of apertures formed in the web of each side rail and spaced apart lengthwise thereof, longitudinally disposed tongues struck from said webs, one at each side of each of said apertures, the end portions of said tongue being bent inwardly and towards one another with their ends disposed in overlapping relation, said overlapped tongue portions having apertures therein axially aligned with the adjacent apertures in the webs of the side rails, a plurality of rungs having cylindrical end portions received in the aligned apertures in each pair of complementary tongues, and the adjacent web portions, and the end portions of said rungs being formed with annular outwardly directed beads at the opposed sides of the side rail webs and said overlapped tongue ends thereby to firmly interlock the ends of the rungs with the rail webs and said tongues to provide a very rugged ladder section.

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