Nov. 21, 1961 C. D. RICHARD ET AL 3,009,532

EXTENSION TYPE LADDER

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FIG. 5

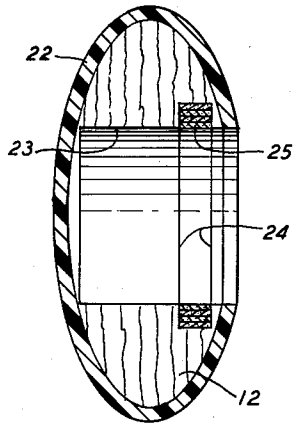

FIG. 6

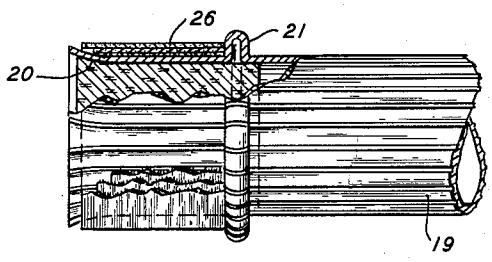

FIG. 7

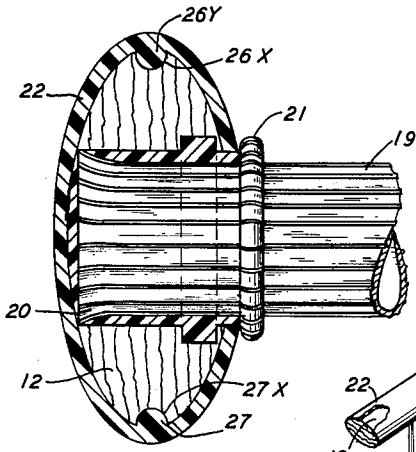

FIG. 1

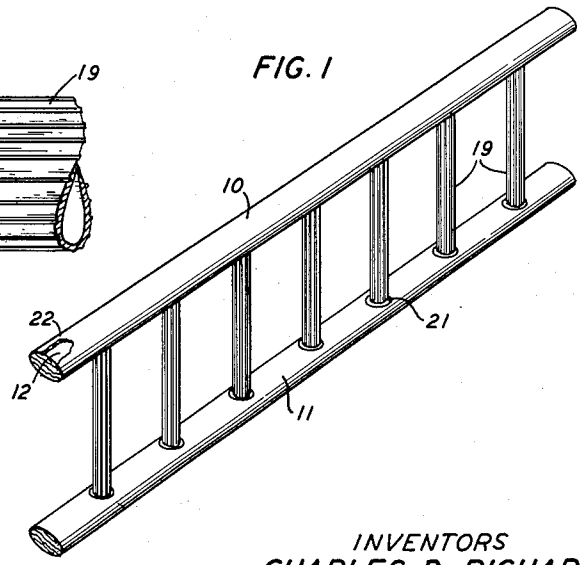

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FIG. 2

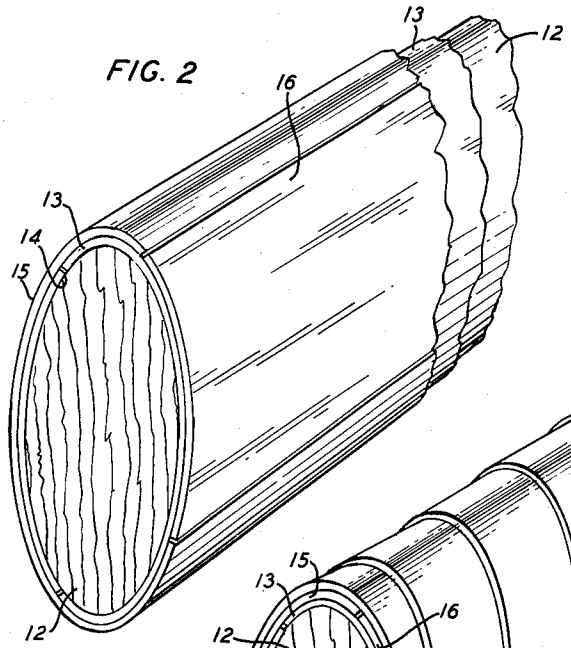
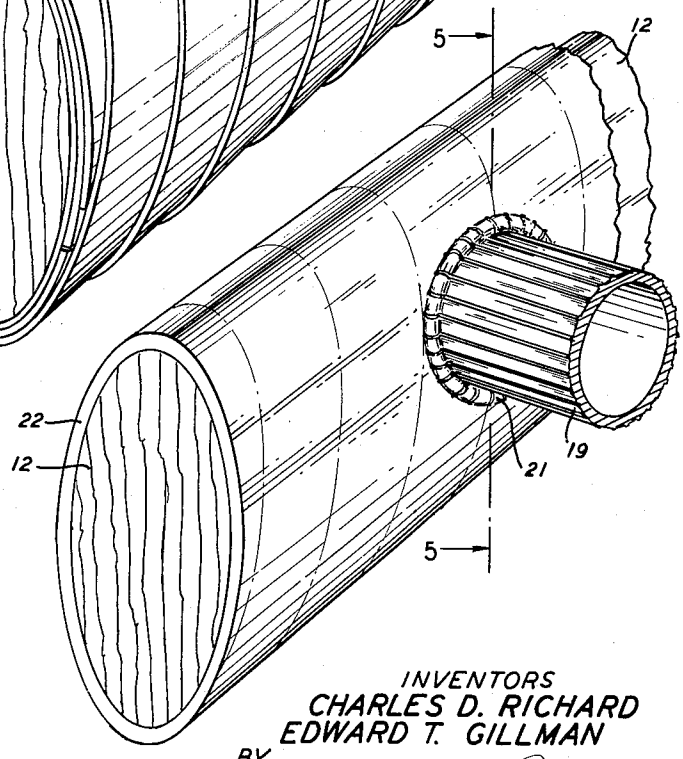


FIG. 3

FIG. 4



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3,009,532

EXTENSION TYPE LADDER

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Filed Apr. 1, 1959, Ser. No. 803,439
7 Claims. (Cl. 182—46)

This invention has reference to extension type ladders, and its object is the provision of a ladder of the type above referred to, having an exceptionally great strength and light weight, which is durable and cheap to manufacture.

In ladders as heretofore constructed, it is a well known fact that points of major weakness result because of the reduction in the cross section of the side rails consequent to the present method used for securing the rungs to the rails in addition to forming critical areas for rotting, rust or corrosion at these points.

Ladders constructed according to the present invention effectively avoid the above defects by being impervious to weathering, non-corrosive, and which possess a high dielectric characteristic, thereby enhancing the safety factor of the ladders when the ladders are used, for example, in proximity to electrically charged high tension wires.

The present invention is related to Patent 2,885,132, issued to Thaddeus C. Campbell May 5, 1959, Serial No. 432,421. In that patent a ladder is disclosed in which each rail is formed of a core constructed of two lengthwise sections of rectangular cross section, each lengthwise core section having semicircular recesses to one side thereof cooperating with each other for receiving fiber glass strips disposed between the two lengthwise core sections over the end portions of the rungs fitted into the recesses, while other fiber glass strips are wrapped around the two part core assembly and the whole immersed into a plastic material in a trough, and subjected to heat and pressure in a molding operation.

In the ladder of the present invention, one of the novel features resides in the provision of a rail for such ladder embodying a core of unit structure constructed of balsa wood or other light density material, having an elliptical cross section, thereby obtaining a core of great strength relative to weight.

Another novel feature resides in the wrapping of fiber glass strips around the core in direction longitudinally thereof, and the winding of another fiber glass strip helically over the longitudinally laid fiber glass strips effected simultaneously with the impregnation of such strips with a plastic while holding all the strips under high tension.

Another feature of the invention is the provision of a simple and efficient novel method and arrangement of parts for supporting and securing the rungs to the side rails of the ladder without the use either of heat or pressure.

Other novel features of the present invention will be apparent from the following description and by the claims appended thereto, reference being had to the accompanying drawing in which:

FIG. 1 is a view in perspective of a ladder constructed according to the present invention;

FIG. 2 is a view in perspective of a portion of a core forming part of the rail of the ladder, showing the disposition of the different longitudinally laid fiber glass strips around the core;

FIG. 3 is a view of the core shown in FIG. 2, but showing helically wound strips coiled in superposed relation to each other over the longitudinally disposed strips, the outer disposed helically wound strip being adapted to be removed from the rail following the simultaneous

impregnation of the fiber glass strips and the core with a plastic material;

FIG. 4 is a view of a portion of a rail, shown in perspective, showing the end portion of one of the rungs in secured position into a supporting bushing formed in the completed rail;

FIG. 5 is a view in section of a completed rail taken on line 5—5 of FIG. 4 but without rung, showing a circular groove in a bushing aperture formed in the rail for receiving a reinforcing fiber glass strip serving for securing the end portion of the rung into the bushing;

FIG. 6 is a partial view of a rung shown with a portion broken away, with a fiber glass strip shown partly in section, the fiber glass strip being wound between the flared end of the rung and a collar formed therewith, the latter serving as a barrier for plastic material inserted in the bushing prior to the insertion of the rung end into the bushing; and

FIG. 7 is a cross sectional view similar to that shown in FIG. 5, but showing a completed rail with plastic material filling the interstices in the fiber glass strips disposed between the rung and the wall of the supporting bushing and one of the ends of a rung and between the core and two diametrically opposite fiber glass strands fitted in lengthwise grooves formed in the core in a modification of the rail of the invention.

The ladder of the present invention, as shown in FIG. 1, consists of two side rails **10** and **11**, each side rail having a core in the form of a bar **12** of elliptical cross section. The core **12** is constructed of a light density material such as balsa wood, with its peripheral surface wrapped in a longitudinal direction with a fiber glass strip **13**, FIGS. 2 and 3, which encircle substantially two thirds the periphery of the core. Another fiber glass strip **14**, made of a thickness similar to strip **13**, also extends longitudinally of the core and is of such width as to form the complement of strip **13** around the core **12** with its edges abutting against the opposite edges of strip **13**.

Another fiber glass strip **15** is laid over the fiber glass strips **13—14** longitudinally of the core, encircling the strips **13—14** in the opposite direction to the ladders to form in cooperation with a fourth fiber glass strip **16** a second envelope over the balsa wood core **12**. The two superposed envelopes formed by the fiber glass strips **13—14** and **15—16** are themselves enclosed in a fiber glass strip **17** and a strip or film **18** of a material known commercially by the trade name "Mylar," to serve in forming a smooth surface over the fiber glass strips in the winding of the strip **18** helically simultaneously with the laying of the longitudinally disposed fiber glass strips while under tension on the core, at which time the core, the fiber glass strips **13—14** and **15—16** and the fiber glass strip **17** are impregnated with a plastic material to form a homogeneous reinforcing covering **22** bonded to the core and having a smooth surface, as shown in FIGS. 1, 4, 5 and 7, at which time the Mylar strip **18** may be easily peeled off from the completed rail, the laying of the different strips under tension over the core, as well as the application of the plastic over the strips and over the core simultaneously being effected by a mechanism now forming the subject matter of Gillman-Basile patent application filed Dec. 31, 1959, Serial No. 863,309.

Tubular runs **19** shown in FIGS. 1, 4, 6 and 7, are constructed of a light density material, such as aluminum or metallic magnesium, with their end portions outwardly flared, and each rung member is formed with two collars as **21** serving for readily determining the spaced relation between the rails **10** and **11**. Collars **21** are disposed at a distance from the flared ends of the rungs corresponding to the transverse width of the core **12** plus one thickness of the cured plastic reinforced fiber glass covering **22** to abut against the surface of such covering as formed

around the core when the rung members are inserted into respective blind bushing apertures **23** drilled in each rail following the completion of the latter, such bushings, in turn, being formed with circular grooves **24** adapted to receive coiled fiber glass strips **25**, shown in FIG. 5, provided for a purpose which will be hereafter described in detail.

Into each end portion of rung member **19**, as shown in FIG. 6, is fitted a plug extending a small distance beyond the inner surface of the wall formed by the collar **21**, while in the recess or space formed between the outwardly flared portion **20** and the collar **21** is spirally coiled a fiber glass strip **26** built up to a diameter corresponding to the inner periphery of bushing aperture **23** in which the end portion of the rung member **19** so constructed is inserted following the filling of the bushing aperture with a plastic compound to form with the fiber glass strips **25** and **26** a homogeneous agglomeration of elements serving for securing the end portion of the rung member to the core and to form a seal between the outer covering thereof and the collar **21**, as shown in FIG. 7. The impregnation of the fiber glass strip **25** in the circular groove **24** and the fiber glass strip **26** on the outer peripheral end of the rung member with a plastic, has been found to produce a substantially inseparable union between the rung members and the side rails, while, as above mentioned, forming an efficient seal against moisture between the collar **21** and the plastic reinforced fiber glass strips covering over the core without submitting these elements neither to pressure nor heat.

In the modification of the rail, as shown in FIG. 7, in addition to the plastic reinforced fiber glass strips, two strands **26***y* and **27** of fiber glass material are placed into respective grooves **26***x* and **27***x* extending longitudinally of the core. These fiber glass strips are agglomerated into the plastic material simultaneously with the impregnation of the core, the fiber glass strips **13—14**, **15—16**, and the fiber glass strip **17**, while under tension, and the whole, with the exception of the Mylar strip **18** which is removed in a final operation, serve for reinforcing the rails in direction at right angles to the plane surface of the ladder.

Ladders constructed according to the modification above described and as best seen in FIG. 7, have been found to be practically unbreakable when loaded with a weight many times that encountered in the ordinary use of a ladder.

What is claimed is:

1. In a ladder, a pair of side rails, each rail having blind bushing apertures formed therein adapted to be filled with a predetermined amount of plastic material, circular grooves formed in said bushing apertures, a ring of fiber glass disposed in each of said grooves, and rung members for said ladder having means at each end thereof for receiving a fiber glass strip wound spirally thereon cooperating with said fiber glass rings in said grooves and with said plastic to form a homogeneous securing means between said rung members and said bushing apertures.

2. In a ladder, a pair of side rails, each rail comprising a core of unit structure constructed of light density material having an elliptical cross section, fiber glass strips of different width wound under high tension lengthwise and helically around the periphery of said core to form a reenforcing covering thereover, blind bushing apertures formed in each of said rails having cylindrically shaped grooves formed therein, fiber glass matrial fitted in said grooves, rung members for said ladder having their end portions shaped to form annular recesses, fiber glass strips coiled in said recesses, engaging said bushing apertures to form homogeneous securing means between said rung members and said rails upon the impregnation of said fiber glass strips in said bushing apertures and on said rungs with a plastic material.

3. In a ladder, a pair of side rails, each of said side rails comprising a balsa wood core of unit structure having an elliptical cross section, a plurality of fiber glass strips of different width, a number of said strips wrapped under tension lengthwise in superposed relation to each other on said core, another strip wound helically around said lengthwise strips to form a reinforcing coating thereover, blind bushing apertures formed in said rails disposed in coaxial relation to each other, rung members having means at their end portions for receiving fiber glass material for engaging said bushing apertures, circular groove formed in each of said bushing apertures, fiber glass strip fitted in said circular grooves, and a plastic in said bushing apertures for impregnating said fiber glass strips to form homogeneous securing means between the end portions of said rungs and said core when in their engaged relation.

4. In a ladder, a pair of side rails and rung members, each of said rung members having their ends flared outwardly, collar elements formed with said rungs co-operating with respective flared ends to form annular recesses, each of said side rails comprising a core of unit structure constructed of a plain solid bar of balsa wood having an elliptical cross section, a pair of fiber glass strips of different width laid over said core under high tension in a direction lengthwise of said core, another pair of fiber glass strips of different width laid under high tension in a direction lengthwise of said core in superposed and overlapped relation to the first mentioned pair, one of said strips in each pair forming the complement of the other strips, other strips of different material wound helically around the last mentioned pair of said strips, a plastic material progressively applied onto the first, second, and third mentioned strips collectively and simultaneously with the laying of said strips on said core for impregnating all of said strips to form a reinforcing covering thereover, blind bearing apertures formed in said rails, each having a diameter greater than the body portion of said rungs but corresponding to the diameter of the flared end portions of said rungs, fiber glass strips spirally wound around said rung members into the recesses formed by the flared end portions and said collars for engaging said bearing apertures, an annular groove in each of said bearing apertures, a fiber glass strip in each of said grooves, and a plastic material in said bearing apertures impregnating the fiber glass strips around said recesses and in said grooves for anchoring said rungs to said rails.

5. A ladder having a pair of side rail members and a plurality of rung members, each of said side rail members consisting of a bar of balsa wood material having an elliptical cross section, a plurality of blind bearing apertures formed in said rails for receiving the end portions of said rung members, an annular groove formed in each of said bearing elements adjacent the open end thereof adapted to receive fiber glass material, said rung members having their end portions flared outwardly, a pair of collar elements carried by each of said rung members for defining the space relation between said rail members, said collar elements cooperating with said flared end portions to form bobbin-like elements for receiving fiber glass strips coiled thereon, and a plastic filling the interstices between said fiber glass in said bearing elements and the interstices in said fiber glass strips on the ends of said rungs to form homogeneous securing means between the ladders and said bearing apertures.

6. In a ladder, a pair of side rails, each of said side rails comprising a core of unit structure constructed of a light density material having an elliptical cross section, a plurality of plastic impregnated reinforcing strips wrapped under tension around said core lengthwise thereof, and another plastic impregnated reinforcing strip wound helically under tension around said lengthwise disposed reinforcing strips to form a homogeneous coating over and including said core, rung members for said rails, each of said rung members having its ends flared outwardly, a collar formed at the end portions of each of said rung members co-operating with said flared ends to form annular recesses, fiber glass strips spirally wound

around the ends of each of said rungs in said recesses, bearing apertures formed in said rails having a diameter larger than the body portion of said rungs, an annular groove formed in each of said bearing apertures, fiber glass material filling said annular grooves, and a plastic material in said bearing apertures for impregnating all of said fiber glass strips upon the insertion of the ends of said rungs into said bearing apertures for anchoring said rungs to said rails.

7. A ladder comprising two rail members and a plurality of rungs, each end portion of said rungs having a plurality of means cooperating with each other to form an annular recess, fiber glass material disposed in said recesses, blind bushing apertures formed in said rails for receiving the enlarged end portions of said rungs, a circular groove formed in each of said apertures, fiber glass material disposed in the grooves in said bushing apertures, and a plastic in said bushing apertures adapted to impregnate the fiber glass material in the grooves in said

bushing apertures and the fiber glass strips in the recesses at the ends of said rungs to form therewith homogeneous securing means between each end of said rungs and said rails when in the assembled relation.

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