

March 24, 1970

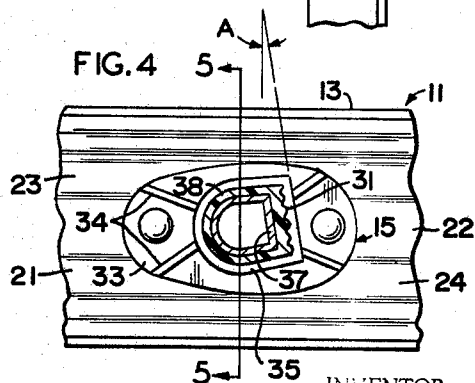
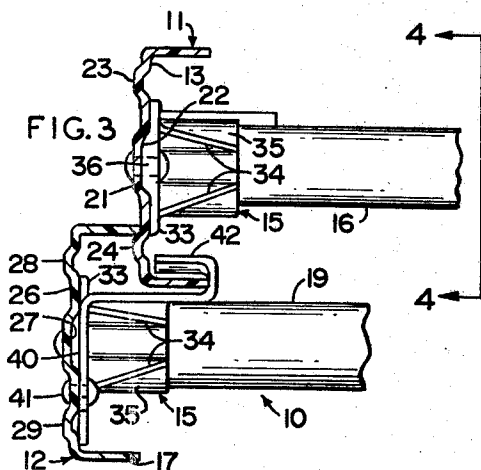
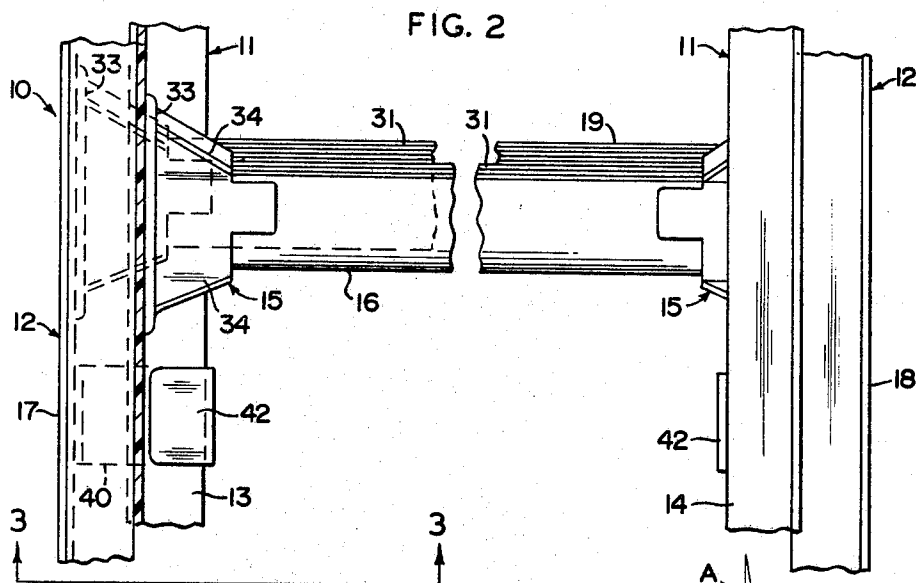
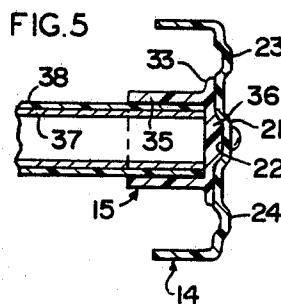
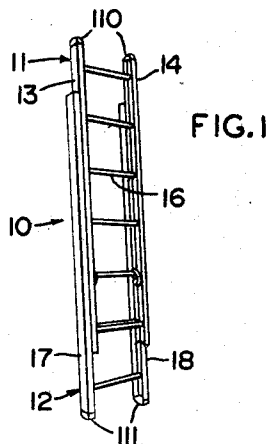
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3,502,173

ELECTRICALLY INSULATED LADDER

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

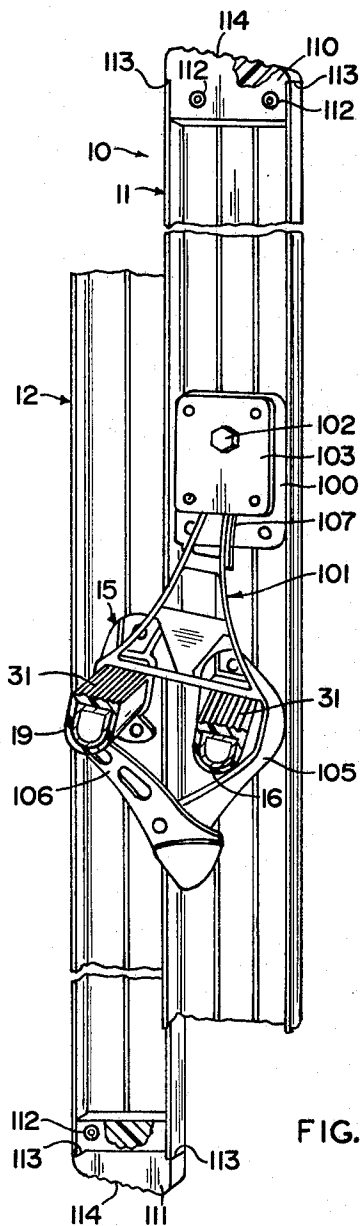


FIG. 6

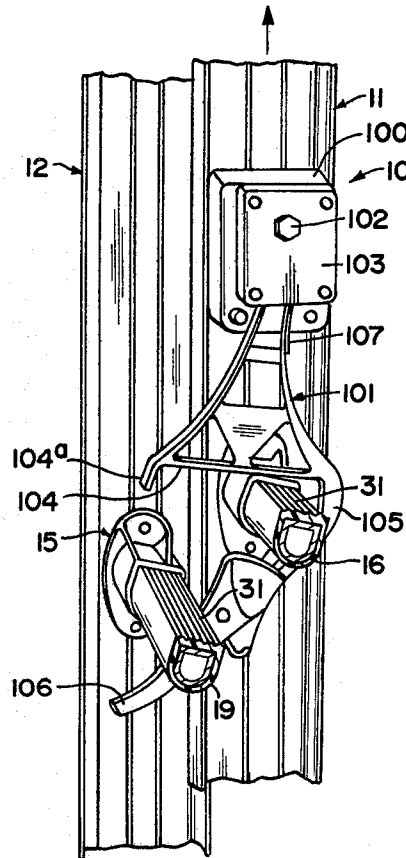


FIG. 7

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1

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ELECTRICALLY INSULATED LADDER

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10 Claims

ABSTRACT OF THE DISCLOSURE

The electrically insulated ladder includes a pair of uprights of flattened U-shape in section each having a longitudinally extending groove in its base portion. A plurality of rungs having non-conductive surfaces are each secured to a pair of sockets which in turn are secured to the uprights in opposed relationship to each other. The sockets, rungs and uprights are all made from or surface covered by electrically insulating materials.

This invention relates to electrically insulated ladders, and particularly to ladders made primarily or completely from relatively hard, molded resin materials and which are light in weight, but yet strong and durable.

Heretofore there have been many different types of ladders made, and some efforts have been made to provide ladders which are electrically non-conductive so that they will be completely safe for workmen using the ladder in any area even those including electrically hot wires or other articles. However, most of such insulated ladders that have been made heretofore have been quite costly, or they have been relatively weak, or they may have been objectionable for other reasons.

The general object of the present invention is to provide a novel and improved electrically insulated ladder which is made from a pair of plastic uprights and wherein cross rungs in the ladder are secured to the uprights by novel, strong connector members or sockets engaging the rungs and affixed to the uprights of the ladder.

Another object of the invention is to provide a ladder which is made from several molded plastic parts and wherein novel interengaging rib and groove means are provided on the different components to improve the strength thereof and to aid in obtaining accuracy of positioning of the different parts.

Further objects of the invention are to provide a ladder wherein the rungs thereof have electrically insulated surfaces and wherein the rungs each have a flat section thereon to be positioned at predetermined uniform angles to the ladder whereby when the ladder is normally operatively positioned at an angle to the vertical, the flat surfaces will all be horizontal or substantially so; to provide a good connecting means associated with a pair of ladders for forming an extension ladder therebetween; to shape the uprights of a pair of extension ladders so that good sliding engagement can be obtained therebetween; and to provide relatively sturdy, but yet no extremely costly ladders which are relatively light in weight, but which are completely electrically non-conductive and which will give a good service life by being made from hard shaped plastic components.

The foregoing and other objects and advantages of the invention will be made more apparent as the specification proceeds.

In general, the present ladder can be said to comprise, as one embodiment thereof, a pair of uprights of flattened, broad U-shape in section and including base portions with a longitudinally extending groove on their inner surfaces, a plurality of rungs having non-conductive surfaces, and a pair of sockets for each of the rungs secured

2

to base portions of the uprights and extending inwardly thereof in opposed relation to receive and secure the ends of a rung therein. All of the sockets and uprights at least being formed from hard, reinforced resin material and with the rungs having non-conductive surfaces.

Reference now is made to the accompanying drawings, wherein:

FIG. 1 is a perspective view of an extension ladder embodying the principles of the invention;

FIG. 2 is a fragmentary enlarged elevation of a portion of the ladder of FIG. 1 with a part of the ladder means being broken away and shown in vertical section;

FIG. 3 is a fragmentary, enlarged vertical section taken on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary vertical section taken on line 4—4 of FIG. 3;

FIG. 5 is a fragmentary vertical elevation taken on line 5—5 of FIG. 4; and

FIGS. 6 and 7 are perspective views of a new ladder lock of the invention.

With particular reference to the details of the structure shown in the drawings, an extension ladder 10 is indicated in FIG. 1 of the drawings and this is made from an inner ladder 11 and an outer ladder 12. These ladders 11 and 12 are of the same general construction except that the inner ladder has a narrower width than the outer ladder 12 to facilitate sliding engagement therebetween in a substantially conventional manner for extension ladder purposes and to provide a useful article longer than either one of the individual ladders used in forming the extension ladder.

The inner ladder 11 includes a pair of uprights 13 and 14, a plurality of sockets, or rung receiving brackets 15 and a plurality of rungs 16. The outer ladder 12 in turn likewise comprises a pair of vertically extending uprights 17 and 18 that have or include a plurality of rungs 19 secured thereto and extending therebetween by a plurality of the sockets just like the sockets 15. It is seen that all of the upright 13, 14, 17 and 18 are all of substantially flattened, broad U-shape in section, and the uprights are all made from a hard molded, or extruded reinforced plastic material. Thus, the upright may be made from any suitable plastic resins, of conventional compositions such as polyesters, epoxys, phenolic, melamine, or silicon, etc. Normally, the resins include reinforcing means such as glass fibers of conventional composition. The resin reinforced material is adapted to be formed by conventional molding and/or extrusion operations under appropriate temperature conditions and under the required pressures whereby a hard, electrically insulating, sturdy but lightweight upright is produced. These uprights then can be cut or produced to any desired length for use in forming the ladder of the invention.

FIG. 3 of the drawings best shows that a base portion 21 of the upright 13 has a longitudinally extending groove 22 formed usually on the center axis thereof and with a pair of relatively flat, narrow ribs 23 and 24 being formed adjacent marginal portions on the outer surface of this base portion 21 of such upright. The upright 17 likewise has a base portion 26 with a groove 27 formed on the inner surface thereof and, usually, ribs 28 and 29, like the ribs 23 and 24, are also formed on the uprights 17 and 18 whereby these members are of uniform shape and can be made from a common mold or die.

To provide electrically insulated rungs in the assembly or ladders of the invention, these rungs 16 and 19 preferably are formed of tubular, or substantially tubular materials of open centered shape and they have corrugated surfaces 31 provided on one portion of their periphery forming substantially flat support surfaces. While these surfaces 31 are corrugated, this is only done to insure

a good frictional engagement with such rung by a person standing on or using the ladder and the peaks of the corrugations or ribs provided on the rungs are at uniform levels to define a top plane for the rung, in effect.

FIG. 2 and FIG. 4 of the drawings indicate that when the uprights of the ladder are vertically positioned, the flat surface 31 is inclined at an angle, such as about 14° to the horizontal, or to the longitudinal axis of the ladder, but which flat surface 31 and particularly the peaks of the ribs thereon will substantially lie in and define a horizontal plane when the uprights are positioned at the normal operative angle to a building or other structure with which the ladder is to be used.

In order to secure the rungs to the ladder uprights, the sockets 15 are provided and with a pair of such sockets 15 being secured to the base portions 21 and 26 of each of the uprights in the individual ladders of the invention to extend inwardly from the base portions thereof in opposed relationship. Thus, each of the sockets 15 has a base 33 formed thereon as more or less of an elongate oval shape and with a plurality of reinforcing ribs, or flanges 34 extending from marginal portions of the base 33 up to a peripheral portion of a generally tubular section 35 formed in each of the sockets 15 to reinforce the same. The sections 35 are complementary to the shape of the rungs. These sockets 15 are preferably formed from substantially the same resin, reinforced material as the uprights and with the sockets 15 normally being molded under conventional molding conditions to the shape shown to provide a hard, rigid, non-conductive member. The base 33 has a longitudinally extending rib 36 provided on the surface thereof abutting on the base portions of the ladder uprights and these ribs 36 are adapted to be received in the grooves 22 and 27 formed in the uprights. Such rib 36 thus positions the socket on an upright in centered relationship thereto, but with it being adapted to have the flat surface 31 being positioned at the angle indicated, such as about 14° to the horizontal.

The rungs 16 and 19 are of uniform shape in section but with the rungs in the outer ladder naturally being slightly longer than the rungs of the inner ladder and with the rungs being formed from a tubular metal member 37 which can be provided with the substantially flat, ribbed or corrugated surface 31 thereon. Then normally the metal members 37 are provided with a suitable coating of a non-conductive plastic insulating material, such as a vinyl resin layer 38 which may be deposited thereon by dipping the metal member 37 into a liquid bath of the resin, or be otherwise applied, as desired. Such vinyl resin 38, or equivalent insulating material then is set up or cured under conventional conditions to form a permanent protective coating on the rung used in the ladder.

In order to secure the inner and outer ladders 11 and 12 together for sliding association therebetween, a plurality of L-shaped metal angles 40, or interlocks, are secured to longitudinally spaced portions of each of the uprights 17 and 18 of the outer ladder. These L-shaped members or angles have the base legs thereof secured, as by rivets 41, to the base portion 26 of the uprights 17 and 18 and with the other leg of the angle extending inwardly of the extension ladder to a point beyond the inner uprights thereof. FIG. 3 shows that the one end or edge of the upright 17 of the outer ladder bears on the outer surface of the upright 13 of the inner ladder and the members are retained in this sliding engagement position by means of a reversely bent flange 42 that is formed on the inner end of one leg of the angle 40, as indicated in FIG. 3, and which reversely bent flange 42 slidably engages with an inwardly extending leg of the upright 13 of the inner ladder. Hence, the two ladders can be telescoped into engagement with each other and be retained in operative association by the plurality of angles 40 provided in the combination ladder shown.

When one is assembling the ladder of the invention,

the rungs 16 and 19 of the ladder can be secured to and extend between the pairs of sockets 15 formed on the uprights of the ladder by any suitable means, such as conventional ambient temperature curing epoxy adhesives that are associated with the outer surfaces of the rungs at the ends thereof and which adhesive may be placed on the inner surface of the tubular portion 34 provided in the sockets 15 whereby when the adhesive has cured or set up, the rungs will be firmly bonded to the sockets and the sockets in turn are fixed to the uprights and the rivets may or may not be used, as desired.

In making the side rails 13, 14, 17 and 18 for the improved ladder of the invention, conventional molding materials and production processes are followed, and normally one or more layers of glass fiber cloth are placed in a mold and a resin liquid is poured or otherwise applied thereover to build up a desired thickness lamination of the resin and glass cloth and with the resin naturally impregnating the glass cloth. For such composition, any suitable thermosetting resin, such as polyesters or epoxy materials, can be used and one typical mixture would be:

	Parts by wt., percent
Glass cloth and mat	40
Polyester resin and filler	55
Hardener and additives	5

After the build-up is provided in the mold, it is then closed and a ladder is formed under conventional molding conditions, such as at a pressure of about 200 p.s.i. and at a temperature of about 255° F. and the cure is completed in about 10 to 15 minutes.

In making the sockets for the ladders, these sockets can, if desired, be cast from metal to the shape shown and then be provided with a plastic coating thereon. However, it is preferred to form these products from a conventional premix of short glass fibers and a resin in the form of a dough. A lump of such material is placed in the mold and then is subjected to pressure and heat as between 600 to 800 p.s.i. for about 10 minutes for the final cure and shaping action. A composition such as:

	Parts by wt., percent
Polyester resin and filler	65
Glass fiber (chopped)	30
Hardener and additives	5

has been found to be suitable.

The desired plastic coating on the ladder rungs preferably is provided by using a lightweight, aluminum or equivalent metal shape for the rung and then dipping the rung into a vinyl to obtain a plastic coating thereover. However, it is also possible to place a glass fiber fabric around the rung and place additional glass fiber over the portion that will form the tread surface on the rung. A liquid resin as described before for the side rails is then applied to the fabric. The resin-glass fabric mix is then suitably cured in place around the aluminum rung.

It should be realized that the rivets used for retaining the ladder sockets in position are helpful in two manners. That is, the rivets will retain the sockets in place while the newly mixed epoxy adhesive is being set up by conventional cure action under ambient temperatures, and naturally initially the ladder rung has been secured to the socket by a newly mixed conventional epoxy adhesive or the like, and then the assembly has the epoxy or equivalent adhesive coated on the base portion of the socket which is applied to the ladder side rail and secured in the desired position by rivets. As a final action, the rivet heads in the ladder will be coated with an epoxy or similar adhesive, insulating coating, whereby there are no metal parts exposed in the ladder.

In making up the guide members 40, or other suitable guides, used to retain the ladders in association with each other, the metal members will be coated with a suitable non-metallic, insulating material, such as by being dipped

5

6

in a vinyl resin or by having a glass fabric resin layer cured thereover and bonded thereto.

In making the ladder of the invention, if desired, the vinyl resin or other material used for coating the ladder rungs may be of a different color than the material used in forming the ladder side rails or uprights so that an attractive, improved appearance ladder is obtained.

FIGS. 6 and 7 of the drawings show an improved top iron or guide iron type of a safety hook used on the ladder of the invention. In this instance, a suitable insulating block 100 is secure, as by rivets to the inner surface of each of the uprights 11 and the gravity acting safety hook 101 is pivotally attached to each block 100 as by a pin, bolt or shaft 102. The pins 102 are suitably secured in individual mounting brackets 103 operatively secured to the blocks 100 on the inner surface thereof. Only one safety hook assembly is shown and will be specifically described. It will be seen that this safety hook 101 is suspended from the pivot pin or shaft 102 and that the safety hook has a relatively straight or flat section 104 therein that is adapted to engage with the tops or tread surfaces of the ladder rungs. The safety hook 101 includes a dependent inwardly curved section 105 that extends inwardly from the ladder upright 11. So as to obtain a normal override of the ladder rungs when the ladder section 11 is being moved downwardly, an arm or guide dog 106 is pivotally secured to the lower end of the section 105 and normally extends upwardly therefrom to a point adjacent and terminating in front of the section 104 of the safety hook whereby such arm or dog 106 will cause the safety hook 101 to ride over the ladder rungs and not engage therewith unless the normal position of the dog 106 is varied to permit the hook to open for engaging or receiving with a pair of the ladder rungs, as shown in FIG. 6. An end flange 104a is formed on the section 104 and the upper end of the dog 106 will normally abut thereagainst.

As another feature of the safety hook 101, it has a spring means 107 associated therewith. Such spring, usually a leaf spring, urges the safety hook forwardly of the ladder assembly towards the section 12 at all times so as to engage with a rung on the outer ladder section 12 and facilitate use of the ladder as an extension ladder when the ladder sections are moved properly with relation to each other to move the dogs 106 down to open position as shown in FIG. 7.

As yet a further feature of the novel ladder of the invention, a pair of insulating pads 110 and 111 are secured to each of the ladder sections, preferably to both the top and bottom ends thereof. These pads are made from a suitable molded glass fiber-resin mix, such as that used in forming the sockets 15 for the ladder. The pads are provided with shoulders 113 adapted to engage the ends of the ladders and aid in retaining the pads in position. Rivets 112 may be used to secure the pads to the ladder uprights. It will be noted that corrugated end surfaces 114 are provided on these pads 110 and with such surfaces being formed at an angle in relation to the longitudinal axis of the uprights whereby when the ladder is placed at its normal preferred operative position, these surfaces 114 will be in full or about full length engagement with the support surface or ground, and the opposite pads on the upper ends of the uprights will engage with the wall or building against which the ladder is positioned.

The individual components of the safety hooks 101 have a suitable insulating cover thereon and any metal rivets, etc. are covered with an insulating plastic. Such cover or coating can be applied by dipping the individual components in a liquid vinyl resin bath followed by a cure of the resin, or painting the part with a liquid resin.

The safety hooks are particularly good in engaging two rungs of different ladder sections to lock them together in operative relation with the load being carried on the straight or flat section 104.

FIG. 4 shows an angle A which the, in effect, flat surface of the ladder rung 16 makes with a perpendicular to the longitudinal axis of the ladder uprights automatically when the rib 36 of the socket engages the groove 22 of an upright. Hence, all rungs are uniformly positioned and take horizontal positions for the surfaces 31 when the ladder is positioned at its preferred operative angle for use.

All components of the plastic resins used in the ladders are conventional materials.

From the foregoing, it will be seen that an electrically nonconductive ladder has been provided and that this ladder is made from sturdy shaped plastic resin parts which will provide a lightweight ladder having a long service life. By the novel interengagement between the uprights, the sockets and the rungs, a sturdy ladder is provided that can have the components thereof relatively easily assembled by substantially unskilled help. Thus, it is believed that the objects of the invention have been achieved.

While one complete embodiment of the invention has been disclosed herein, it will be appreciated that modification of this particular embodiment of the invention may be resorted to without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. An electrically insulated ladder comprising a pair of uprights of flattened broad U-shape in section and including base portions, each of said uprights having a longitudinally extending groove on its base portion on the inner surface thereof and each being made of a fiberglass reinforced resin,

- a plurality of rungs having non-conductive surfaces, and
- a pair of sockets for each of said rungs secured to the bases of said uprights and extending inwardly of the uprights in opposed relation and each receiving the end of a rung therein, said sockets each having a base with a rib formed thereon to seat in said groove on a said upright, said sockets being formed from fiberglass reinforced plastic resin.

2. A ladder as in claim 1 where said rungs are tubular, and each of said sockets includes a tubular section having a bore complementary to a said rung to receive the same and where reinforcing flanges extend substantially radially of said tubular sections from said socket base to the inner ends of said sockets.

3. A ladder as in claim 2 where said rungs have flat peripheral surfaces extending the length thereof, and said sockets position said flat surfaces at uniform angles to the longitudinal axes of said uprights.

4. A ladder as in claim 1 where an extension ladder is formed from two of said ladders and including an outer ladder which is wider than an inner ladder in the extension ladder, said outer ladder having corresponding edges of its said uprights bearing on the outer surfaces of said base portions of said inner ladder uprights, and where a plurality of substantially L-shaped metal angle sections are attached to said base portions of the uprights of said outer ladder at longitudinally spaced portions thereof and have legs extending inwardly beyond said uprights of said inner ladder and terminating in a reversely bent flange engaging an edge portion of said inner ladder uprights for sliding engagement of the ladders.

5. An electrically insulated ladder comprising a pair of uprights of flattened broad U-shape in section and including base portions, each of said uprights having a longitudinally extending groove on their base portions on the inner surface thereof and each being made from reinforced resin,
- a plurality of rungs having non-conductive surfaces,
- a pair of sockets for each of said rungs secured to the bases of said uprights in opposed relation and each receiving the end of a rung therein, said sockets

7

each having a base with a rib formed thereon to seat in said groove on a said upright, said sockets being formed from reenforced plastic resin, and means securing said sockets to said uprights in opposed relation.

6. A ladder as in claim 5 where an extension ladder is formed from two of said ladders and including an outer ladder which is wider than an inner ladder in the extension ladder, said outer ladder having corresponding edges of its said uprights bearing on the outer surfaces of said base portions of said inner ladder uprights, and where a plurality of substantially L-shaped metal angle sections are riveted to said base portions of the uprights of said outer ladder at longitudinally spaced portions thereof and have legs extending inwardly beyond said uprights of said inner ladder and terminating in a reversely bent flange said flanges engaging edge legs of said inner ladder uprights for sliding engagement of the ladders.

7. A ladder as in claim 5 where a pair of said ladder sections are slidably engaged and a pair of safety hooks are pivotally secured to one ladder section, each safety hook comprising a member having an inwardly curved lower end forming a portion of a hook, a flat section positioned above said curved lower end and having a dependent front flange, and a dog pivotally secured to said lower end and adapted to extend up to and normally abut against said front flange to close a hook means formed in said safety hook, said flat section being of a length to engage two adjacent rungs on a pair of ladder sections operatively engaging each other.

8. A ladder as in claim 5 where a pair of safety hooks are pivotally secured to a ladder section, each safety hook comprising a member having an inwardly curved lower end forming a portion of a hook, and a flat section extending across a mid portion of said safety

8

hook and having a dependent front flange above said curved lower end, said flat section being of a length to engage two adjacent rungs on a pair of ladder sections operatively engaging each other.

9. A method of making an electrically insulated ladder comprising the steps of

forming a pair of uprights of flattened broad U-shape in section,

adhesively attaching a pair of sockets to the ends of each of a plurality of rungs, which sockets have bases positioned in corresponding relation to the rungs,

setting the adhesive,

coating the bases of said sockets with an adhesive, mechanically securing said sockets to a pair of said uprights to have said rungs extend therebetween, and

thereafter setting the adhesive to provide a double bond of said sockets to said uprights.

10. A method as in claim 9 including the step of positioning the sockets and rungs in predetermined relation to the uprights prior to securing the sockets to the uprights.

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