Oct. 7, 1958 H. G. ARNOLD 2,855,134

METAL LADDER

Filed Oct. 4, 1956 2 Sheets-Sheet 1

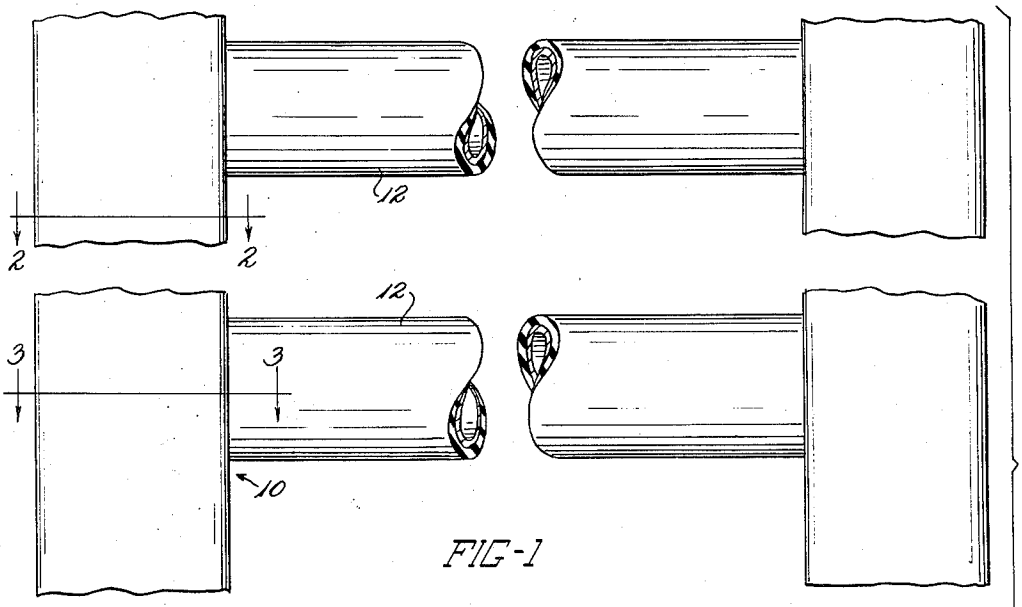
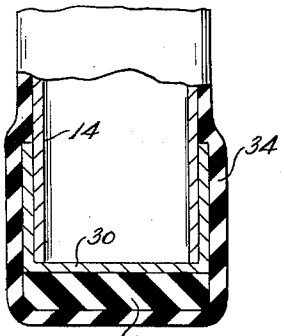


FIG-1



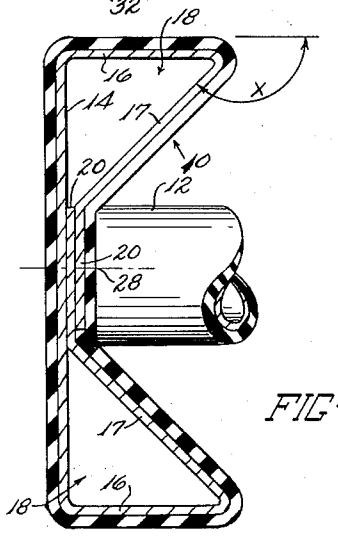


FIG-2

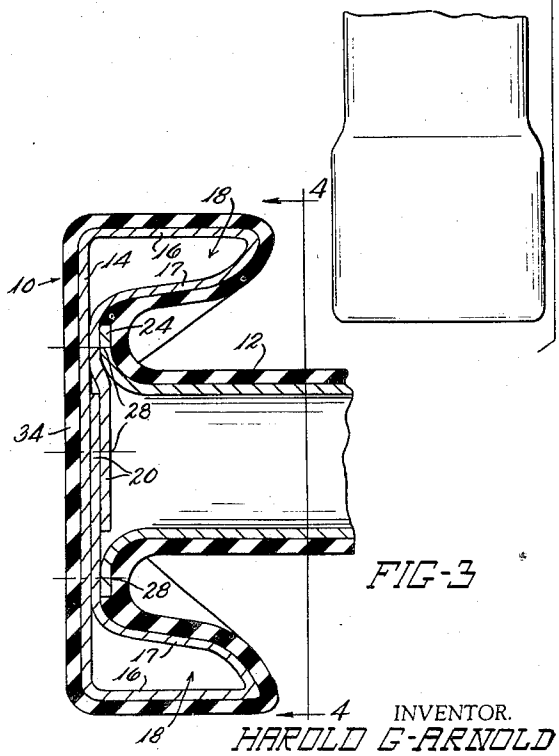


FIG-3

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METAL LADDER

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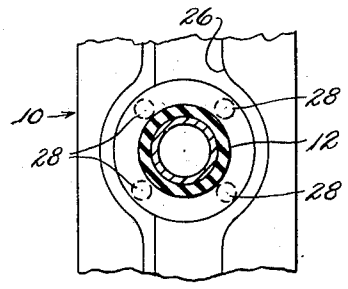


FIG-4

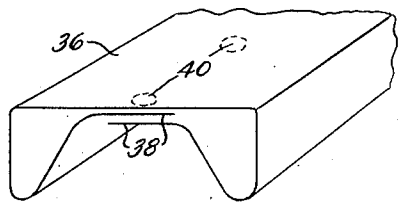


FIG-5

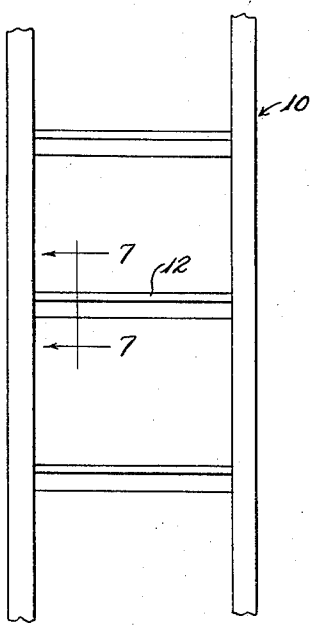


FIG-6

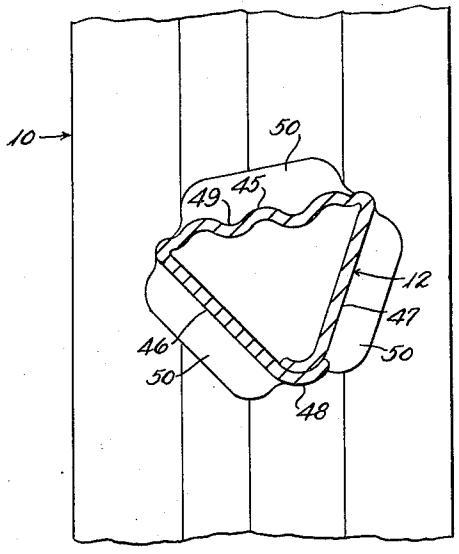


FIG-7

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METAL LADDER

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Application October 4, 1956, Serial No. 614,004

3 Claims. (Cl. 228—56)

This invention relates to metal ladders, and more particularly, is concerned with an improved sheet metal ladder characterized by high strength and light weight.

Various types of metal ladders have been proposed heretofore, and some have been made and sold, but these have usually been made from extruded aluminum or aluminum alloy sections which are often relatively heavy in order to provide the requisite strength. Efforts to make a metal ladder from steel have not been very satisfactory for the reason that the resulting ladders have always been objectionably heavy, and subject to corrosion. Additionally, for many industrial uses of ladders around electric wiring, steam pipes, and the like, wooden ladders have been preferred because of their non-electrical conductivity.

It is the general object of my invention to avoid the foregoing and other objections to and difficulties of prior art practices by the provision of an improved relatively light-weight but high strength ladder made from sheet steel.

Another object of my invention is the provision of a sheet metal load-carrying member for a ladder, the sheet metal being rolled to provide substantially tubular columns along its edges and with the edges of the strip overlapping and being welded to each other and to the center or base portion of the strip.

Another object of my invention is the provision of a metal ladder protected against corrosion and electric conductivity by a tough durable coating layer of plastic covering substantially the entire outer surface of the ladder.

Another object of my invention is the provision of a metal ladder having the simplicity of fabrication and the high strength of steel, but approaching the lighter weight of aluminum and its alloys or of wood.

Another object of my invention is the provision of a metal ladder characterized by relatively low initial and maintenance cost, great durability, and simplicity of manufacture.

A still further object is to provide a metal ladder having tubular rungs of triangular cross-section having treads inclined to the standards and horizontal in an inclined ladder.

The foregoing objects of my invention, and other objects which will become apparent as the description proceeds, are achieved by the provision of a ladder having standards each comprising a strip of sheet metal having its edges bent to form substantially tubular columns and with the edges of the strip continuing into overlapping relation with each other and in substantial engagement with the center of the strip, means welding the overlapping edges to each other and to the center portion of the strip, sheet metal rungs having integral flanges on their ends, means welding the rung flanges to the inwardly turned overlapping edges of the strip of sheet metal and to the center portion of the strip of sheet metal forming each standard. Usually sheet metal caps are provided over the ends of the standards, and I preferably

provide a tough durable coating of plastic over substantially the entire outer surface of the ladder to render the ladder non-conductive of electricity, and to protect it against corrosion.

For a better understanding of my invention, reference should be had to the accompanying drawings wherein:

Fig. 1 is a front view of a ladder constructed in accord with the principles of my invention, certain portions thereof being broken away and others shown in section;

Fig. 2 is a cross-sectional view taken substantially on line II—II of Fig. 1;

Fig. 3 is a cross-sectional view taken substantially on on line III—III of Fig. 1;

Fig. 4 is a cross-sectional view taken substantially on line IV—IV of Fig. 3, but on a reduced scale;

Fig. 5 is a diagrammatic perspective view of a flat step-type rung which may be used instead of the tubular rung.

Fig. 6 is a front view of a ladder showing a modification of the ladder rung;

Fig. 7 is a cross-sectional view on an enlarged scale, taken on line VII—VII of Fig. 6.

In the drawings, the numeral **10** indicates generally a pair of uprights or standards which are joined together at spaced points by rungs **12**. In accord with the teaching of the invention, each standard **10** is made from a single strip of sheet metal having a base portion **14** terminating in substantially right angle flanges **16**, the edges of the strip being continued and bent inwardly back towards each other at **17** to form angle X which is equal to at least about 135° to thereby form substantially tubular columns **18** along each edge of the strip.

The inwardly turned ends or edges **20** of each sheet metal strip after defining the columns **18** are bent to overlap each other in the manner shown in Fig. 2, and with at least one of the edges **20** engaging with the center portion of the base **14**, and with the base **14** and the overlapped edges **20** being welded together usually by spot-welds positioned every inch or two along the length of the standards.

It is also possible to seam or line-weld the base **14** to the overlapped edges **20**, instead of spot-welding them.

The resulting standards made from sheet metal because of the spaced columns **18** and the overlapping of the edges **20** and the welding of these edges to each other and to the center portion of the base **14**, results in a very high strength load carrying member, and this is true even though the gauge of the sheet metal is reduced materially below the thickness of an extruded aluminum alloy section so that the improved load carrying member of my invention is definitely competitive with aluminum alloy from a weight standpoint, and, further, possesses the characteristic that the sheet metal can be quickly rolled from the flat or skelp through a series of stands of rolls into the form illustrated and described, followed by a relatively rapid welding operation so that the manufacture is simple, inexpensive, and rapid.

Figs. 3 and 4 illustrate the positioning and shape of the parts at the point of joinder of each rung **12** with the standard **10**.

The end of each tubular sheet metal rung **12** is provided with an integral belled flange **24** which extends at right angles to the rung itself. In order to receive the belled flange **24**, substantially circular recesses **26** are provided in each standard **10** and this is accomplished by flattening the inwardly turned flange portions **17** to bring them into substantial alignment with the edges **20** and into substantial engagement with the base **14**, so that spot-welds **28** can be provided at a plurality of circumferentially spaced points on the bell flange **24** to secure the flange **24** to the base **14** and the flange portion **17**.

It is often desirable to cover the ends of the standards

10, and as illustrated at the lower left-hand side of Fig. 1, this can be accomplished by the provision of sheet metal caps 30 which are shaped to slide over the ends of the standards being suitably tack or spot-welded into position.

The end of the cap 30 may be provided with a rubber or other wear-pad 32 which is vulcanized or secured to the end of the cap.

An important feature of the invention is the provision of a tough durable coating layer 34 of plastic over substantially the entire outer surface of the ladder, this being usually applied to the ladder by dipping the ladder in a liquid bath of plastic, removal of the ladder from the bath and the setting up of the plastic by evaporation of solvents and/or the application of heat to effect vulcanization or polymerization. I typically employ a polyvinyl chloride plastic which adhesively secures itself to the entire outer surface of the ladder and which serves to protect the ladder against corrosion and likewise to render the ladder non-conductive to electricity.

Normally the thickness of the plastic layer 34 is at least equal to the thickness of the sheet metal, but preferably I make the layer about twice the thickness of the sheet metal in the manner rather diagrammatically shown in the drawings. It should be understood that in the drawings, the thickness of the sheet metal and of the plastic has been somewhat exaggerated in order to more clearly illustrate the parts, and that in the actual practice of the invention the sheet metal is normally not thicker than number 24 gauge, and oft-times thinner gauges than number 24 can be employed to achieve the advantages of the invention.

Fig. 5 illustrates a modification of the rung structure of the ladder of the invention, the numeral 36 indicating a flat step-type rung made from a rolled strip of sheet metal contoured substantially in the manner particularly illustrated and described with respect to the standards 10, but with the rung 36 being somewhat smaller in width and vertical height, and with the overlapping edges 38 of the edges of the strip engaging each other and the center portion of the base of the strip and being spot-welded together at longitudinally spaced points 40. A rung of this type is provided with integral end flanges which can be spot or otherwise welded to the standards 10 by providing a substantially rectangular recess in the standards instead of the circular recess 26.

Figs. 6 and 7 illustrate another modification of the invention in which the ladder rungs are tubular and of triangular cross-section with the tread surfaces inclined relative to the standards. In this form of the invention, the rung 12 is made of sheet metal formed to provide a tube of triangular cross-section having a one generally flat face 45 inclined to the standards so as to present a horizontal tread face when the ladder is inclined as against a building. The other two faces 46, 47 brace the tread face and their lower margins are preferably overlapped and welded as at 48. The tread face 45 may be formed with longitudinal corrugations 49 or other projections to increase resistance to slipping.

The ends of the rungs are formed with outwardly turned flanges 50 which are welded to the standards.

From the foregoing, it will be recognized that the various objects of my invention have been achieved by the provision of a simplified, inexpensive, light-weight and durable steel ladder having particularly high strength, and adapted to be covered with plastic to protect the ladder against corrosion and to render it non-conductive of electricity.

In accord with the patent statutes, I have specifically illustrated and described one best known embodiment

of my invention, but it is to be particularly understood that I am not to be limited thereto or thereby, but that the scope of my invention is to be defined in the appended claims.

I claim:

1. The combination in a ladder of sheet metal standards, each standard being made from a single strip of sheet metal having its edges turned at substantially right angles to form flanges and the edges of the flanges being turned inwardly at angles of at least about 135 degrees to engage with the center portion of the strip and define therewith longitudinal spaces triangular in cross-section throughout the standard, the edges overlapping and being flattened to engage with each other and with the center portion of the strip, means welding the flattened edges to each other and to the center portion of the strip at close intervals to provide a three-ply longitudinal reinforcement, rungs of tubular sheet metal, belled integral flanges on the ends of the rungs, and means welding the belled flanges to the inwardly turned edges of the flanges of the standards and to the reinforced center portion thereof, the inwardly turned edges of the flanges being pressed toward the right angle flanges in the regions adapted to receive the belled flanges to provide circular socket-like recesses.

2. The combination in a ladder of sheet metal standards, each standard being made from a single strip of sheet metal having its edges turned at substantially right angles to form flanges and the edges of the flanges being turned inwardly to engage with the center portion of the strip and to define therewith longitudinal spaces triangular in cross-section throughout the standards, the edges overlapping and being flattened to engage with each other and with the center portion of the strip, means welding the flattened edges to each other and to the center portion of the strip at close intervals to provide a three-ply longitudinal reinforcement, rungs of tubular sheet metal, belled integral flanges on the ends of the rungs, means welding the belled flanges to the inwardly turned edges of the flanges of the standards and to the center portion thereof, and a tough durable coating layer of plastic covering the entire outer surface of the ladder.

3. The combination in a ladder of sheet metal standards, each standard being made from a single strip of sheet metal having its edges turned at substantially right angles to form flanges and the edges of the flanges being turned inwardly to engage with the center portion of the strip and to define therewith longitudinal spaces triangular in cross-section throughout the standards, the edges overlapping and being flattened to engage with each other and with the center portion of the strip, means welding the flattened edges to each other and to the center portion of the strip at close intervals to provide a three-ply longitudinal reinforcement, rungs of sheet metal, integral flanges on the ends of the rungs, and means welding the rung flanges to the inwardly turned edges of the flanges of the standards and to the center portion thereof.

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