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FLEXIBLE LADDER

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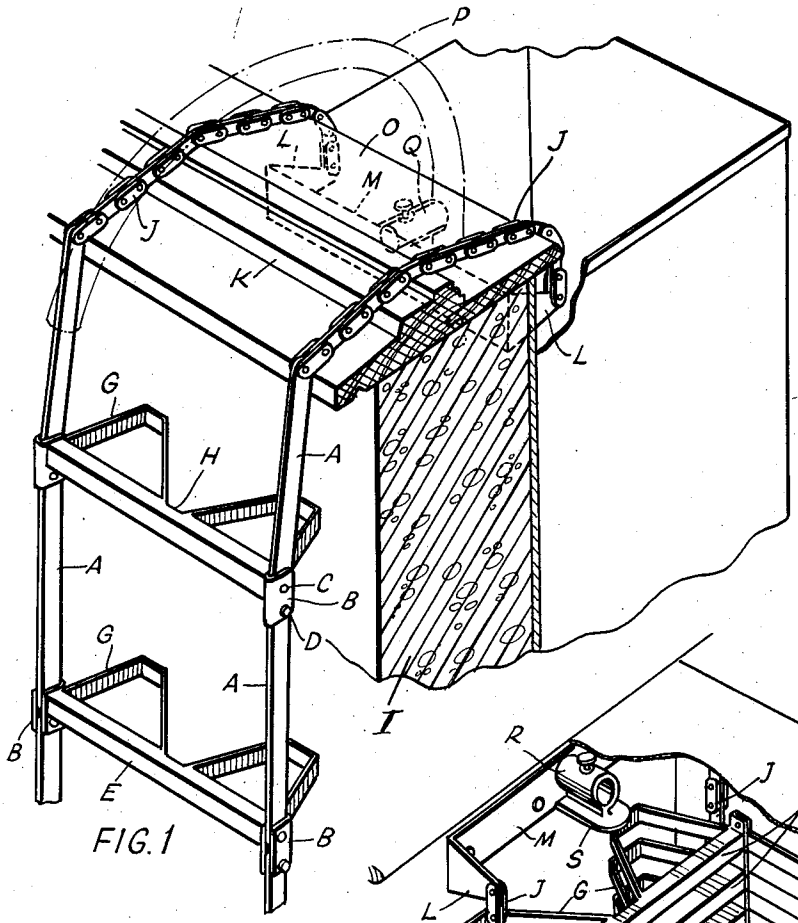


FIG. 1

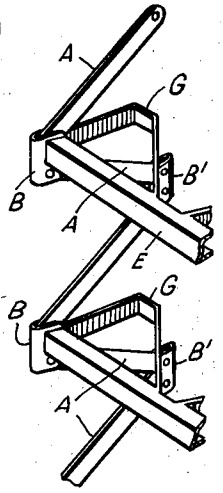


FIG. 4

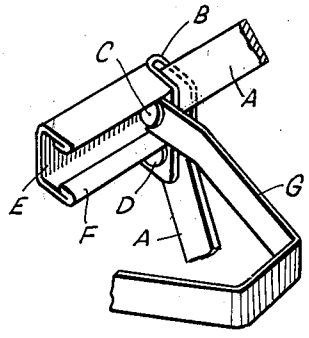


FIG. 2

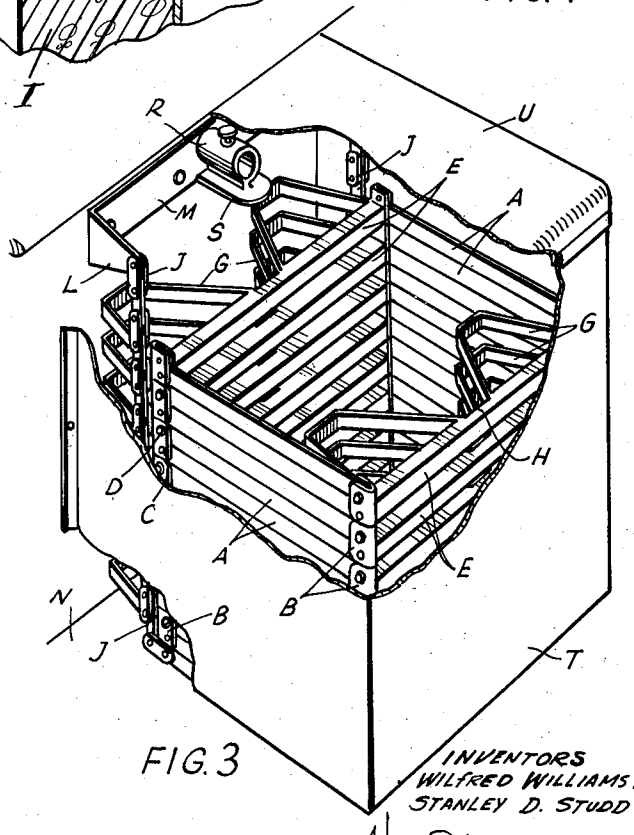


FIG. 3

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FLEXIBLE LADDER

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This invention relates to an improved flexible ladder, which is intended primarily, though not exclusively, as a fire-escape appliance.

In this connection, the known form of rope ladder, whilst possessing the obvious advantage that it can be stored in a relatively small space (for example in a box immediately below the selected escape window), with one end anchored within the building, and ready to be put in position merely by throwing the free end out of the window, has two major disadvantages; i. e.

(1) It is not fireproof and may be rendered useless before or during use; and

(2) Its liability to swing about freely calls for considerable skill and practice to find and engage the rungs with the feet, especially as there is nothing to prevent the ladder from lying flat against the wall of the building. In fact the natural consequence of the forces exerted during use of the ladder is for the rung which bears the bulk of the user's weight to be forced nearer the wall than the next higher rung or that portion of the side rope which is being held by the hand. For these reasons rope ladders are not generally approved as a fire escape appliance.

The object of the present invention is an improved flexible ladder, capable of being folded into a relatively small compass and in which the aforesaid disadvantages of a rope ladder have been eliminated.

The invention is illustrated with reference to the accompanying drawings, wherein:

Fig. 1 is a fragmentary perspective view showing one form of the improved ladder extended down the wall of a building.

Fig. 2 is a similar view showing, to an enlarged scale, a detail of Fig. 1.

Fig. 3 is a perspective view illustrating the ladder of Fig. 1 fully collapsed within the building.

Fig. 4 is a fragmentary perspective view of a modified construction of ladder showing the manner of folding.

In the example illustrated in Figs. 1–3, the side members of the ladder are of metallic chain-like construction, each comprising a plurality of main links A connected end-to-end through the medium of interposed short links B of U section, the various pivotal connections being effected by means of rivets C and/or bolts D.

The U section of each short link B embraces

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the ends of the adjacent main links A, and alternate links B in each side member are arranged with their sections facing in opposite directions as shown.

Conveniently the main links A are formed as flat metal strips, say ¾ by ⅛ inch in section and measuring about 5 inches between the centers of the rivet- or bolt-holes near their ends. The short links B may be produced by suitably folding rectangular blanks of sheet metal of, say, 0.08 in. thickness and the holes therein may be arranged with their centers about ⅞ inch apart.

The two side members are of identical construction and each short link B of one such member is connected by a rung E to the corresponding link of the other side member.

Each rung E is formed by pressing a narrow rectangular blank of sheet metal into channel form, the edges of the channel being preferably turned inwards or folded over, as at F, to provide the requisite stiffness. Convenient dimensions for the channel so produced are 12 inches long, 1 inch in width, and ¾ inch in depth.

The inner faces of two of the short links B are rigidly united, as by welding, to the ends of each rung channel, associated with which is a wall engaging member. This latter may be formed by bending a strip of metal into the general shape of the letter W, the extremities of the strip abutting the short links B aforesaid and the central link being engaged between the side walls of the channel, which may deform as at H to retain it.

The rung E is fixed to the opposed links B in alignment with corresponding holes in the latter, and the rivets C (or their equivalent) which engage in such holes are preferably passed also through the extremities of the wall engaging member G (see Fig. 2).

Conveniently the member G is formed from strip about ¾ inch wide by 0.08 inch thick, its length being such as to provide two angular loops projecting about 4 inches from the base of the rung channel. These loops (represented by the two halves of the letter W) are preferably flattened at their outer ends, and the central part of the member G within the rung channel may be similarly flattened.

When in use against the wall I of a building, the ladder is suspended with its rungs E at the upper ends of the associated links B and with

the members G projecting towards the wall aforesaid, so that under the weight of a person standing on the ladder, they bear against such wall and serve to space the rungs E therefrom as shown in Fig. 1. The rule-joint action between the connected links A, B, effectively prevents any appreciable tilting of the rungs E and wall-engaging members G when under load.

Their construction permits the side members of the ladder to fold in zig-zag formation and to be collapsed into a stack as shown in Fig. 3, the main links A under these conditions being in superposed edge-to-edge relation whilst the short links B are disposed at right angles thereto and end-to-end with one another.

Owing to the manner in which the side members fold up, and the fact that the main links A are longer than the projection of the wall-engaging members G from the rungs E, alternate members G are disposed one above another within the rectangular stack, while the remainder project outwardly thereof, two walls of the said stack being formed by the superposed rungs E.

The pair of main links A which are uppermost when the ladder is extended are preferably connected to the ends of a pair of plate-link chains J adapted to extend in laterally spaced relation across a window-sill K, the other ends of the chains J being connected to anchorage brackets L within the building. These brackets may be ends of a metal plate M adapted to be screwed or otherwise secured to the wall I at a suitable height above the floor of an upper room.

The height of the brackets aforesaid is governed by the desirability of using chains J long enough to suspend the links A connected thereto wholly or mainly below the level of the window-sill K when the ladder is in use (Fig. 1) and at the same time, of avoiding any considerable slackness of such chains when the links in question are resting on the floor N (Fig. 3).

With the arrangement above described, the suspension chains J ensure that the parts of the collapsed ladder are automatically stacked close to the wall I, the superposed members G which project outwardly from the stack being disposed as close as possible to the inner face of such wall and between the chains J as they hang from the brackets L.

To extend the ladder it is merely necessary to throw the stacked elements out of the window, whereupon the weight of the rungs E and associated parts will automatically bring the links A of each side member into mutual alignment and eventually drag the suspension chains J into an operative position across the window-sill K.

To prevent the adjacent members G from catching on the internal window-ledge O and sill K as the ladder unfolds, some form of temporary guiding means may be provided. For example, a suitably curved tube or rail (indicated at P in Fig. 1) may be detachably mounted adjacent the position of the stacked ladder so as to form a chute extending upwardly and outwardly over the window-ledge O and sill K. Conveniently a spigot Q on the chute member P is engaged in a socket R carried by the anchorage plate M, a bracket S on which provides a seating for the lower end of the chute member P and serves to maintain the latter erect.

The use of a chute as above described greatly facilitates and expedites the extension of the ladder, inasmuch as it is only necessary to lift the uppermost adjacent rungs E and to slide them along the tube or rail P with their wall-engaging members supported astride the latter. As soon as the end portion of the ladder is hanging freely, its weight will cause the rest of the ladder to be dragged out of the window, unfolding as it goes. The chute member P will then, of course, normally be dismounted.

Corresponding links of the suspension chains J may be connected by tubular or other cross-members adapted to provide a secure grip for a person climbing over the window-sill, and washers or collars of relatively large diameter may be attached to the chain links so as to cause these cross-members to stand well away from the surface of such sill.

The bottom rung of the ladder, which becomes the top rung when the ladder is collapsed, may be provided with a harness or cradle in which a child may be secured and lowered by unfolding the ladder.

The collapsed ladder may be housed in a sheet-metal or other casing T of suitable dimensions, such casing being secured to the wall I and/or the floor N and having a removable lid U.

It will be appreciated that the height of the stack into which the ladder collapses is determined by the number of main links A in each side member thereof and the individual widths of such links.

When the various parts are made to the dimensions previously quoted, a 30 foot ladder may be folded into a stack measuring approximately 12 inches wide, 15 inches deep, and 30 inches high.

In the event of the available floor-space being limited, the depth of the stack from front to rear may be reduced employing the modified construction shown in Fig. 4.

In this modification, the main links are made only about half the length of those used in the preceding construction, the pairs of links B associated with two consecutive rungs E being connected by two pairs of such main links and a third pair of short links B' whose U sections face oppositely to those of the rung-carrying links B.

The side members of the modified ladder fold in zig-zag formation as previously described, but in this case, all the superposed members G are disposed within the stack, which is U shaped, instead of rectangular, in plan view.

With such an arrangement, the overall depth of the stack is approximately halved, but on the other hand its height is proportionately increased, so that the preceding construction is preferred unless the window-ledge O is unusually high above the floor N.

What we claim is:

1. A flexible ladder comprising collapsible side members, a plurality of rungs connected at their ends to said side members, and wall-engaging members connected to said rungs intermediate said side members and longitudinally of said rungs, said wall-engaging members having two angular loops projecting from said rungs and flattened at the outer ends thereof, said wall-engaging members being constrained, on extension of the ladder, to assume an operative position outstanding from the line of rungs.

2. A flexible ladder comprising a plurality of links connected together to form two chain-like assemblies serving as the side members of the ladder, a plurality of rungs each connected at its ends to corresponding links of said two chain-like assemblies, and wall-engaging members connected to said rungs intermediate said side members and longitudinally of said rungs, said wall-engaging members having two angular loops pro-

jecting from said rungs and flattened at the outer ends thereof, said wall-engaging members being constrained, on extension of the ladder, to assume an operative position outstanding from the line of rungs.

3. A flexible ladder comprising two chain-like side members each consisting of main links connected by short links, each of said short links having a U section which embraces the ends of the adjacent main links and alternate short links having their sections directed oppositely to the other short links of the same side member, a plurality of rungs each rigidly united at its ends to corresponding short links of said two side members, and wall-engaging members rigidly mounted upon said rungs so that, on extension of the ladder, they automatically assume an operative position outstanding from the line of rungs, the complete ladder being foldable in zig-zag formation with the main links of each side member mutually superimposed and the rungs and wall-engaging members similarly stacked between the folded side members.

4. A flexible ladder comprising two chain-like side members each consisting of main links of equal length connected by short links, each of said short links having a U section which embraces the ends of the adjacent main links and alternate short links having their sections directed oppositely to the other short links of the same side member, a plurality of rungs rigidly united at their ends one to each pair of corresponding short links in said two side members, and wall engaging members rigidly mounted upon said rungs so that, on extension of the ladder, they automatically assume an operative position outstanding from the line of rungs by an amount not exceeding the length of a main link, the complete ladder being foldable in zig-zag formation with the main links of each side member mutually superposed and with alternate rungs and associated wall-engaging members disposed in two spaced stacks.

5. A flexible ladder comprising two chain-like side members each consisting of main links connected by short links each of said short links having a U section which embraces the ends of the adjacent main links and alternate short links having their sections directed oppositely to the other short links of the same side member, a plurality of rungs rigidly united at their ends to corresponding alternate short links in said two side members, and wall-engaging members rigidly mounted upon said rungs so that, on extension of the ladder, they automatically assume an operative position outstanding from the line of rungs, the complete ladder being foldable in zig-zag formation with the main links of each side member mutually superimposed and the whole of the rungs and wall-engaging members similarly stacked between the folded side members.

6. A flexible ladder comprising two chain-like side members each consisting of main links connected by short links, each of said short links having a U section which embraces the ends of the adjacent main links and alternate short links having their sections directed oppositely to the other short links of the same side member, a plurality of rungs rigidly united at their ends to corresponding alternate short links in said two side members, and wall-engaging members rigidly mounted upon said rungs and directed similarly to the sections of the short links carrying the latter, so that they automatically assume an operative position outstanding from one face of

the ladder when the same is extended, the complete ladder being foldable in zig-zag formation with the main links of each side member mutually superimposed and the whole of the rungs and wall-engaging members similarly stacked between the folded side members.

7. A flexible ladder comprising collapsible side members, a plurality of channel-section rungs connected at their ends to said side members and wall-engaging members in the form of strip-metal loops rigidly mounted one in each rung channel, the arrangement being such that, when the ladder is extended, the various wall-engaging members automatically assume an operative position outstanding from the line of rungs.

8. A flexible ladder comprising collapsible side members, a plurality of channel-section rungs connected at their ends to said side members and strip-metal members of W shape each having its extremities rigidly mounted in one of the rung channels, the arrangement being such that, on extension of the ladder down a wall, said rungs automatically assume an operative position with the projecting parts of said W-shaped members thereon bearing against the wall.

9. A flexible ladder comprising a plurality of links connected together to form two chain-like assemblies serving as the side members of the ladder, a plurality of rungs each connected at its ends to corresponding links of said two chain-like assemblies, wall-engaging members connected to said rungs intermediate said side members and longitudinally of said rungs, said wall-engaging members having two angular loops projecting from said rungs and flattened at the outer ends thereof, said wall-engaging members being constrained, on extension of the ladder, to assume an operative position outstanding from the line of rungs, anchorage means for location within a building including a plate secured to a wall of said building beneath a window and anchoring brackets at the ends of said plate, and suspension members connecting the end links of the ladder to said anchorage means and adapted to lie over a window-sill of the building when the ladder is hung externally of the latter.

10. A flexible ladder comprising a plurality of links connected together to form two chain-like assemblies serving as the side members of the ladder, a plurality of rungs each connected at its ends to corresponding links of said two chain-like assemblies, wall-engaging members connected to said rungs intermediate said side members and longitudinally of said rungs, said wall-engaging members having two angular loops projecting from said rungs and flattened at the outer ends thereof, said wall-engaging members being constrained, on extension of the ladder, to assume an operative position outstanding from the line of rungs, spaced anchorage brackets adapted for location within a building, and further chain-like assemblies connecting the end links of the ladder one to each of said brackets and adapted to rest upon a window-sill of the building when the ladder is hung externally of the latter.

11. A flexible ladder comprising a plurality of links connected together to form two chain-like assemblies serving as the side members of the ladder, a plurality of rungs each connected at its ends to corresponding links of said two chain-like assemblies, wall-engaging members connected to said rungs and constrained, on extension of the ladder, to assume an operative position outstanding from the line of rungs, spaced anchorage brackets adapted for location within

a building, and suspension members connecting the end links of the ladder one to each of said brackets, in combination with dismountable guide means adapted to span a window-sill of the building while the ladder is being extended down the wall of the latter and to support said wall-engaging members clear of said window-sill during the progressive movement of the ladder over it.

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