June 26, 1945. N. L. DAHLANDER 2,378,913

FLEXIBLE LADDER

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Fig. 1.

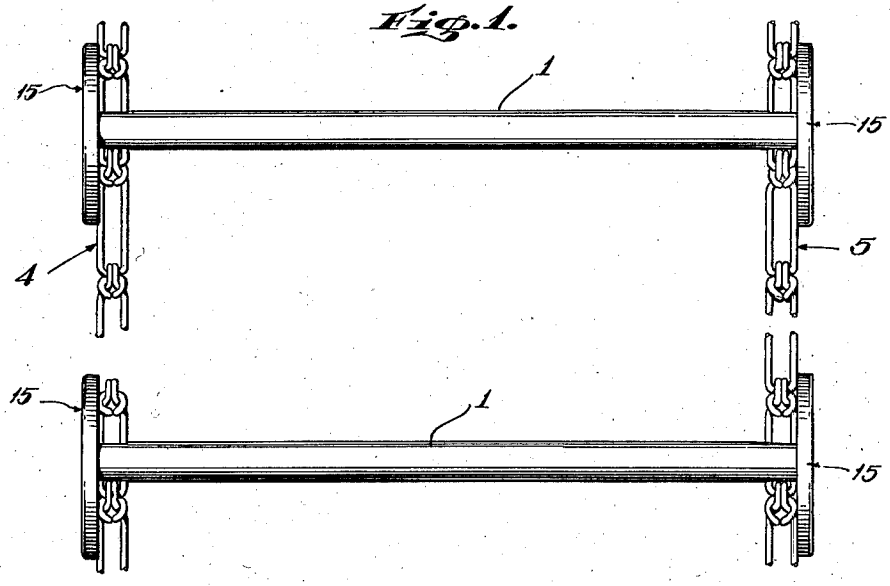


Fig. 2.

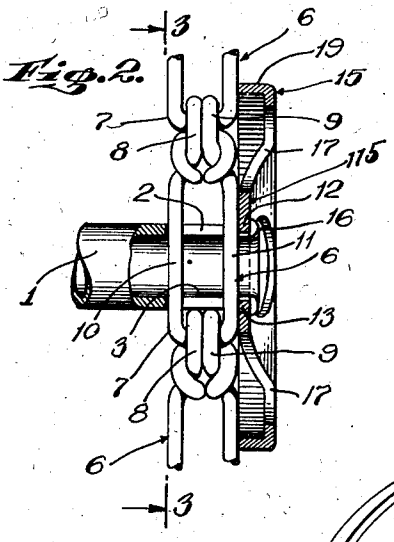


Fig. 3.

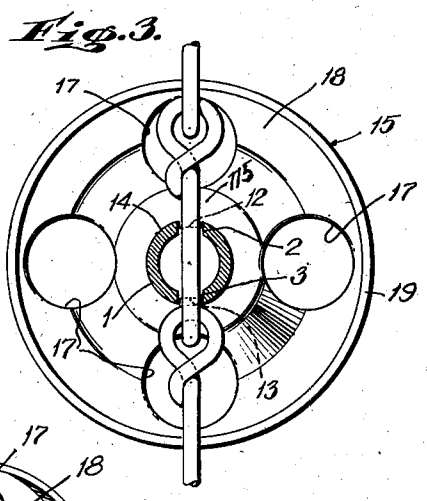
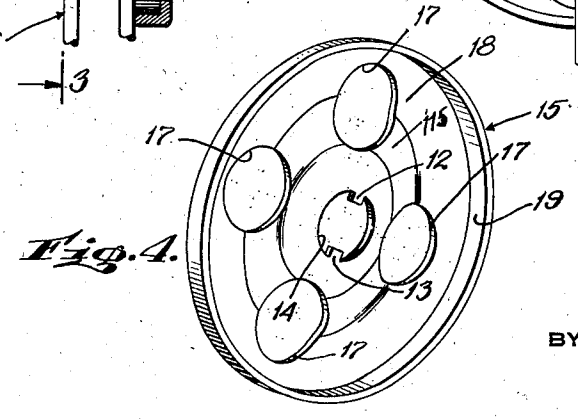


Fig. 4.



INVENTOR
NÖEL L. DAHLANDER
BY Gustav Drews
ATTORNEY

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Fig. 5.

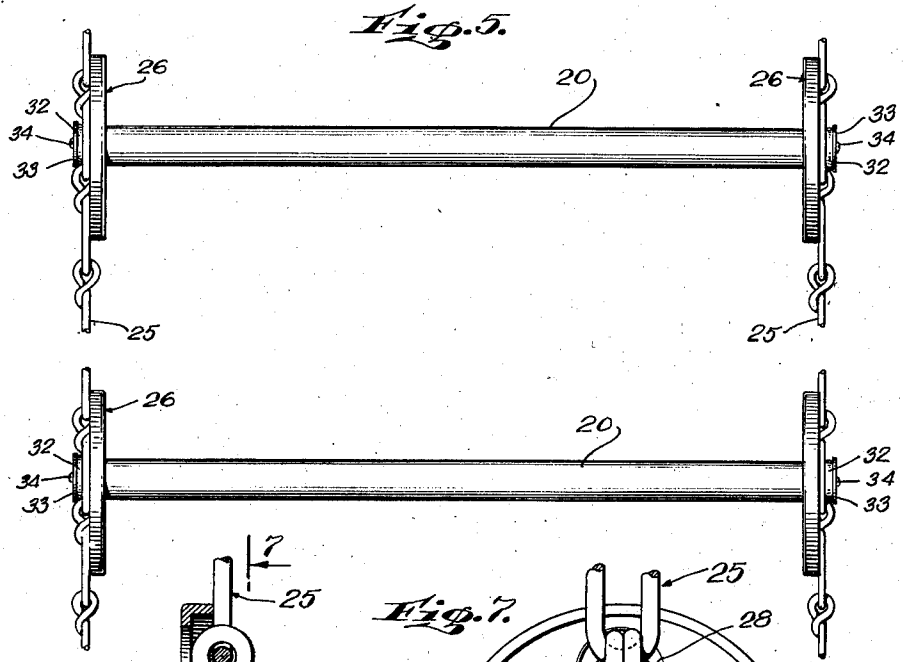


Fig. 6.

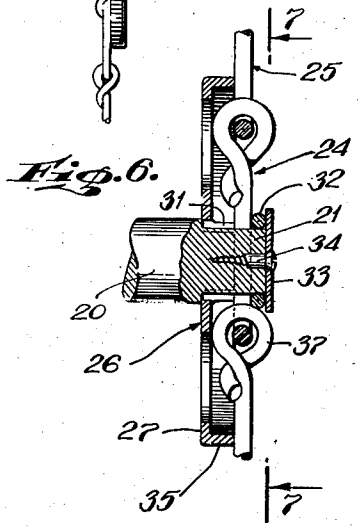


Fig. 7.

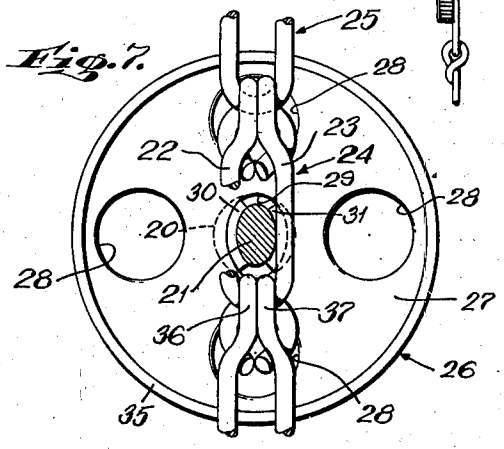
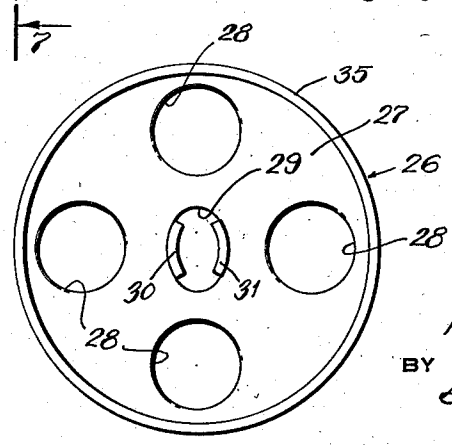


Fig. 8.



INVENTOR
NÖEL L. DAHLANDER
BY Gustav Drews
ATTORNEY

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FLEXIBLE LADDER

Noël L. Dahlander, New York, N. Y., assignor of one-half to Robert J. Earl, New Canaan, Conn.

Application January 8, 1943, Serial No. 471,663

3 Claims. (Cl. 228—40)

This invention relates to improvements in flexible ladders, such as chain ladders and the like.

Among the objects of the present invention it is aimed to provide an improved flexible ladder having rigid rungs, spacing means mounted on the rungs adjacent to the suspensory elements, which spacing elements will be provided with an annular peripheral flange of sufficient width to form an extensive wearing surface as distinguished from the cutting edge of a disc or the like, and which spacing means will be anchored against rotation to reduce the wear to a minimum.

It is still another object of the present invention to provide an improved flexible ladder such as a chain ladder having rigid rungs and spacing disks mounted on the rungs and cooperating with the suspensory members to insure the proper alinement of the individual elements of the suspensory members, maintain the suspensory members and spacing members adjacent to one another and yet reduce to a minimum the points of engagement between the suspensory members and the spacing members.

These and other features, capabilities and advantages of the invention will appear from the subjoined detail description of specific embodiments thereof illustrated in the accompanying drawings in which

Figure 1 is a front fragmental elevation of a part of a flexible chain made according to one embodiment of the present invention.

Fig. 2 is a fragmental enlarged detail partly in section showing the association of rung spacing member and suspensory member made according to the embodiment illustrated in Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a perspective of the spacing member shown in Fig. 2.

Fig. 5 is a fragmental front elevation of another embodiment of the present invention.

Fig. 6 is an enlarged fragmental detail partly in section showing the association of rung spacing member and suspensory member according to the embodiment illustrated in Fig. 5.

Fig. 7 is a section on the line 7—7 of Fig. 6.

Fig. 8 is a side elevation of the spacing element shown in Fig. 6.

According to the embodiment illustrated in Figs. 1 to 4, inclusive, the flexible ladder there shown is provided with rigid rungs 1 preferably composed of cylindrical metal bars, each having a pair of alined slots 2 and 3 at their ends diametrically disposed. The suspensory members 4 and 5 are preferably composed of a plurality of chain links 6, as an instance of the type known as the "Lock Link" type, the loop 7 of which is engaged by the looped ends 8 and 9 of an adjacent link as shown in Fig. 2. The loop 7 as shown has two shanks 10 and 11. Advantage is taken of this construction in the present instance to locate the two shanks 10 and 11 of the loop 7 in the slots 2 and 3 of the bar 1 with the lower loop extending beyond the slot 3 to receive the looped ends 8 and 9 of the adjacent lower link 6 and the upper looped ends 8 and 9 of the loop 7 of the link 6 disposed above the slot 2 to engage the loop 7 of the next above adjacent link 6.

The slots 2 and 3 are preferably long enough as shown to receive the shanks 10 and 11, with the shank 10 adjacent the inner ends of the slots 2 and 3, and the shank 11 free to be engaged by the inner face of the inwardly extending annular zone 115 and the inner faces of the projections 12 and 13 extending radially inward from the periphery of the central opening 14 in the annular zone 115 of the spacing member 15. The projections 12 and 13 are preferably as shown diametrically opposite to one another relative to the opening 14 and of a width to fit nicely in the slots 2 and 3 as shown in Fig. 2. The spacing member 15 is secured in position either by turning over the free outer edge 16 of the bar 1, as an instance by burring, or by welding, brazing or otherwise securing the outer edge 16 of the bar 1 to the spacing member 15.

In order to save material and to reduce the weight of the member 15 without materially reducing its strength, the openings 17 are formed in the disc portion 18 of the member 15. The spacing member 15 is also provided with a flange 19 the width of which is predetermined to enable its inner free edge to aline the inner face of the annular zone 115 and the inner faces of the projections 12 and 13 as shown to engage the shanks 11 of links 6 disposed above and below the link 6 extending through the bar 1 via the slots 2 and 3. The disc portion 18 of the spacing member 15 is circular and the flange 19 and zone 115 annular and circular in the interest of reinforcing the spacing member 15, and the flange 19, wide enough and provided with an outer smooth surface to form a smooth wide engagement surface for engaging the side of the vessel with which the latter is to be used, thereby to minimize the danger of fracturing the side of the vessel which might occur with a sharp edged disc, especially with the thin hulls today extensively used in the war work for lighter craft, the greater the width of the flange 19, of course, the greater latitude for

distributing the load or force exercised against the side of the vessel by the spacing member 15.

While the dimensions of the spacing member 15 may vary according to the service to be performed, it should be noted that excellent results have been achieved when the over-all diameter of the disc portion 18 is five inches and the width of the flange 19 is about one-fourth of an inch, when the diameter of the bar 1 of the rung is about one and one-fourth inches. While the zone 115, the projections 12 and 13 and the flange 19 practically engage the shanks 11 of the links 6 in actual use, this engagement should not be a locking engagement, but allow free movement of the outer links 6, as an instance to fold over upon one another when it is desired to store the ladder, and also to allow for curves or bends in the face of the vessel.

The anchoring of the spacing members 15 onto the bars 1 by the cooperation of the projections 12 and 13 with the slots 2 and 3 prevents needless turning and consequent loosening due to the wear of the spacing members 15 relative to the bars 1.

The alinement of the links 6 and the suspensory members 4 and 5 afforded by the flange 19 tends more evenly to distribute the stresses and strains to which the ladder is subjected and to avoid the stresses and strains that would arise due to accidental misalinement of the links with one another, particularly adjacent the points where the forces are applied, as an instance, on the rungs during use.

Preferably as shown, the looped ends 8 and 9 of the adjacent lower link 6 are disposed at the upper end of such link to receive the bar 1 and thereby aid in locking the link in place, it having been found in practice that there is a tendency to open the link when the looped ends 8 and 9 of the link 6 extending through the bar 1 are at the bottom instead of at the top.

In actual practice it has also been found that excellent results have been obtained when the several parts, to wit, bar 1, links 6, and spacing member 15, are composed of steel.

In the embodiment shown in Figs. 5 to 8, inclusive, there is shown a flexible ladder having a rigid rung 20, preferably composed of a wooden bar, circular in cross section as shown, provided with diminished ends 21, the cross sections of which as shown in Fig. 7 are oblong, the narrow axis of which is preferably less than the width between the two shanks 22 and 23 of a link 24 of the "Lock Link" type, the long axis of which is preferably greater than the width between the two shanks 22 and 23 as shown in order to facilitate in anchoring the bar 20 against rotation and to the suspensory member 25 composed of links of this type as shown. On each diminished oblong end 21 there is first mounted a spacing member 26 having a disc portion 27 provided with openings 28 in the interest of saving material and to reduce the weight thereof without materially reducing the strength of the spacing member 26. The spacing member 26 also has a central oblong opening 29 provided with two arcuate flanges 30 and 31 along the opposite long sides of the oblong opening 29, the inner faces of the flanges 30 and 31 conforming to the outer long curved faces of the diminished end 21 so that the spacing member may be mounted on the diminished portion 21 with its flanges 30 and 31 extending outwardly as shown in Fig. 6 toward the suspensory member 25. After the spacing member 26 has been mounted upon the diminished portion 21, then the suspensory member 25 is secured to the diminished portion 21 by having the diminished portion 21 pass between the shanks 22 and 23 of a link 24 as shown in Fig. 6. Thereupon an oblong metal ring 32 is forced on the peripheral end of the diminished portion 21, and then a metal disc 33 secured to the free plane end of the diminished portion 21 by the screw 34, the disc 33 extending beyond the ring 32 to anchor the same in position.

Each spacing member 26 is provided with an outer peripheral flange 35, the width of which is the same as the width of the flanges 30 and 31, in order to permit alinement of adjacent links 24 of the suspensory member 25. In other words, the flanges 30 and 31 will engage the sides of the shanks 22 and 23 of the link 24 spanning the diminished portion 21 while the flange 35 will engage the shank portions 22 and 23 not only of the link 24 below the link spanning the portion 21, but also engage the shank portions 22 and 23 of the link 24 above the link 24 spanning the portion 21.

Preferably as shown with the embodiment first described, the looped ends 36 and 37 of each link 24 will be disposed at the upper end thereof so that the rung 20 may rest upon the looped ends 36 and 37 of the link 24 below the link 24 spanning the diminished portion 21. The looped ends 36 and 37 in the present embodiment not only rest against the ring 32 as shown in Fig. 6, but also are disposed opposite the lower space between the flanges 30 and 31 so that the looped ends 36 and 37 will not be engaged by the sharp edge of the spacing member 26.

With this embodiment also, the dimensions will depend upon the service to be performed. However, excellent results have been achieved in practice when the diameter of the circular portion of the rung 20 is about one and one-fourth inches over-all, the screw 34 is about two inches in length, the diminished portion 21 about three-fourths of an inch in width, the diameter of the spacing member about five inches, and the width of the flange 35 as well as of the flanges 30 and 31 about one-fourth of an inch.

Similarly, the selection of materials may depend upon the service to be performed. Excellent results, however, have been achieved when the bar 20 is composed of wood and the spacing member 26, suspensory members 25, ring 32, disc 33 and screw 34 are composed of steel.

With this embodiment it will be noted that the spacing members 26 are on the inside of the suspensory members 25. While in use, the wearing ring 32 will rest on the looped ends 36 and 37, when it is desired to store the ladder, the suspensory members 25 will be free to flex outwardly away from the rungs 20 to facilitate folding up the ladder and confining it to a compact space. When the suspensory members 25 are so folded outwardly, obviously the links will permit pivotal motion practically in all directions and allow the rungs with their spacing members 25 to be freely staggered relative to one another.

With both embodiments, furthermore, it will be noted that the spacing members will reduce to a minimum the engaging surfaces between the same and the suspensory members, thereby reducing to a minimum the wear on the suspensory members without in any way impairing the utility of the same, and on the other hand actually make possible the use of an extended bearing surface, to wit, the outer annular flanges, with the face of the vessel.

It is obvious that various changes and modifications may be made to the details of construction without departing from the general spirit of the invention as set forth in the appended claims.

I claim:

1. In a ladder, the combination of two flexible suspensory members composed of chain links, rigid rungs having slots at the ends thereof to receive links of said members and resting on the ends of links, and spacing members mounted on said rungs adjacent the outer sides of said suspensory members, each spacing member having a central opening to receive the end of a rung, an outer uninterrupted circular flange the free edge of which and a portion adjacent its central opening being in radial alinement with one another and in engagement with three successive links of one of said suspensory members to aline the same, said flange forming an extended bearing surface for the spacing member between the spacing member and the face of the vessel to be engaged, said rungs having fastening means on the outer free ends thereof to anchor said suspensory members and spacing members in place and resting within centrally formed depressions in said spacing members.

2. In a ladder the combination of two flexible suspensory members composed of chain links, rigid rungs having slots at their ends to receive links of said suspensory members and resting on the ends of links, and spacing members having depressions deflecting inwardly with central openings to receive the ends of said rungs, each spacing member having an outer annular flange and a portion adjacent its central opening formed by said depression and in radial alinement with the free edge of its flange, the free edge of said flange and said centrally deflected portion being in engagement with successive links of one of said suspensory members to serve to aline the same, said flange forming an extended bearing surface for the spacing member between the spacing member and the face of the vessel to be engaged, said rungs having fastening means on the outer free ends thereof to anchor said suspensory members and spacing members in place and resting within the centrally formed depressions in said spacing members.

3. In a ladder the combination of two flexible suspensory members composed of chain links, hollow metal rungs having slots at their ends to receive links of said suspensory members and anchor the same against rotation relative to said rungs, spacing members having central openings to receive the ends of said rungs and having projections extending into said slots to anchor the spacing members against rotation relative to said rungs, the ends of said rungs being burred and disposed against the outer faces of said spacing members, each spacing member having a centrally depressed portion engaging the adjacent link and also having an outer annular flange parallel to the axis of its associated rung and extending inwardly with the free edge of the flange engaging links to either end of the link confined in the associated rung, with the burrs at the ends of the rungs resting within the centrally formed depressions in said spacing members.

NOËL L. DAHLANDER.