April 25, 1961 J. WEBBER 2,981,364

FOLDING LADDER

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Fig. 1

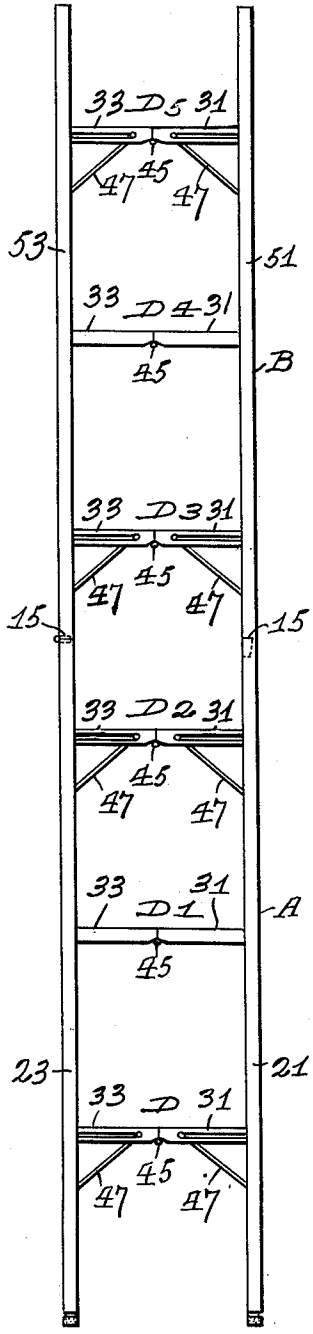

Fig. 2

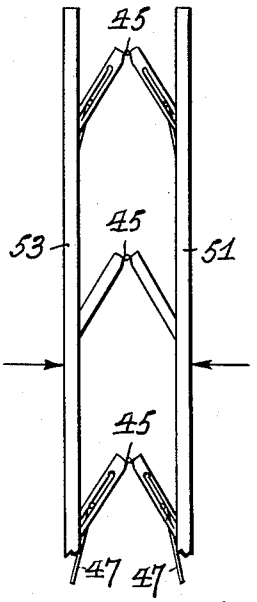

Fig. 3

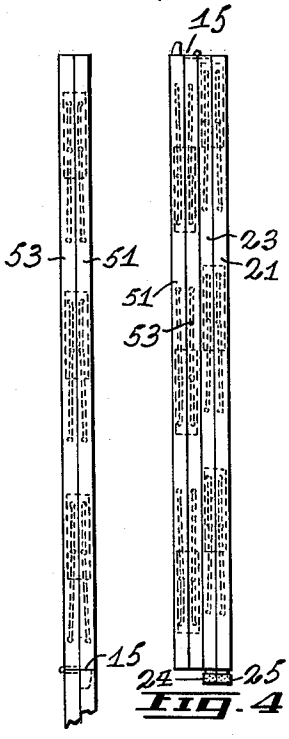

Fig. 4

Fig. 5

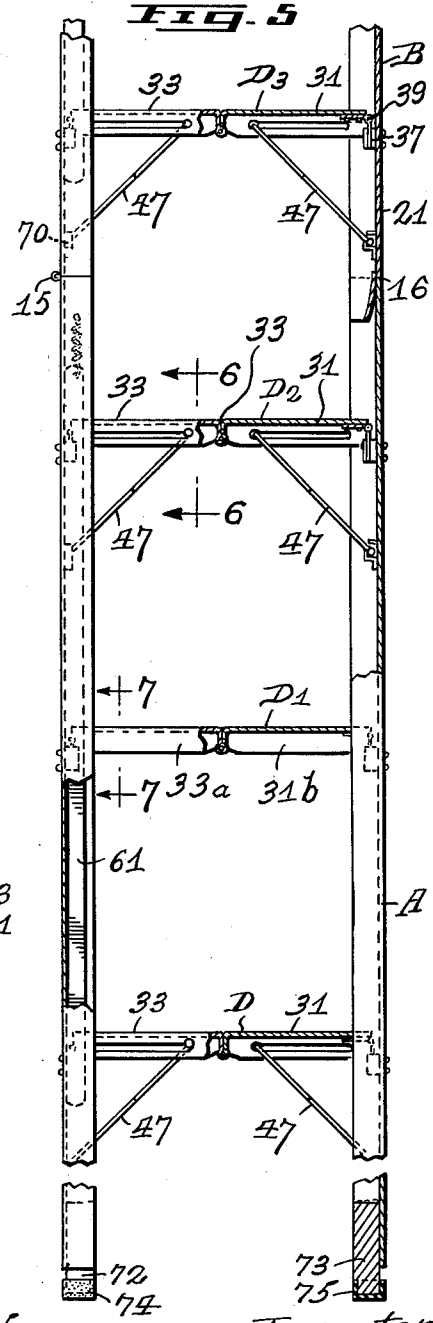

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Fig. 6

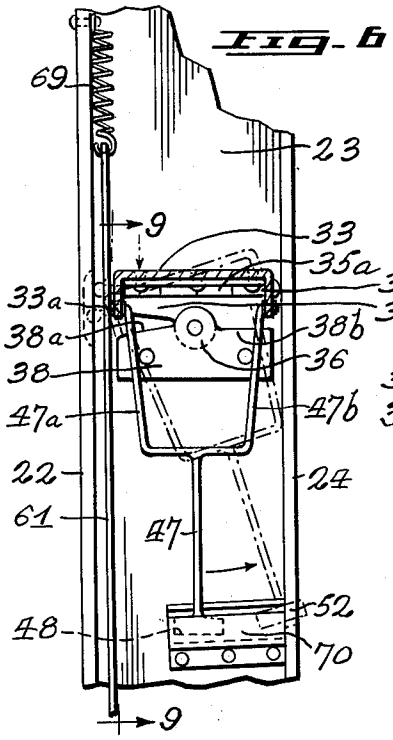


Fig. 9

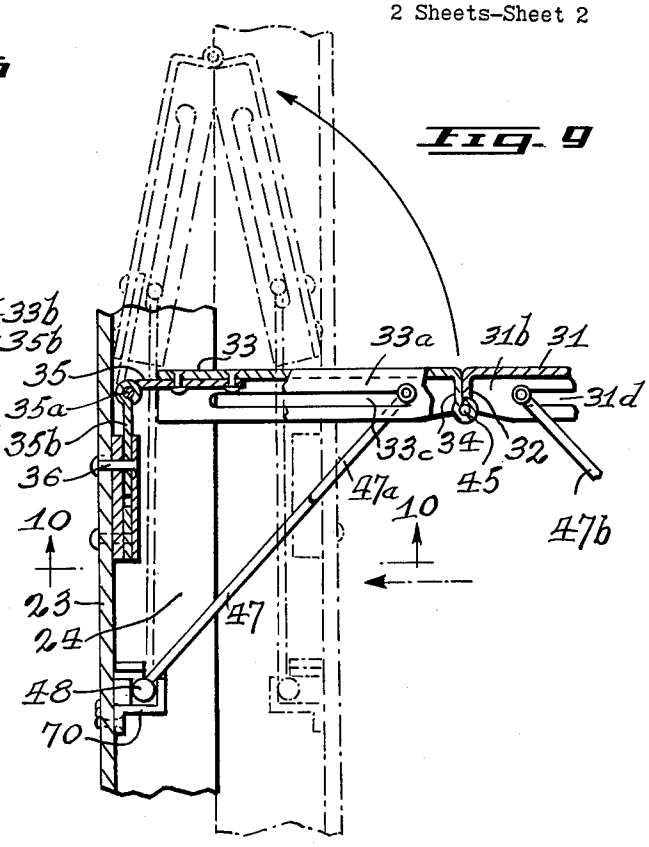


Fig. 7

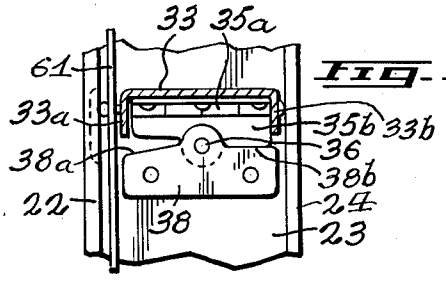
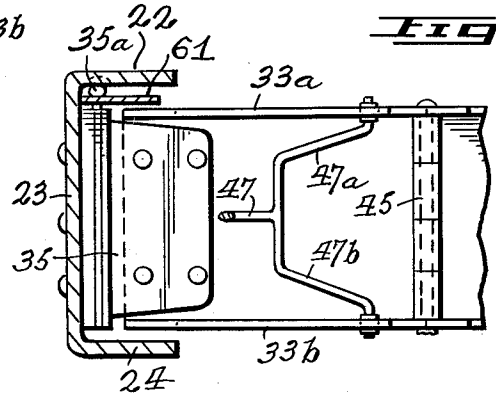


Fig. 10



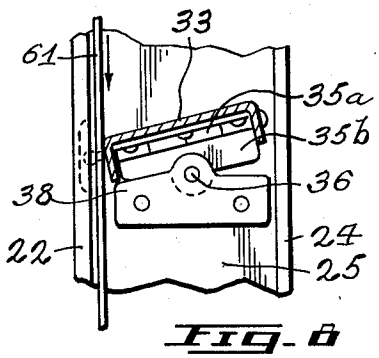


Fig. 8

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2,981,364

FOLDING LADDER

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Filed July 13, 1959, Ser. No. 826,648

13 Claims. (Cl. 182—159)

This invention relates to a folding ladder.

Folding ladders are known, although generally the surface of the steps remain perpendicular to the uprights so that when the uprights are placed in a diagonal position the step surfaces are also perpendicular.

An aim of the present invention is to provide a ladder which can be conveniently folded into a small space and yet the steps of which are adjustable so that they can be moved so that their surfaces are substantially horizontal when the uprights are diagonal.

A ladder according to the invention is provided with a pair of uprights carrying spaced apart steps. Each step is made up of a pair of sections which are centrally hinged together for collapsing and folding the latter. Each section is pivotally related to the upright at the rear and relates for limited longitudinal movement to the upright at the front. Means is provided which normally keeps the steps in horizontal position related to the uprights so that they can be folded flush against the uprights, but when pressure is exerted on the steps they are movable into a position diagonal to the uprights and substantially horizontal to the ground. Supporting means is provided to support the steps in a diagonal position against downward pressure.

Preferably the uprights are channel members and the steps are connected to the front and rear flanges of the channels. Preferably also the step sections are channels having front and rear flanges. In this case the supporting members preferably include a fork having each prong engaged in slots in the flange of a step section and a leg extending downwardly from the fork and adapted to engage in an opening in the rear flange of the channel.

Detailed description

The invention has been generally described and will now be described in more detail by reference to the accompanying drawings, which illustrate a preferred embodiment and in which

Figure 1 is a front view of the preferred ladder in set-up position.

Figure 2 is a fragmentary front view of part of the ladder in partially-collapsed position.

Figure 3 is a side fragmentary elevation of the ladder shown in Figure 1.

Figure 4 is a side elevation of the ladder in folded position.

Figure 5 is a fragmentary longitudinal view of the ladder of the previous figures in set-up position, on an enlarged scale partly in elevation and partly in section.

Figure 6 is a cross-section along the line 6—6 of Figure 5 with the step in position for folding.

Figure 7 is a cross-section along the line 7—7 of Figure 5, with the step as in Figure 6.

Figure 8 is a cross-section corresponding to Figure 7 showing the step in tilted position.

Figure 9 is a detailed fragmentary view on a still larger scale showing the relationship of one of the uprights and a locking strut.

Figure 10 is a cross-section along the line 10—10 of Figure 9.

More specific reference will now be made to the drawings. The ladder is made up of a bottom section A and a top section B connected by the hinge 15 at one side and by the pin and socket 16 at the other side. The section A is made up of uprights 21 and 23, each having a front flange 22 and a rear flange 24, and section B of uprights 51 and 53. A number of rungs or steps D, D1, D2, D3, etc. are mounted between the respective uprights. The step D also described by way of example of the similar construction of the steps D1, D2, etc. is made up of companion parts 31 and 33. One end of part 33 is connected by hinge plate 35 and hinge pin 35*a* to a rocker arm 35*b* which is pivotally mounted at 36 on upright 23, midway between flanges 22 and 24. Movement of rocker arm 35*b*, and thus part 33, on pivot 36 is restricted by plate 38 secured to upright 23. The top edges 38*a* and 38*b* of plate 38 are so formed to permit rocker arm 35*b* to travel only between the horizontal position and inclination at an angle shown in Figure 8, which angle will correspond roughly to the angle made with the vertical by the ladder in normal operation, so that the steps D may assume a horizontal or roughly horizontal position. The other end of the part 33 carries a downwardly extending flange 34, the lower end of which is pivoted as at 45 to a similar flange 32 on the part 31. The other end of part 31 is similarly hinged and pivoted to upright 21 by hinge 39 and pivot 37. The parts 31 and 33 are provided at each side with downwardly extending flanges 31*a*, 31*b* and 33*a*, 33*b*, respectively.

By this arrangement the steps can be extended so that the ladder is in set-up position as shown in Figure 5, or the steps can be collapsed so that the ladder can be folded as in Figure 4.

In order to hold the ladder in set-up position each half of the step is provided with a strut 47 which is forked to provide parts 47*a* and 47*b* which fit in slots 33*c* and 33*d* respectively of the flanges 33*a* and 33*b*. The end of the strut 47 is in the form of a T having a cross piece 48 which engages in a slot 52 in the rear flange 24 of the upright 23.

The ladder is set up by extending the uprights and pulling them apart to the position shown in Figure 4, thus extending the steps D. The steps D are normally held in perpendicular position with respect to the uprights by the link 61, which engages all the hinge pins 35*a* thereby actuating rocker arms 35*b*, and by the spring 69 acting on the link 61. When the ladder is inclined and pressure is applied by a foot on any step, all steps assume a substantially horizontal position, and being spring-loaded return to the perpendicular position when pressure is released.

The lower half A has been described, but the upper half B is similar.

A guard member or governor 70 is provided in the form of a shield within which the end 48 of the supporting member is held for movement from a perpendicular position to a diagonal position with respect to the uprights, as best shown in Figure 6. This governor prevents the member 47 from wandering. Preferably also the lower end of the ladder is provided with blocks 72 and 73 which are bolted to the flanges of the channel and provided with feet 74 and 75 of rubber or other resilient material for engaging the ground or floor.

I claim:

1. A folding ladder comprising in combination a pair of flanged channel members constituting uprights, a plurality of steps each made up of a pair of channel members and each having a terminal inner flange abutting the flange of the other member and means pivoting the inner

flanges together, the other end of each of said step channel members being hinged to a rocker arm pivotally mounted on said upright, movement of said rocker arm being restricted to the range from a substantially horizontal position to an angle therefrom corresponding substantially to the inclination of the ladder away from vertical when in operational position, each of said channel members being related to a strut having a fork with ends engaging in a slot in the flange of the channel member and a leg having an end adapted to engage in an opening in the rear flange of one of the uprights, a link extending longitudinally inside the front flange and having spaced-apart openings engaging the end of the hinge connected to each of said step members, spring means normally pulling the said link in a direction to pull the legs perpendicular to the flanges of the uprights, the link being adapted to be moved against the spring means when downward pressure is applied to a step whereby all the steps are brought into diagonal relationship to the uprights and the supports engage in said supporting openings in the rear flange.

2. A folding ladder in which there are two sections as defined in claim 1, having the ends of their uprights abutting, one pair of ends being hinged together for folding laterally and connecting means for disconnectably connecting the abutting end of the other upright.

3. A folding ladder comprising in combination, a single rigid leg at each side of the ladder, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface and an inner end foldably connected to the inner end of the companion section, the respective companion sections having their outer ends pivoted to a connecting member for folding movement towards and from the leg, said connecting member being pivotally related to the adjacent leg for movement when the ladder is set up from a folding position with the stepping surfaces of the steps substantially perpendicular to the longitudinal axis of the leg to a climbing position with said stepping surfaces diagonal to the axis of the legs, a connecting member interconnecting all the steps, and retaining means acting on said connecting member when the ladder is set up to urge the steps into folding position and resilient under climbing pressure to allow the steps to move to climbing position, and means for supporting each step in climbing position when under climbing pressure.

4. A folding ladder as claimed in claim 3 in which the means for supporting the steps in climbing position includes a member slidably connected to a step section of each companion pair, and having an extension adapted to engage stop means on one of said legs.

5. A folding ladder comprising in combination a pair of legs, one at each side of the ladder, said legs being channel members having a wide body portion and side flanges extending from the body portion, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface slightly narrower than the width of said body portion thereby to enable the stepping portion to fit between the flanges, each of said companion sections being foldably related at their inner ends to the other section, each of the stepping sections being foldably related to a leg at its outside end, and rotatably related to the leg for movement when the legs are extended from folding position with the climbing surface perpendicular to the longitudinal axis of the leg to a climbing position diagonal to the leg, common means active when the ladder is set to urge the steps towards folding position but adapted to allow the steps to be moved under climbing pressure into climbing position, and separate means for supporting each step in climbing position when under climbing pressure.

6. A folding ladder comprising in combination, a pair of legs one at each side of the ladder, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface and an inner end foldably connected to the inner end of the companion section, the respective companion sections having their outer ends pivoted to a connecting member for folding movement towards and from the leg, said connecting member being pivotally related to the adjacent leg for movement when the ladder is set up from a folding position with the stepping surfaces of the steps substantially perpendicular to the longitudinal axis of the leg to a climbing position with said stepping surfaces diagonal to the axis of the legs, each of said companion sections being made up of a channel member having a web constituting the stepping surface and side flanges, at least one of said side flanges being provided with a slot, a strut having a part slidably engageable with said slot and an opposite end part engageable with a member connected to said leg, said strut being adapted to support said step section when the ladder is in set-up position.

7. A folding ladder comprising in combination, a pair of legs one at each side of the ladder, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface and an inner end foldably connected to the inner end of the companion section, the respective companion sections having their outer ends pivoted to a connecting member for folding movement towards and from the leg, said connecting member being pivotally related to the adjacent leg for movement when the ladder is set up from a folding position with the stepping surfaces of the steps substantially perpendicular to the longitudinal axis of the leg to a climbing position with said stepping surfaces diagonal to the axis of the legs, each of said companion sections being a channel member having a web constituting the stepping area and side flanges, each of said side flanges being provided with an elongated slot, a bifurcated strut for supporting the sections and having a forked portion including a pair of arms, and a stem extending from the forked portion, each of said arms being engageable with one of said slots, the stem terminating in a foot, guiding means on the adjacent leg including a bracket having an elongated trough portion for engaging said foot and guiding it when the ladder is in set-up position, the foot being slidable from a middle position when the steps are in folding position to a slide position when the steps are in climbing position, the adjacent leg including an opening providing means for receiving and supporting the foot when the steps are in climbing position.

8. A folding ladder comprising in combination, a pair of legs one at each side of the ladder, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface and an inner end foldably connected to the inner end of the companion section, the respective companion sections having their outer ends pivoted to a connecting member for folding movement towards and from the leg, said connecting member being pivotally related to the adjacent leg for movement when the ladder is set up from a folding position with the stepping surfaces of the steps substantially perpendicular to the longitudinal axis of the leg to a climbing position with said stepping surfaces diagonal to the axis of the legs, each of said sections being provided with a downward extending terminal flange abutting the terminal flange of the other section when the ladder is in set-up position, the flanges being hinged together adjacent to their lower extremities to permit folding of the step, means acting on all the steps to urge them towards folding position when the ladder is set up, and separate means for supporting each step independently in climbing position when under climbing pressure.

9. A folding ladder comprising in combination, a pair of legs one at each side of the ladder, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface and an inner end foldably connected to the inner end of the companion section, the respective companion sections

having their outer ends pivoted to a connecting member for folding movement towards and from the leg, said connecting member being pivotally related to the adjacent leg for movement when the ladder is set up from a folding position with the stepping surfaces of the steps substantially perpendicular to the longitudinal axis of the leg to a climbing position with said stepping surfaces diagonal to the axis of the legs, an elongated connecting member positioned adjacent the front of one of said legs and having a connection with the front of each of the step sections, spring means urging said connecting member upwards thereby normally to pull the steps into folding position and being free to release the steps against the spring means under climbing pressure.

10. A folding ladder as defined in claim 9 in which the connecting member is a link provided with openings and each of the sections is connected thereto, a protuberance engaging an opening in said link, a spring connected to an upper portion of the leg, said spring being connected to the upper end of said link.

11. A folding ladder comprising in combination a pair of legs, one at each side of the ladder, said legs being channel members having a wide body portion and side flanges extending from the body portion, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface slightly narrower than the width of said body portion thereby to enable the stepping portion to fit between the flanges, each of said companion sections being foldably related at their inner ends to the other section, each stepping section being foldably related to a leg at its outside end and rotatably related to the leg for movement when the legs are extended from a folding position with the climbing surface perpendicular to the longitudinal axis of the leg to a climbing position diagonal to the leg, common means urging all the steps into folding position and separate means for supporting each step in climbing position when under climbing pressure.

12. A folding ladder comprising in combination, a pair of legs one at each side of the ladder, a plurality of spaced-apart folding steps each made up of a pair of companion sections having a wide stepping surface and an inner end foldably connected to the inner end of the companion section, the respective companion sections having their outer ends pivoted to a connecting member for folding movement towards and from the leg, said

connecting member being pivotally related to the adjacent leg for movement when the ladder is set up from a folding position with the stepping surfaces of the steps substantially perpendicular to the longitudinal axis of the leg to a climbing position with said stepping surfaces diagonal to the axis of the legs, an elongated connecting member positioned adjacent one of said legs and having a connection with the front of each of the step sections, spring means urging said connecting member upwards thereby normally to pull the steps into folding position and being free to release the steps against the spring under climbing pressure.

13. A folding ladder comprising in combination an upper and a lower section having a leg at each side thereof of a channel section, the top end of the leg of the lower section being hinged to the bottom end of the leg of the upper section whereby the legs may be folded against each other, the bottom of the other leg of the upper section being adapted to abut the top of the leg of the lower section and having a protruding portion adapted to engage the inside of the leg of the lower section to retain the respective ends in position when the ladder is set up, each section being provided with a plurality of steps each made up of a pair of sections hinged together at their inner ends whereby the legs may be collapsed, the respective step sections being rotatably and hingedly related at their outside ends to a leg whereby they may assume a nesting position within the leg channel section when their stepping surfaces are perpendicular thereto and moved into a climbing position with the stepping surfaces diagonal to the legs, means normally urging all the steps to folding position when the ladder is set up resilient under climbing pressure to allow the steps to move to climbing position diagonal to the legs, and means for supporting each step in climbing position under climbing pressure.

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