May 13, 1952 J. B. BELL 2,596,521

STEPLADDER

Filed May 7, 1949 2 SHEETS—SHEET 1

Fig. 8.

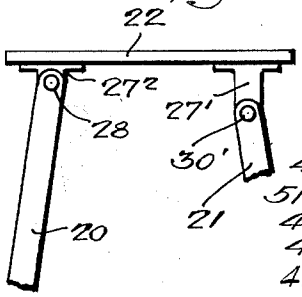


Fig. 1.

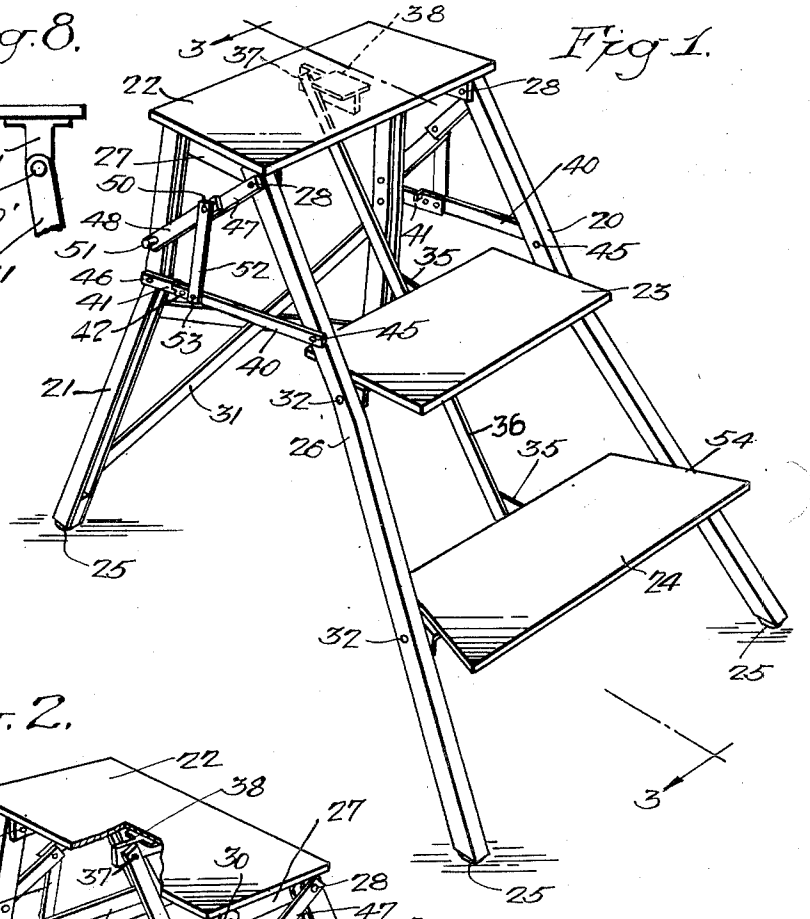


Fig. 9.



Fig. 2.

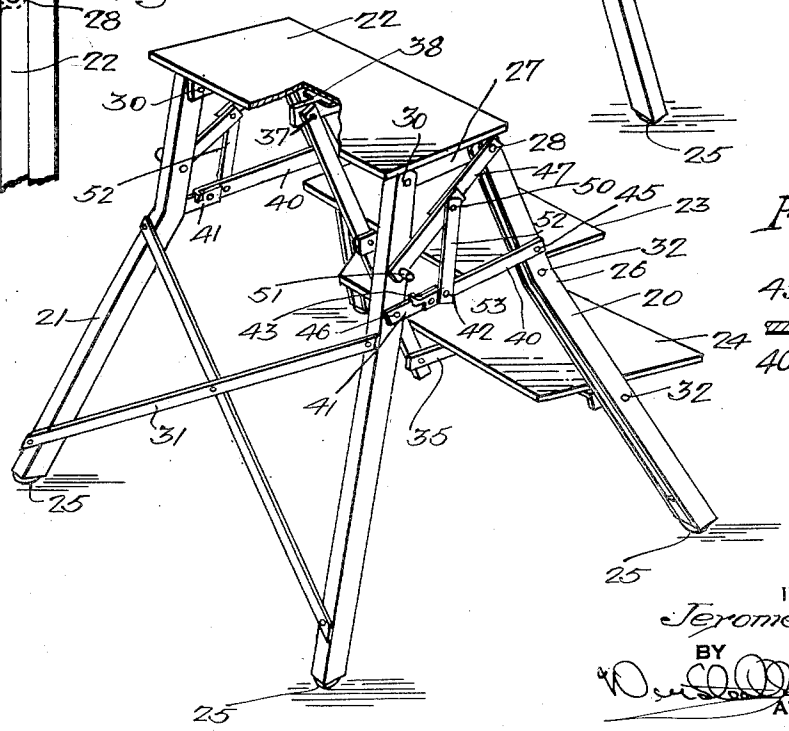
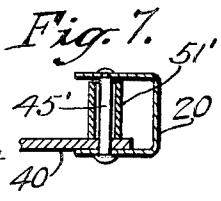


Fig. 7.

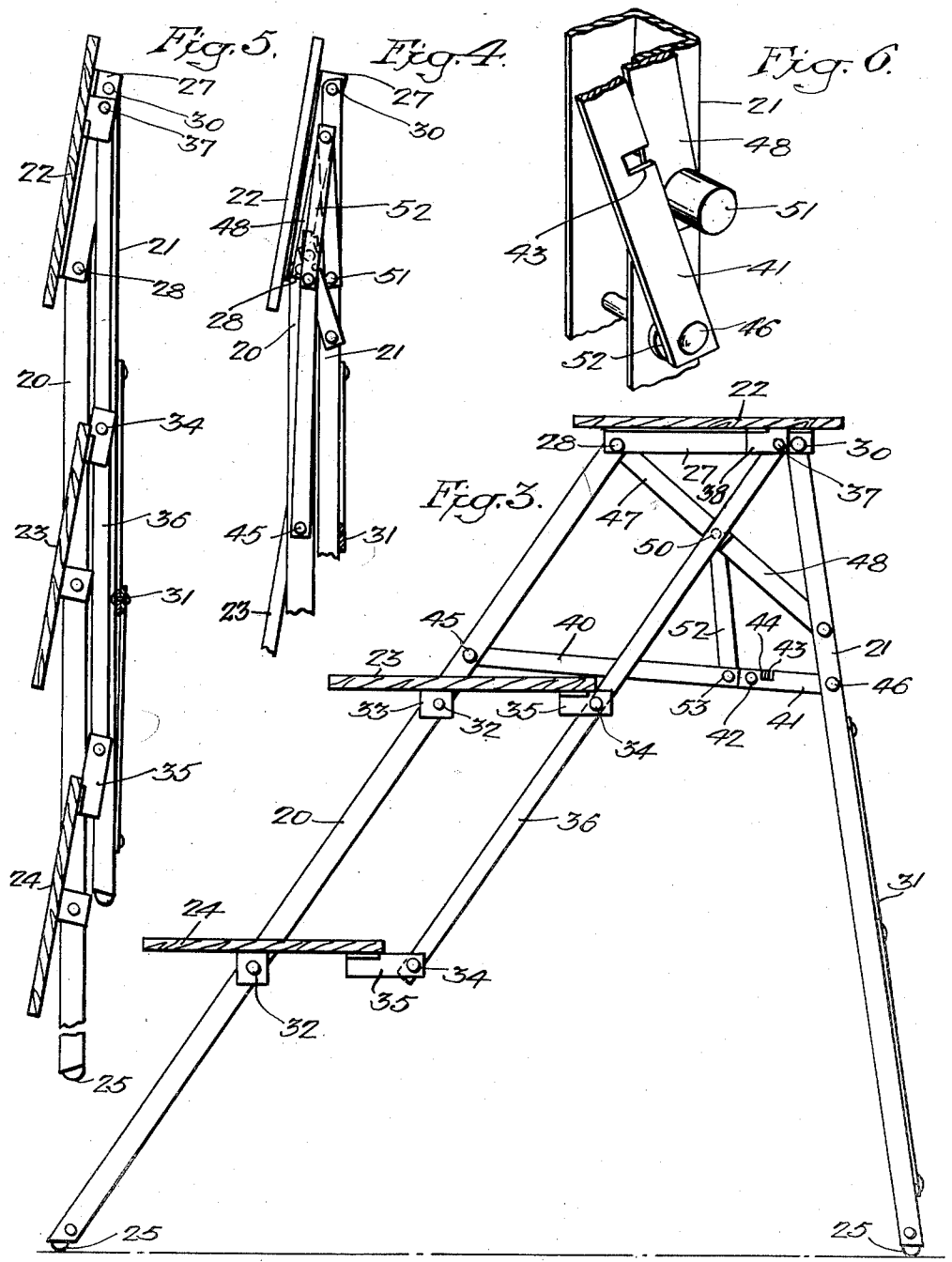


INVENTOR
Jerome B. Bell
BY
ATTORNEYS

May 13, 1952 J. B. BELL 2,596,521

STEPLADDER

Filed May 7, 1949 2 SHEETS—SHEET 2



INVENTOR
Jerome B. Bell.
BY
ATTORNEYS

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2,596,521

UNITED STATES PATENT OFFICE

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STEPLADDER

Jerome B. Bell, Wallingford, Pa.

Application May 7, 1949, Serial No. 92,035

4 Claims. (Cl. 228—33)

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The present invention relates to step ladders.

A purpose of the invention is to permit a step ladder to fold into a comparatively flat form and occupy a minimum of space in folded position, while at the same time having ample depth of step when the ladder is opened up, thus providing security and safety of tread on the ladder.

A further purpose is to provide a step positioning bar pivotally connected to the individual lower steps and below the top step, and preferably to make such bar extend parallel with the front rails.

A further purpose is to employ an interlocking system of upper and lower limiting bars interconnected by an intermediate limiting bar to limit the opening of the rails in opening position.

A further purpose is to make the distance between the pivots of the upper and lower limiting bars on the front rail the same as the distance between the pivot of the lower limiting bars on the front rail and the pivot of the intermediate limiting bar on the lower limiting bars.

A further purpose is to make the length of the intermediate limiting bar between its pivots the same as the distance between the pivot of the upper limiting bars on the front rail and the pivot connection between the upper limiting bars and with the intermediate limiting bars.

A further purpose is to locate a stop on the lower limiting bars toward the back rail with respect to the pivotal connections between the lower limiting bars and the intermediate limiting bar.

A further purpose is to locate a stop adjacent the pivot of the upper limiting bars on the back rail.

Further purposes appear in the specification and in the claims.

Figure 1 is a perspective mainly from the front showing the ladder of the invention in open position.

Figure 2 is a perspective partly from the rear showing the open ladder, with a portion of the top step broken away to illustrate the step positioning bar.

Figure 3 is a section of Figure 1 on the line 3—3.

Figure 4 is a fragmentary end elevation of the folded ladder showing the limiting bars in folded position.

Figure 5 is a fragmentary section corresponding to Figure 3 but showing the folded ladder.

Figure 6 is a fragmentary perspective of the rear rail showing the limiting bars and the pivotal connection thereto.

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Figure 7 is a transverse perspective through one of the rails showing a variation in the manner of pivoting the limiting bars.

Figure 8 is a fragmentary end elevation of the ladder of the invention, showing a variation in the pivot support for the rear rails, with the ladder open.

Figure 9 is a view corresponding to Figure 8, with the ladder folded.

Describing in illustration but not in limitation and referring to the drawings:

In the prior art step ladders, where it is desired to make the ladder fold into a very compact form, the tendency has been to use very narrow steps which are uncomfortable and unsafe for the user. By the present invention comparatively wide or deep steps are used, while at the same time the ladder is enabled to fold into a very compact form.

The single limiting bar construction employed in the prior art has in some cases failed to provide adequate limitation when open, resulting in accidents due to unexpected collapse of the ladder when the user has been subjected to some unexpected force incident to the work he has been doing. By the present invention a double system of interconnected limiting bars is employed, which is much less likely to become dislodged and is much less subject to the danger of breakage.

The ladder of the invention comprises front rails **20**, rear rails **21**, a top step **22** and lower steps **23** and **24**.

The rails are suitably made of any desirable material, such as wood, or metal, but preferably comprise metallic channel or box sections as shown. The rails conveniently have cushion feet **25** at the bottom, suitably of rubber. The rails are desirably diverged outwardly at **26** to provide wide spacing at the feet for greater stability.

The steps may desirably be formed of any suitable material, such as wood or metal, metal stampings being desirable. Any suitable antifriction or roughening surface may be used on the steps. The top step carries beneath it brackets **27** at each end, suitably attached to the step, which pivotally interconnect with the front rails at **28** and with the back rails at **30**.

The back rails are cross braced by bars **31** suitably cross connected at the middle for greater strength.

Each of the lower steps **23** and **24** is pivotally connected at **32** at its ends with the front rails, pivot brackets **33** on the steps desirably making the connections. It will be evident that the

shorter the brackets 33 and the closer the pivots 32 to the top of each step, the flatter will be the fold of the ladder and the more nearly flush will be the folded position of the steps with respect to the front rails. The step 24 below the bend 26 in the rails has diagonal ends 54 to conform to the rails in folding.

At the rear of each of the lower steps pivotal connection is made at 34, suitably through a pivot bracket 35 with a step positioning rail 36 which extends behind the steps and makes pivotal connection beneath the top steps at 37 suitably on a pivot bracket 38 secured to the bottom of the top step. The positioning bar 36 as shown in Figures 3 and 5 preferably remains at all times parallel with the front rails 20, so that the steps, the front rails and the step positioning bar make a parallelogram.

The improved limiting bar construction at the rails comprises lower limiting bars 40 and 41 pivotally interconnected at 42. A slot 43 suitably in the upper portion of the bar 41 receives a stop 44 on the end of bar 40 to limit the motion of the lower limiting bars 40 and 41 downward. The lower limiting bar 40 is pivotally interconnected with the front rail at 45 while the lower limiting bar 41 is pivotally interconnected with the back rail at 46. In open position the lower limiting bars can desirably be approximately horizontal, located however above the point 26 at which the rails diverge.

Above the lower limiting bars upper limiting bars 47 and 48 extend across between the rails, being pivotally interconnected at 50 near the middle. The upper limiting bar 47 is pivotally connected to the front rail at 28 and the upper limiting bar 48 is pivotally connected to the back rail at 51, suitably by a stud stop extending out sufficiently to prevent the lower limiting bars in folded position from moving beyond the upper limiting bars as best seen in Figure 6. To prevent interference the lower limiting bars are desirably spaced out from the rails as by washers 52 while the upper limiting bars are positioned closer to the rails as shown in Figure 6. Thus a slight overlapping of the bars is possible in folded position.

The upper and lower limiting bars are interconnected by an intermediate limiting bar 52 pivoted at one end to the lower limiting bars at 53 and pivoted at the other end to the upper limiting bars at 50, the point where the upper limiting bars pivot to one another. The pivot 53 is preferably located on the side toward the front rail of the pivotal connection 42 between the lower limiting bars. In open position the intermediate limiting bar 52 is inclined off the vertical as shown, tending to prevent the possibility that vertical components of torsional forces normally encountered in the ladder could cause the limiting bars to "break" and thus permit the ladder to fold at a time which is not intended.

It has been found very desirable to employ a certain relation of lengths, creating a trapezoidal character on the front and also on the back portion of the limiting bars. The distance between the pivotal connection 45 of the lower limiting bars with the front rail and the pivotal connection 28 of the upper limiting bars with the front rail should equal the distance between the pivotal connection 45 of the lower limiting bars and the front rail and the pivotal connection 53 between the intermediate limiting bar and the lower limiting bars.

Likewise the effective length of the upper limiting bar 47 (between its pivotal connections) should equal the effective length of the intermediate limiting bar 52 (between its pivotal connections). For convenience in manufacture, the effective length of the upper limiting bar 48 (between its pivotal connections) should also equal those of the upper limiting bar 47 and the intermediate limiting bar 52.

In open position as seen in Figures 1, 2 and 3, the two lower limiting bars extend in prolongation of one another and almost horizontal, while the two upper limiting bars extend in prolongation of one another and sharply inclined toward the rear, the intermediate relating bar being inclined similarly to the front rails. The lock between the slot 43 and the stop 44 prevents the limiting bars from travelling beyond this straight position.

While the embodiments shown illustrate limiting bars on both sides of the ladder, and illustrate a single step positioning bar, it will be evident that the invention is not limited to use of any particular number of sets of limiting bars, nor to the use of a single step positioning bar as distinguished from a plurality of step positioning bars as desired.

The detail as to how the pivotal connection is to be made to the steps, and whether the pivots are carried clear across from one to the other of the steps or are individual on each side is not to be regarded as vital in the invention. It has been found that advantage can be obtained by pivoting the limiting bars on the front and back rails inside the channel sections of the rails, as indicated by pivot 45' in Figure 7. By carrying the pivots 45' of Figure 7 clear across the channel and locating washers 51' around the pivots, the function of the stop 51 in the form of Figures 1 to 6 inclusive is performed by the washers 51'.

As shown in Figures 8 and 9, the top step can fold flatter if the pivotal connection between the top step and the rear rails is carried farther below the top step on brackets 27' than the pivotal connection between the top step and the front rails on brackets 27². The additional length of bracket 27' should correspond to the depth of the front rail section.

In operation it will be understood that in closing the ladder from the open position as shown, the user should grasp the lower limiting bars near the center and cause the limiting bars to "break" upward at their pivots 42, at the same time of course causing a similar deflection in the upper limiting bars due to the pressure transmitted upward through the intermediate limiting bars 52. At the same time the front and back rails are pivoted toward one another, causing the ladder to fold. The step positioning bar 36 automatically swings the lower steps into the positions shown in Figures 4 and 5, thus producing a very compact folded ladder. When the ladder reaches its fully folded position, the pin 51 prevents the limiting bars from moving too far.

To open the ladder it is merely necessary to pull the rails apart, the step positioning bar automatically positioning the lower steps in the correct position when the rails are fully open. To assure that the limiting bars are fully locked, the user should press down on the middle of the limiting bars on both sides to insure that the stops 44 engage in the slots 43.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to

others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a step ladder, front and back rails, a top step pivotally connecting the front and back rails, lower limiting bars extending between one front rail and the adjoining back rail, pivotally connected to the respective rails and to one another, upper limiting bars extending across between the same front and back rails, pivotally connected to those front and back rails at points above the lower limiting bars and pivotally connected to one another and an intermediate limiting bar extending across between the upper and lower limiting bars and pivotally connected to the upper and lower limiting bars.

2. In a step ladder, front and back rails, a top step pivotally connecting the front and back rails, lower limiting bars extending between one front rail and the adjoining back rail, pivotally connected to the respective rails and to one another, upper limiting bars extending across between the same front and back rails, pivotally connected to the front and back rails at points above the lower limiting bars and pivotally connected to one another and an intermediate limiting bar extending across between the upper and lower limiting bars, pivotally connected to the lower limiting bars, and pivotally connected to the upper limiting bars where they pivotally connect to one another, the distance between the pivotal connection of the lower limiting bars to the front rail and to the intermediate limiting bar, and the distance between the pivotal connections at the ends of the intermediate limiting bars being the same, and the distance between the pivotal connection of the upper limiting bars with the front rail and with the intermediate limiting bar being the same as the distance between the pivotal connections of the intermediate limiting bar.

3. In a step ladder, front and back rails, a top step pivotally connected to the rails, lower limiting bars extending across between a front rail and its adjoining back rail, pivotally connected to the front and back rails and pivotally connected to one another, stop means limiting the motion of the lower limiting bars downward beyond the straight extension position, upper limiting bars extending across between the same front and back rails, pivotally connected to the rails above the pivotal connections of the lower limiting bars and pivotally connected to one another and an intermediate limiting bar pivotally connected to the lower limiting bars and pivotally connected to the upper limiting bars where they pivotally connect with one another, the upper

limiting bars extending in prolongation of one another and the lower limiting bars extending in prolongation of one another when the ladder is fully open, the distance between the pivotal connections of the upper and lower limiting bars to the front rail being the same as the distance between the pivotal connection of the lower limiting bars to the front rail and to the intermediate limiting bar and the distance between the pivotal connections of the intermediate limiting bar with the upper and lower limiting bars being the same as the distance between the pivotal connection of the upper limiting bars with the front rail and with one another.

4. In a step ladder, front and back rails, a top step pivotally connected to the rails, lower limiting bars extending across between a front rail and its adjoining back rail, pivotally connected to the front and back rails and pivotally connected to one another, stop means limiting the motion of the lower limiting bars downward beyond the straight extension position, upper limiting bars extending across between the same front and back rails, pivotally connected to the rails above the pivotal connections of the lower limiting bars and pivotally connected to one another, a stop adjacent the pivot of the upper limiting bars on the back rail, and an intermediate limiting bar pivotally connected to the lower limiting bars and pivotally connected to the upper limiting bars where they pivotally connect with one another, the upper limiting bars extending in prolongation of one another and the lower limiting bars extending in prolongation of one another when the ladder is fully open, the distance between the pivotal connections of the upper and lower limiting bars to the front rail being the same as the distance between the pivotal connection of the lower limiting bars to the front rail and to the intermediate limiting bar and the distance between the pivotal connections of the intermediate limiting bar with the upper and lower limiting bars being the same as the distance between the pivotal connection of the upper limiting bars with the front rail and with one another.

JEROME B. BELL.

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