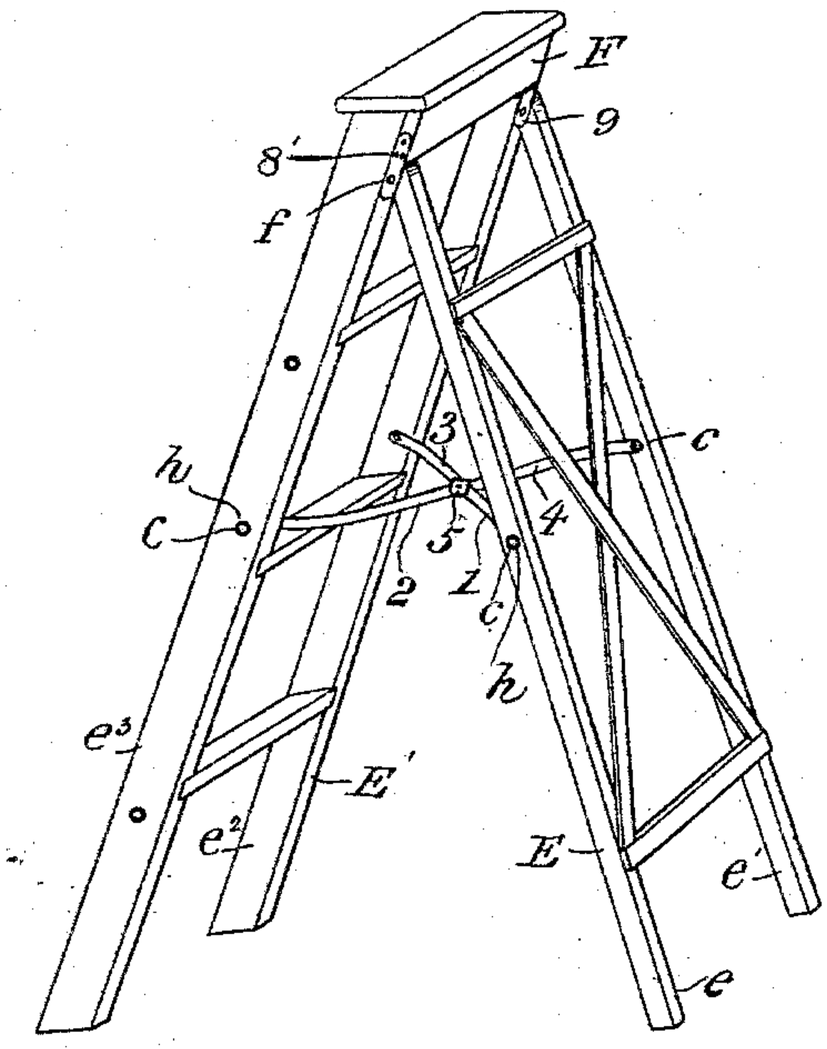
(No Model.)

H. LIEFER.

STEP LADDER OR OTHER SUPPORTING DEVICE.

No. 551,445. *FIG 1.* Patented Dec. 17, 1895.



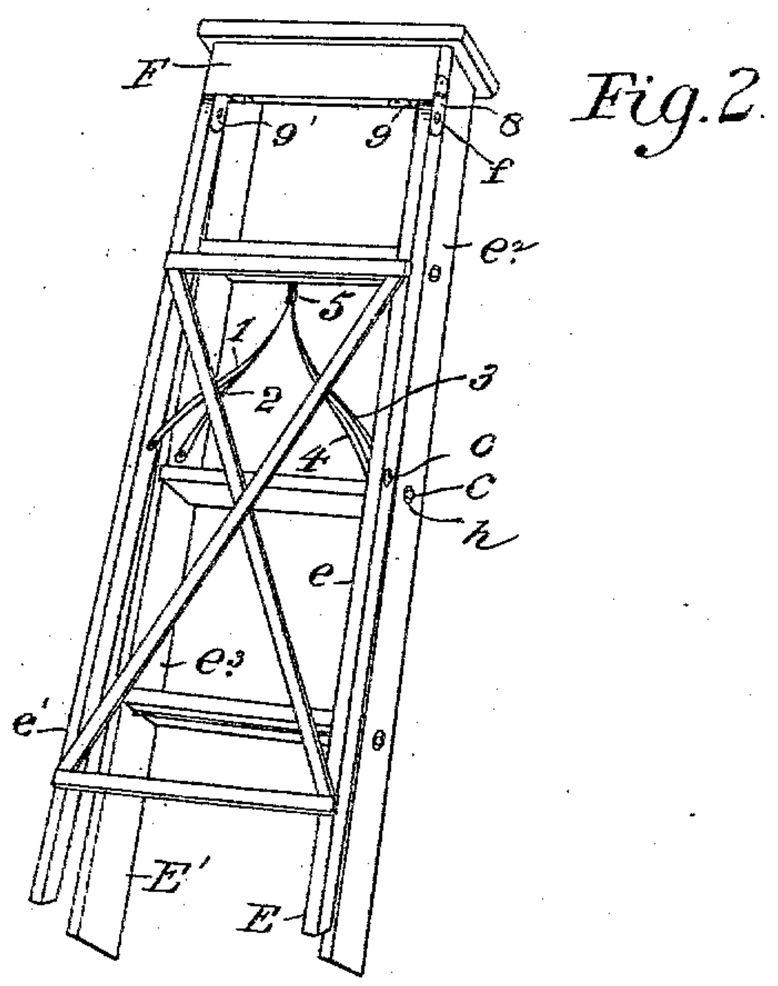


Fig.2

FIG 3.

FIG 4.

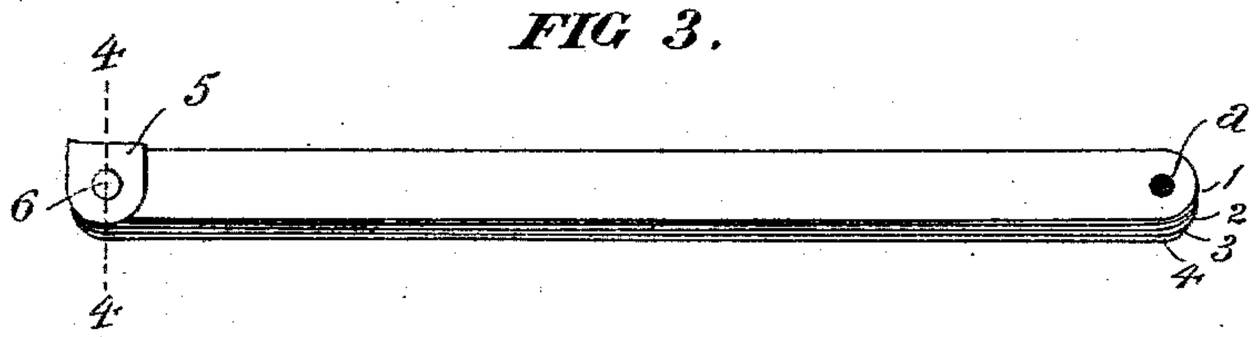
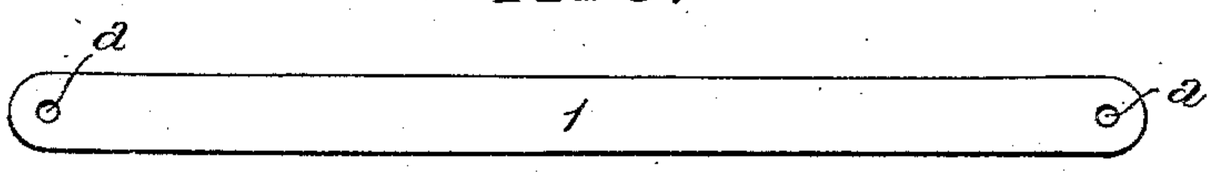


FIG 5.



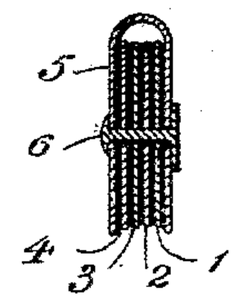


FIG 6.

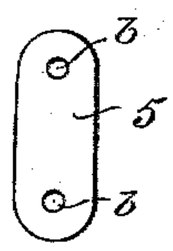


FIG 7.

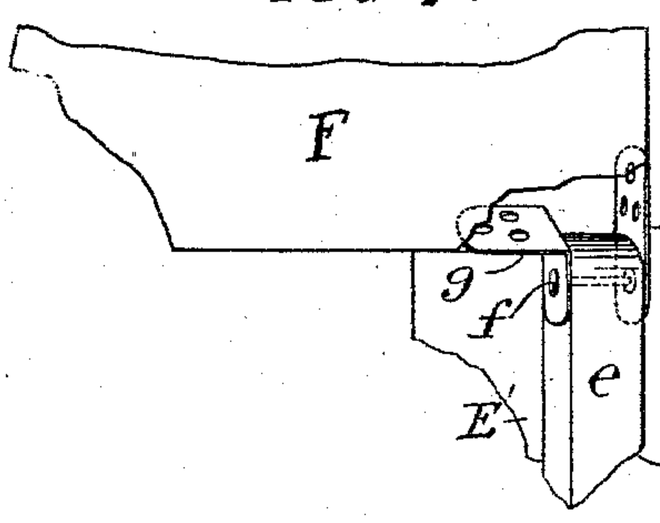
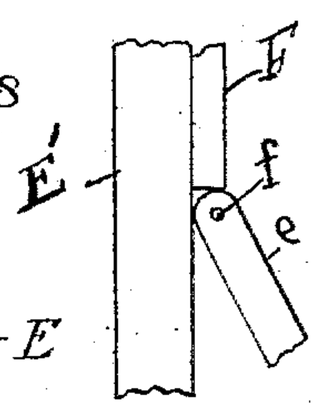


FIG 8.



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HENRY LIEFER, OF LOS ANGELES, CALIFORNIA.

STEP-LADDER OR OTHER SUPPORTING DEVICE.

SPECIFICATION forming part of Letters Patent No. 551,445, dated December 17, 1895.

Application filed April 10, 1895. Serial No. 545,165. (No model.)

To all whom it may concern:

Be it known that I, HENRY LIEFER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Step-Ladders or other Supporting Devices, of which the following is a specification.

My invention relates to ladders and supporting devices in which the supports or legs fold together. Among other devices it is applicable to carpenters' and plasterers' trestles, &c.

One object of my invention is to provide an improved brace for the legs which when adjusted for use will give in proportion to the weight of metal used greater rigidity and strength to the step-ladder or like support than the braces heretofore known.

Another object is to provide an improved step-ladder or other foldable support with a brace which will serve to hold the legs together when the ladder is folded.

Another object of my invention is to provide a superior construction of the hinge parts, whereby greater strength is secured, combined with cheapness of construction and lightness of parts.

The accompanying drawings illustrate my invention.

Figure 1 is a perspective view of my invention as applied in a step-ladder. The ladder is shown in position for use. Fig. 2 shows the step-ladder folded. Fig. 3 shows the folding brace as it appears ready to be sold to the trade. Fig. 4 is a cross-section, in larger scale, of the folding brace on line 4 4, Fig. 3. Fig. 5 shows one of the members or spring-straps of the folding brace detached. Fig. 6 shows the knuckle-strap detached and before being bent. Fig. 7 is a fragmental detail illustrating one of the leg-hinges. Fig. 8 is a fragmental detail of one hinge.

I will first describe my folding brace. It is composed of four spring-straps 1 2 3 4, each provided with a pivot-hole *a* at each end, a knuckle-loop 5 arranged embracing said four straps at one end thereof and provided in its ends with pivot-holes *b*, and a pivot 6 pivoting the straps and the knuckle-loop together. The straps and knuckle-loop are preferably formed of strap-steel of the kind which is used ordinarily for cask-hoops, &c., the same being of sufficient strength and resiliency or springiness to give the desired rigidity to the parts when the ends are sprung apart and pivoted, two to one of the legs and two to the other leg, as hereinafter described. The four straps are alike and are rounded at the ends and can be separately cut by a double die, which will perfectly form one end of two straps at each cut, so that the cost of manufacturing these straps is very slight. The knuckle-loop is also cut from the same material, and cut by the same die to the desired length, which is sufficiently greater than twice the width of the strap to allow for the bend, so that when bent it will clasp the ends of the four straps and the pivot-holes will register with each other. It is then bent and the ends of four straps 1, 2, 3, and 4 placed in the recess thus formed, the pivot-holes are made to register, and the pivot 6 is then inserted and riveted in place, thus binding close together between the sides of the loop those ends of the straps which are embraced by the loop, and forming a knuckle-joint which will bend in one direction and which is rigid in the other direction when the brace is straightened out. This brace when thus formed is ready for the trade and can be applied to any step-ladder and can be applied to many other uses in which a folding brace is desired to bend in only one direction. This brace is very compact and can be applied instantly by means of bolts, screws, or rivets *c*. By thus making my improved brace of four spring-straps held together and braced by the knuckle-loop and spread apart in pairs, as shown, I am enabled to secure much greater strength and rigidity of bracing with members of a given weight and simplicity of construction than is possible with any of the former braces known to me.

Another feature of my improved step-ladder is the hinges by which the legs are hinged together at the top.

In the drawings, E E′ indicate the legs of the step-ladder. The bars or standards *e e′* of the rear or under legs E are rounded at their upper ends and are fitted in the angle formed between the hinge brace or block F

and the bars e^2 e^3 of the upper leg E′ of the step-ladder.

8 indicates the straight hinge-strap, which is like the other straps heretofore described in all respects except length and additional nail-holes for securing the strap to the upper or front leg of the ladder. One of these straps is fastened to the outside face of each bar of the upper leg. This may be done, as shown in the drawings, by nails driven through the holes in the straps and into the ends of the hinge-bar F, which is fastened to the bars of the legs. This way is preferable for the reason that the strap is thus made to perfectly cover the joint between the brace-block and the rounded ends of the bars of the rear leg and affords a more ornamental appearance.

9 9′ are the inner hinge-straps, which correspond to the outer hinge-straps 8 8′, except that each is bent at right angles so as to fasten to the under side of the hinge-block to which they are all nailed or screwed, and to respectively fit against the inner faces of the bars e e' of the rear leg.

The outer and inner hinge-straps are so placed that the pivot or rivet f can be inserted through them and the end of the side bar of the under leg when the same is in place. When the pivots have been inserted for both bars of the under leg, the ladder is ready for the folding brace to be secured in place.

My invention as thus completed comprises the combination of the front leg, provided at its top with the hinge-bar, the straight hinge-straps fastened respectively to the outer faces of such leg, an angle hinge-strap fastened to the under side of the hinge-bar near one of the straight hinge-straps to form therewith a hinge-socket for the end of one bar of the rear leg, the other angle hinge-strap fastened to the under side of the hinge-bar near the other straight hinge-strap to form therewith a hinge-socket for the end of the other bar of the rear leg, the rear leg having its side bars rounded at their upper ends and arranged with such rounded ends respectively in such hinge-sockets and fitting into the angle between the hinge-bar and the body of the front leg and the pivots pivoting the rounded ends of the bars of the rear leg in said sockets respectively.

I will now describe the manner in which I apply the folding brace to the step-ladder. I first close the legs together and mark on the several side bars e e' e^2 e^3 the points at which the brace is to be fastened. The brace-pivots on the rear leg are set nearer to the top of the ladder than are the brace-pivots on the front leg. I then place the ladder upon one edge and fasten the free ends of two straps to the inner sides of the two side bars which are undermost. The ladder is then turned over and the straps are then sprung apart and the free ends of the other two straps are fastened to the inner sides of the other two side bars of the ladder. Screws or bolts may be used for this purpose; but I prefer to use rivets c, applying a washer h on the outside to hold the head of the rivet.

My invention as thus completed comprises the combination of the front leg, the rear leg hinged at one end to the front leg, the knuckle-loop, the four spring-straps arranged with four ends thereof together within the knuckle-loop and with their other ends spread apart and pivoted two to the rear leg and two to the front leg respectively, the knuckle-pivot pivoting the knuckle-loop and the strap ends within the knuckle-loop together, and the brace-pivots pivoting the other strap ends to the legs respectively.

Since the brace-pivots on one of the legs are higher than those on the other leg, when the ladder is folded, the difference in height between the ends of the straps which are fastened to the rear leg and the ends of the straps which are fastened to the front leg will cause the straps to bow into a spring, the tendency of which is to cause the joint to bind and to hold the ladder in its folded position. When the legs are forcibly spread apart, this spring-bow yields and the brace opens until its arms are almost in one plane. Then the knuckle is pushed down by hand until the upper edges of the arms or members 1 2 3 4 engage the knuckle-loop 5. Then the arms are prevented by the knuckle-loop from moving farther and the brace becomes rigid, slightly bent down at the knuckle, so that before the legs can again be folded together the knuckle must be pushed up. Since the straps on each side of the knuckle are spread apart, the four straps and the legs to which they are pivoted brace one another and give great rigidity to the device.

Now, having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a support such as set forth the combination of the front leg; the rear leg hinged at one end to the front leg; the knuckle loop; the four spring straps arranged with four ends thereof together within the knuckle loop, and sprung apart with their other ends pivoted, two to the rear leg and two to the front leg respectively; the knuckle-pivot pivoting the knuckle-loop and the strap ends within the knuckle-loop together; and the brace-pivots pivoting the other strap ends to the legs respectively.

2. In a support such as set forth the combination of the front leg; the rear leg hinged at one end to the front leg; the knuckle-loop; the four spring straps arranged with four ends thereof together within the knuckle-loop, and with their other ends spread apart and pivoted, two to the rear leg and two to the front leg respectively; the knuckle-pivot pivoting the knuckle-loop and one end of each strap within the knuckle-loop together; brace-pivots pivoting the ends of two of the straps to

one of the legs; the brace-pivots pivoting the other ends of the two remaining straps to the other leg at a higher point than the brace-pivots on the first leg.

3. The brace set forth composed of the four spring straps, the knuckle-loop embracing said straps at one end thereof and the pivot pivoting the straps and the knuckle-loop together.

4. The combination of the front leg provided with the hinge-bar; the straight hinge straps fastened respectively to the outer faces of such leg; an angle hinge strap fastened to the under side of the hinge bar near one of the straight hinge straps to form therewith a hinge socket; another angle hinge strap fastened to the under side of the hinge bar near the other straight hinge strap to form therewith a hinge socket; the rear leg having side bars rounded at their upper ends and arranged with such rounded ends respectively in such hinge sockets and fitting into the angle between the hinge bar and the body of the front leg; and the pivots pivoting the rounded ends in said sockets respectively.

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