

(No Model.)

4 Sheets—Sheet 1.

A. LEO.
COLLAPSIBLE LADDER.

No. 501,950.

Patented July 25, 1893.

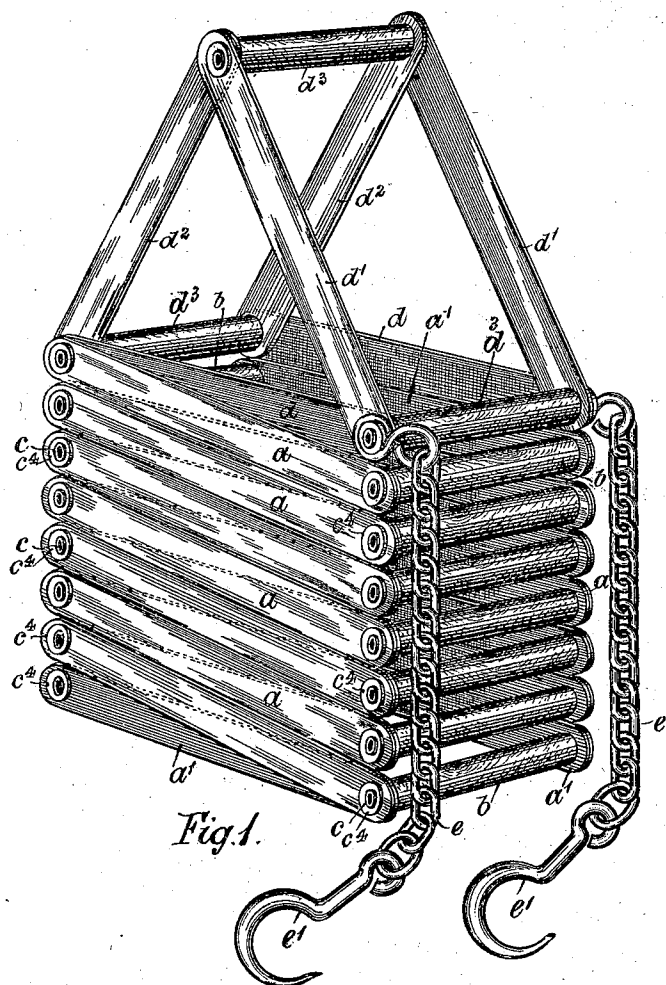


Fig. 1.

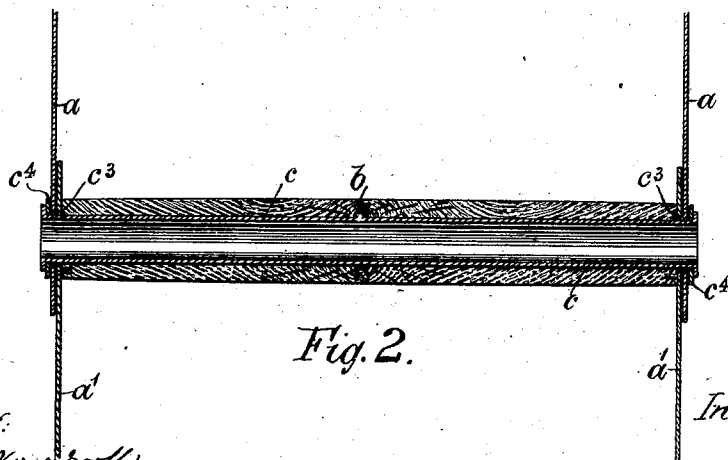


Fig. 2.

Witnesses:
Charles Woodruff
Robt. A. Blake.

Inventor:
Angel Leo.
by Henry H. Leigh
Attorney.

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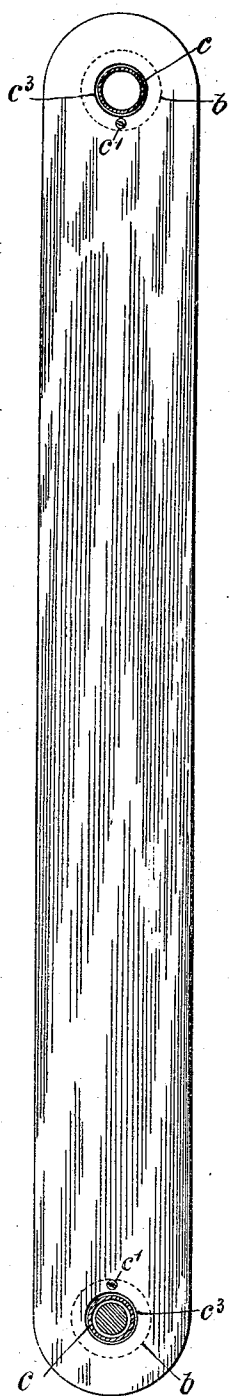


Fig. 3.

Witnesses:
Chas. Woodroffe
Robt. A. Blake.

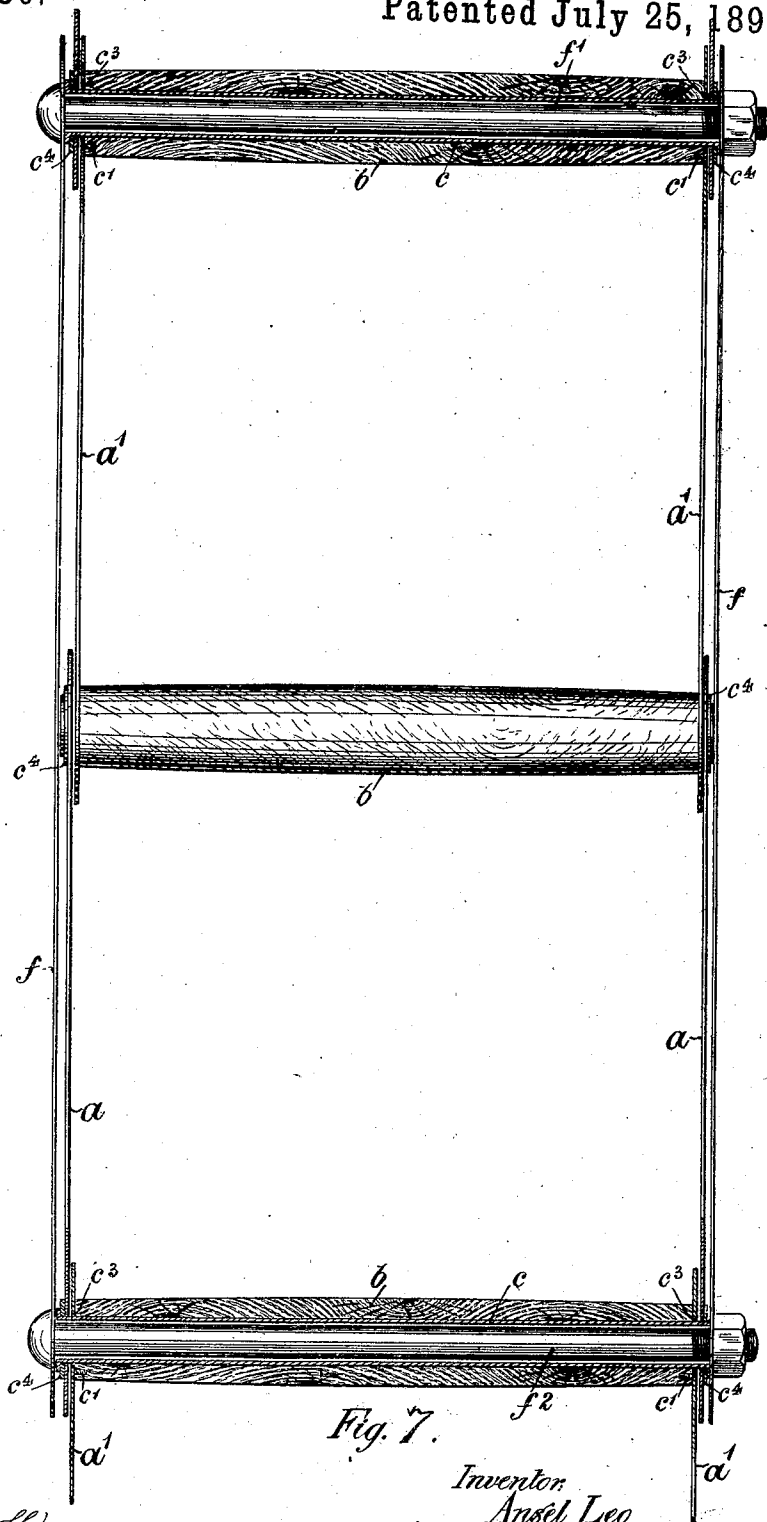


Fig. 7.

Inventor
Angel Leo
by Henry H. Veitch
Attorney

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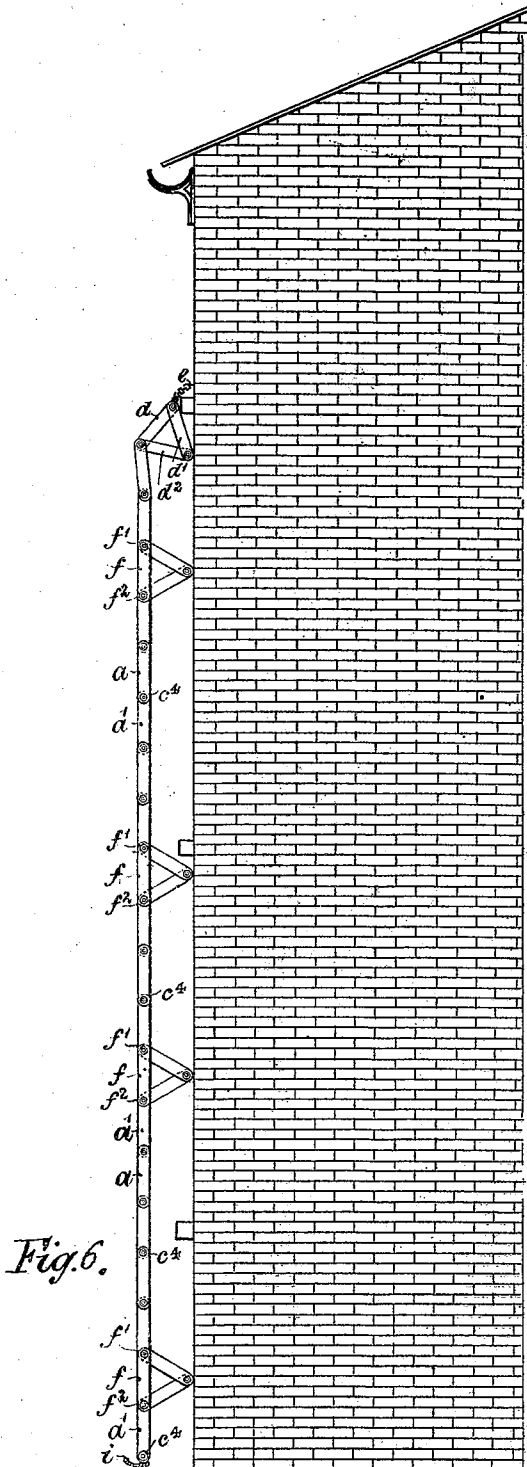


Fig. 6.

Witnesses:
Chas. Woodruffe.
Robt. A. Blake.

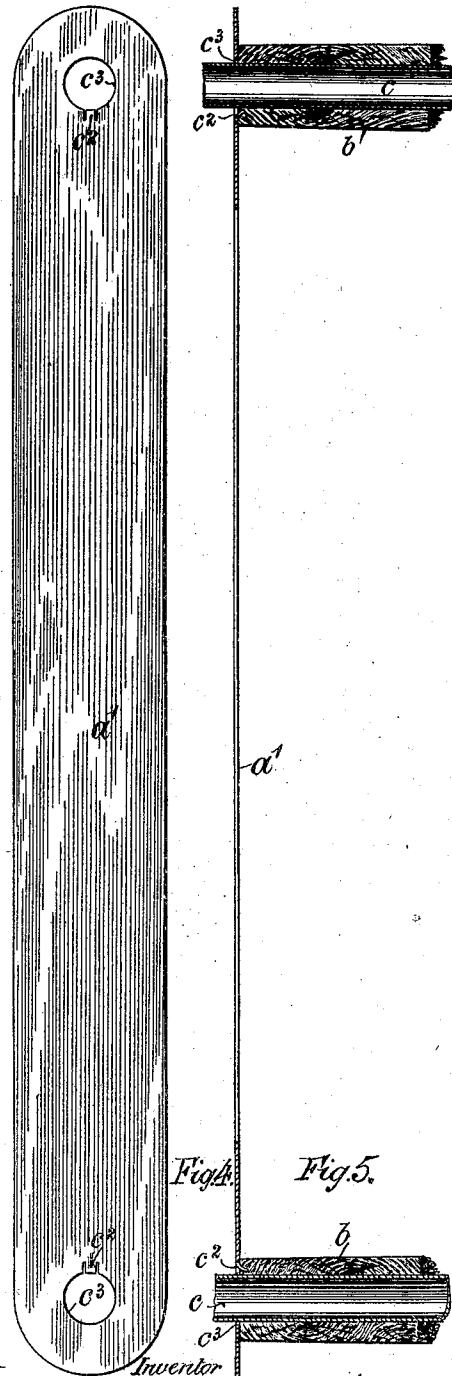


Fig. 5.

Inventor
by *Angus Leo*
Henry H. Keighy
Attorney.

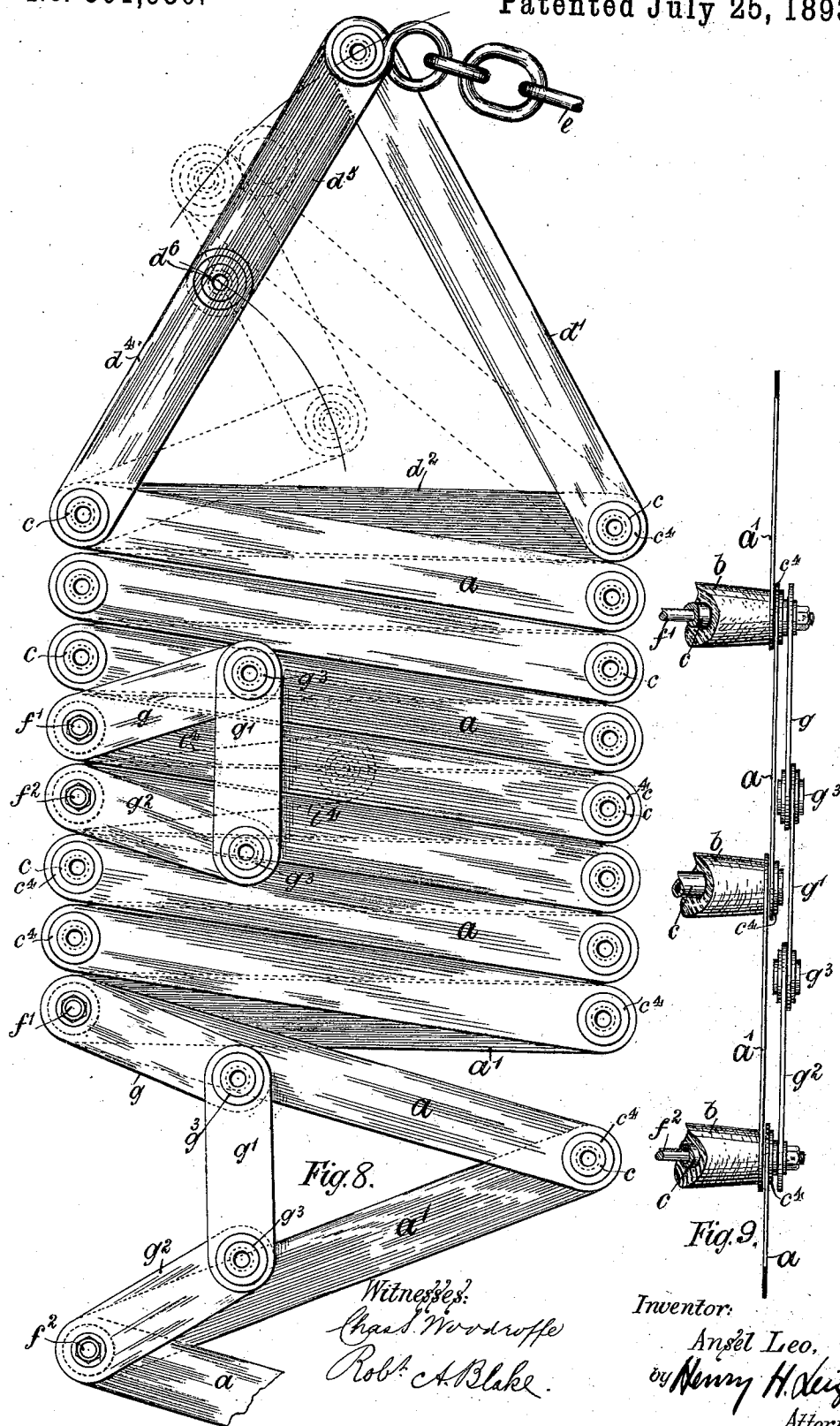
(No Model.)

4 Sheets—Sheet 4.

A. LEO.
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Patented July 25, 1893.



UNITED STATES PATENT OFFICE.

ANSEL LEO, OF LONDON, ENGLAND.

COLLAPSIBLE LADDER.

SPECIFICATION forming part of Letters Patent No. 501,950, dated July 25, 1893.

Application filed July 5, 1892. Serial No. 439,007. (No model.) Patented in England April 14, 1892, No. 7,205.

To all whom it may concern:

Be it known that I, ANSEL LEO, sculptor, a subject of the Queen of Great Britain and Ireland, residing at No. 18 Maclise Road, West Kensington Park, London, in the county of Middlesex, England, have invented certain new and useful Improvements in Collapsible Ladders, (for which I have received Letters Patent in England, No. 7,205, dated April 14, 1892;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in portable collapsible ladders, and its special object is to provide, by combining lightness with incombustibility and portability with steadiness and strength, a ladder better adapted for use as a fire-escape after it has been paid out or dropped from an upperstory, than those hitherto proposed or manufactured.

It consists in combining with a collapsible ladder a steadying head adapted to hold the ladder away from the wall front, as well as improved steadying stays. I attain the said special object by the mechanism and devices illustrated in the accompanying drawings which are to be taken as part of this specification and read therewith.

Figure 1 is a perspective view of a ladder with a rigid head and without stays made according to my invention, showing it folded up or collapsed. Fig. 2 is a detail sectional elevation illustrating the connection between a pair of ladder-sections and a rung. Fig. 3 is a side elevation, on an enlarged scale, of an inside ladder-section and its rungs, illustrating the connection between the rungs and the section. Figs. 4 and 5 are, respectively, detail side and front elevations illustrating a modification of such connection. Fig. 6 is a side elevation of a ladder made according to my invention hanging vertically from the sill of a second floor window and steadied by a series of rigid stays which bear against the front wall of the building. Fig. 7 is a detail front elevation, on an enlarged scale, of two adjacent rungs and a rigid stay. Fig. 8 is a side elevation, on an enlarged scale, of the top portion of a ladder fitted with a folding head and folding stays. The holding chains are

broken off short. Fig. 9 is a detail front elevation on an enlarged scale illustrating the same type of stay.

a, a' are, respectively, the outside and inside ladder-sections. They are made of any light, but tough or strong, metal, because of the incombustibility of this material, and are all of equal length. As many as may be necessary to provide the desired length of ladder-side are pivoted together end to end as hereinafter described.

The ladder-sections of one side are, respectively, opposite those of the other. Not only so, but the four ends of any pair of sections—by “pair of sections” is to be understood two sections opposite to each other—are either outside or inside the adjacent four ends of the two pairs of sections above and below them. The pairs are therefore alternately outside and inside for the entire length of the ladder. This alternation provides for the ladder being collapsed or folded up into a comparatively small space in an exceedingly convenient way, and one which will have the effect of leaving it in the best condition for extending itself and assuming, by its own weight, the position proper for the purpose of my invention. All the sections of a side are in two planes which are parallel with and adjacent to each other. Consequently, when the ladder is folded together, or collapsed, each of the sections rests for its full length upon the one immediately underneath it.

b are the rungs. They are of a substantial thickness and are made out of some material which is light and does not readily get very hot, such as wood or paper, for when my improved ladder is to be used as a fire-escape, it is desirable that the rungs should keep tolerably cool. If the rungs are made of combustible material, they must be fire-proofed by any suitable process. The rungs and sections are held together, and the pairs of sections pivoted to the adjacent pairs, by light but strong metal tubes c . Each of the latter is passed through a rung and the ends of the respective two inside and two outside ladder-sections, the rungs being bored or otherwise made tubular according to the material used, and the ends of the ladder-sections having eyes c^3 punched in them accordingly. The tube c fits so tightly upon the rung that the

two are incapable of independent motion. The rung is made fast to the respective ends of the inside ladder-section for the purpose of preventing it turning about its axis. This may be done in any convenient way, *e. g.*, by driving a pin or screw *c'* through the end of the ladder-section into the rung, as illustrated in Figs. 2, 3 and 7; or by forming a tongue *c²* on the edge of the eye *c³* which is punched in each end of the ladder section, bending it inward and so causing it to enter the rung when the latter and the ladder-section are brought together, as illustrated in Figs. 4 and 5. The tubes are therefore held fast to the inner ladder-sections, and as the ends of a tube pass through the respective four eyes *c³* and are burred over washers *c⁴*, the outer sections are pivoted upon the said ends.

The head or top of the ladder consists of a pair of rigid triangles, each being built up of three bars *d*, *d'*, *d²* which are conveniently of the same size as the ladder-sections. The head is preferably of the same width as the ladder, and the two triangles are held together by transverse ties *d³* which connect their respectively corresponding angles. I prefer to hold them together in the same way as are the sides of the ladder. The head is pivoted to the ladder by one of these ties, the one in which the bars *d*, *d²* meet, while the holding chains *e*, *e* are made fast to the one in which the bars *d*, *d'* meet. These chains are shown as terminating in hooks *e'*, *e'*, but this is a detail which may be modified as may be convenient, provided that the chains are firmly and securely fixed to the wall under the window (or to a balcony floor if there be one) if the ladder is to be used as a fire-escape. If it is intended for other than life-saving purposes, the connection between the holding chains and the wall-front may be a detachable one of any convenient type.

The function of the ladder-head is to project and hold the top rung of the ladder at a sufficient distance away from, *i. e.*, in front of, the window sill, to provide for the ladder itself dropping and hanging clear of any projections, such as window-heads or sills or ornamental protuberances which it may have to pass on its way down.

The two bars *d'*, *d'* with their transverse ties form a base of a sufficient depth to take two bearings according to the style of architecture of the building from which the ladder is to be used. The bearings in the case of a plain building, as that in Fig. 6, are the edge of the sill and the face of the wall. In any case there must be two bearings. These need not be vertically one above the other, but unless there are two, the ladder-head would rock with the naturally more or less hurried tread of those descending the ladder. When the ladder is pushed out of the open window, the weight of it will forthwith adjust the head in the position described above and then begin to pull itself toward the pavement opening the sections out.

The ladder-head illustrated in Figs. 1 and 6 is a rigid one, *i. e.*, it cannot be folded down or collapsed. Consequently, when the ladder is standing upon a floor, collapsed and out of use, the head is almost necessarily at the top, the foot of the ladder being next the floor with the rest of the ladder upon it. According to the modification illustrated in Fig. 8 each of the bars marked *d²* in the two figures last mentioned consists of two links *d⁴*, *d⁵* pivoted together at *d⁶*. There may be more than two links in each bar. The holding chains *e* are consequently connected to the head at the junction of the pivoted bars with the opposite bars *d'* instead of at the junction of the bars *d* with the bars *d'*. This alteration is inevitable, inasmuch as provision must be made for the jointed bars being in tension when the ladder is fixed for use.

When the head is made to fold down or to collapse as described above, it becomes practicable for the collapsed ladder to stand upon a floor upon its head. This position facilitates the act of paying the ladder out, inasmuch as, the foot of the ladder being uppermost, instead of underneath, it is not necessary to turn the ladder upside down, nor to lift it bodily. Instead of being lifted bodily, the ladder is paid out gradually, beginning with the foot, as a sailor pays out a rope.

I do not confine myself to the use of a head, inasmuch as the presence of a sufficient projection from the building, such as a wide sill or a balcony, might render the use of one unnecessary. Whether one is advisable or not is to be decided by the special circumstances of the particular case to which the invention is to be applied.

Due and improved provision is made by my invention for steadying a vertical ladder by stays adapted to bear against the wall front. These are of two kinds, one rigid and the other folding. The former is illustrated in Figs. 6 and 7, and the latter in Figs. 8 and 9.

Referring to Figs. 6 and 7, *f*, *f* are a pair of sections. They are preferably of the same dimensions and material as the ladder-sections already described, but are, for the purpose of preventing confusion, hereinafter referred to as stay-sections. They are fixed to the outsides of the ladder, opposite each other, by means of a bolt *f'* which is passed through them and the tube of the rung immediately above where the stay is to be produced. This is done not when the ladder is made, but at the premises or house where it is to be used, in order that the stays may be fixed in the best positions along the ladder so as to miss windows, and to conform with the architectural details of the facade generally. After as many pairs of stay-sections as the circumstances of the case may require have been fixed to the ladder-sides by bolts *f'*, the ladder is collapsed and placed in the position ready for use.

When the ladder is wanted for use the stays are set—commencing with the bottom stay—

in the following way which will be best understood by a reference to Figs. 6 and 7. The pair of stay-sections f, f will be hanging from their bolt f' . The rung immediately below—

5 the middle one in Fig. 7—is pulled or pushed backward out of the plane of the ladder until the next lower rung and the bottom eyes of the stay-sections coincide, when a bolt f^2 is passed through the three, holding the stay-sections to the ladder in the same way as already described with reference to the bolt f' . Care of course is to be taken that the stay is set in the proper direction for bearing against the façade and not for sticking out from the opposite side of the ladder. The other stays are to be set out in the same way in the required position, the ladder being paid out as they are set one by one. The bolts f^2 must all be taken out before the ladder can be collapsed again. When this has been effected, the stay-sections hang from their respective bolts f' close up to the sides of the ladder.

Folding stays have this advantage over those just described, viz., that as they can be folded with the ladder, they can be fixed permanently to it, thereby dispensing with the above described setting out of the stays each time the ladder is wanted and the subsequent taking out of the bolts f^2 . The difference in respect of construction between a rigid stay and a folding one is that the stay sections of the latter consist of links pivoted together.

Referring to Figs. 8 and 9, two stay-sections are shown by the full lines as consisting of three links g, g', g^2 pivoted together by eyelets g^3 or their equivalents. The united length of the three links is preferably equal to that of one ladder-section. I do not confine myself to the number of links in each of a pair of stay-sections so long as they will fold up. The dotted lines z^1 illustrate one of a two link section. If the stays are required close together along the length of the ladder, two-link sections are preferable and may be necessary, as they fold together more closely than those made up of three lengths. These folding stays are attached to the ladder in the same way as the rigid ones, but, as already pointed out, permanently so. In Fig. 8 the major portion of the ladder shown is closely collapsed, the top stay being capable of folding up also. The bottom portion—the last three pairs of ladder-sections—is shown as dropping, the stay-sections belonging to it being half-extended. Fig. 9 shows the formed stay, the folding stay-sections being fully extended. The triangle formed by any stay will be either equilateral or isosceles according to the relative length of the stay-sections. The ladder having descended within reach

of any person standing ready, or the person coming down it having reached the ground, it is by either made fast to the pavement in the following manner: Two eyes h, h are let into the pavement at a distance apart equal 65 to the width of the ladder, and to these the ladder-sides are, respectively, made fast by means of pieces of cord i, i which hang ready from the foot of the ladder for that purpose. The eyes are of any suitable type, and the 70 cords may be replaced by any device adapted to effect the rapid and firm fixation of the foot of the ladder to the pavement. The eyes are placed according to the position in which the ladder is to be used, whether vertically or 75 obliquely.

I make no claim to the collapsible ladder consisting of pairs of ladder sections pivoted together and adapted thereby to be folded together, but

What I claim is—

1. The combination in a collapsible ladder, of pairs of ladder-sections, tubular rungs and central tubes holding the sections and rungs together.

2. The combination in a collapsible ladder, of tubular rungs, central tubes passed through the respective rungs and sections and holding them together, and devices for preventing the rungs moving about their respective 90 axes.

3. The combination in a collapsible ladder of any adjoining pairs of sections, their three rungs and a pair of stay sections attachable to the rungs to form a stay by connecting the 95 terminal rungs of the three by the stay sections, the intermediate rung and the ends of the sections adjoining thereto being offset from the plane of the ladder, as set forth.

4. The combination with a collapsible ladder of a collapsible head pivoted thereto, said head consisting of a pair of triangles each made by pivoting three bars to each other at their respective ends and three transverse ties holding the said triangles rigidly together 105 in parallel planes at their respective angles, the bars forming two opposite sides of the face of the head which is in tension when the ladder is in use consisting of shorter bars of links pivoted together by their ends, as set 110 forth.

In witness whereof I have hereunto set my hand, in the presence of two subscribing witnesses, this 25th day of May, 1892.

ANSEL LEO.

Witnesses:

CHAS. S. WOODROFFE,
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THOMAS LAKE,
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