No. 799,163. PATENTED SEPT. 12, 1905.

F. B. HUBBARD.

DOUBLE JOINTED EXTENSION LADDER.

APPLICATION FILED MAR. 28, 1904.

FIG. 1.

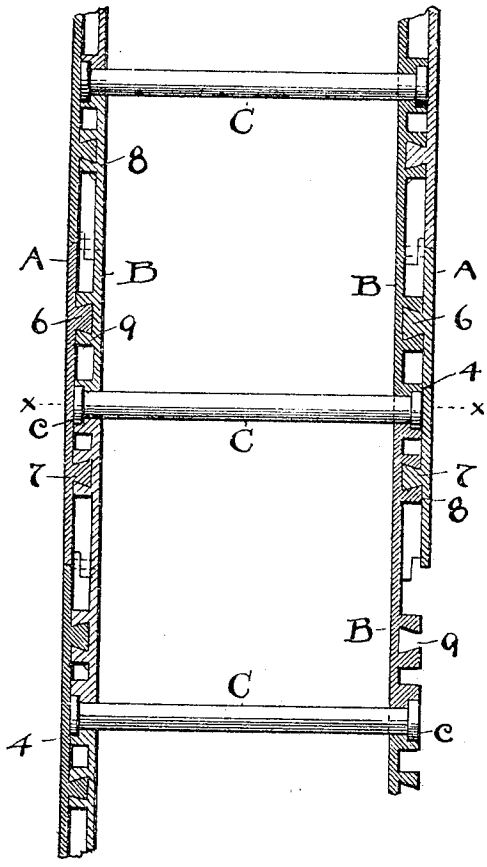


FIG. 3.

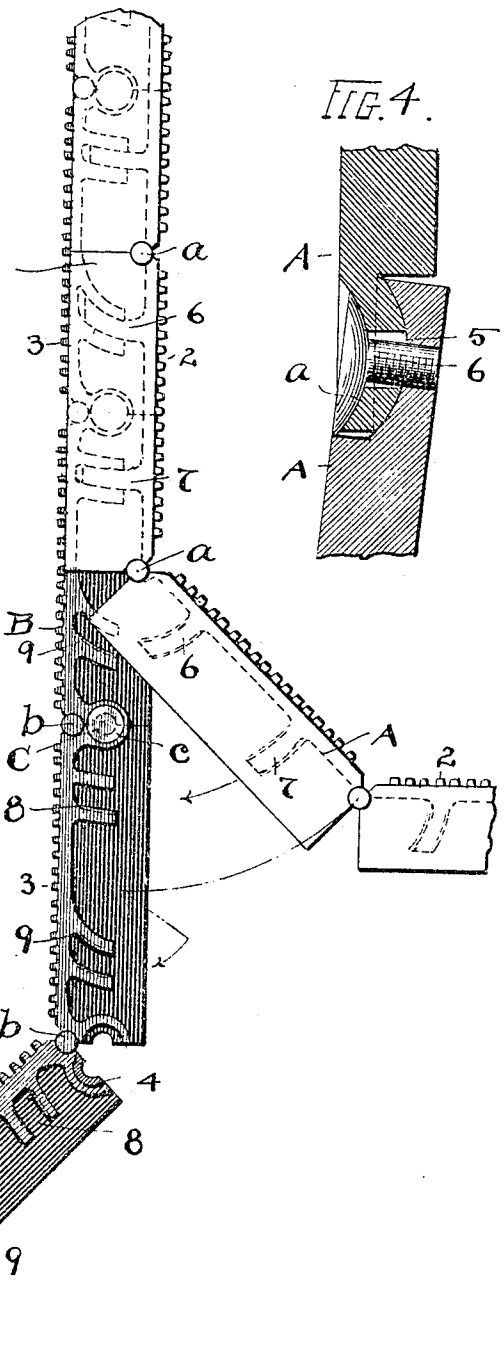
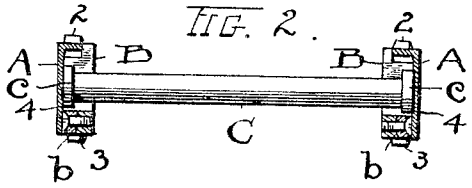


FIG. 4.

FIG. 2.



WITNESSES:

R. B. Moore

A. M. Moore

INVENTOR.

Frank B. Hubbard

BY H. J. Fisher.

ATTORNEY.

ANDREW B. GRAHAM CO. PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANK B. HUBBARD, OF WARREN, OHIO.

DOUBLE-JOINTED EXTENSION-LADDER.

No. 799,163. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed March 28, 1904. Serial No. 200,245.

To all whom it may concern:

Be it known that I, FRANK B. HUBBARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Double-Jointed Extension-Ladders; and I do 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 a double-jointed extension-ladder adapted to be automatically locked in a rigid form for use and to be wound on drums or otherwise cared for when not in use, all substantially as shown and described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of a portion or single member of my improved ladder on the line of the rounds; and Fig. 2 is a cross-section thereof on line *x x*, Fig. 1. Fig. 3 is a side elevation of a portion of the ladder having its sections partially separated. Fig. 4 is a sectional view showing one of the hinge joints or connections.

The invention as thus shown consists in a ladder which is extensible, jointed, double-sided, and self-locking, so that when run up to any length the portion so extended is perfectly rigid and when out of use its two members may be wound on a drum or folded, as may be found most convenient.

Now, having special reference to the parts, A represents one of a series of joints or sections of one of the two longitudinal jointed members constituting the complete ladder, and B represents one of a series of the opposite sections of the other member of the ladder, and the said series of sections A and B are similar at each side of the ladder, and each side of the ladder is double by reason of the separate overlapping and interlocking joints A and B, as shown. Joints or sections A constitute the outer part or member of the ladder, and joints B the inner part or member, and said joints have hinge or joint connections *a* and *b*, respectively. Said sections, furthermore, are so disposed relatively to each other that they break joints, the joints or hinges of one coming midway opposite the body of the other. Said sections are practically L shape in cross-section and provided each with racks or teeth 2 and 3, respectively, on opposite edges and on the inwardly-extending portions thereof. Said teeth are adapted to be engaged by hoist mechanism, (not shown,) and when the ladder is to be put away each member or series of sections A and B is run off separately and in a direction opposite to the other, according to its hinges, the joints of said sections being on opposite sides of the ladder. These hinges are of the rule-joint pattern, so as to yield only one way, and the rounds C are engaged between the sections B at their pivots in semicircular cavities 4, formed in each section. Heads *c* on the ends of the rounds are overlapped outside by sections A, and thus the rounds are confined and securely held in place. They are placed in position one at a time as the ladder is extended and are also removed one at a time when the ladder is wound up or otherwise disposed of. In order that the members of the ladder may be wound spirally, like a rope, I provide each joint with concave convex matching surfaces on the opposite parts, and one of the parts has an oblong or elongated hole 5, through which connecting-bolt 6 passes and affords just enough side play of one part or joint in respect to the other to provide for spiral winding, but does not interfere with the rigidity of the joint in other essential particulars.

Now, having the ladder constructed as above described, I make it rigid when extended for use by interlocking one line or section or member with the other side by side, such locking occurring automatically when the sections are extended and in the same way at each side. To this end the section-joints A have each two curved dovetail laterally-projecting ribs 6 and 7, adapted to be engaged each with a pair of curved dovetailed lateral ribs 8 and 9 on sections B. The locking or interlocking effect between these ribs is obtained by curving their interlocking portions on a different radius with different degrees of curvature from the hinge or joint from which said curvatures are taken, and the curvatures of each group of ribs 8 and 9, respectively, corresponds to that of ribs 6 and 7, which engage therewith. It will be noticed also that the respective sections A and B break joint between the respective sets of interlocking ribs, so that a certain rib of sec-

tion A will engage with one set of ribs on a curvature of a certain degree from its own initial pivot, while another lug or section A will engage with a set of ribs on another section B across an intervening joint *b* and on a materially different curvature from the first engagement. Thus in Fig. 3 we see an inclined or partly-open section with a fragment of another section attached and extended sections B. Now the rib 6 on section A corresponds in curvature or arc with ribs 9 on section B, and rib 7 corresponds in curvature or arc to rib 8 of the next succeeding joint B, thus bringing hinge *b* of joint B between these two points of engagement. If this were all, there would be nothing to prevent the first section A from opening at any time; but the said section is hinged to the next following section or fragment of section A, as shown, which has a rib 6 to engage with ribs 9 on section B, which are wholly off the lines of curvature of the previous ribs 7 and 8 of the preceding parts A, and hence form a cross-lock on the intervening joint or hinge between sections B and make the engagement such that neither of the sections A can be detached when both are extended and such that each must be separately released to unlock the other. It follows when these two engagements are made that both members or series of sections A and B become interlocked across their hinges and neither can be separated from the grip of the other except in a joint-by-joint release, just as they were brought together. The dovetail or undercut formation of the transversely-curved lugs, ribs, or projections prevents the spreading of the joints laterally, while the double-locking of each and every joint or section on different lines of curvature of the interlocking ribs makes a perfectly rigid ladder which cannot possibly be collapsed when extended and which can be made of any practical length and strength. Obviously the strength is very great with the parts shaped and locked together as shown.

The ladder thus shown and described consists, essentially, of two distinct and separate members longitudinally, comprising the joints or sections A and B, respectively, and each adapted to be wound upon a drum or reel independently of the other. The rounds C also are separate and are incorporated with the other parts or sections one by one as the ladder is erected. This occurs before sections A swing into line, as they are adapted to close over the ends of the rounds after they have come into the grip of sections B.

What I claim is—

1. In extension-ladders, a ladder consisting of two side members, each member consisting of two series of sections hinged together and the said members provided with projections which interlock, said projections curved on varying radii from the hinges of said sections and rounds, substantially as described.

2. An extension-ladder formed in two separate members longitudinally comprising each two series of hinged sections breaking joint on opposite sides of the ladder, curved interlocking projections on said sections uniting said members and separate rounds, substantially as described.

3. A ladder consisting of two independent side members and each member consisting of two series of hinged sections side by side, and the meeting sides of said sections having curved projections interlocking one with another, and rounds, substantially as described.

4. In extension-ladders, a ladder consisting of two separate side members comprising each two series of hinged sections and provided with projections on their adjacent surfaces adapted to interlock, said sections breaking joints successively, and rounds engaged at said joints, substantially as described.

5. A ladder formed of two side members longitudinally and each member consisting of two series of sections hinged together and having interlocking projections curved on different arcs of a circle in each section and adapted to engage and render the ladder rigid, and rounds, substantially as described.

6. A ladder consisting of two separate members consisting each of two series of hinged sections and arranged side by side, and said members each constructed with a series of dovetailed transversely-curved projections on their opposed surfaces adapted to interlock, and rounds, substantially as described.

7. A ladder formed of two side members consisting each of two series of sections, and said members having transversely-curved lateral dovetailed projections, the curvature of said projections on each section being on different arcs according to their distance from the pivot-point, and rounds, substantially as described.

8. A ladder formed of two side members longitudinally, each member made of two series of sections hinged together and the joints thereof having substantially concave convex overlapping portions, one portion of each joint having an oblong opening and a bolt connecting said jointed parts through said opening, whereby the ladder is adapted to be wound spirally, and rounds, substantially as described.

9. A jointed ladder formed in two independent side members its entire length having each two series of sections, the joints of said sections being on opposite sides of the ladder, and removable rounds confined between the said joints, substantially as described.

10. A ladder consisting of two series of sections hinged together, and cavities in the ends of the said sections opposite each other, and

rounds confined in said cavities, and overlapping outer jointed parts across the ends of the said rounds, substantially as described.

11. A ladder formed of two side members longitudinally consisting each of two series of sections, and each section having a curved dovetailed projection on its side near each end and the said projections having different degrees of curvature, whereby different sections of the opposite members of the ladder are interlocked one with another, and rounds, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

FRANK B. HUBBARD.

Witnesses:

CHAS. E. GRIMM,

D. L. HELMAN.