

No. 654,394.

Patented July 24, 1900.

J. HARGREAVES.  
FOLDING OR FLEXIBLE LADDER.

(Application filed June 17, 1899.)

(No Model.)

Fig.1.

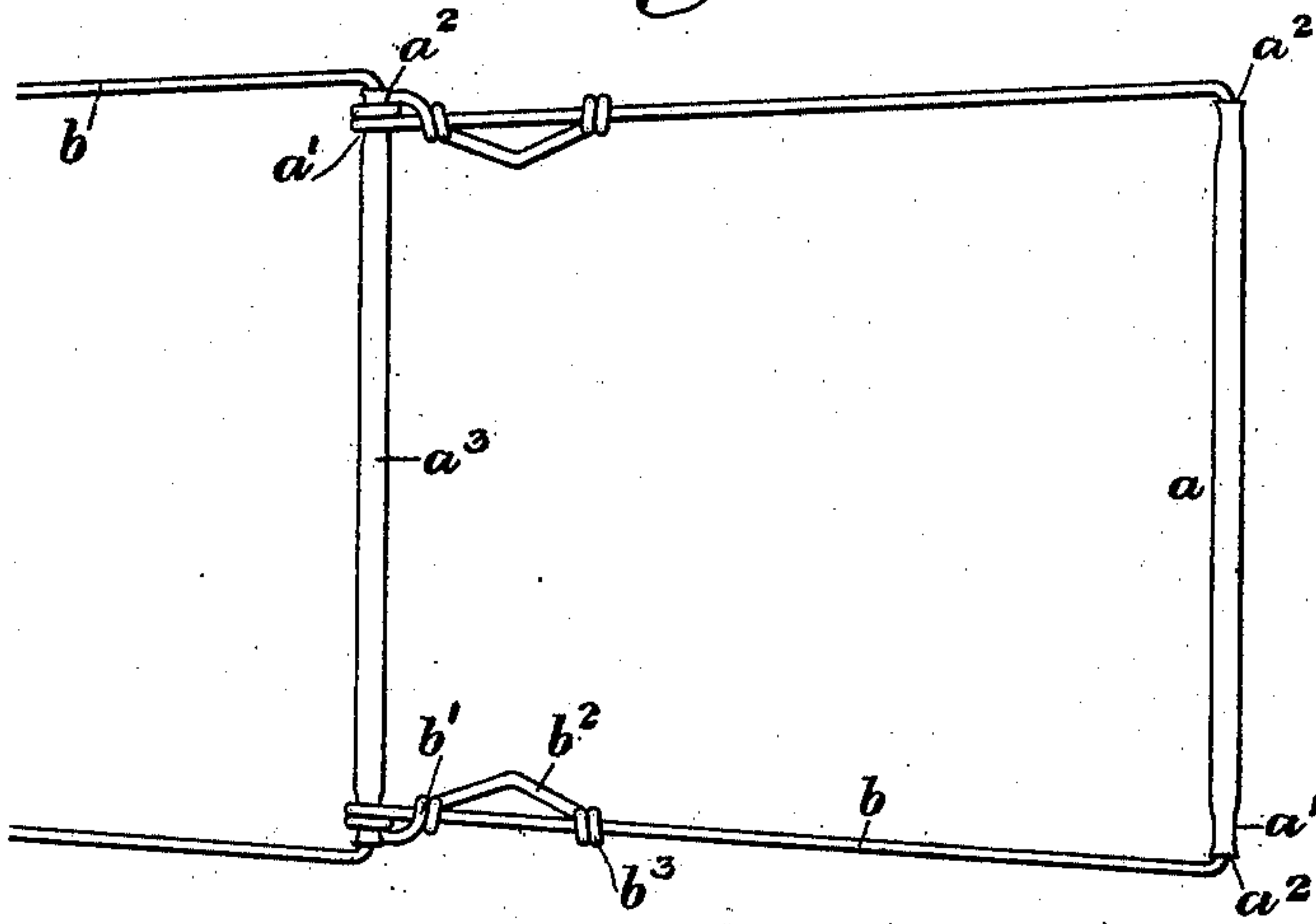


Fig.2.

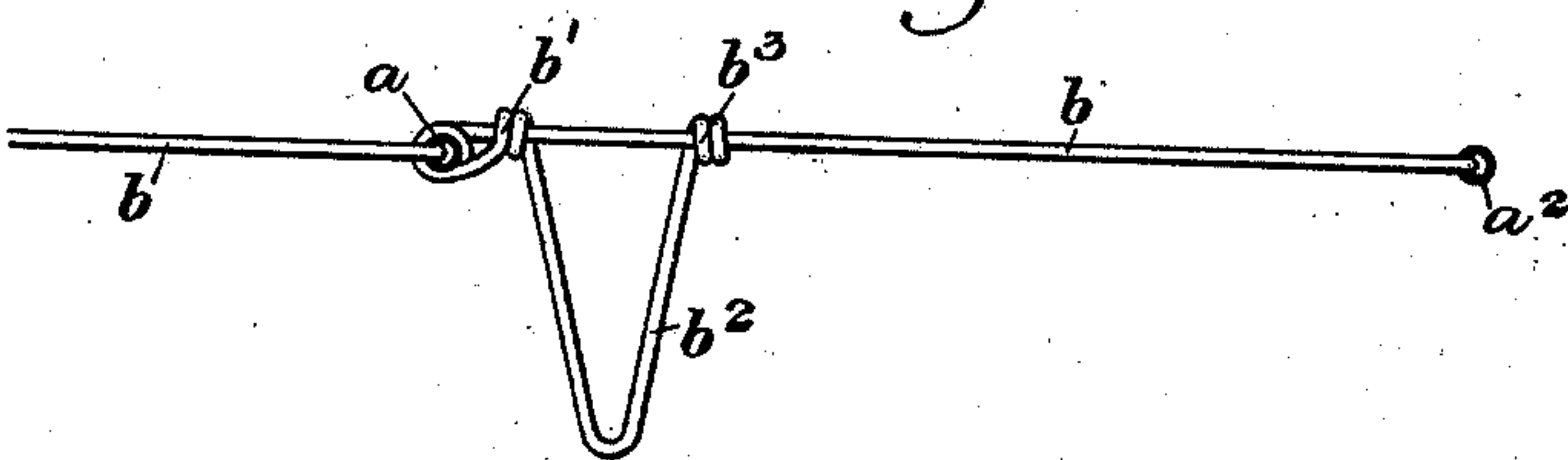


Fig.3.

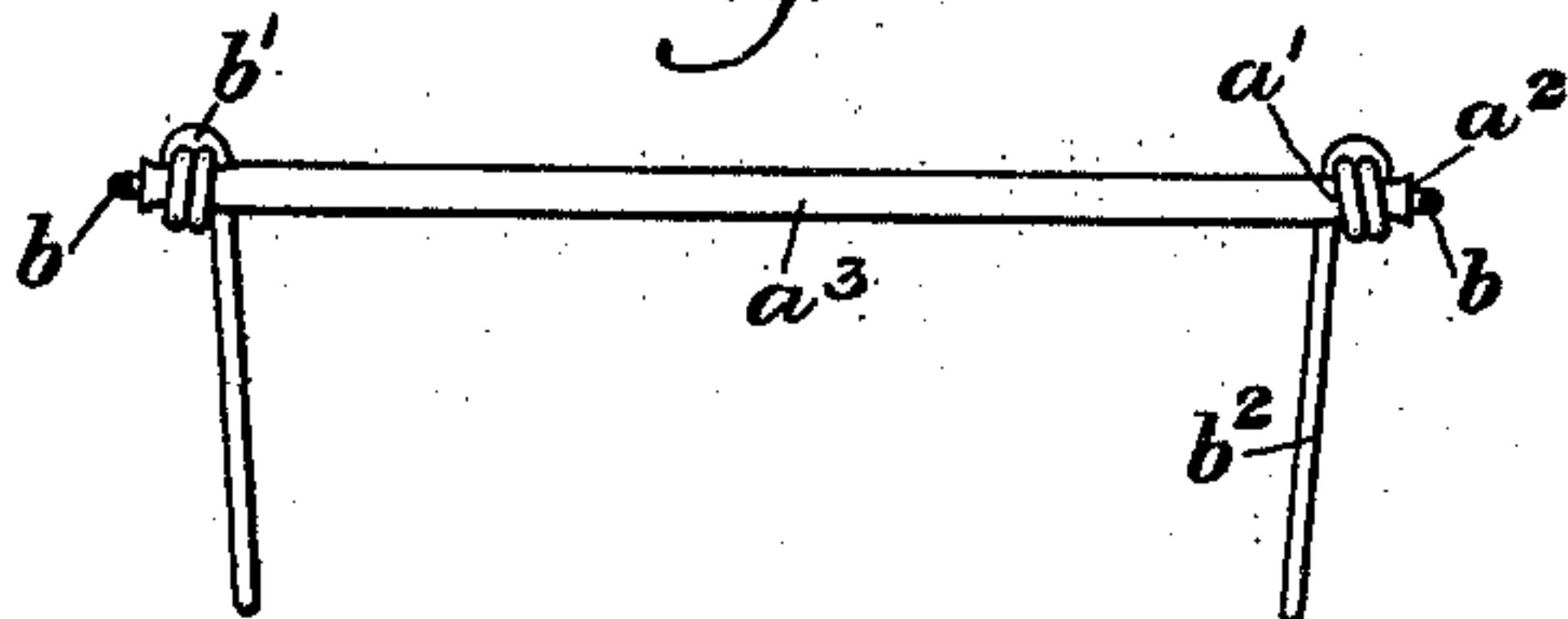


Fig.4.

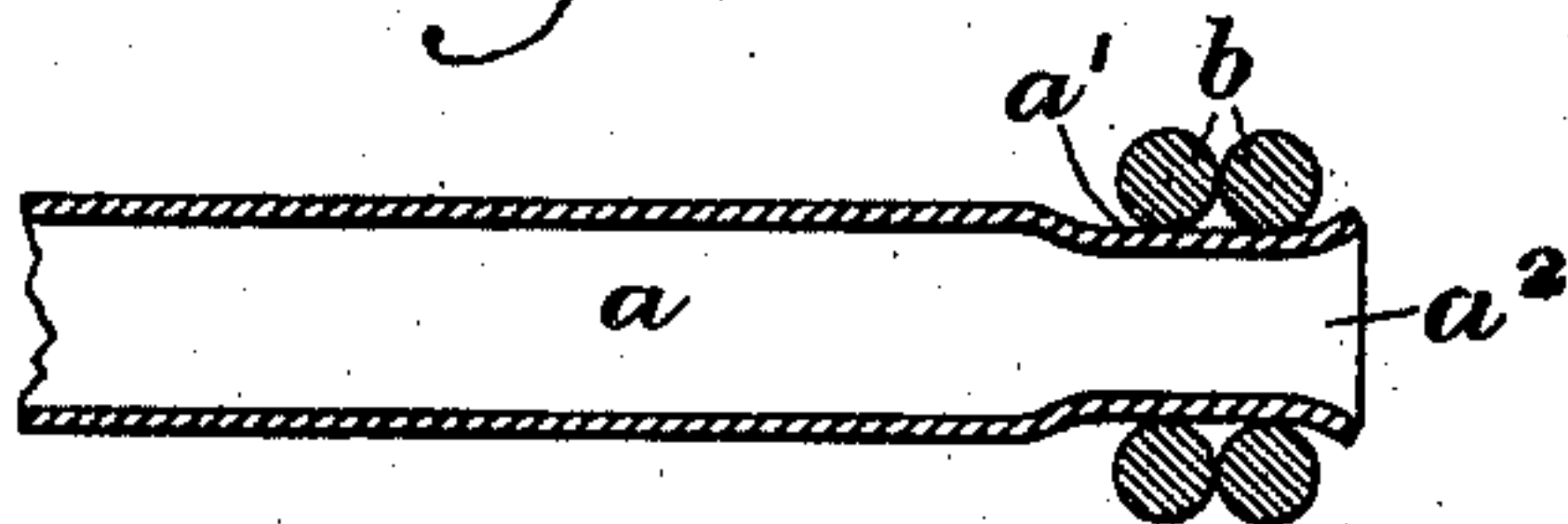
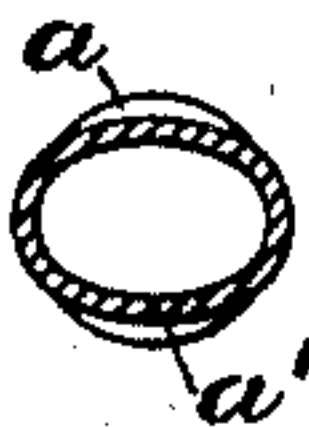


Fig.5.



WITNESSES

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# UNITED STATES PATENT OFFICE.

JAMES HARGREAVES, OF WIDNES, ENGLAND.

## FOLDING OR FLEXIBLE LADDER.

SPECIFICATION forming part of Letters Patent No. 654,394, dated July 24, 1900.

Application filed June 17, 1899. Serial No. 720,893. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES HARGREAVES, a subject of the Queen of Great Britain, residing at Widnes, in the county of Lancaster, England, have invented new and useful Improvements in the Construction of Folding or Flexible Ladders, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a plan of a portion of a ladder. Fig. 2 is a side elevation, Fig. 3 is an end view, and Figs. 4 and 5 are sectional detail views of the end portion of the tubes.

This invention relates to ladders which can be folded up into a small compass, and has for its object to construct such ladders in a simple manner and so that they shall be very strong and not liable to be deranged when folded up.

I form the steps of the ladders of tubes  $a$ . Such tubes are laterally compressed, so as to be partially flattened or made elliptical in cross-section near each end  $a'$ , and the extreme end  $a^2$  is splayed out. (See Figs. 4 and 5.) The sides of the ladder are made of pieces of wire  $b$ , which are threaded through the tubes  $a$ , the ends of the wire being then twisted twice around the flattened or elliptical portions  $a'$  of the next tube, thus forming one complete step. The flat or elliptical portion of the tube being held by the wire, the tube cannot turn around, thus securing a firm foothold. The splayed ends  $a^2$  prevent the wire slipping off the tube. After being twisted around the tube the wire is twisted around itself, as shown at  $b'$ , and a V-shaped projecting part  $b^2$  is formed, which serves to keep

the step away from the walls of buildings, &c., when in use. The extremity of the wire  $b^3$  is finally twisted around the side wires, as shown, or it may be twisted around the tube  $a^3$ , if desired. These projecting parts  $b^2$  may be dispensed with when desired. Any length of ladder can thus be built up with great rapidity.

I do not confine my invention to the precise details of construction set forth, as it is obvious various arrangements may be made to effect the same object; but

What I do claim, and desire to secure by Letters Patent, is—

1. A flexible ladder having tubular metal rungs, with compressed portions near their ends, and wires extending through the rungs, the end portions of each wire being twisted about the compressed portions of the next rung, substantially as described.

2. A flexible ladder having tubular rungs, with wires extending through the rungs, the ends of each wire being twisted about the next rung and about the side portions of the ladder, substantially as described.

3. A ladder having tubular rungs with compressed portions near their ends, wires threaded through the tubes, the end portions of each wire being twisted about the compressed portions of the next rung and then about the side portions of the wire, and having laterally-projecting parts, substantially as described.

JAMES HARGREAVES.

Witnesses:

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GEORGE HERBERT WILSON.