

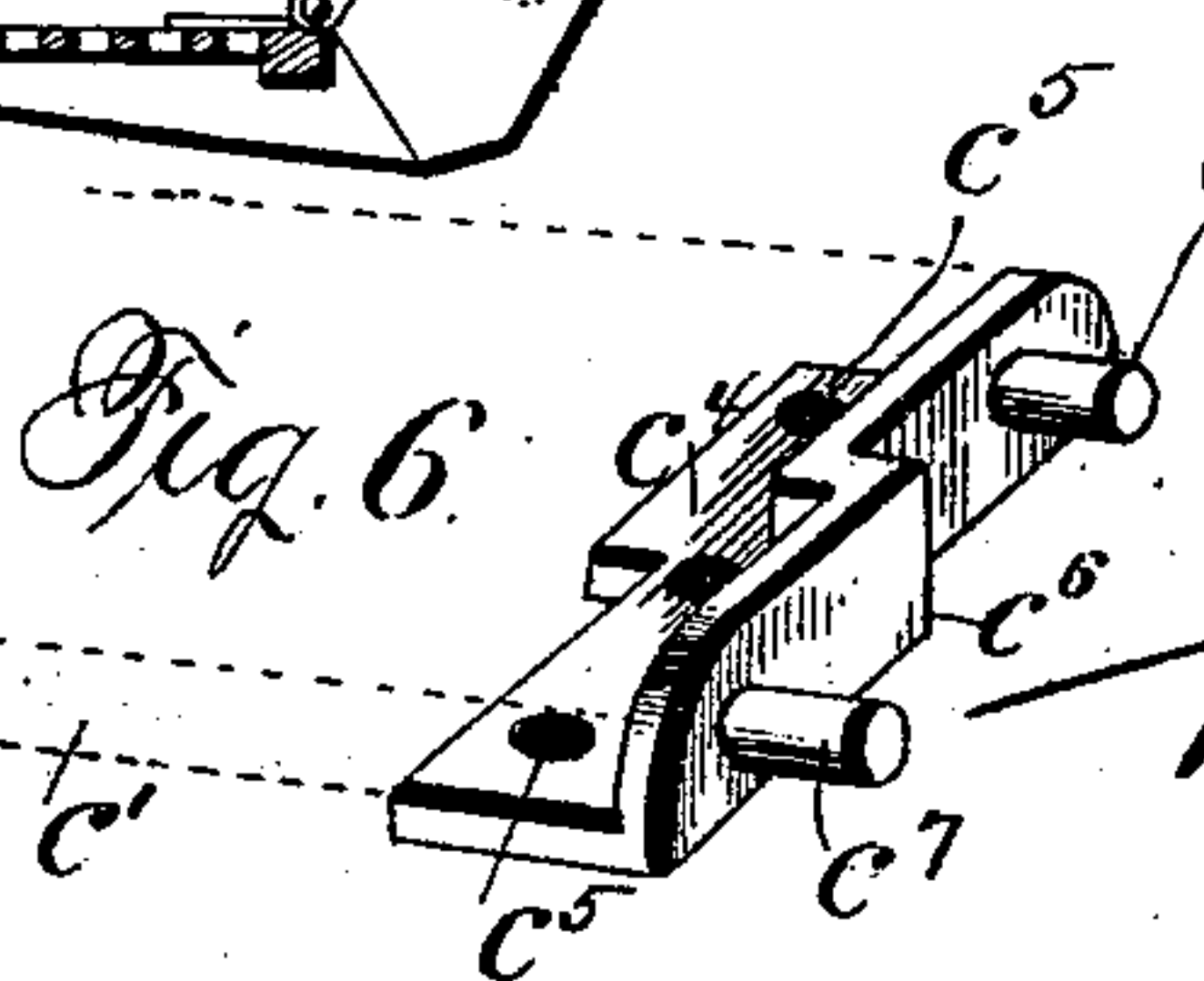
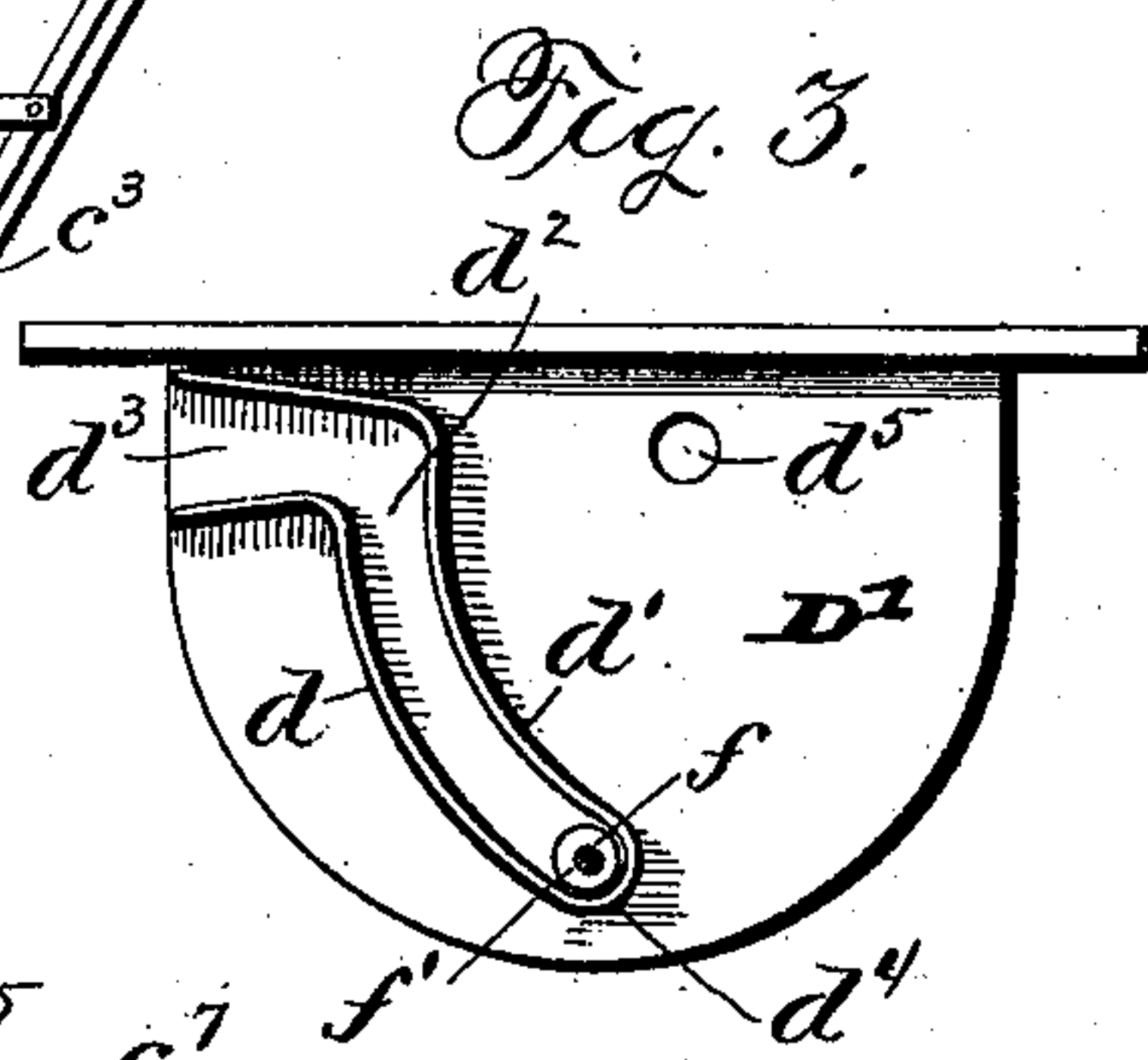
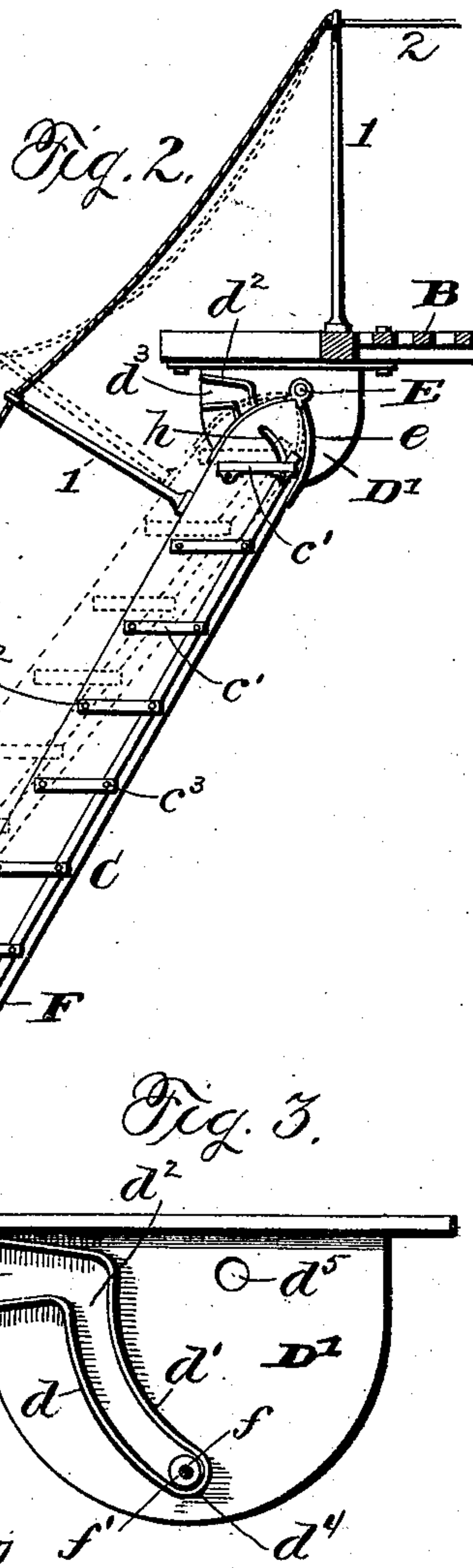
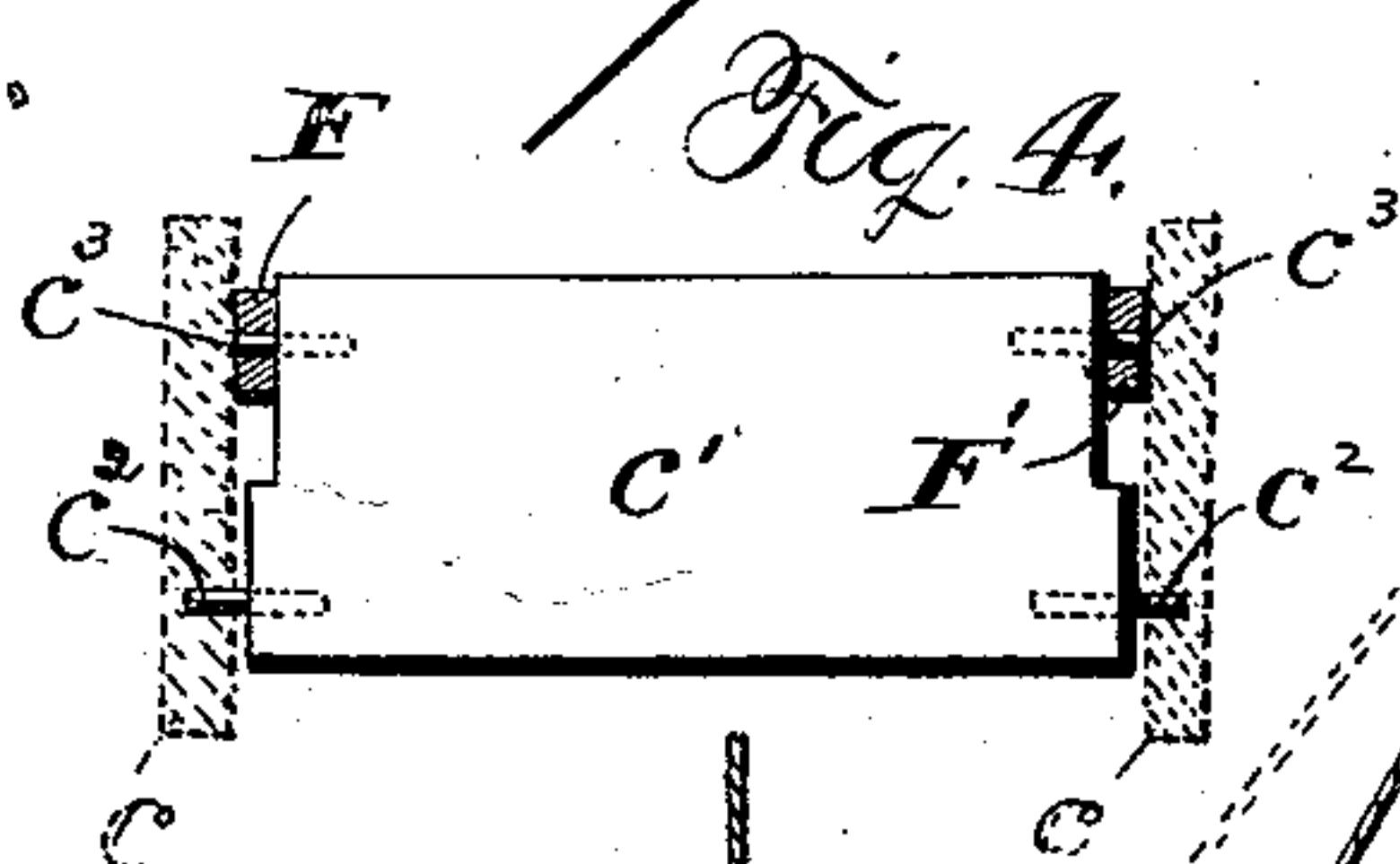
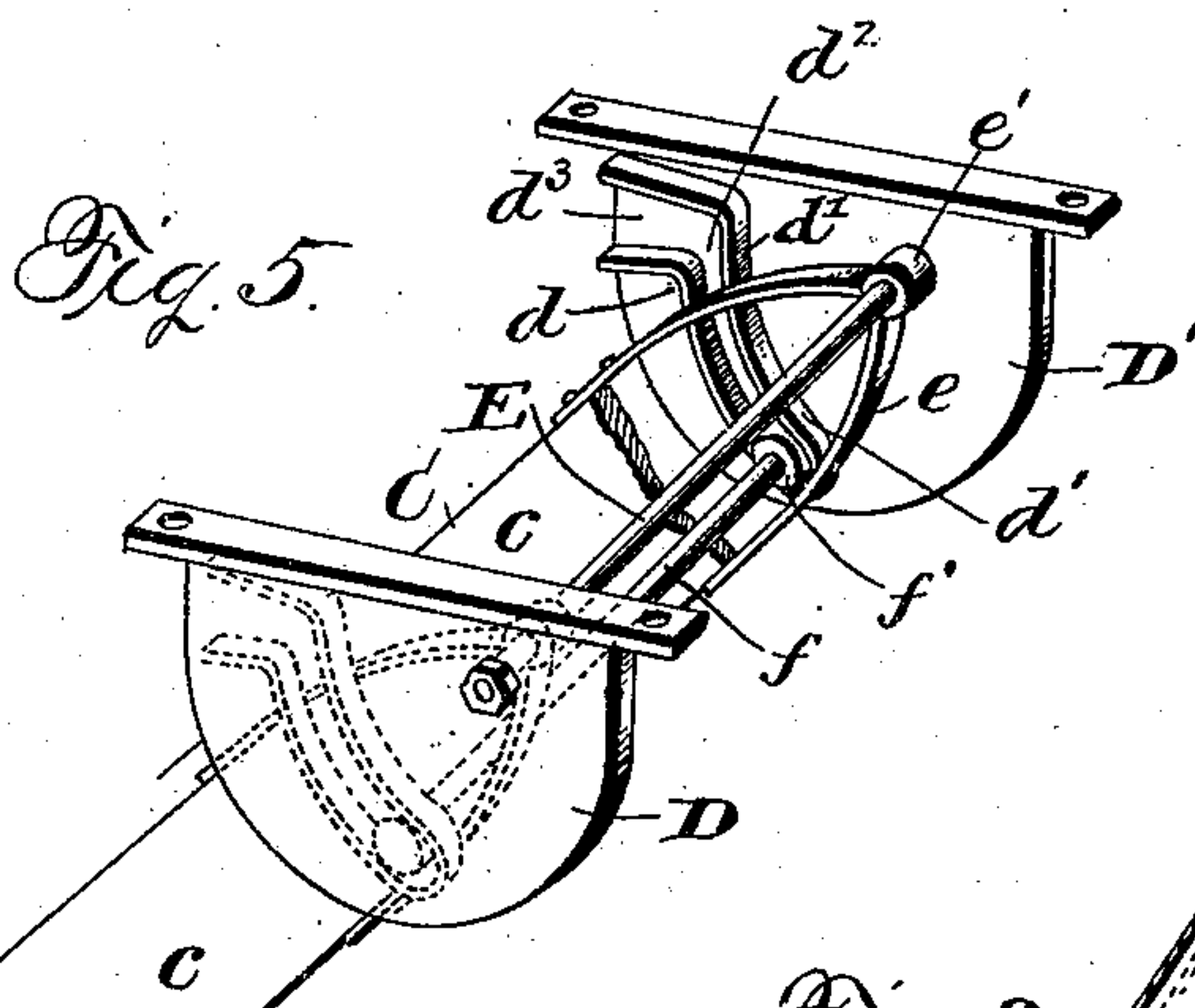
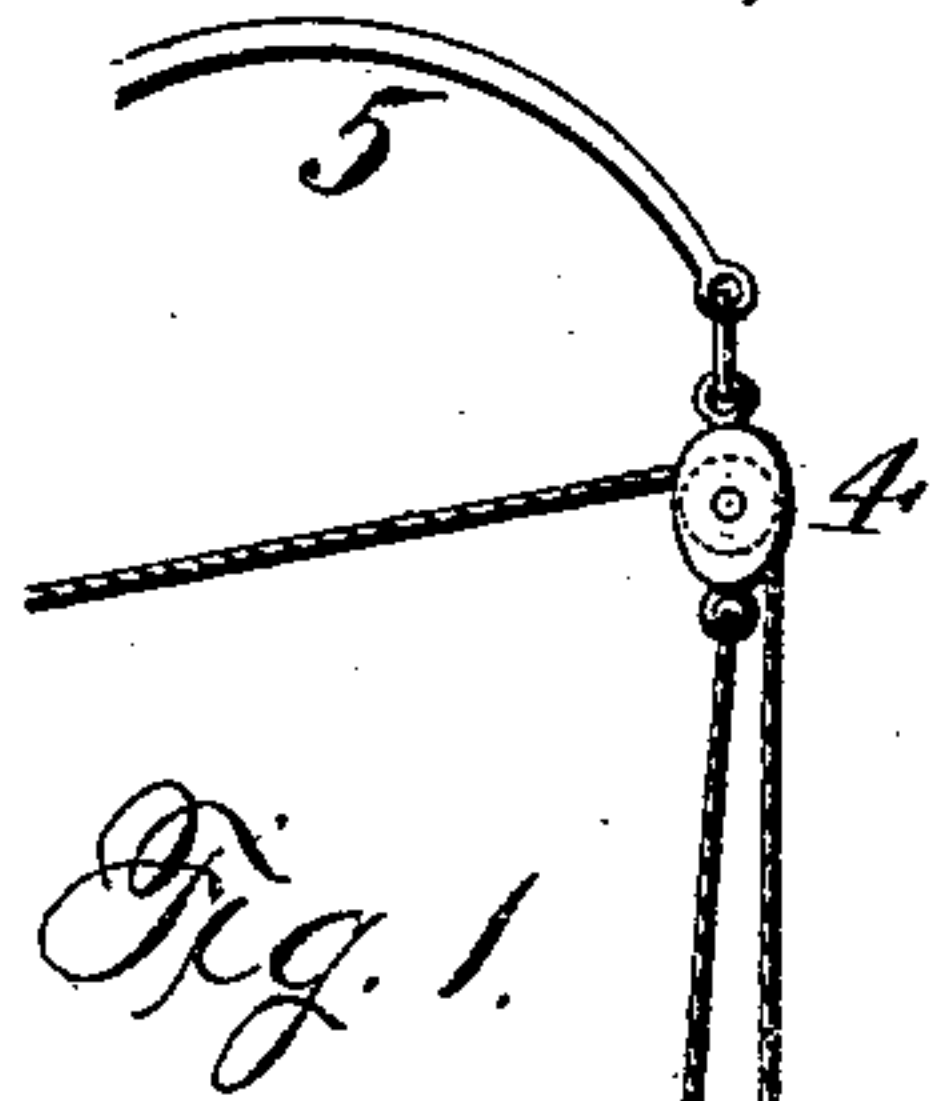
(No Model.)

2 Sheets—Sheet 1.

W. E. RICHARDS.
LADDER.

No. 501,694.

Patented July 18, 1893.



Witnesses
G. Williamson,
E. B. Bolton

Inventor
William E. Richards

(No Model.)

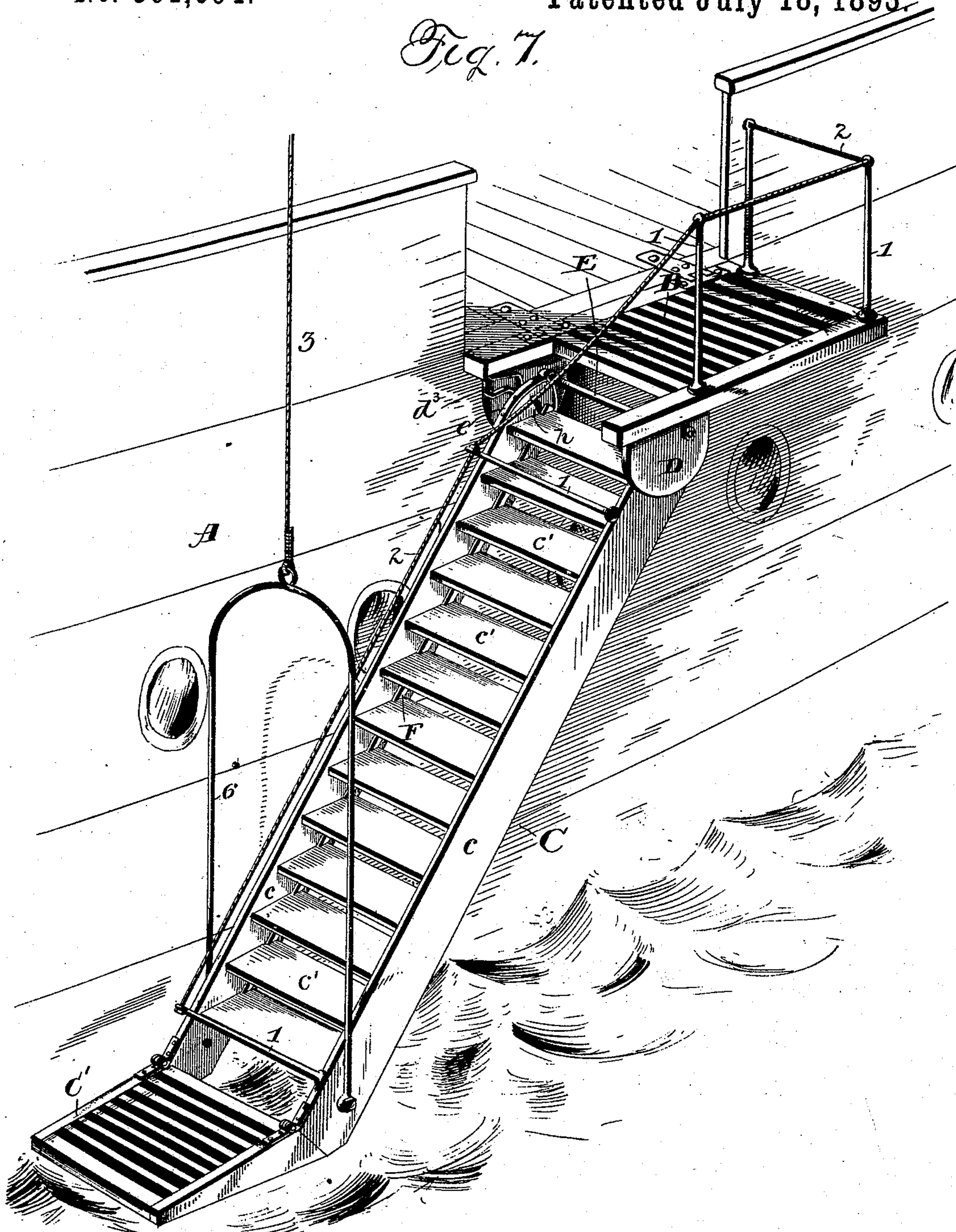
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Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM E. RICHARDS, OF NEW YORK, N. Y.

LADDER.

SPECIFICATION forming part of Letters Patent No. 501,694, dated July 18, 1893.

Application filed March 3, 1893. Serial No. 464,580. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM EVARTS RICHARDS, a citizen of the United States, residing at New York, county and State of New York, have invented certain new and useful Improvements in Ladders or Similar Structures, of which the following is a full, clear, and exact description.

My invention has for its object to construct a ladder or similar structure, in which the steps or treads may be automatically maintained in a horizontal position, irrespective of the angle at which the ladder itself may be adjusted or secured to the structure with which it is used.

My invention is particularly adapted to be applied to ships' ladders, where the ladder is pivotally attached at its upper end to a platform constructed at some convenient part of the ship's side, the lower end of the ladder being supported by a rope or chain passing over a block, carried by a davit aboard ship, and lowered thereby to the water line to receive or discharge passengers or cargo. Such ladders, it is well known, are extensively used for receiving and discharging passengers when ships are in ports where there are no wharves or piers. In ladders of this kind, the angle at which it is desired to lower the ladder for use at different times is not a constant one, for as the displacement of the ship varies as it carries a greater or less load, the distance from the gang-way or platform to the water line is decreased or increased, and the angle at which the ladder must be adjusted when in use, varies accordingly.

As far as I am advised, the usual form of ship's ladder consists simply of a construction wherein flat steps or treads are rigidly secured between the sides of the ladder. As the treads are thus rigidly secured, it follows that they are horizontal only when the ladder is maintained in one position or angle relative to its platform, and are out of the horizontal in every other position of the ladder, and frequently objectionably incline so that it is difficult, and sometimes dangerous, to use the ladder, particularly so if the ship is rolling or pitching in the sea. Various attempts have been made to remedy this, the most usual course being to attach additional supporting pieces or cleats to the side pieces of the lad-

der, arranging them at an angle to the rigid treads, upon which may be placed removable steps or treads, which are used instead of the rigid treads whenever the inclination of the latter is such that they cannot be conveniently or safely used. But this method is objectionable as it necessitates the carriage and care of an additional set of treads, which are apt to be mislaid or lost; the adjusting of these treads into position whenever they are to be used, and their removal and storage at other times; while at the same time only a limited degree of adjustability is secured thereby. By the use of my invention the steps are always maintained in a horizontal position, no matter what may be the angle of inclination of the ladder itself; the use and storage of loose parts are dispensed with, as well as the labor necessary for their adjustment; and a light, convenient, and durable ladder insured, complete in itself, and capable of automatic adjustment.

I will now proceed to describe my invention in connection with the accompanying drawings which form a part of this specification, and in which similar letters of reference indicate the same parts wherever they occur. The particular features of novelty that I claim as my invention are pointed out in the claims at the end of this specification.

Referring now to the drawings: Figure 1 is a front view of a ship's gang-way and ladder embodying my improvements. Fig. 2 is a side view partly in section. Fig. 3 is a detail side view or elevation of one of the brackets to be secured to the gangway or platform. Fig. 4 is a detail plan of one of the steps or treads. Fig. 5 is a perspective view of the upper part of the ladder, (part of one step and one side piece being broken away,) and suspending brackets or segment pieces, showing the relation and operation of the parts more clearly. Fig. 6 is a detail perspective view of a shoe or step support. Fig. 7 is a perspective view showing my improved ladder as applied to a ship's gangway.

The line A is intended to represent the side of the ship, to which is attached in the usual or any suitable way, the gangway or platform B.

The attachment of the gangway or platform to the ship forms no part of my invention,

but I may mention here, to aid in the more complete comprehension thereof, that it is usual to construct this platform at some convenient place upon the ship's side, and to attach the ladder thereto in such manner that the latter may be easily unshipped and taken aboard when not in use, while the platform itself may be closed up against and secured to the ship's side, so that it will not be carried away in rough weather.

To the platform B, is pivotally secured one end of the ladder C, which is constructed with the usual side pieces *c c* and steps or treads *c'*, which may be as many in number as desired or required. To the lower end of the ladder is attached a landing or platform C'. It is customary to provide the ladder with the standards 1, 1, and the cables 2, 2, strung thereto, and forming handrails or guards. The lower end of the ladder is raised or lowered and supported in the desired position by a rope or chain 3, passing over blocks 4, 4, carried by a davit 5, which is secured aboard ship at some suitable position relative to the gangway or platform B, the rope or chain 3 being attached to a bail or yoke 6, which is pivotally secured to the lower end of the ladder, preferably to the side pieces thereof as shown in the drawings.

It has been usual to secure the upper end of the ladder C to the platform B by a bolt passing through eyes formed in the side bars of the ladder, and carried by bearings or straps affixed to the bottom of the platform, (not shown.) This bolt acts as a fulcrum when the ladder is mounted thereon, permitting the lower end of the ladder to be raised or lowered as desired by means of the bail 6 and the rope 3, while the upper end of the ladder remains attached to the platform B.

In carrying out my invention I secure to the under side of the gangway or platform B a pair of brackets or segments D, D', by means of bolts 7 or other suitable fastening means. These brackets or segments are preferably of metal, and are made sufficiently strong to support the ladder C. If desired the brackets D, D', can be connected by suitable brace-rods, (not shown,) with each other, or they may be cast in one piece with a bridge piece. Upon the inner face of these brackets or segments I form laterally projecting ribs *d, d'*, so disposed as to form a cam-groove, or inclined bearing *d²*, open at one end *d³*, and closed at the other end *d⁴*. The outer portion, or the end *d³* of said groove or bearing is horizontal, or nearly so, while the remainder thereof is downwardly curved, forming a cam or bearing surface. The brackets or segments D, D', are further provided with openings or bearings *d⁵*, adapted to receive the transverse bar or bolt E, upon which the upper end of the ladder C is pivotally supported.

I form my ladder C with the usual side pieces *c, c*, between which are the steps or treads *c'*, but instead of securing these treads or steps rigidly to the side-pieces, I pivotally secure

them between said side-pieces in such a manner that as the lower end of the ladder is raised or lowered, the steps or treads will always be automatically adjusted and retained in a horizontal position. This I accomplish by the following construction: I provide each of the steps or treads *c'* upon its two side edges with front and rear lugs or pins *c², c³*. These lugs or pins may be of metal, and be seated in recesses or bearings formed to receive them in the side edges of the steps or treads *c'*, or they may be rods, which pass entirely through the steps or treads *c'*, and project beyond the edges thereof, or, if desired, the steps or treads *c'* may rest upon, and be secured to such rods as last described. The forward lugs *c²* engage in recesses or bearings formed therefor directly in the side pieces *c, c*, while the rear lugs *c³* engage in similar recesses or bearings, formed in an auxiliary or supplemental frame or portion, presented by a movable pair of bars F, F'. It will be seen therefore that the forward edges of all the steps or treads *c'* are pivotally supported directly by the side-pieces *c, c*, by means of the lugs *c²*, while the rear edges of all the steps or treads *c'* are pivotally supported by the auxiliary frame or bars F, F', by means of the lugs *c³*, and that the rear edge of all the steps or treads may be raised or lowered relative to their front edge, by simply raising or lowering the auxiliary frame. Instead, however, of providing the steps with the lugs *c², c³*, the shoe or step-support shown in Fig. 6 may be employed, which consists of an angle-plate *c⁴*, the base-portion of which is provided with openings *c⁵*, through which may extend bolts or screws to secure the step in position thereon. The side *c⁶* of the plate is provided with pintles or lugs *c⁷*, which are designed to engage the openings formed in the side pieces, and the auxiliary portions, respectively, and subserve the same function as the lugs *c², c³*. The upper ends of the auxiliary frame or bars F, F', are supported by, and carried upon, a transverse rod *f*, which passes through slots *h* formed in the side bars *c, c*, for this purpose, and upon either end of the rod *f* is provided a friction roller *f'*, which engages and rides in the cam-shaped groove *d²* of the brackets D, D', which thus support the auxiliary frame F, F', and the rear half of the steps or treads *c'*.

As I have before stated, the ladder is supported upon a transverse bar or bolt E, which has its bearings *d⁵* in the brackets D, D'. I have shown the upper ends of the side pieces *c, c*, provided with a metal strap-piece *e*, having an opening or eye *e'*, through which this bar E passes.

In operating my invention, when it is desired to connect the ladder with the platform, the ladder is brought into position, and the ends of the rod *f*, carrying the anti-friction rollers *f'*, are introduced into the cam-shaped groove *d²*, through the open ends *d³*. The ladder is then secured in place by passing the

bolt E through the eyes e' and the bearings d^5 , as shown in Figs. 1 and 2, suitable nuts being provided upon the ends of said bar to secure the same. The lower end of the ladder is then lowered into the desired position by means of the davit 5, block and tackle 4, 3, and bail 6. During this operation and in all positions of the ladder, the steps or treads c' are automatically maintained in a horizontal plane, for as the main frame of the ladder is moved upon its axis,—the bolt E,—the auxiliary frame F, F', is also moved or swung upon its axis,—the rod f ,—which is supported in, and caused to travel in the cam-groove d^2 , the pitch of which is so adjusted as to elevate or lower the auxiliary frame F, F', and therefore the rear edges of the steps or treads c' , at the same time that the ladder itself is raised or lowered, and to just a sufficient degree to accomplish this result. For instance, supposing the ladder to be in the position shown in full lines in Fig. 2, and it is desired to raise it to the position shown in dotted lines, the lower end of the ladder is raised by means of the block and tackle, and as this is done, while the front edges of the steps are maintained in their place between the side pieces c , c , the auxiliary frame F, F', and the rear edges of the steps or treads c' , are elevated as the rod or bar f , with its friction rollers f' is caused to travel up the cam-groove d^2 .

When it is desired to unship the ladder, all that is necessary is, to withdraw the bar E, and pass the rod f with its friction rollers f' , out of the cam-groove d^2 , by way of the open ends d^3 , when the ladder may be taken aboard ship.

It should be understood that the drawings forming part of this specification are not working drawings. They are sufficiently exact however to clearly illustrate the features of novelty contained in my invention, and to enable any person skilled in the art to which it pertains to clearly understand and practice the same. It should also be understood that while I have described my invention more particularly with reference to a ship's ladder, its use is not confined to that form of ladder, but that it may be used in any structure to which it may be found applicable in which it is desired to regulate the plane of one portion of the structure with relation to other portions. It will also be understood that instead of a cam-groove d^2 a toothed rack might be used, the bar f in this case being provided with a toothed wheel that would gear with the teeth of the rack.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination in a ladder or similar structure of a suspending bracket, of main and auxiliary portions pivotally suspended from said bracket, steps or treads pivotally mounted in both of said portions, a variable bearing operating the auxiliary portion as

the ladder itself is moved, and means for raising and lowering the ladder, substantially as set forth.

2. The combination with a structure of a ladder mounted thereon, having a main and an auxiliary portion, said main and auxiliary portions being pivotally supported and separately suspended in suitable bearings, steps or treads pivotally mounted in both the main and auxiliary portions, said auxiliary portion being suspended in a variable bearing that imparts movement to the auxiliary portion additional to that of the main portion whenever the ladder is moved, substantially as set forth.

3. The combination in a ladder or similar structure, of a suspending bracket, a main frame pivotally suspended from a rigid bearing in said bracket, an auxiliary portion pivotally suspended therefrom, and free to move in a variable bearing in said bracket, steps or treads pivotally mounted in both said main and auxiliary portions, said main and auxiliary portions being capable of motion relatively of each other, whereby the position of the steps is changed as the ladder is moved from one position to another, substantially as set forth.

4. In combination with a bracket, a ladder pivoted thereto, steps pivoted at one edge to said ladder, a movable frame supporting the other edge of said steps and cam shaped bearings for the upper end of said frame having open ends, substantially as set forth.

5. The combination in a ladder or similar structure, of a suspending bracket with its bearings, main and auxiliary portions pivotally suspended from said bracket in such bearings, and steps or treads pivotally supported between said main and auxiliary portions, one of said portions of the ladder being provided with suitable openings to permit the passage and operation of the shaft or bar upon which the other of said portions of the ladder is supported, substantially as shown and described.

6. The combination with the depending brackets adapted to be secured to a gangway or platform, and each provided with a cam-bearing, of a ladder pivotally suspended from said brackets, an auxiliary portion engaging said cam-bearings, together with a series of steps pivotally mounted in the main and auxiliary portions of the ladder as set forth.

7. In a ladder, the segmental brackets D, D', provided with bearings d^5 to receive the bar E for supporting the ladder, and with ribs d , d' forming an inclined bearing for supporting and actuating an auxiliary portion, substantially as shown and described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

WILLIAM E. RICHARDS.

Witnesses:

EDWARD K. STURTEVANT,
A. J. UNDERHILL.