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PATENTED JAN. 14, 1908.

T. M. HOUGHTON.
LADDER AND TRAP DOOR MECHANISM.

APPLICATION FILED JULY 21, 1906.

FIG. 1.

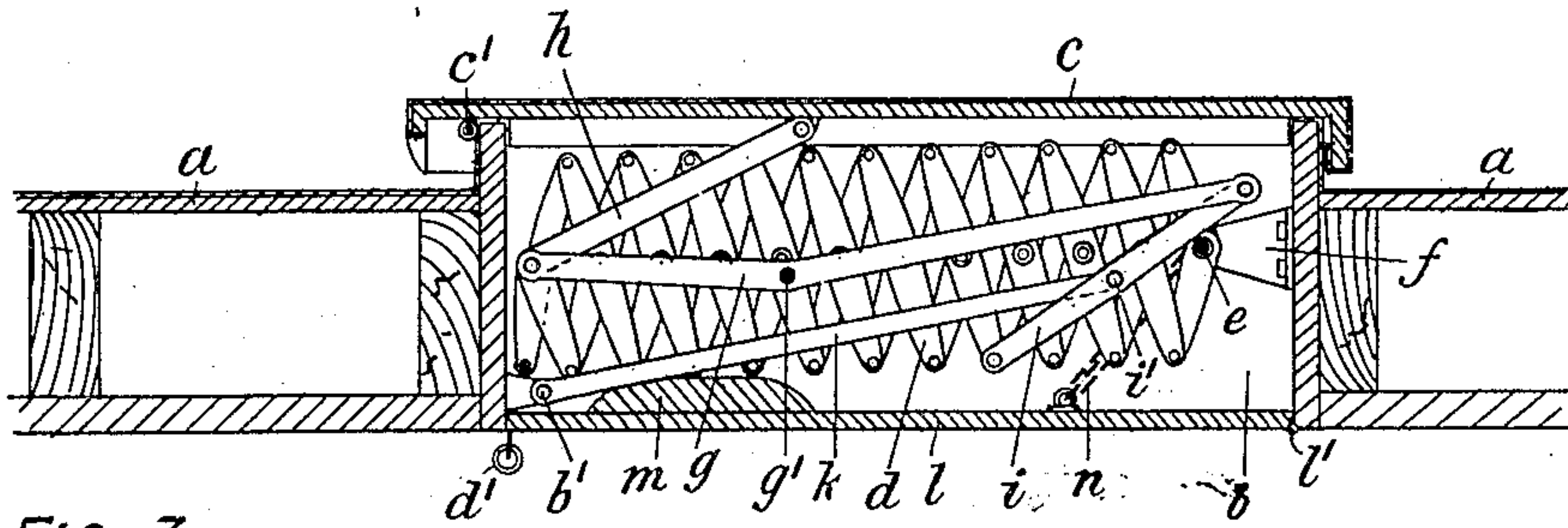


FIG. 3.

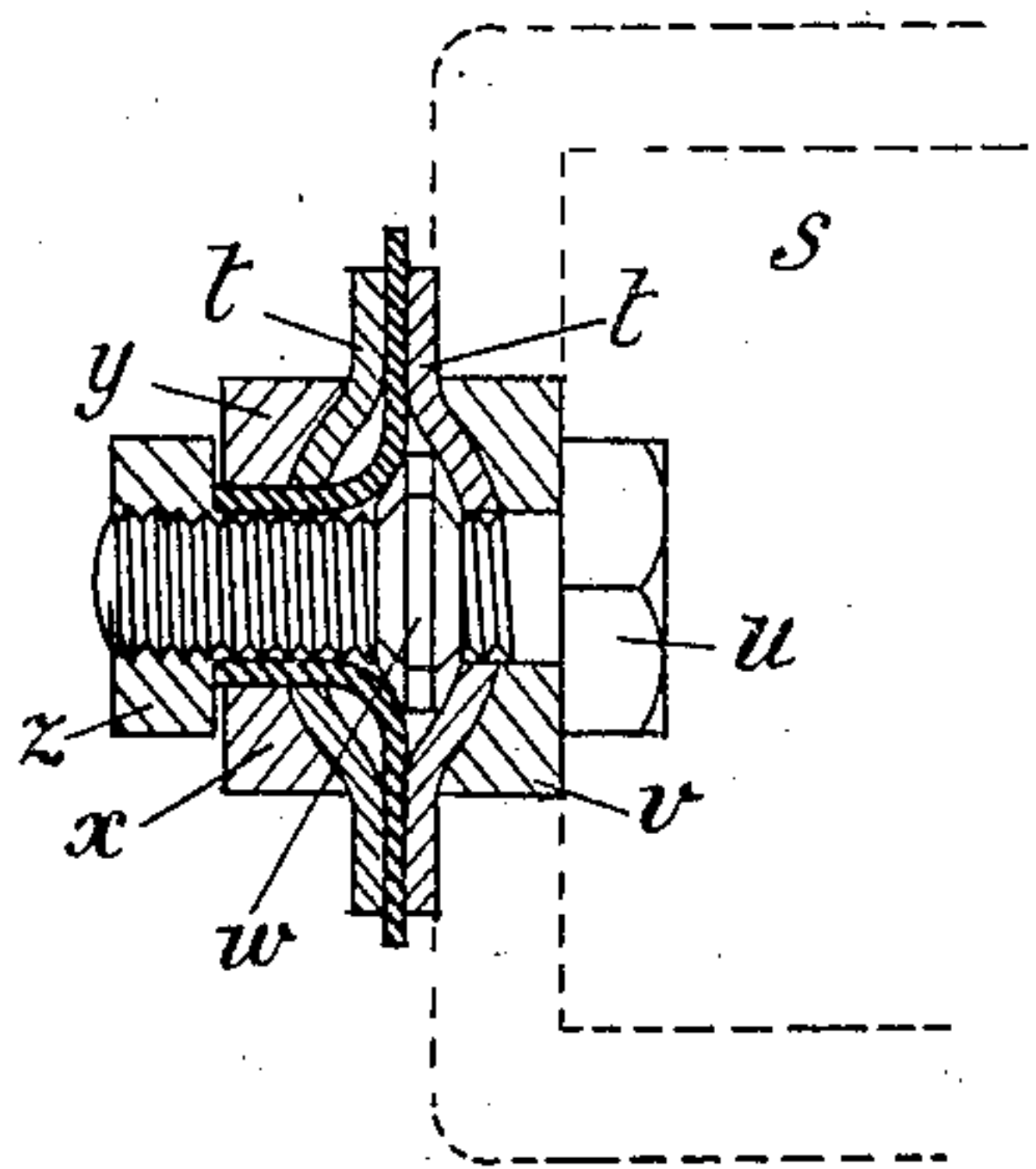
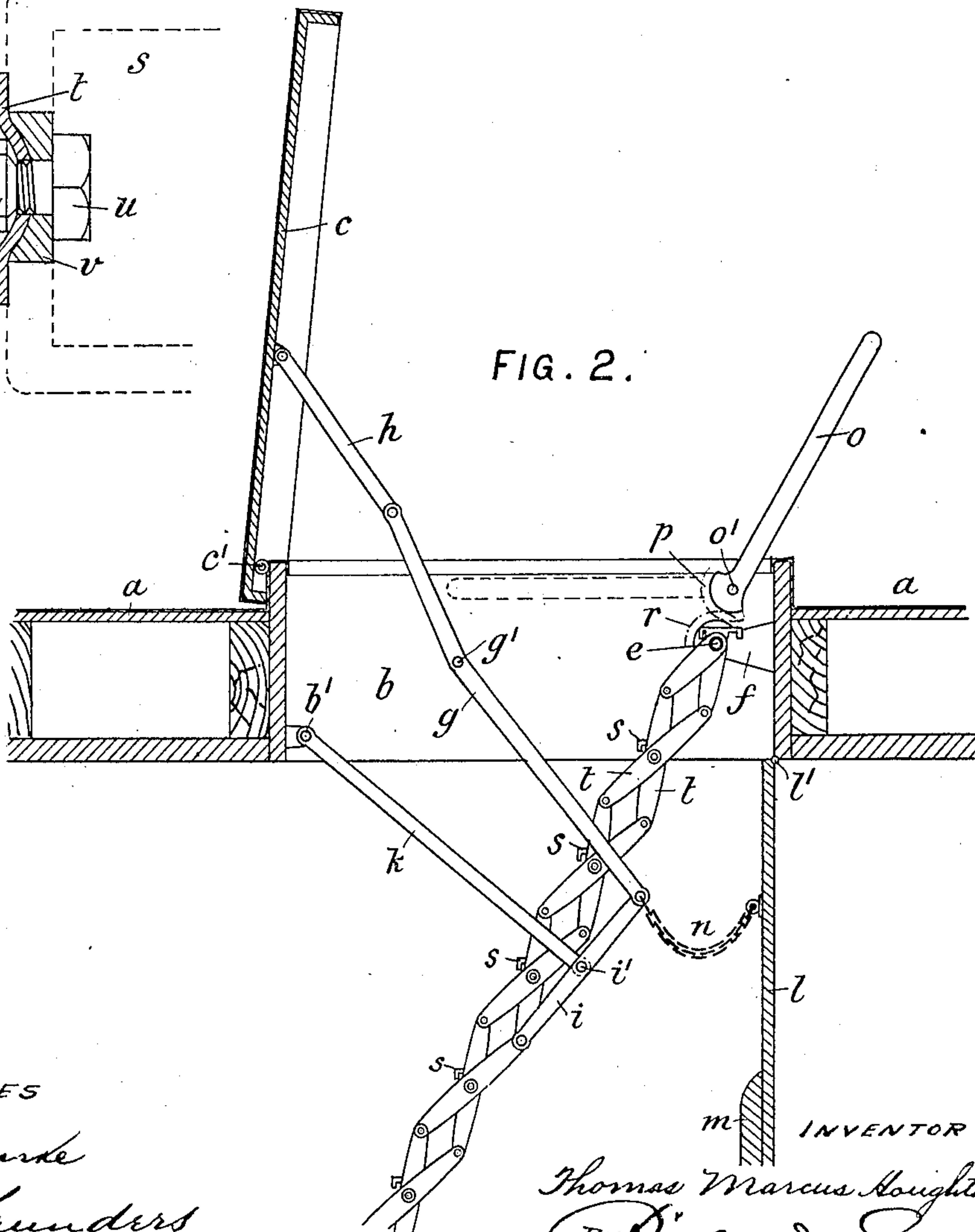


FIG. 2.



WITNESSES

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THOMAS MARCUS HOUGHTON, OF LONDON, ENGLAND.

LADDER AND TRAP-DOOR MECHANISM.

No. 876,354.

Specification of Letters Patent.

Patented Jan. 14, 1908.

Application filed July 21, 1906. Serial No. 327,198.

To all whom it may concern:

Be it known that I, THOMAS MARCUS HOUGHTON, a subject of the King of Great Britain, residing at 311 Clapham road, London, England, have invented a Ladder and Trap-Door Mechanism, of which the following is a specification.

In warehouses, people's dwellings, ships and other places there is often fitted a ladder which is slung in a raised horizontal position immediately beneath a trap-door (or in the case of a ship, a hatch) by opening which access may be gained to the roof (or deck). Such ladders are provided generally for use as a fire escape, the ladder being lowered so that one end thereof rests on the floor. In event of the escape being required, it is often found that the bolts or fastenings of the trap-door or hatch have become rusted and fixed through disuse, and some difficulty is experienced in forcing the door open. It has been proposed to connect said bolts to the ladder, so that upon the ladder being lowered for use the bolts are withdrawn thereby, the trap-door being provided with a spring or weight by means of which the door is alleged to be raised or opened automatically; in use, however, the bolts become fixed and it is obvious that springs and weights are defective, get out of order, and fail to act when required.

My invention consists in providing means whereby when the ladder is lowered for use, the trap-door is positively raised or otherwise opened by a mechanical connection therewith, as by a system of levers and links as hereinafter described with reference to the accompanying drawings.

Figure 1 is a section of a roof and trapdoor showing a collapsible ladder and apparatus closed; Fig. 2 is a similar view showing the ladder and apparatus open ready for use. Fig. 3 is a detail section showing the method of constructing the joints of the ladder.

a is the roof, *b* is the well-hole, *c* is the trap-door, which latter is hinged at *c'* to the curb of the well-hole.

d is the ladder, which is of the well-known lazy-tongs description, being pivoted at *e* to brackets *f* fixed in the well-hole. At each side of the well-hole a lever *g* is pivoted at *g'*, one end of which is connected to the trap-door by a link *h*; the other end of the lever *g* is connected to the ladder by a link *i*, which is itself linked by an arm *k* to the well-hole, being pivoted at *i'* to the link *i* and at *b'* to

a bracket fixed to the well. The arrangement of the pivots of the system of levers and links is preferably such that any attempt to move the trap-door, whether closed or opened, causes said levers to act against the applied force.

In the drawings, a ceiling flap *l* is shown hinged at *l'* and provided with a runner block *m*, which is adapted to hide the ladder from view when inclosed within the well-hole. The flap *l* is connected by chains or the like *n* with the system of levers so that as the ladder is raised out of use the flap *l* is caused to shut, a suitable spring latch or other fastening being fitted to retain the flap or ladder.

It will be understood that if an inextensible ladder is used, or if a sliding door is to be operated, the system of levers and links would be modified to suit the motion.

The lowering of the ladder may be utilized to throw up hand rails or posts, an example of such a device being illustrated in Fig. 2. The posts *o* are pivoted at each side of the well-hole at *o'* and are provided with toothed sectors *p* which gear with other toothed sectors *r* fixed to and rotated by the pivot *e* when the ladder is operated. The same effect may be produced by levers and links, or by other well known contrivances.

The construction of the ladder is shown in section in Fig. 3, which illustrates the means employed for fixing the step *s* to the sides *t*. As shown, the sides of the ladder are composed of a number of members pivoted together at the point of intersection by a screw bolt *u* and at their ends. The members *t* are dished as shown to give them sufficient strength laterally, their adjacent edges being flat as shown. The step *s* is formed with concave recesses to fit the convex surfaces of the inner member *t*, the bolts *u* passing through flanges *y* on the underside of the step and being locked to the inner member *t* by a lock nut *w*. A flanged sleeve *x* (or a sleeve or bush and a washer) is mounted loosely on the bolt *u*, upon which sleeve the other member of the slide is journaled, a shaped washer *y* and a lock nut *z* serving to retain the parts in suitable working position.

The lower end of the ladder (or the flap *l*) is provided with a ring *d'* by means of which the ladder may be lowered by pulling same with a suitable hooked rod; or a rope, chain, or other means may be connected therewith and hang within easy reach of the operator.

The arrangement and disposition of the pivots of the system of levers and links in the open and closed positions of the trap door is preferably such that the directions of forces
5 will produce a lock as shown on the drawings, so that any attempt to move the trap door, whether open or closed, by the direct application of force thereto is frustrated.

In Fig. 1 if an attempt is made to raise
10 the trap door *c*, the links *h* would raise their ends of the levers *g* and depress the opposite ends thereof, tending to rotate the links *i* upon their pivotal connections *i'* on the links *k*, which however prevent any appreciable
15 motion.

In Fig. 2, the trap door is held open by the pivotal connections between the links *h* and the levers *g* having passed out of alinement with the pivots *g'* and the pivotal connections of the links *h* with the trap door. The
20 tendency of a motion to close the door would be to further depress the lower end of the lever *g*, but this is prevented by the links *i* and the ladder which is fully extended.

25 I claim:—

1. In a ladder and trap door mechanism a collapsible ladder hinged or pivoted within the well-hole and adapted to be shortened to occupy a position wholly within said well-
30 hole and extended so as to reach to the floor, levers pivoted within the well-hole, links connecting said levers with the trap door, links connecting said levers with said ladder

and a disposition of the pivotal connections of said levers and links to secure the trap
35 door in the open and closed positions.

2. In a ladder and trap door mechanism, a collapsible ladder hinged or pivoted within the well-hole and adapted to be shortened to occupy a position wholly within said well-
40 hole and extended to reach to the floor levers pivoted within said well-hole, door links connecting said levers with the trap door, ladder links connecting said levers with the ladder, and radius links connecting said ladder links
45 with the end wall of the well-hole.

3. In a ladder and trap door mechanism, a collapsible ladder hinged or pivoted within the well-hole and adapted to be shortened to occupy a position wholly within said well-
50 hole and extended to reach to the floor, levers pivoted within said well-hole, door links connecting said levers with the trap door, ladder links connecting said levers with the ladder, a disposition of the pivotal
55 connections of said levers and links to secure the trap door in the open and closed positions, and radius links connecting said ladder links with the end wall of the well-hole.

In testimony whereof, I have hereunto set
60 my hand in presence of two subscribing witnesses.

THOMAS MARCUS HOUGHTON.

Witnesses:

T. J. OSMAN,

GEO. J. B. FRANKLIN.