

951,433.

R. CAREY.  
LUFFING CRANE.  
APPLICATION FILED JUNE 11, 1909.

Patented Mar. 8, 1910.  
2 SHEETS—SHEET 1.

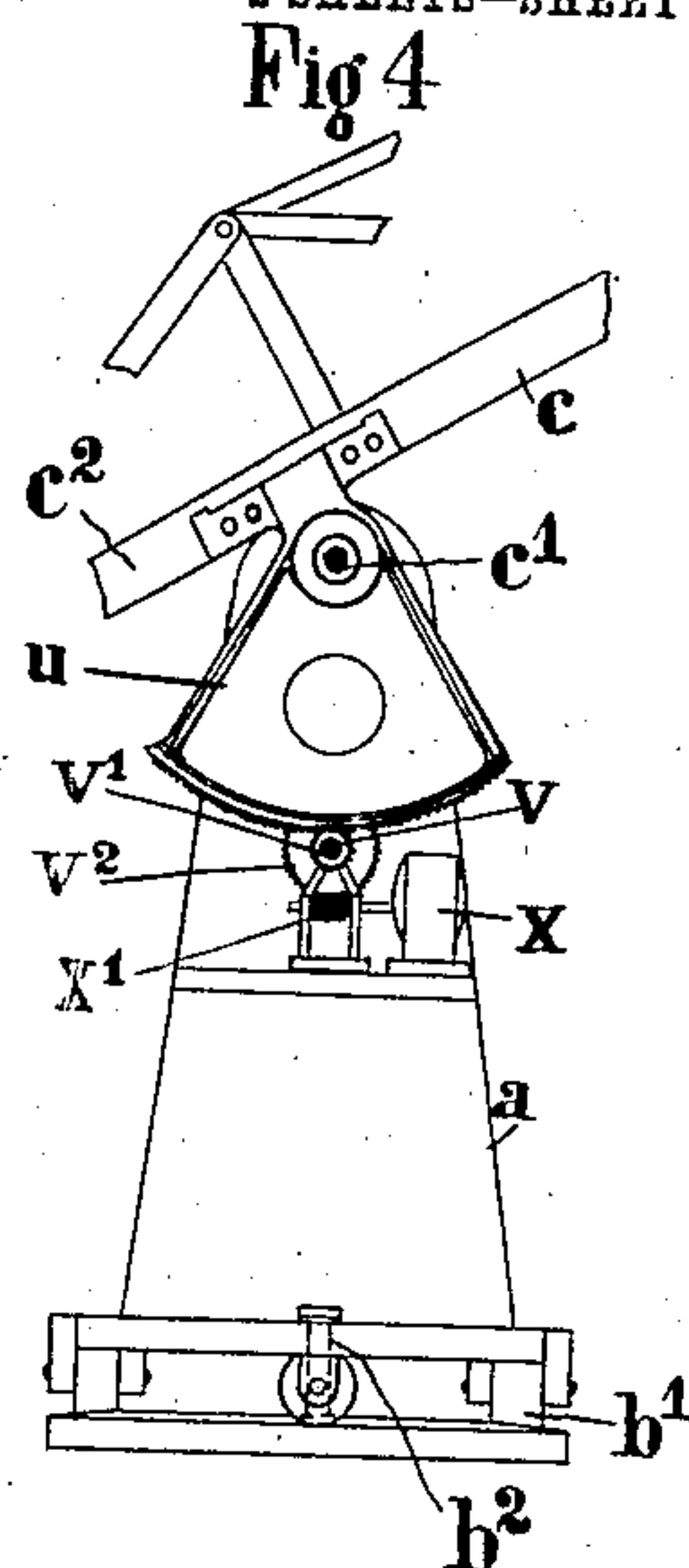
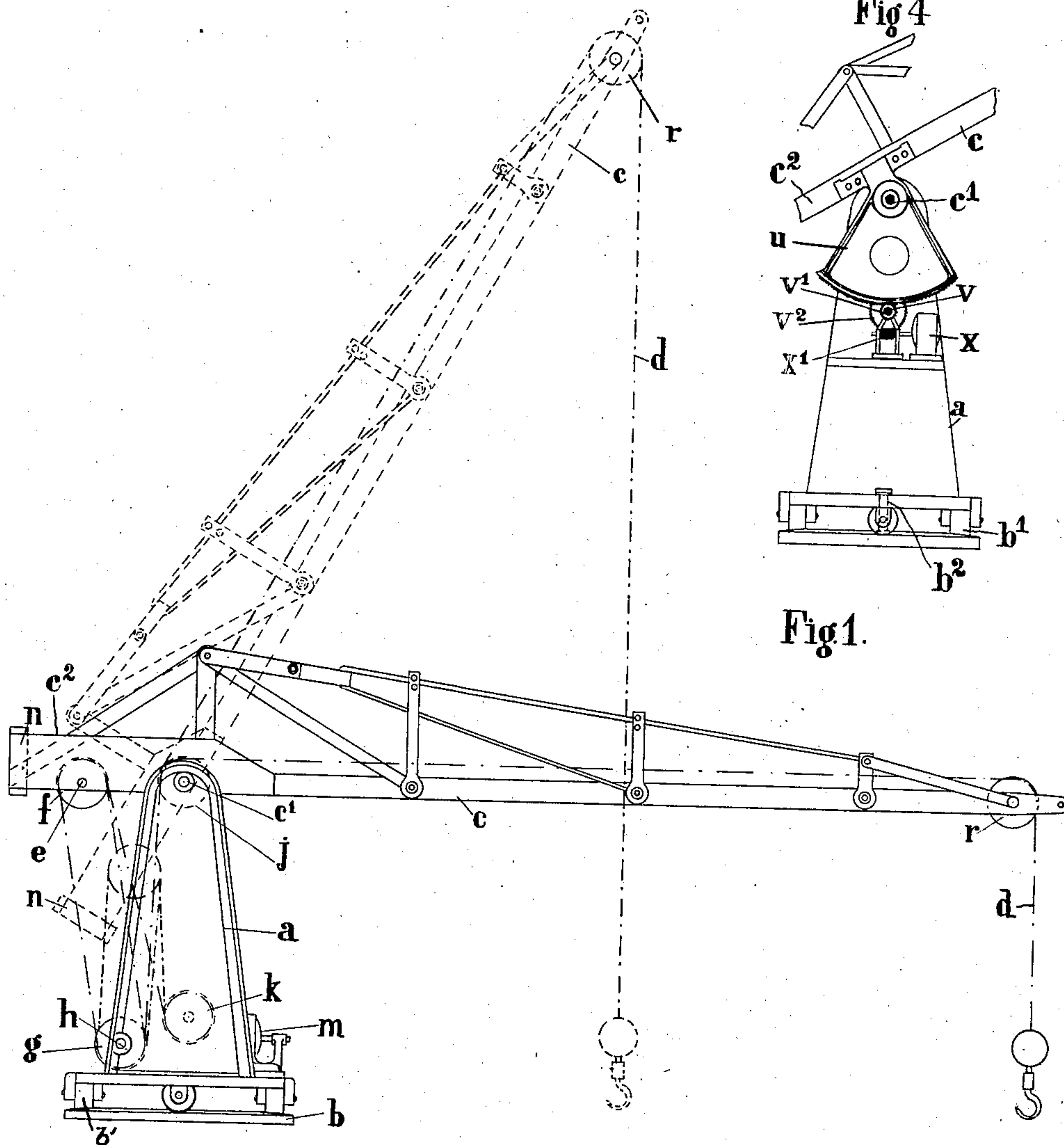


Fig. 2.

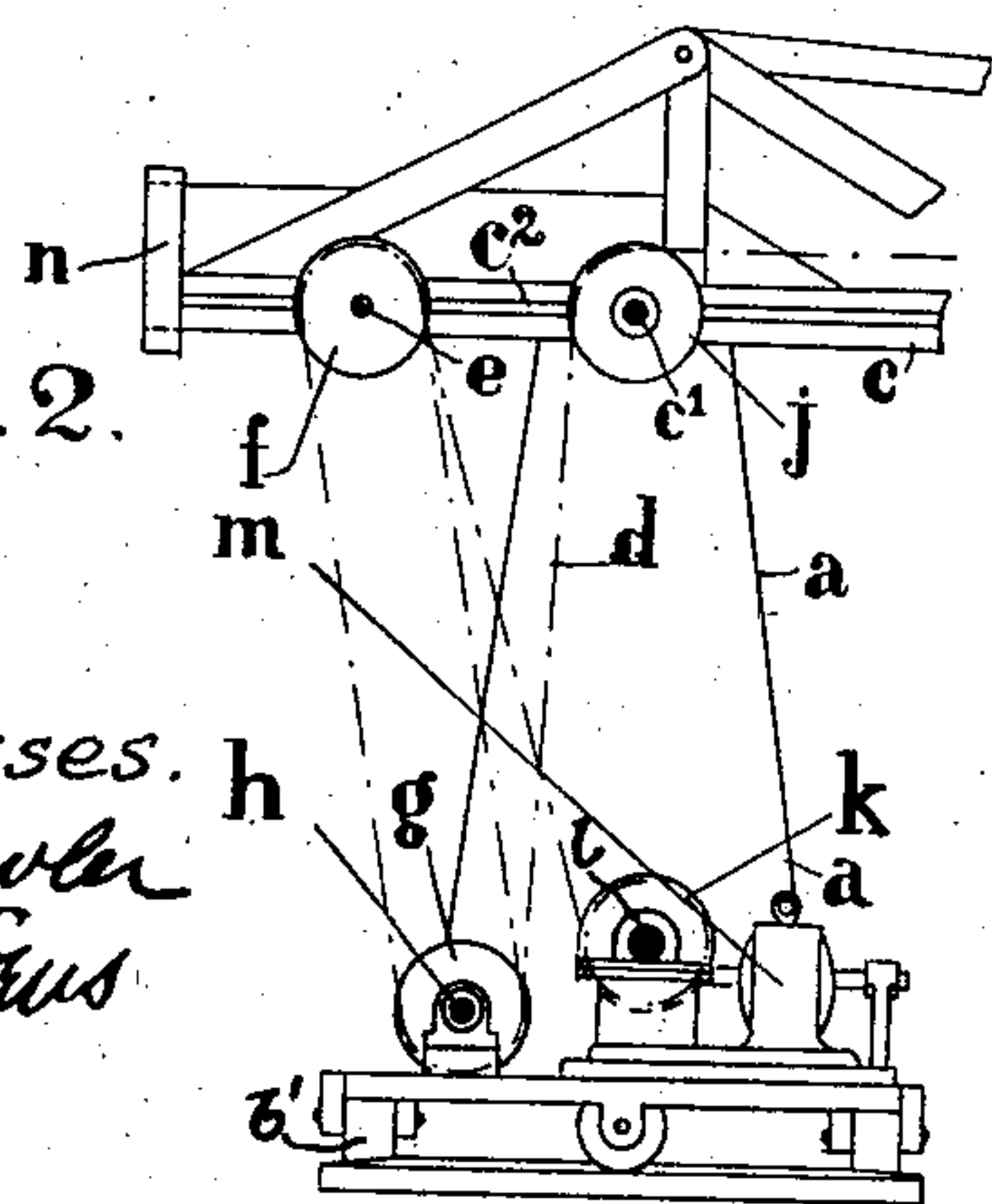
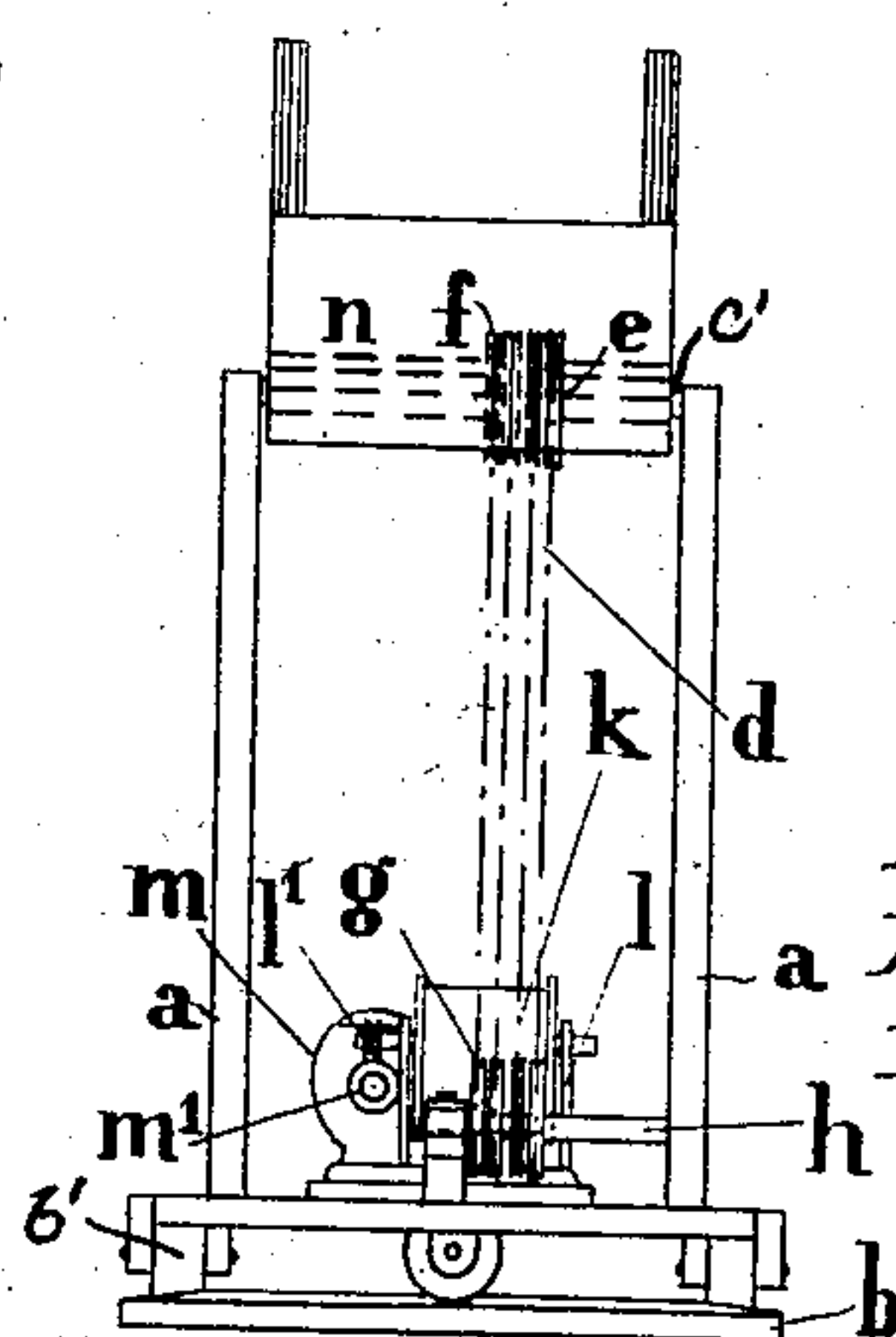


Fig. 3.



Witnesses.  
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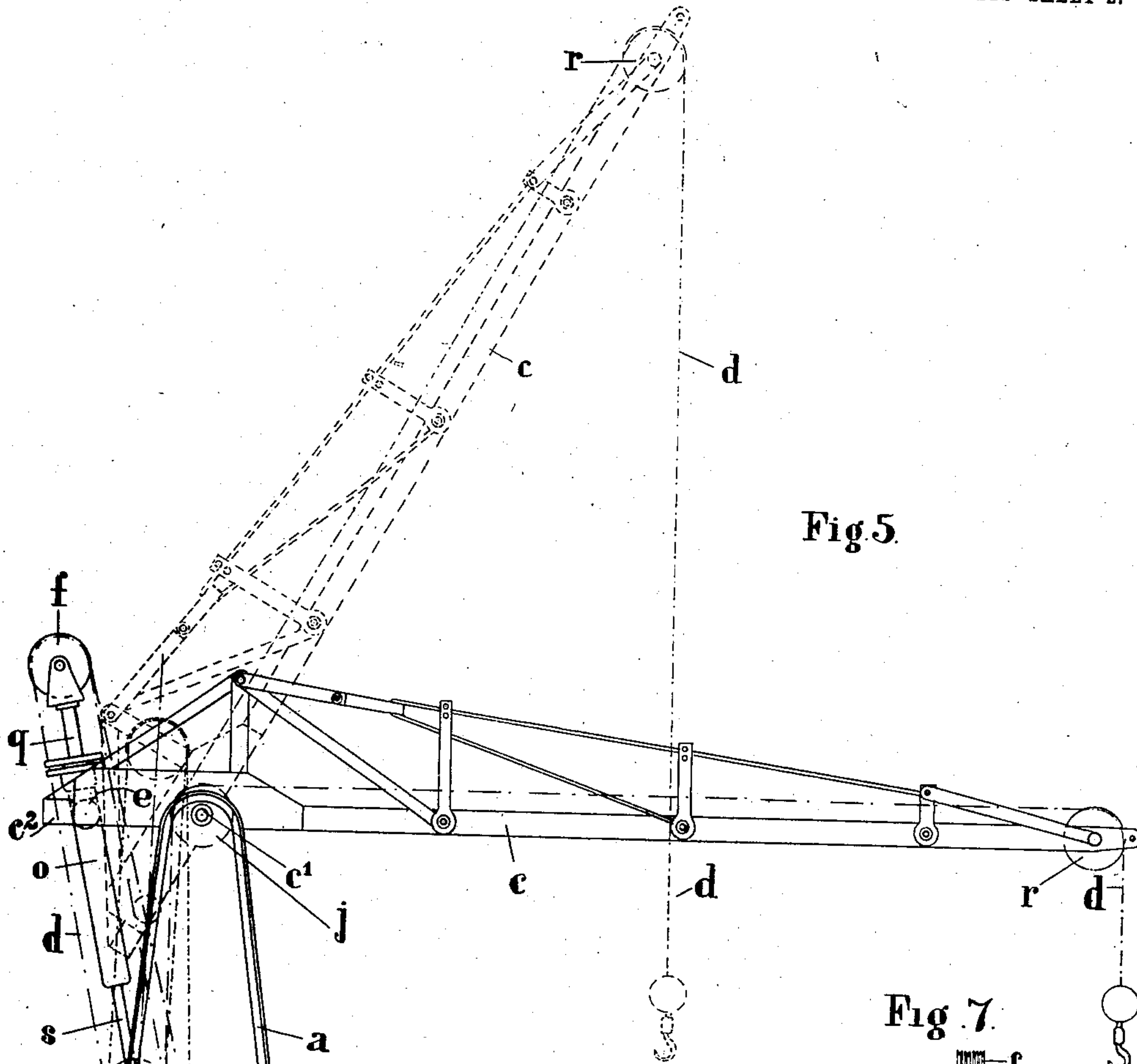


Fig. 5.

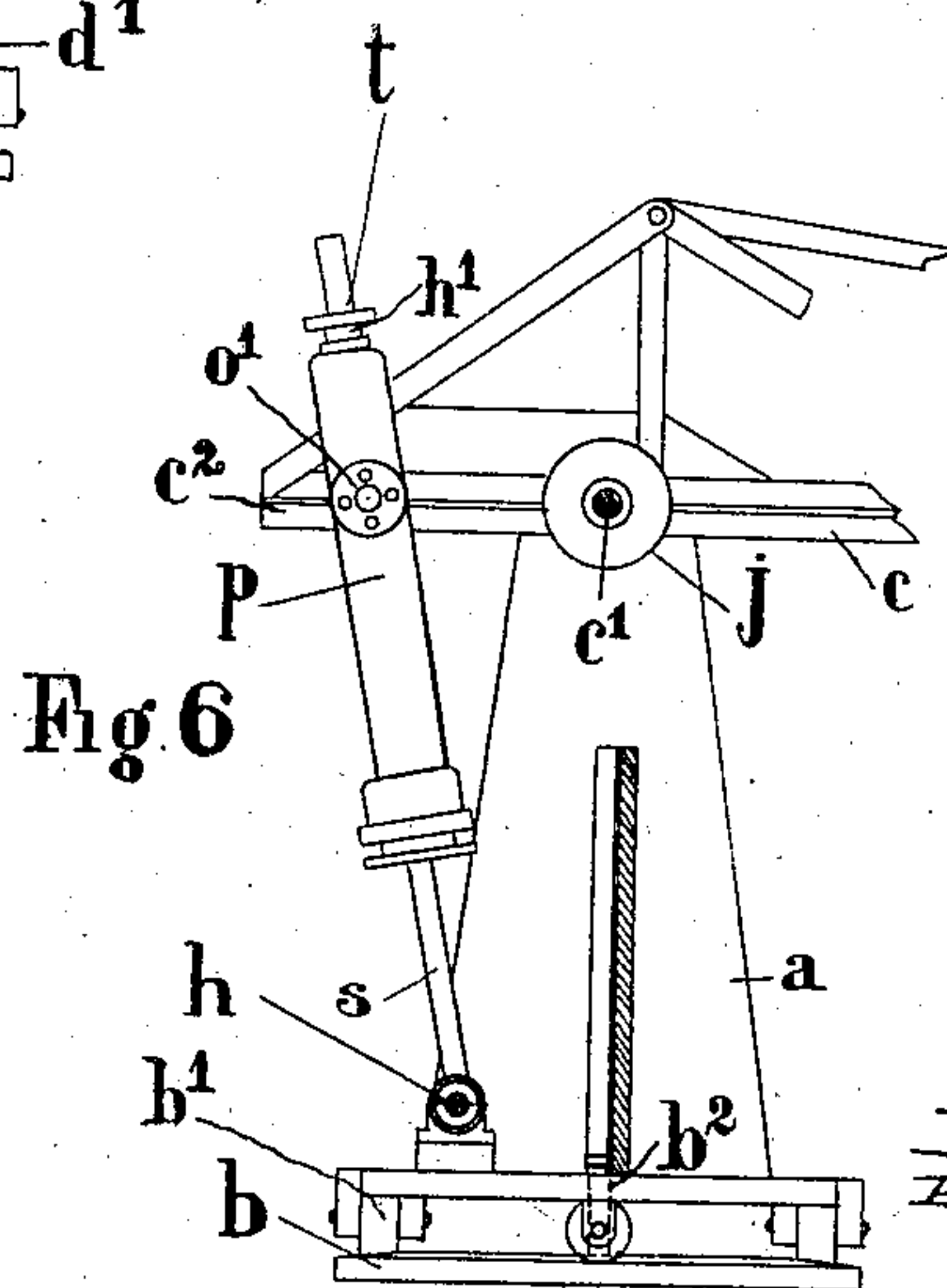


Fig. 6.

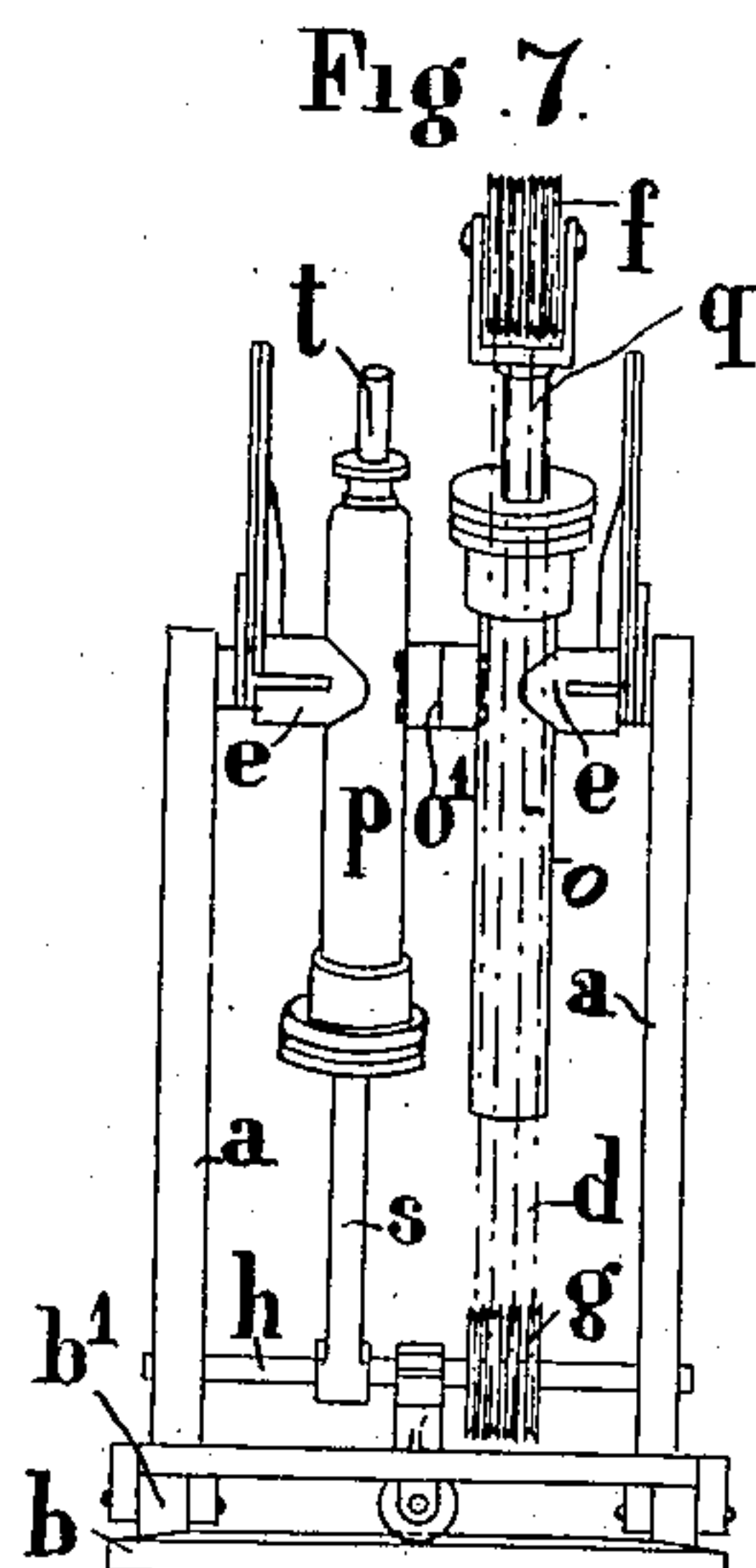


Fig. 7.

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# UNITED STATES PATENT OFFICE

ROBERT CAREY, OF WIMBLEDON, LONDON, ENGLAND, ASSIGNOR OF ONE-HALF TO R. WAYGOOD & COMPANY, LIMITED, OF LONDON, ENGLAND.

LUFFING-CRANE.

951,433.

Specification of Letters Patent.

Patented Mar. 8, 1910.

Application filed June 11, 1909. Serial No. 501,594.

*To all whom it may concern:*

Be it known that I, ROBERT CAREY, a subject of the King of England, and residing at 22 Quintin avenue, Wimbledon, London, England, engineer, have invented certain new and useful Improvements in Luffing-Cranes, of which the following is a full, clear, and exact description.

This invention relates to cranes and the like having a "luffing" or "derricking" jib and it consists of an improved arrangement of the parts whereby the jib can be made self-sustaining in all positions, whatever be the weight of the load suspended, by rendering the elevation of the load independent of the luffing action. The present invention enables this object to be attained with an accuracy sufficient for all practical purposes.

According to the present invention, the jib extends rearwardly beyond its support and carries on the side remote from the load a number of compensating pulleys or sheaves around which the rope, chain or other connection is passed, the arrangement being such that the point of attachment of the pulleys to the rearward prolongation of the jib is in approximate alinement with the pivots of the jib and the head-sheave; the moment produced by the load suspended is balanced by the moment of the pull of the ropes upon these compensating pulleys. The number of such pulleys will depend upon the length of the jib in proportion to the distance of the line of action of the ropes from the pivot upon which the jib is mounted. The rope passes to one of these pulleys from the winch or drum and back to one of a number of corresponding pulleys or sheaves on the frame of the support. From the last of these pulleys the rope passes up to a pulley mounted axially of the pivot of the jib, and thence along the jib to and over the pulley or sheave at its extremity. The axes of the two sets of compensating pulleys are so placed that as the jib is raised or "luffed" to bring the load nearer to the crane the distance of the line of action of the compensating lengths of rope or chain from the pivot of the jib is reduced in proportion in order to preserve the balancing effect. This may be accomplished, for example, by causing the ropes upon the compensating pulleys to remain approximately vertical in all usual positions of the jib, or otherwise causing the

pull of these ropes to have the greatest effect when the jib is horizontal. Any slight inequality in the compensating action resulting, for example, from a small divergence from the vertical line will be insufficient to overcome the ordinary friction of the parts, so that this approximation may be regarded as sufficiently accurate for practical working.

The invention is hereafter described with reference to the accompanying drawings, in which:—

Figure 1 represents by way of example and in side elevation an electric luffing crane constructed in accordance with the present invention. Fig. 2 is a similar view in part section. Fig. 3 is a rear elevation of the same. Fig. 4 is a detail showing the luffing gear. Fig. 5 represents in side elevation a hydraulic crane constructed in accordance with a modification. Fig. 6 is a similar view in part section. Fig. 7 is a rear elevation of the same.

In the construction illustrated in Figs. 1, 2, 3 and 4, the crane is provided with a double-framed standard *a* revoluble upon conical rollers *b'* traveling on the fixed base *b* in conjunction with a central guide or pivot *b''*. The jib *c* is pivoted at *c'* and carries at its outer end a pulley or head-sheave *r* over which the rope or chain *d* supporting the load is passed. On the side remote from the load, the jib *c* is extended as at *c''* beyond its pivot *c'* and provided with an axle *e* upon which are journaled a number of compensating pulleys or sheaves *f*. A corresponding number of pulleys *g* are mounted upon an axle *h* on the frame of the standard *a*. The rope *d* which sustains the load passes over a guide-pulley *j*, preferably mounted upon the pivot *c'* of the jib, and over the two sets of pulleys *g* *f*. From the last of the pulleys *f* it passes to the winding drum *k* which is mounted upon supports *l* and rotated by suitable gearing such as the worm wheel *l'* and worm *m* actuated by the electric or other motor *n*. Any suitable means for controlling the position of the jib *c* may be employed, for instance, as shown in Fig. 4, a toothed quadrant *u* secured upon the extended jib is engaged by a pinion *v* mounted upon a shaft *v'*. This shaft *v'* is rotatable in either direction by an electric motor *x* which operates a worm *x'* engaging with a worm wheel *x''*



upon the shaft. The rearward extension  $c^2$  of the jib may be provided with a counterpoise  $n$  to balance the weight of the jib, which is of course independent of the load suspended.

In Figs. 5, 6, and 7, I have shown an application of the invention to a hydraulic crane. The jib  $c$  is pivoted at  $c'$  upon the standard  $a$  revoluble upon its base  $b$ , and upon its rearward extension  $c^2$  are mounted two oscillating cylinders  $o$   $p$  to receive the hydraulic power under suitable control. The two cylinders are secured together by a flanged joint  $o'$  and oscillate on the trunnions or axle  $e$ , through which the power may be supplied. The compensating sheaves  $f$  are carried by the ram  $q$  of the hoisting cylinder  $o$  and connected to the stationary sheaves  $g$  as in the previous construction. One end of the hoisting rope or chain  $d$  is anchored to the standard  $a$  as at  $d'$  while the other passes over the guide pulley  $j$  and along the jib  $c$  to the pulley  $r$  at its extremity from which the load depends. The luffing cylinder  $p$  is preferably double-acting and its piston-rod  $s$  is connected to the axle  $h$  fixed upon the standard  $a$ . A tail-rod  $t$  passes out through a stuffing box  $h'$  at the top of the cylinder. The luffing cylinder  $p$  with its piston-rod  $s$  maintains the hoisting cylinder  $o$  in the direct line of the ropes or chains because of the rigid connection of the two cylinders. In this construction the weight of the two cylinders  $o$   $p$  may be designed to balance the jib with or without any other counterpoise  $n$ .

It will be noted that as the jib is luffed toward the position shown in dotted lines, the motion of the compensating pulleys causes the rope or chain to travel so that the load remains at approximately the same elevation without rotation of the winding drum  $k$  or travel of the hoisting ram  $q$  in its cylinder  $o$ , as the case may be. This is of great advantage when the position of the crane requires the jib to be constantly or repeatedly raised and lowered in order to reach the desired points for picking up or depositing the load.

Having thus described my invention, what I claim as such and desire to secure by Letters Patent is:—

1. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, and a number of loops in said flexible connection, said loops passing around said axle and said fixed axle.

2. A luffing crane comprising a standard, a jib, a pivot for said jib upon said standard, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said

extension, an axle upon said standard, and a number of loops in said flexible connection passing around said axles.

3. A luffing crane comprising a jib, a pivot for said jib, a head-sheave upon said jib, a load-supporting flexible connection passing over said head-sheave, an extension of said jib to rear of said pivot, an axle upon said extension, said pivot, head-sheave and axle having axes in approximately the same plane, a fixed axle, and a number of loops in said flexible connection passing around said axles.

4. A luffing crane comprising a standard, a jib, a pivot for said jib, said pivot being located at the top of said standard, a head-sheave upon said jib, a load-supporting flexible connection over said head-sheave, an extension of said jib to rear of said pivot, an axle upon said extension, said pivot, head-sheave and axle having axes in approximately the same plane, an axle upon said standard, and a number of loops in said flexible connection passing around said axles.

5. A luffing crane comprising a standard, a jib, a pivot for said jib upon said standard, a flexible connection supporting at one end a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, a number of loops in said flexible connection passing around said axles, and means for retaining the other end of said flexible connection.

6. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, a number of loops in said flexible connection around said axles and means for luffing said jib.

7. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, a number of loops in said flexible connection passing around said axles, means for luffing said jib, and means for hoisting the load dependent from said jib.

8. A luffing crane comprising a standard, a jib, a pivot for said jib upon said standard, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, a number of loops in said flexible connection passing around said axles, and means for luffing said jib.

9. A luffing crane comprising a standard, a jib, a pivot for said jib, said pivot being located at the top of said standard, a flexible connection supporting a load dependent



from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, a number of loops in said flexible connection passing around said axles, means for luffing said jib, and means for hoisting the load dependent from said jib.

10. A luffing crane comprising a base, a standard, said standard revoluble upon said base, a jib, a pivot for said jib upon said standard, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, and a number of loops in said flexible connection around said axles.

11. A luffing crane comprising a base, a standard, a central guide for said standard upon said base, conical rollers supporting said standard upon said base, a jib, a pivot for said jib upon said standard, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, and a number of loops in said flexible connection around said axles.

12. A luffing crane comprising a standard, a jib, a pivot for said jib upon said standard, a head-sheave upon said jib, a sheave upon said jib-pivot, a load-supporting flexible connection over said head-sheave and said pivot-sheave, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, and a number of loops in said flexible connection passing around said axles.

13. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, and a number of loops in said flexible connection passing around said axles.

14. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, a counterweight upon said extension to balance said jib, an axle upon said extension, a fixed axle, and a number of loops in said flexible connection around said axles.

15. A luffing crane comprising a standard, two side frames to said standard, a jib, a pivot for said jib, said pivot extending between said side frames, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, an axle extending between said side-frames, and a number of loops in said flexible connection passing around said axles.

16. A luffing crane comprising a base, a standard revoluble upon said base, a central guide for said standard upon said base, con-

ical rollers supporting said standard upon said base, a jib, a pivot for said jib, said pivot being located at the top of said standard, a hand-sheave upon said jib, a sheave upon said jib-pivot, a flexible connection supporting at one end a load dependent from said jib, said flexible connection passing over said head-sheave and said pivot-sheave, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, a number of loops in said flexible connection passing around said axles, means for retaining the other end of said flexible connection, means for luffing said jib, and means for hoisting the load dependent from said jib.

17. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, a hydraulic cylinder, a piston and piston-rod to said hydraulic cylinder, said hydraulic cylinder and piston-rod being pivoted on said axles, and a number of loops in said flexible connection passing around said axles.

18. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, a hydraulic luffing cylinder, a piston and piston rod to said cylinder, said piston rod being pivoted on said fixed axle, a hydraulic hoisting cylinder, a ram to said hoisting cylinder, said luffing and hoisting cylinders being pivoted on said axle upon said extension, compensating sheaves carried by said ram, means for maintaining said cylinders parallel, and a number of loops in said flexible connection passing around said axles and said compensating sheaves.

19. A luffing crane comprising a jib, a pivot for said jib, a flexible connection supporting a load dependent from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, compensating sheaves upon said fixed axle, a hydraulic luffing cylinder, a piston and piston-rod to said cylinder, said piston-rod being pivoted upon said fixed axle, a hydraulic cylinder, a ram to said hoisting cylinder, said luffing and hoisting cylinders being secured together and pivoted on said axle upon said extension, compensating sheaves carried by said ram and a number of loops in said flexible connection passing around said axles and said compensating sheaves.

20. A luffing crane comprising a standard, a jib, a pivot for said jib upon said standard, a flexible connection supporting a load from said jib, an extension of said jib to rear of said pivot, an axle upon said extension, an axle upon said standard, a hydraulic



lic luffing cylinder, a piston and piston-rod to said cylinder, said piston-rod being pivoted on said axle upon said standard, a hydraulic hoisting cylinder, a ram to said hoisting cylinder, said luffing and hoisting cylinders being pivoted on said axle upon said extension, compensating sheaves carried by said ram, said axles and said compensating sheaves having their axes in the same plane, and a number of loops in said flexible connection passing around said axles and said compensating sheaves.

21. A luffing crane comprising a jib, a pivot for said jib, a load-supporting flexible connection, an extension of said jib to rear of said pivot, an axle upon said extension, a fixed axle, a hydraulic luffing cylinder, a piston and piston-rod to said cylinder, said piston-rod being pivoted on said fixed axle, a hydraulic hoisting cylinder, a ram to said hoisting cylinder, said luffing and hoisting cylinders being pivoted on said axle upon said extension, compensating sheaves carried by said ram, said axles and compensating sheaves having their axes in the same approximately vertical plane, and a number of loops in said flexible connection passing around the said axles and compensating sheaves.

22. A luffing crane comprising a jib, a pivot for said jib, a head-sheave upon said jib, a load supporting flexible connection over said head-sheave, an extension of said jib to rear of said pivot, an axle upon said extension, said pivot, head-sheave and axle having axes in approximately the same plane, a fixed axle, a hydraulic luffing cylinder, a piston and piston-rod to said cylinder, said piston-rod being pivoted on said fixed axle, a hydraulic hoisting cylinder, a ram to said hoisting cylinder, said luffing and hoisting cylinders being pivoted on said axle upon said extension, compensating sheaves carried by said ram, said axles and compensating sheaves having their axes in the same plane, and a number of loops in said flexible connection passing around the said axles and compensating sheaves.

23. A luffing crane comprising a jib, a pivot for said jib, a head-sheave upon said jib, a load-supporting flexible connection over said head-sheave, an extension of said

jib to rear of said pivot, an axle upon said extension, said pivot, head-sheave and axle having axes in approximately the same plane, a fixed axle, a hydraulic luffing cylinder, a piston and piston-rod to said cylinder, said piston-rod being pivoted on said fixed axle, a hydraulic hoisting cylinder, a ram to said hoisting cylinder, said luffing and hoisting cylinders being pivoted on said axle upon said extension, compensating sheaves carried by said ram, the said axles and compensating sheaves having their axes in the same approximately vertical plane, and a number of loops in said flexible connection passing around the said axles and compensating sheaves.

24. A luffing crane comprising a base, a standard revoluble upon said base, a central guide for said standard upon said base, conical rollers supporting said standard upon said base, a jib, a pivot for said jib, said pivot being located at the top of said standard, a head-sheave upon said jib, a sheave upon said jib-pivot, a flexible connection supporting at one end a load dependent from said jib, said flexible connection passing over said head-sheave and said pivot-sheave, an extension of said jib to rear of said pivot, an axle upon said extension, said pivot, head-sheave and axle having axes in approximately the same plane, an axle upon said standard, a hydraulic luffing cylinder, a piston and piston-rod to said cylinder, said piston-rod being pivoted on said axle upon said standard, a hydraulic hoisting cylinder, a ram to said hoisting cylinder, said luffing and hoisting cylinders being secured together and pivoted on said axle upon said extension, compensating sheaves carried by said ram, the said axles and compensating sheaves having their axes in the same approximately vertical plane, and a number of loops in said flexible connection passing around the said axles and compensating sheaves.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT CAREY.

Witnesses:

VICTOR F. FEENY,  
CYRIL J. FEENY.