

(No Model.)

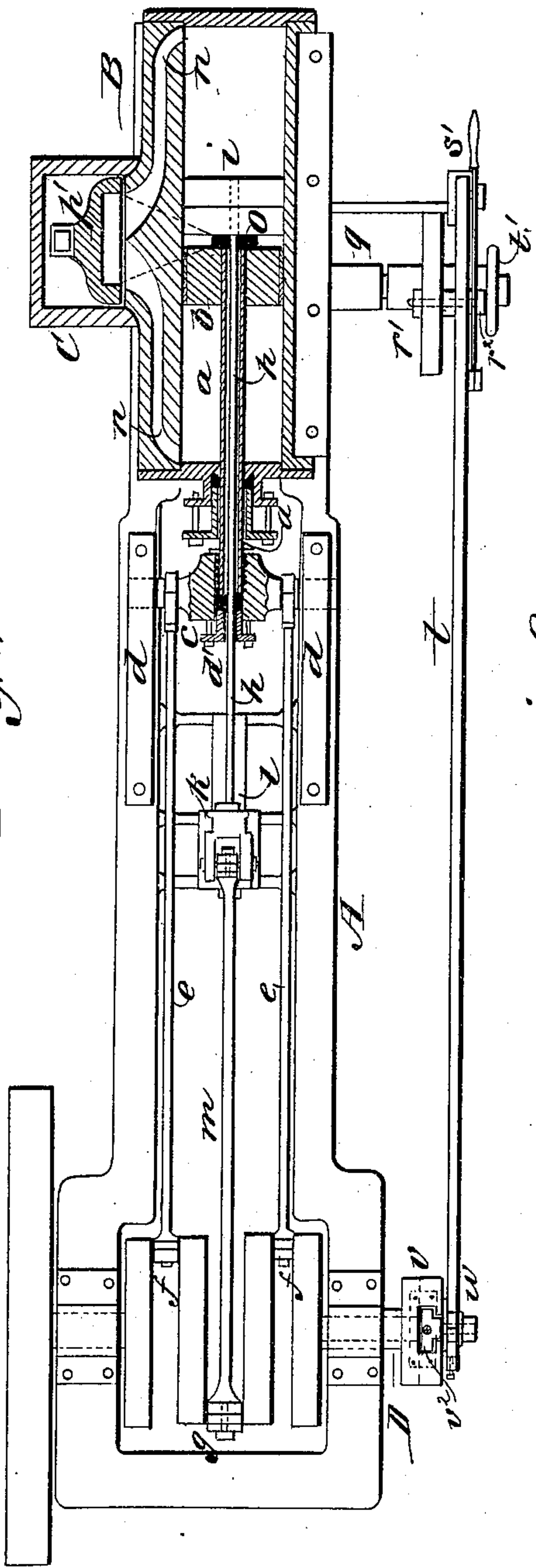
2 Sheets—Sheet 1.

B. C. WAITE.  
STEAM ENGINE.

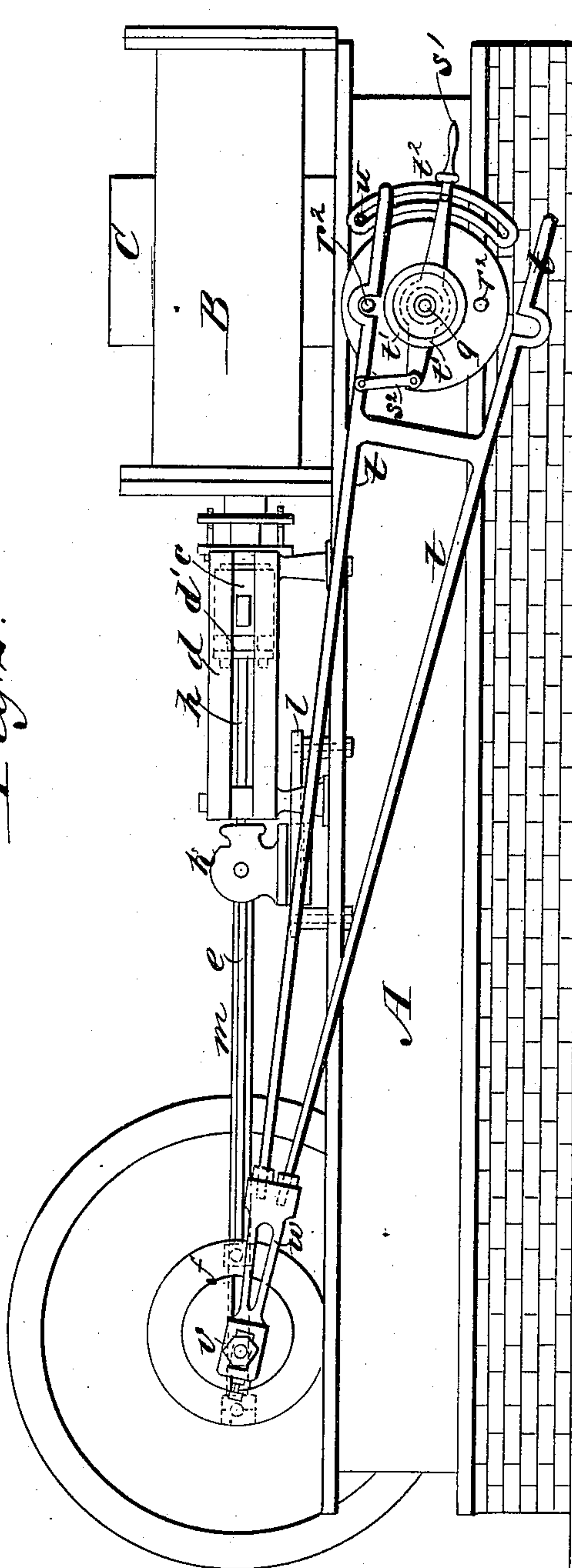
No. 322,999.

Patented July 28, 1885.

*Fig. 1.*



*Fig. 2.*



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ATTORNEYS.

(No Model.)

2 Sheets—Sheet 2.

B. C. WAITE.

STEAM ENGINE.

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Fig. 6

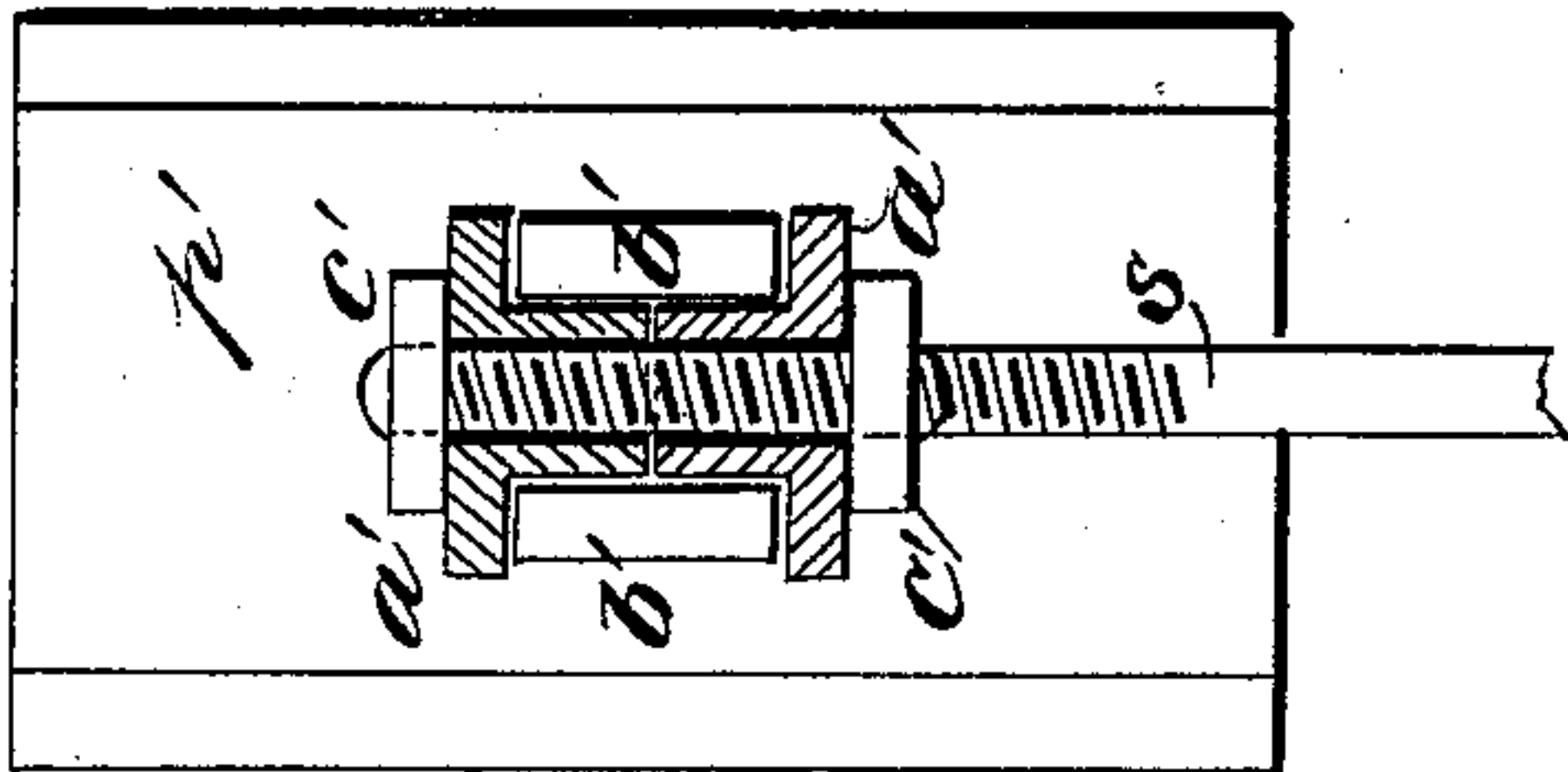


Fig. 5.

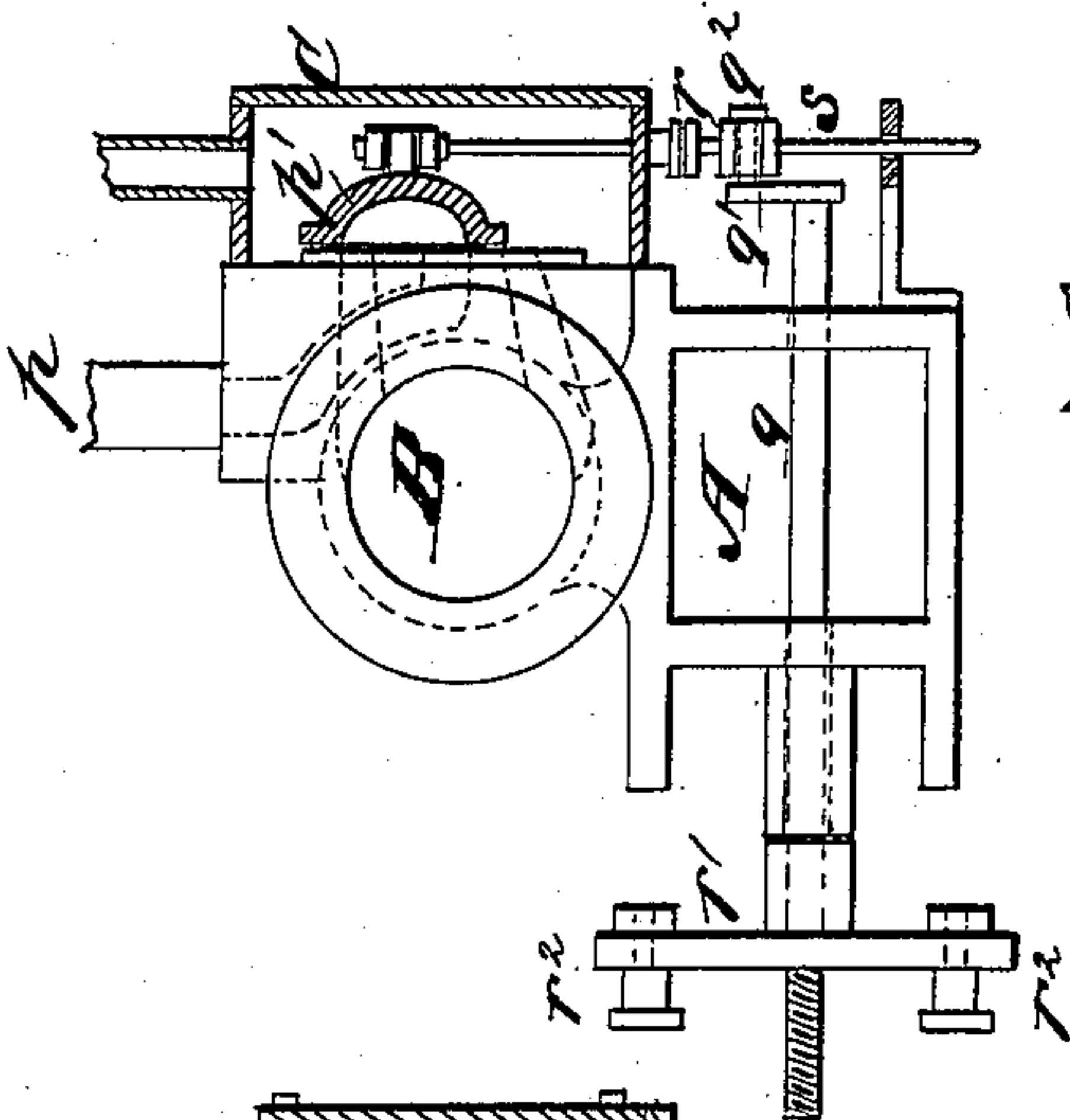


Fig. 3

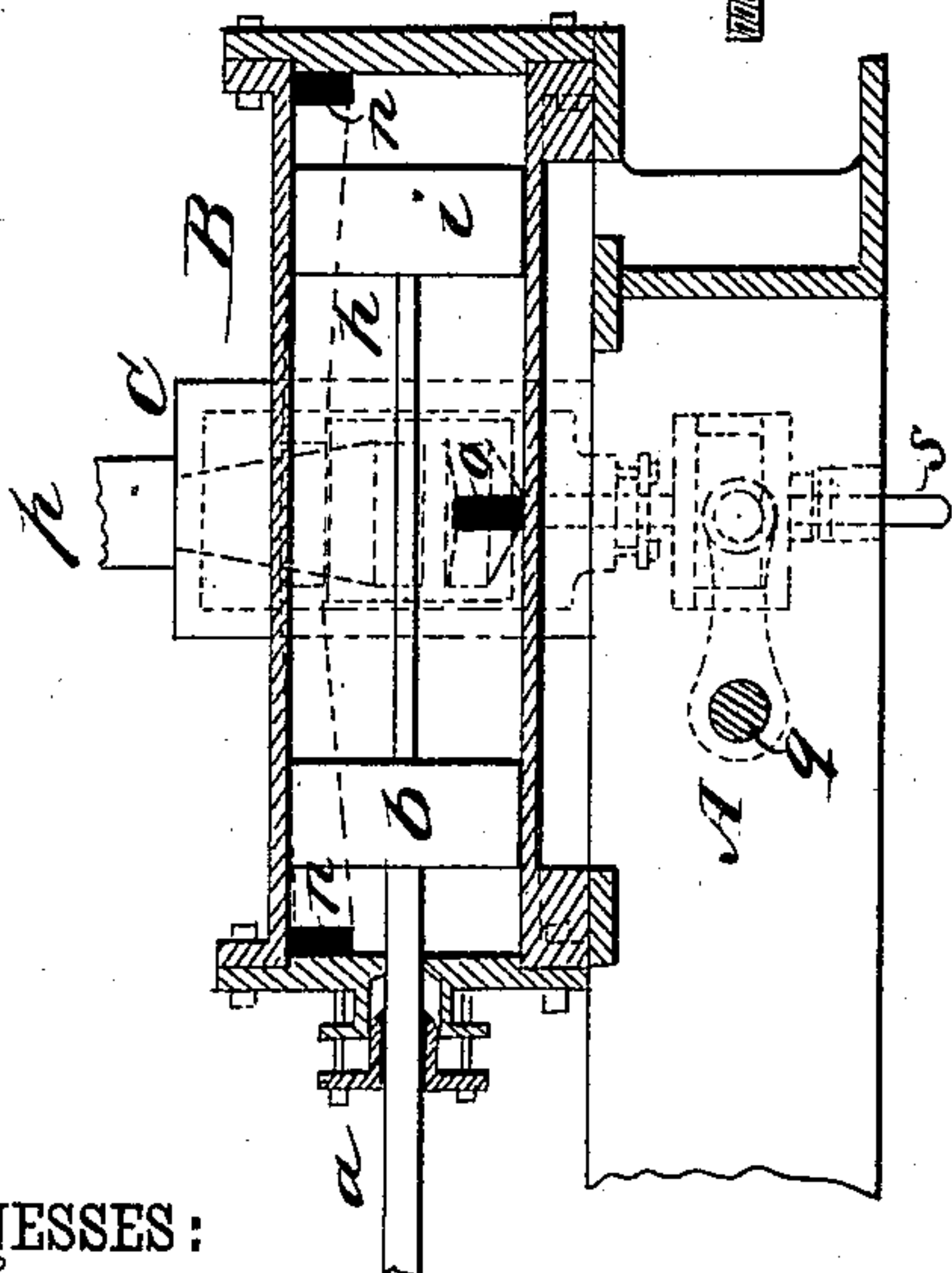


Fig. 4

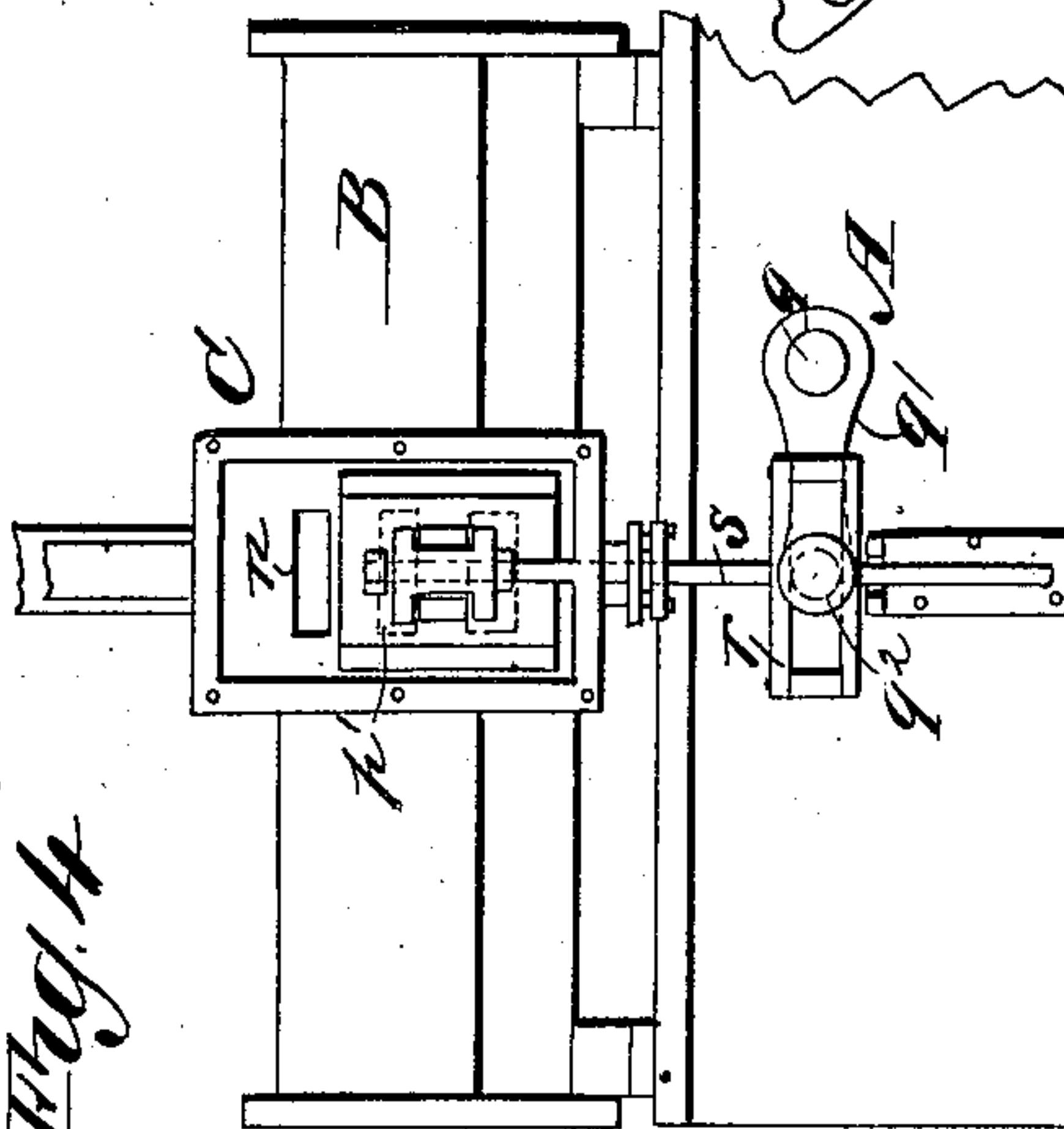


Fig. 7

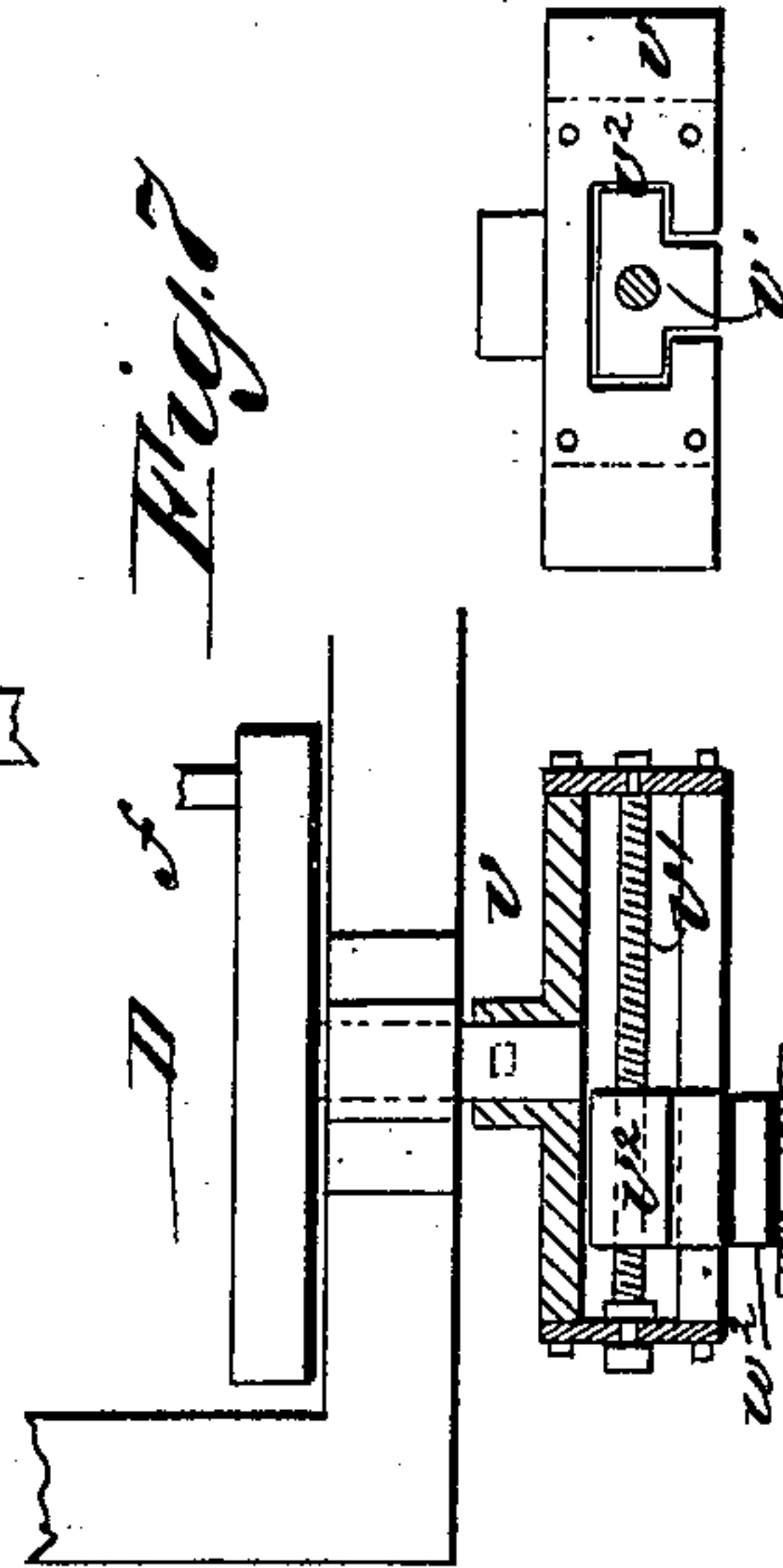


Fig. 8

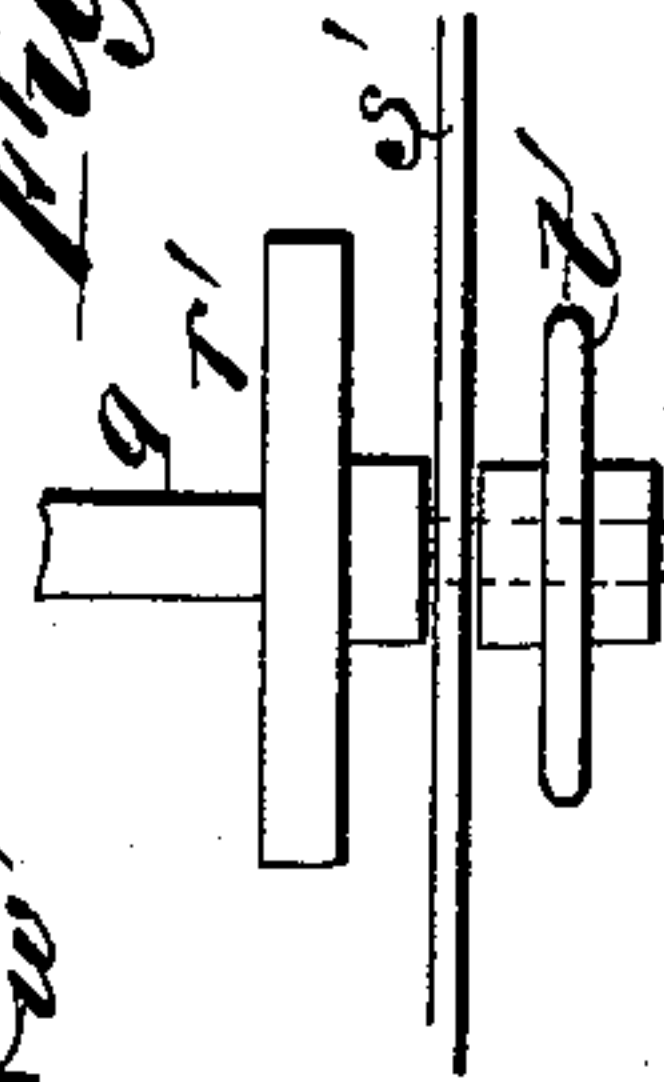
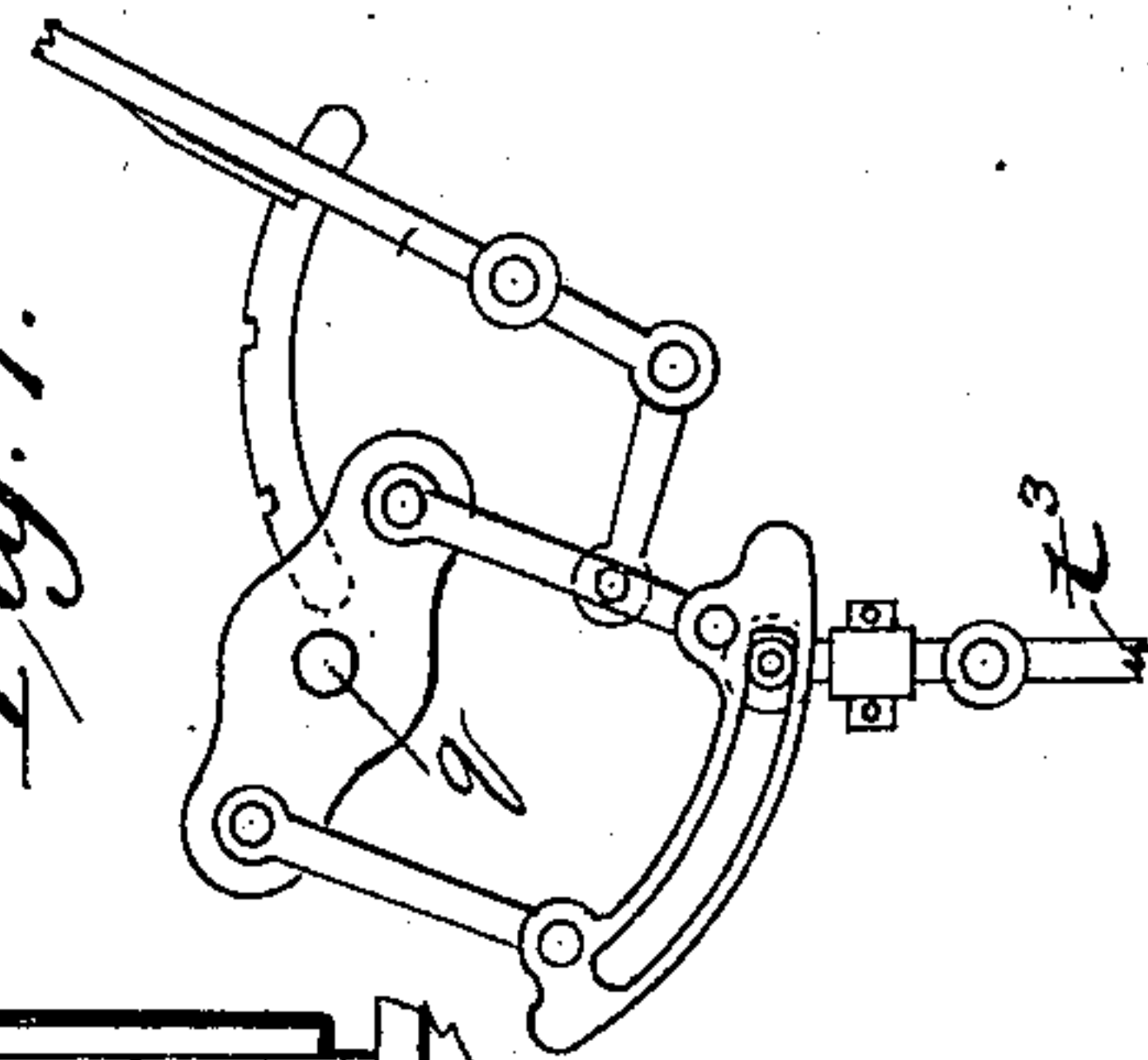


Fig. 9.



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# UNITED STATES PATENT OFFICE.

BENJAMIN C. WAITE, OF BROOKLYN, NEW YORK.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 322,999, dated July 28, 1885.

Application filed June 23, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, BENJAMIN C. WAITE, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful  
5 Improvement in Steam-Engines, of which the following is a full, clear, and exact description.

My improvements relate to the employment in steam-engines of two pistons in one cylinder, the movement of the pistons to be in opposite directions, and both connected to the same crank-shaft.

The invention consists in certain features of construction and arrangement having the object to obtain simplicity and durability of construction and economical operation of that  
15 type of engine whether the power in use is the full or only the partial capacity of the engine, all as hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional plan view of an engine of the improved construction. Fig. 2 is a side elevation of the same. Fig. 3 is a longitudinal section of the cylinder in a plane at right angles to Fig. 1. Fig. 4 is a side view of the cylinder in reverse of Fig. 2 and with the steam-chest cover removed. Fig. 5 is an end view of the cylinder with the head removed and steam-chest in section. Figs. 6, 7, and 8 are detail views. Fig. 9 is a side elevation of the ordinary link-motion.

The engine shown is horizontal. A is the bed-plate; B, the cylinder; C, the steam-chest at one side of the cylinder; and D, the shaft, provided with three cranks, *f f g*, two being at one side, and the third crank, *g*, diametrically opposite and between the other two.  
40

The piston-rod *a*, carrying one head, *b*, is tubular, and is attached rigidly to a cross-head, *c*, that is fitted to move on slideways *d*. From the cross-head *c* rods *e e* pass to the cranks *f f*. The piston-rod *h*, connected to head *i*, passes through the rod *a* and cross-head *c*, and is connected to a cross-head, *k*, on slideways *l*, and a rod, *m*, connects head *k* with crank *g*. The cross-head *c* is provided with a stuffing-box, *d'*, around rod *h*.  
50

The cylinder is formed with steam-passages

*n n* from its ends, uniting at a common opening in the valve-seat. There is also a steam-passage, *o*, from the mid-length of the cylinder-opening to a separate part in the valve-seat, and between these two steam-ports there is an exhaust-port in the seat connecting to the exhaust-pipe *p*. The valve *p'* is of **D** form, and has a transverse movement in relation to the cylinder for connecting either steam-passage with the exhaust. 60

For operating the valve and reversing the movement the following mechanism is employed: *q* is a rock-shaft fitted transversely of the bed-plate and beneath the cylinder. On one end of this shaft is an arm, *q'*, (see Fig. 4,) having a crank-pin, *q''*, that takes the slot of a T-piece, *r*, on the valve-rod *s*, the piece *r* being adjustable for setting the valve. On the other end of shaft *q* is a disk, *r'*, provided with crank-pins *r''* at opposite sides. *t t* are rods connected together, having hooked ends for engaging pins *r''*. *t'* is a nut and hand-wheel on shaft *q*. *s'* is a lever that connects by a link, *s''*, with one rod *t*, and the longer arm of the lever has a bolt at *t''* entering a slot in a fixed segment, *u*, so that the lever can be secured by a nut on the bolt *t''*. 70

The lever *s'*, as shown in Fig. 8, lies between the hand-wheel *t'* and hub of disk *r'*, so as to be clamped by the hand-wheel when the rod *t* engages the upper pin *r''*. When the engine is reversed and rod *t* engages the lower pin, the lever is to be locked to the segment *u*. The rods *t* may be operated by an ordinary eccentric on the shaft; but I prefer the device shown. 85

On the engine-shaft D is a straight-grooved disk, *v*, (shown most clearly in Fig. 7,) having lengthwise of the groove a screw, *v'*, carrying a nut, *v''*, that is formed with a crank-pin receiving the head-piece *w*, to which the two rods *t* are connected. The piece *w* has a slot receiving a collar on the crank-pin, and on the pins are washers *w''*, at opposite sides of piece *w*, while a nut, *w'*, on the end of the pin clamps the inner collar to the disk *v*, thereby holding the parts firmly together. This construction allows adjustment to regulate the length of movements of the valve, and by shifting the rods *t* so as to release one and engage the other with disk *v'* the movement of the valve is reversed. 95 100



As shown most clearly in Fig. 6, the rod *s* is connected to valve *p* by means of flanged collars *a'* engaging lugs *b'* on the valve. The collars *a'* are held on the rod by nuts *c'*, which  
 5 allow their adjustment; and in case of wear the outer collar can be taken off, filed down, to bring the flanges nearer together, and then replaced and screwed up to the lugs.

In the operation of the engine steam entering between the two piston-heads by the passage *o* forces them apart and to the opposite ends of the cylinder, and they are again forced to the middle position by the steam entering by passages *n*. Each piston thus has a stroke  
 10 half the length of the cylinder, and the momentum of their movement is balanced by their motion in reverse of each other. The strain is also balanced by the reverse cranks on the shaft, so that the engine runs without  
 15 jar or tendency to oscillate.

When the full capacity of the engine is not required, one cross-head may be made fast with the piston-head at the center of the cylinder and the shaft driven by the movement  
 20 of the other head alone, thereby obtaining full power from a small amount of steam.

The details of construction specified may be varied within the scope of my invention. In

place of the reversing mechanism shown, the ordinary link-motion may be used with a  
 30 single eccentric-rod, *t*<sup>3</sup>, as shown in Fig. 9.

By passing one piston-rod through the other, only one additional stuffing-box is needed, and that being on the cross-head is readily accessible.  
 35

The slide-valve and valve-gear herein shown and described forms no part of the present invention, but I reserve to myself the right to make a separate application therefor at some  
 40 future time.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent—

1. In a steam-engine, the combination of cylinder *B*, having steam-passages *n o*, heads  
 45 *b i*, piston-rods *a h*, stuffing-box *d'*, and cross-heads *c k*, substantially as shown and described.

2. The combination of valve *p'*, fitted for movement transversely of the cylinder, with a cylinder formed with steam-passages *n n o*  
 50 and intermediate exhaust-port, and the two pistons *b i*, substantially as described.

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Witnesses:

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