

(No Model.)

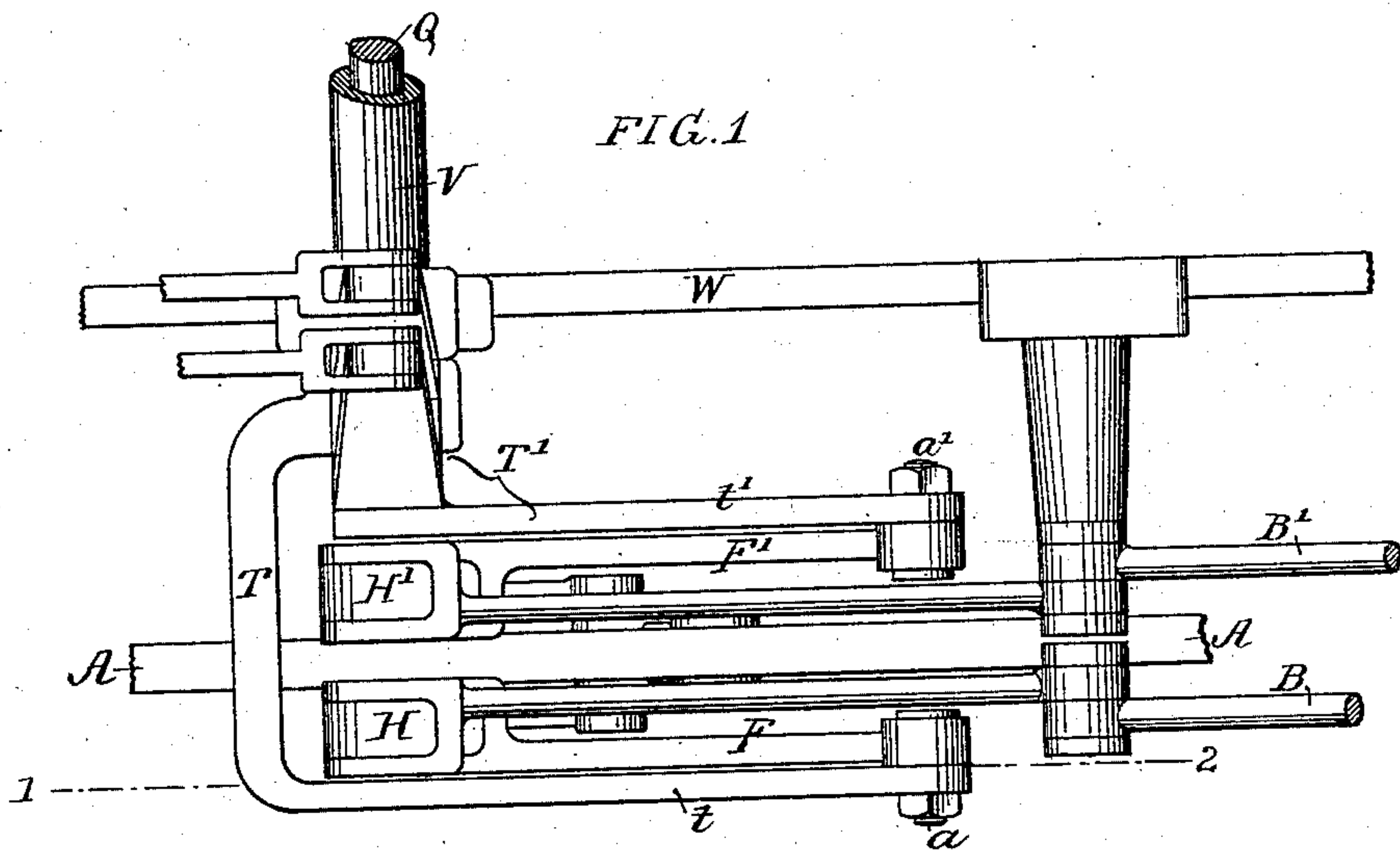
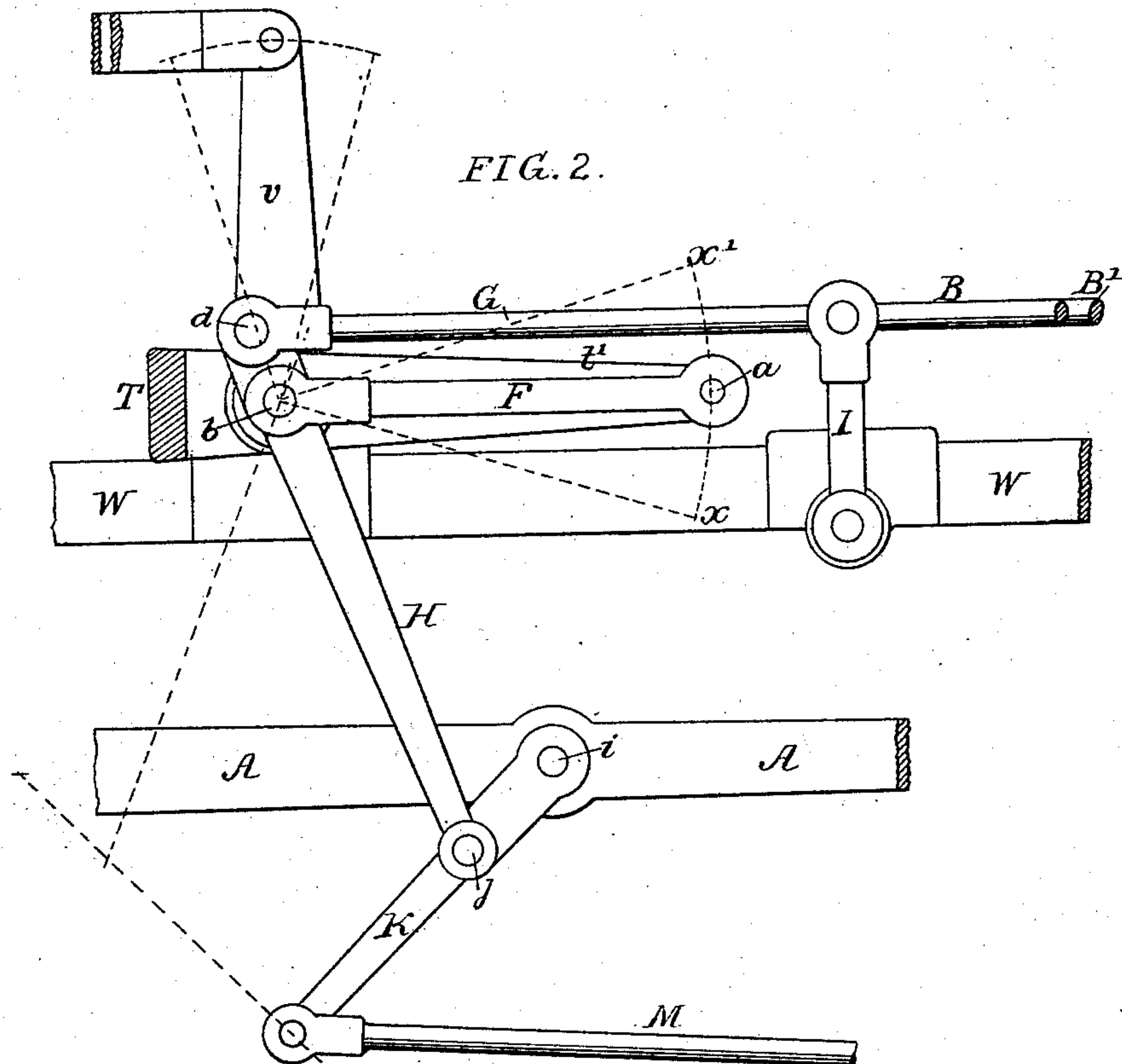
4 Sheets—Sheet 1.

G. S. STRONG.

VALVE GEAR FOR STEAM ENGINES.

No. 304,972.

Patented Sept. 9, 1884.



WITNESSES:

John & Parker
James F. Tobin

INVENTOR:

George S. Strong
by his Attys
Howson and Sons

(No Model.)

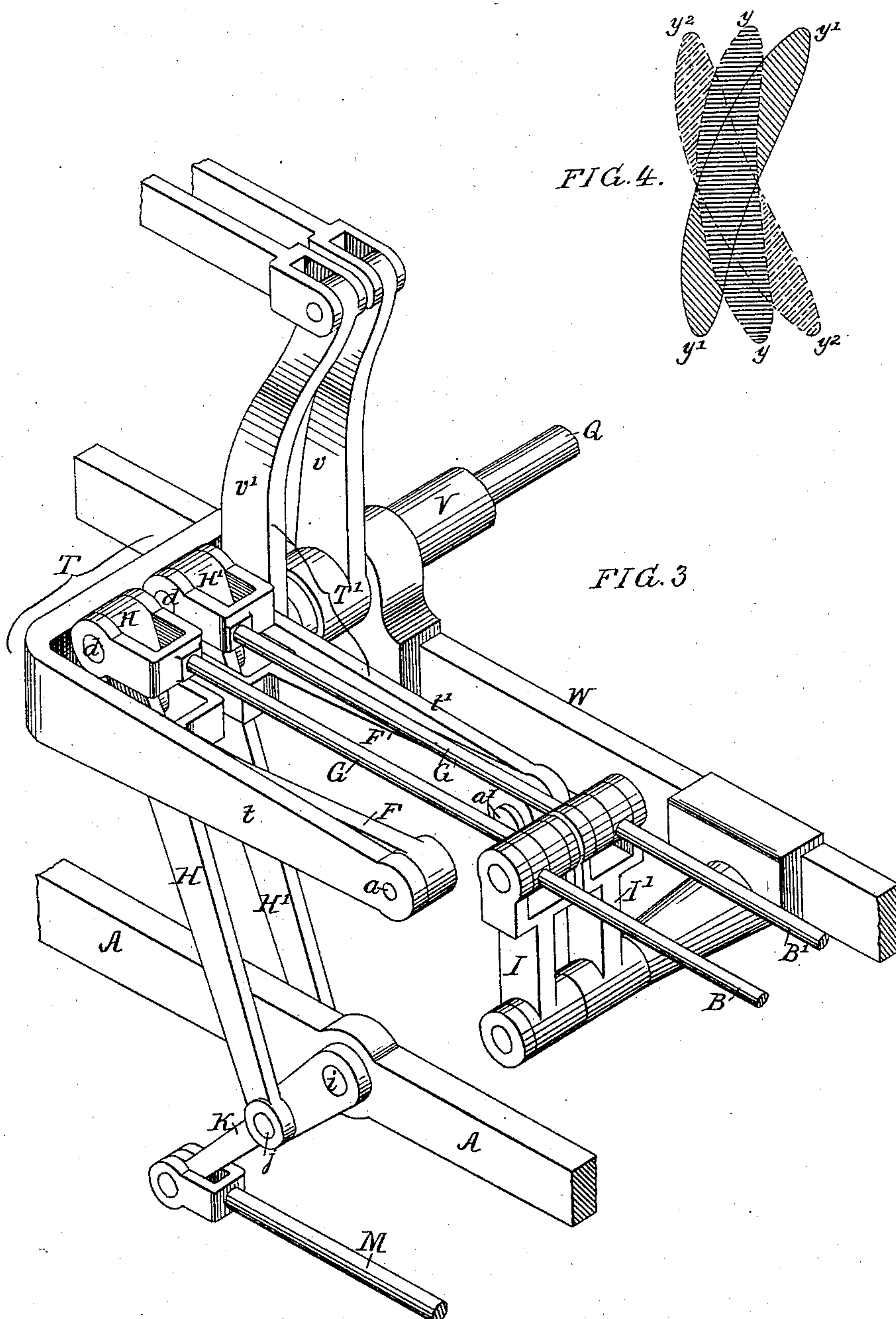
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G. S. STRONG.

VALVE GEAR FOR STEAM ENGINES.

No. 304,972.

Patented Sept. 9, 1884.



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(No Model.)

4 Sheets—Sheet 3.

G. S. STRONG.

VALVE GEAR FOR STEAM ENGINES.

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Patented Sept. 9, 1884.

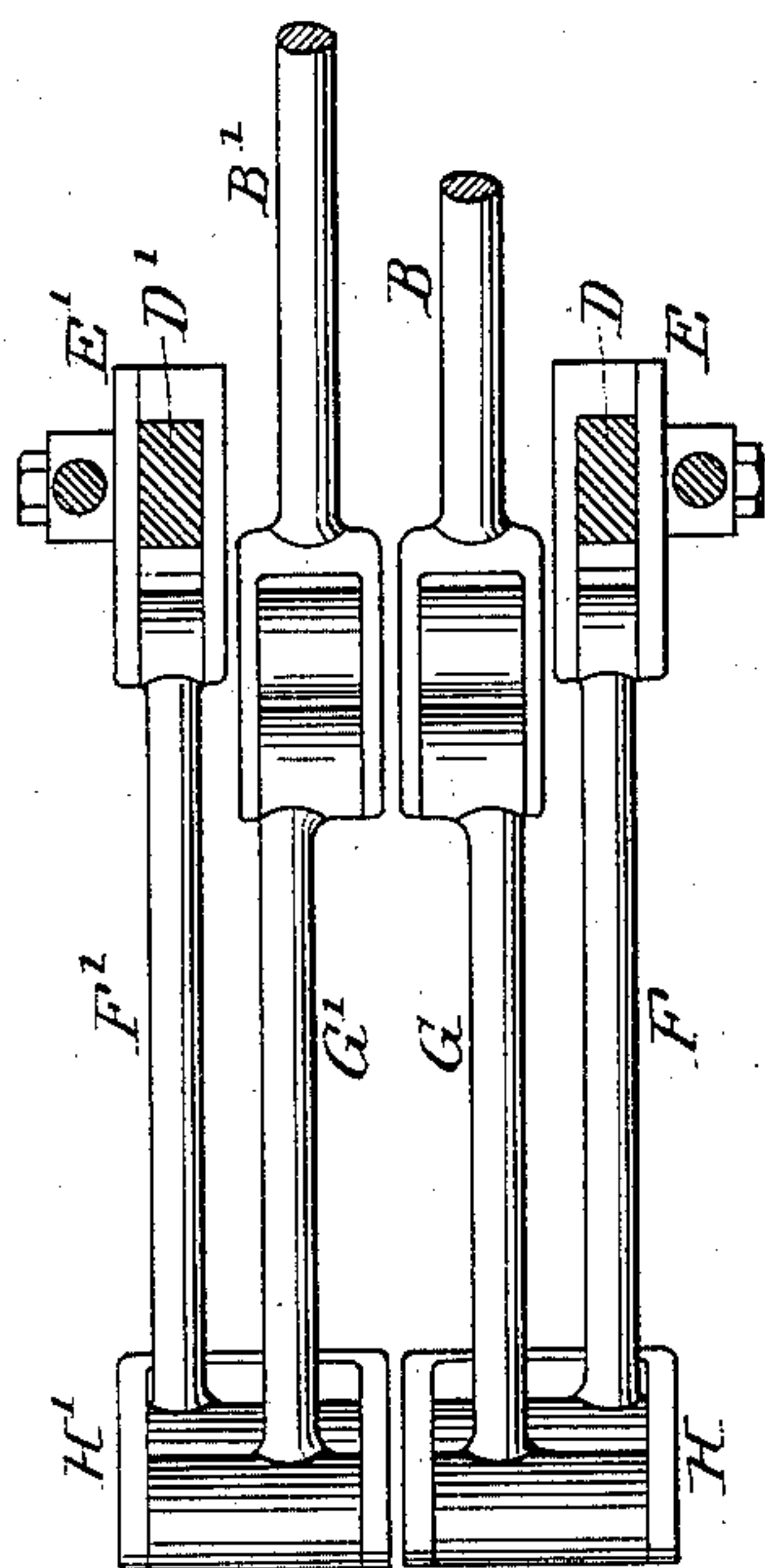


FIG. 6.

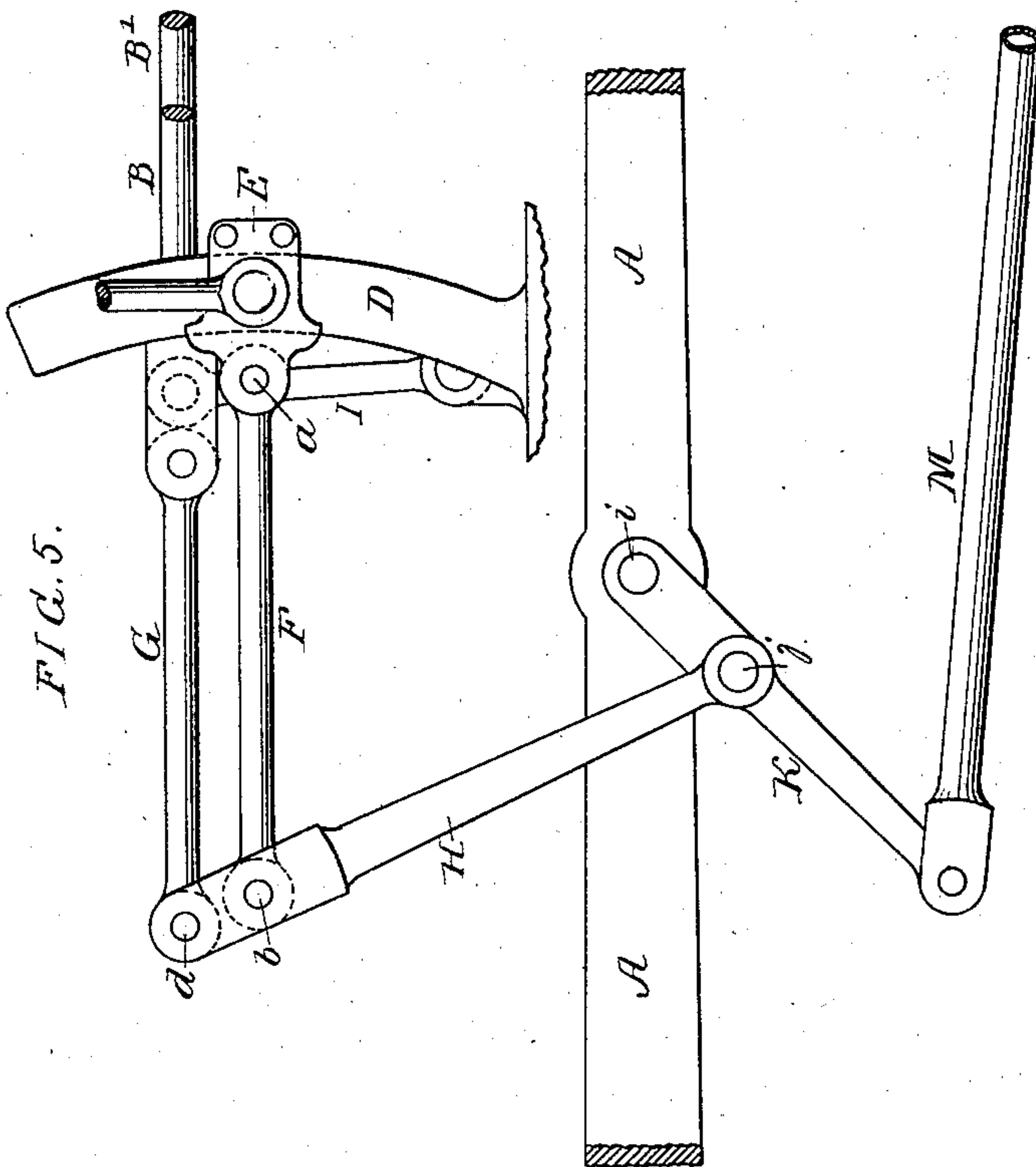


FIG. 5.

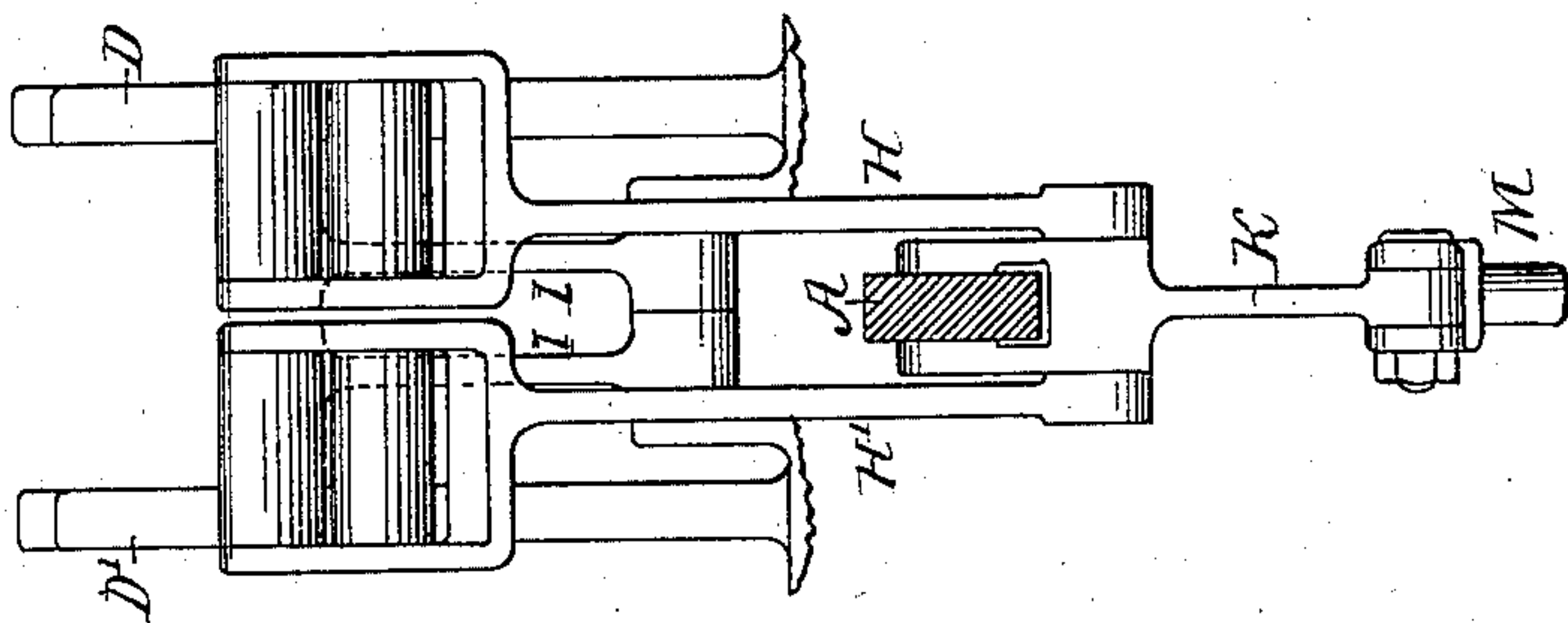


FIG. 7.

WITNESSES:

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(No Model.)

4 Sheets—Sheet 4.

G. S. STRONG.

VALVE GEAR FOR STEAM ENGINES.

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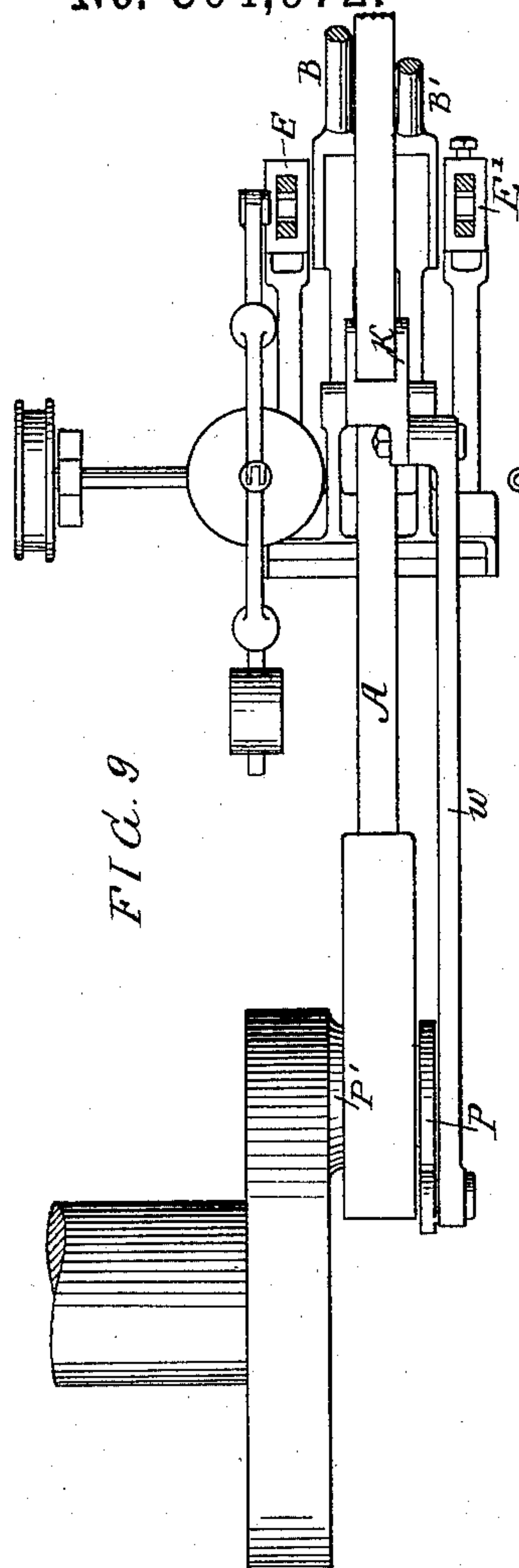


FIG. 9.

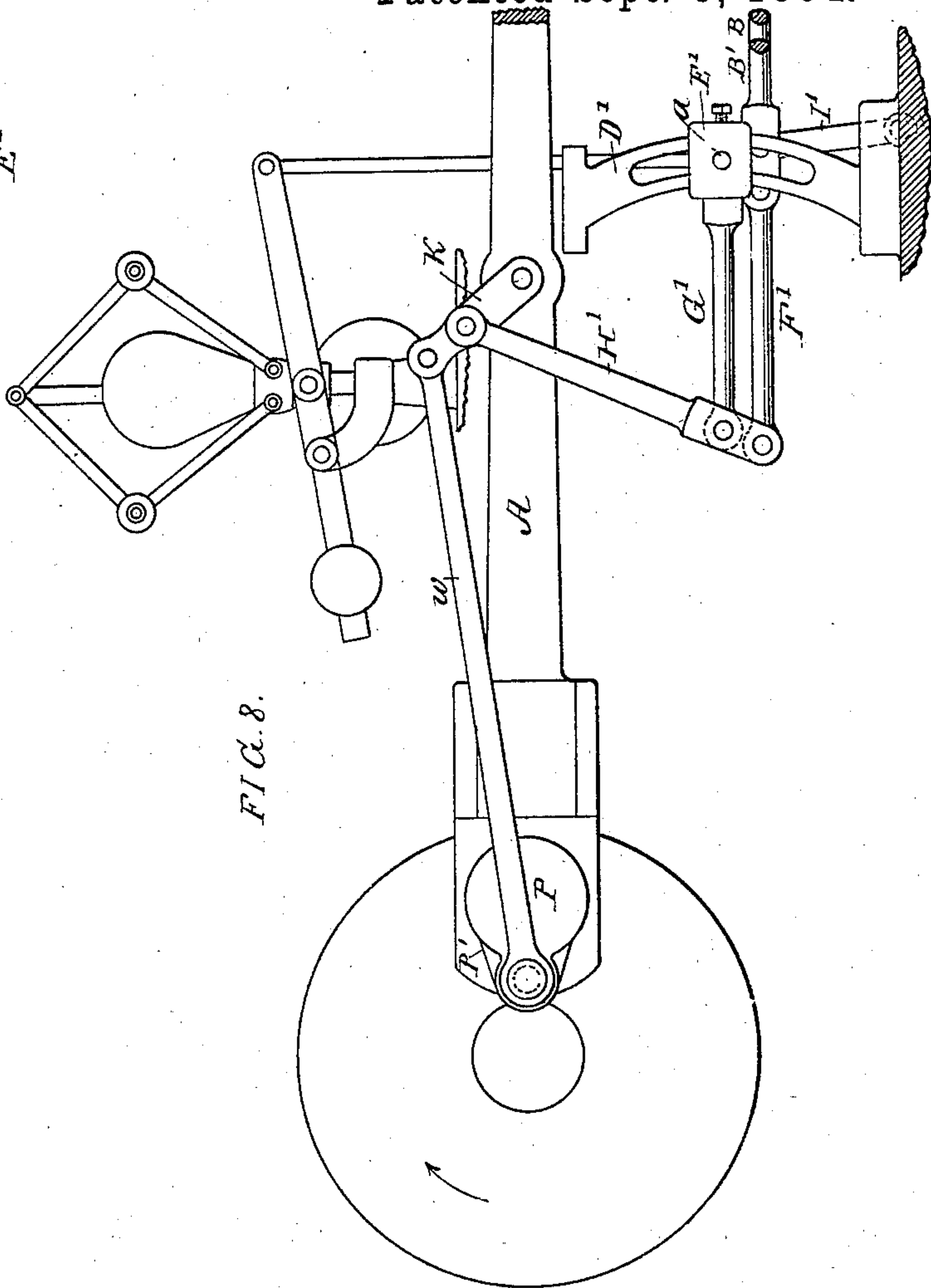


FIG. 8.

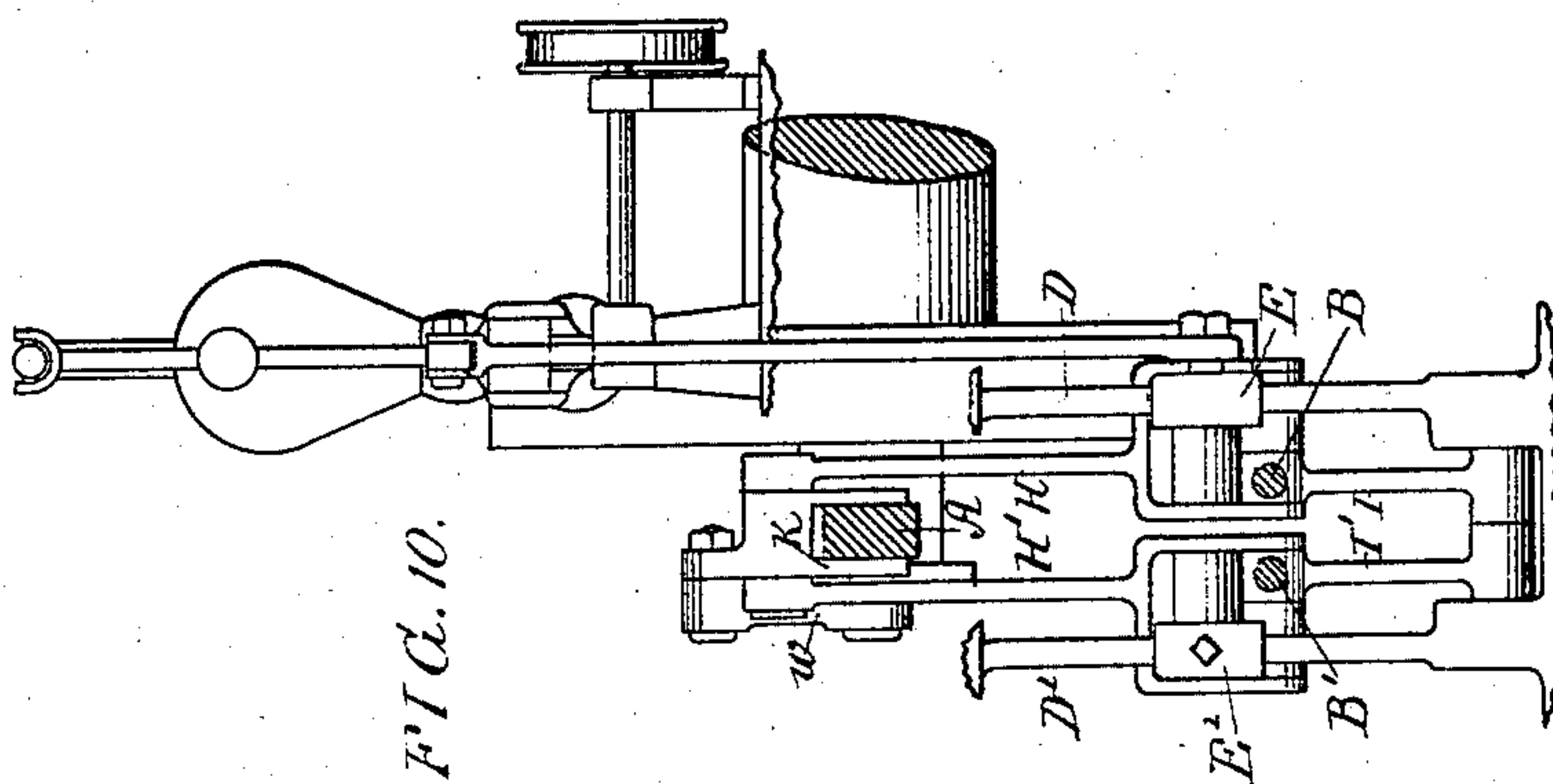


FIG. 10.

Witnesses
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Inventor
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UNITED STATES PATENT OFFICE.

GEORGE S. STRONG, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO
JOHN T. MORRIS, TRUSTEE, OF SAME PLACE.

VALVE-GEAR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 304,972, dated September 9, 1884.

Application filed January 21, 1884. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. STRONG, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Valve-Gear for Steam-Engines, of which the following is a specification.

The valve-gear which forms the subject of this application is based on that described in another application, marked A, filed January 19, 1884, Serial No. 118,025, my present invention, which is fully described hereinafter, and which I term a "duplex valve-gear," being intended for that class of steam-engines in which the steam valve or valves and exhaust valve or valves are separate and have independent movements, the gear in the application A being intended for a valve which is common to both steam and exhaust.

In the accompanying drawings, Figure 1, Sheet 1, is a plan view of the duplex valve-gear; Fig. 2, a vertical section of Fig. 1 on the line 1 2; Fig. 3, Sheet 2, a perspective view of the valve-gear; Fig. 4, a diagram illustrating the operation of part of the valve-gear; Figs. 5, 6, and 7, Sheet 3, views showing a modification of my invention; and Figs. 8, 9, and 10, Sheet 4, views representing another modification of the invention.

Referring to Figs. 1, 2, 3, and 4, A represents part of the connecting-rod of a steam-engine, and B and B' the two valve-rods, the former appertaining to the steam-valve, and the latter to the exhaust-valve, W being part of the fixed frame of the engine. An arm, K, is connected by a pin, *i*, to the rod A, the outer end of the arm being connected by a rod, M, to a fixed pin on any available part of the engine-frame. The lower ends of two levers, H H', are connected by pins *j* to the arm K, and the upper end of the lever H is connected by a pin, *d*, to one end of a rod, G, the opposite end of which is connected to the rod B of the steam-valve and to a rocking link, I, the lower end of which is hinged to any available fixed part of the engine-frame, and the object of which is to support the end of the rod G and that of the steam-valve rod B. In like manner the rod B' of the exhaust-valve is connected to a rocking link, I', and

to a rod, G', which is connected by a pin, *d*, to the arm H'. The fulcrum-pin *b* of the lever H is connected, by a rod, F, and pin *a*, to the outer end of the bent arm *t* of a lever, T, secured to a tubular rock-shaft, V, adapted to suitable bearings on the engine-frame, and the other arm, *v*, of this lever is connected by suitable appliances to the stopping, starting, and reversing mechanism appertaining to the steam-valve, the character of this mechanism depending upon the style of engine to which my improved valve-gear is applied. A shaft, Q, passes through the tubular shaft V, and carries a lever, T', one arm, *t'*, of which carries at its outer end a pin, *a'*, which is connected by a rod, F', to the fulcrum-pin *b* of the lever H'.

The parts composing the exhaust-valve gear are essentially the same as those composing the steam-valve gear, and both are actuated from the connecting-rod through the medium of the arm K, controlled by the rod M. Precisely similar and simultaneous compound movements are imparted to the levers H H'; but the movements of the steam and exhaust valves derived from these levers are rendered independent of each other, as I will now proceed to describe.

Referring in the first instance to the gear for the steam-valve, the center of the pin *d* will, when the engine is in motion and the pin *a* is in the position shown in Fig. 2—that is, at mid-gear—traverse in a course indicated by the margin of the darkest figure *y y* in the diagram Fig. 4. The cause of this is so fully set forth in my said application for a patent marked A that an explanation here will be unnecessary. There will be no motion of the steam-valve when the pin *a* is in the position shown in Fig. 2 other than the movement appertaining to the lap, lead, and cut-off; but when the pin *a* has, by operating the lever T, been moved in the arc of a circle to the point *x*, Fig. 2, the center of the fulcrum-pin *d* will take a course indicated by the margin of the figure *y'* in the diagram, when the valve will have its full throw in addition to the movement appertaining to the lap and lead and cut-off. If the pin *a* be moved to the point *x'*, the course pursued

by the pin d will be that indicated by the margin of the figure $y^2 y^2$ in the diagram, and the motion of the engine will be reversed. The results are precisely the same as those attained by the valve-motion described in the aforesaid application, the only difference in the mechanism being this, that in the present case the pin a is made adjustable in the arc of a circle by means of the rod F and lever T , instead of being on a block carrying the pin and made adjustable on a fixed segment, as in modifications explained hereinafter. The valve-gear described in my said application, however, was intended for a single valve common to both steam and exhaust; but the duplex gear in the present case is intended for that class of engines in which there are steam and exhaust valves operating independently of each other. Hence the pin a of the steam-valve gear is adjustable in the arc of a circle independently of the pin a' of the exhaust-valve gear.

In the modification shown in Figs. 5, 6, and 7 there is the same arm K , to which the required compound motion is imparted, and two valve-rods, $B B'$ —one for the steam and the other for the exhaust valve—each rod deriving its movement from the arm, but through the medium of separate and independent but similar mechanism. There are in this case two fixed segments, $D D'$ —the former for the steam-valve gear and the latter for the exhaust-valve gear—a block, E , being fitted to, but so as to be moved freely on, each segment, and each block carrying a controlling-pin, a , which in this case is adjustable in the arc of a circle by means of the segment instead of by levers, as described in referring to Figs. 1, 2, and 3. The blocks may be connected to any hand gear mechanism which will permit the adjustment of the controlling-pin of one motion independently of that of the other motion.

In Figs. 8, 9, and 10 I have shown a stationary engine in which the same system of duplex valve-gear is used, each controlling-pin a being in this instance carried by a block adapted to a fixed segment—one for the steam-valve and the other for the exhaust-valve; but the block E' of the exhaust-valve gear is provided with a set-screw or other equivalent attachment, by which it can be secured to its segment in any position which may be required, while the block E of the other segment, D , appertaining to the steam-valve motion, is connected to a

governor in a manner which will be at once understood by those skilled in the art without explanation. In this case the duplex valve-gear is in a position the reverse of that shown in the other views, and the desired compound motion is imparted to the lever H from the connecting-rod by mechanism differing from that described above, the levers $H H'$ being connected to an arm, K , pivoted to the connecting-rod A , and this arm being connected by a rod, w , to the pin of the return-crank P on the crank-pin P' —a device for which I have made a separate application for a patent, filed June 16, 1884, Serial No. 134,985.

It should be understood that I do not restrict myself to any specific device for imparting the within-described compound movement to the lever H , for, as explained in my said application marked A , where the character of the movement is fully described, different devices may be used for imparting that movement.

Different styles of valves may also be used in connection with the duplex valve-gear.

I claim as my invention—

1. A duplex valve-gear in which the following elements are combined, namely: first, two levers, $H H'$, and mechanism for imparting a compound motion to the same; second, two valve-spindles—one for the steam-valve and the other for the exhaust-valve—one spindle being connected to one lever and the other to the other lever; third, two pins, $a a'$, and mechanism for adjusting each in the arc of a circle independently of the other; and, fourth, a rod, G , for connecting one pin, a , to one lever, and another rod for connecting the other pin, a' , to the other lever, all substantially as set forth.

2. The combination of the levers $H H'$, one connected to the steam-valve spindle and the other to the exhaust-valve spindle, the tubular shaft V , carrying a lever, T , the bent arm t of which is connected by a rod to the lever H , and the shaft Q , carrying a lever, T' , one arm of which is connected by a rod to the lever H' , all substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEO. S. STRONG.

Witnesses:

JOHN E. PARKER,
HARRY SMITH.