

(No Model.)

2 Sheets—Sheet 1.

F. M. STEVENS.

VALVE MECHANISM FOR LOCOMOTIVES.

No. 246,236.

Patented Aug. 23, 1881.

Fig:1.

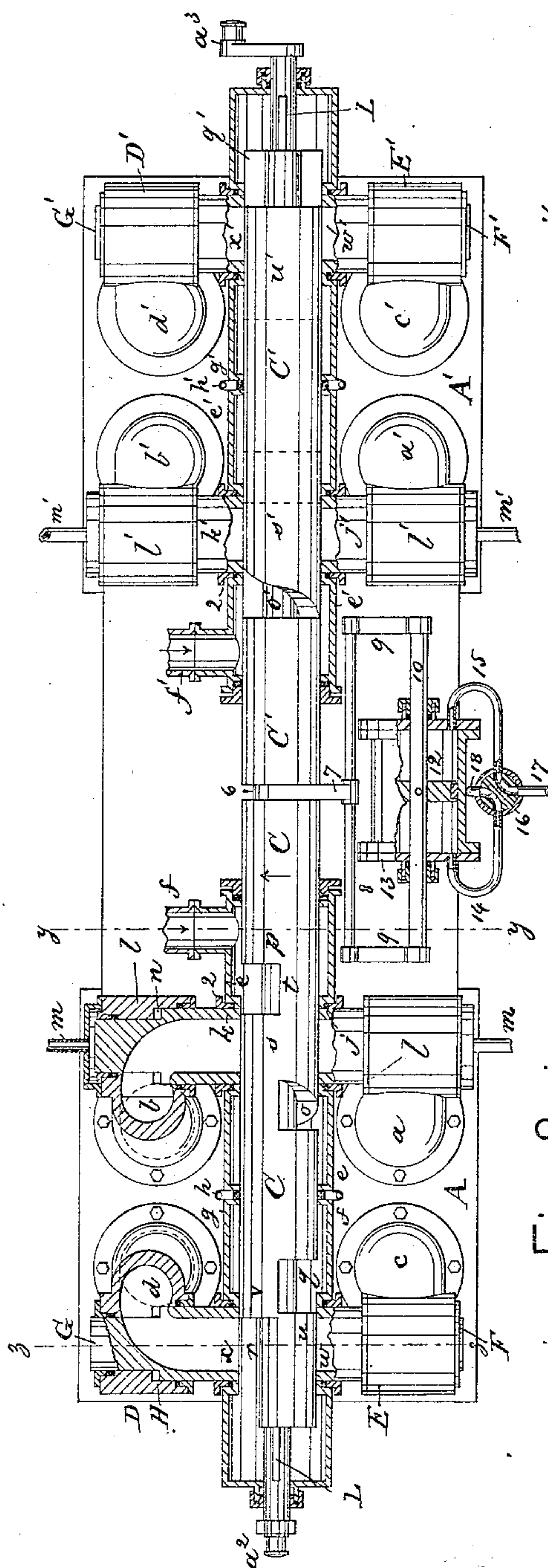
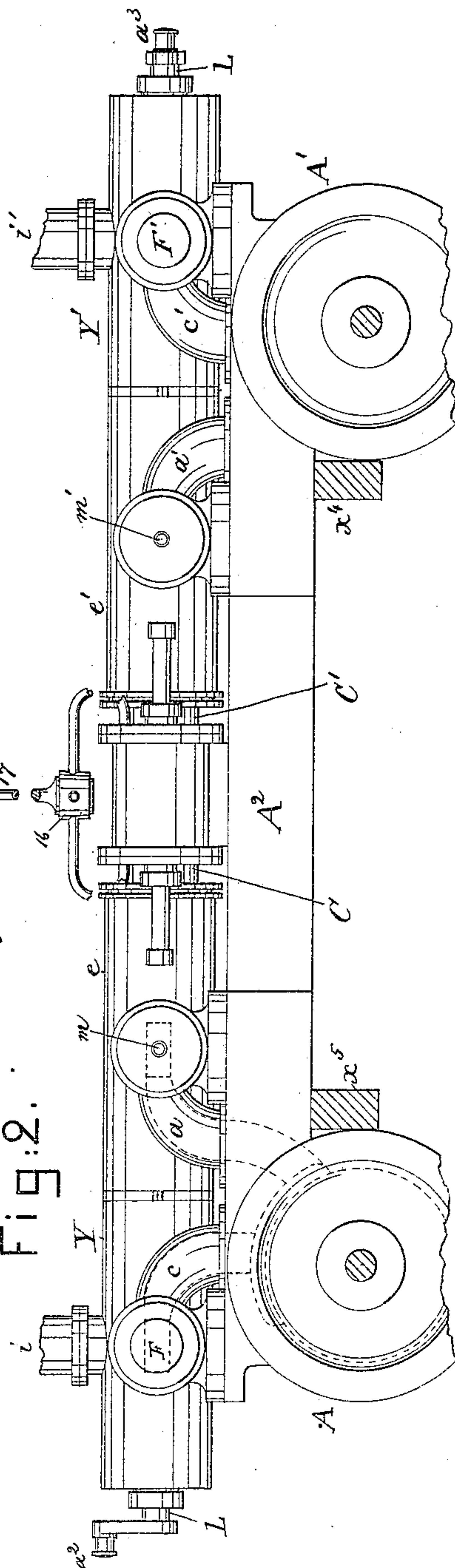


Fig:2.



Witnesses.
Arthur Reynolds
L. F. Connor.

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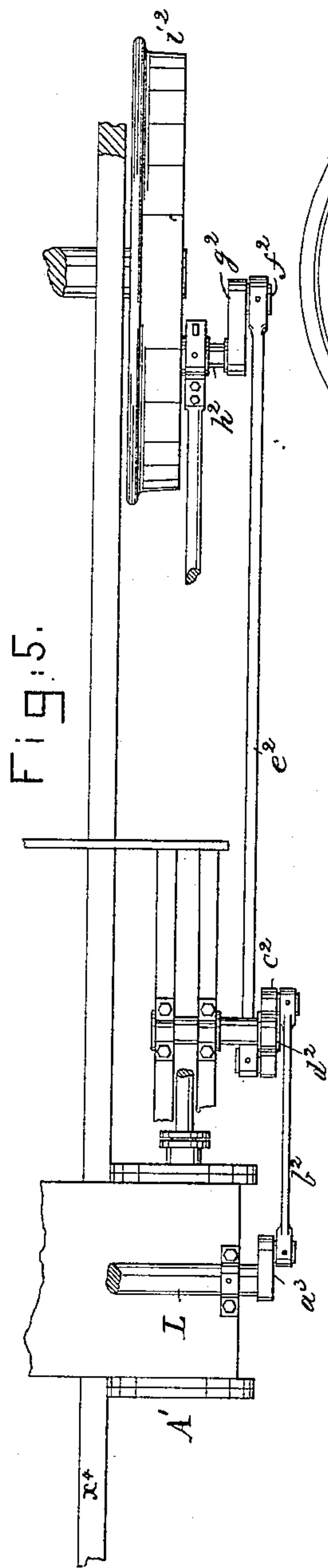


Fig: 5.

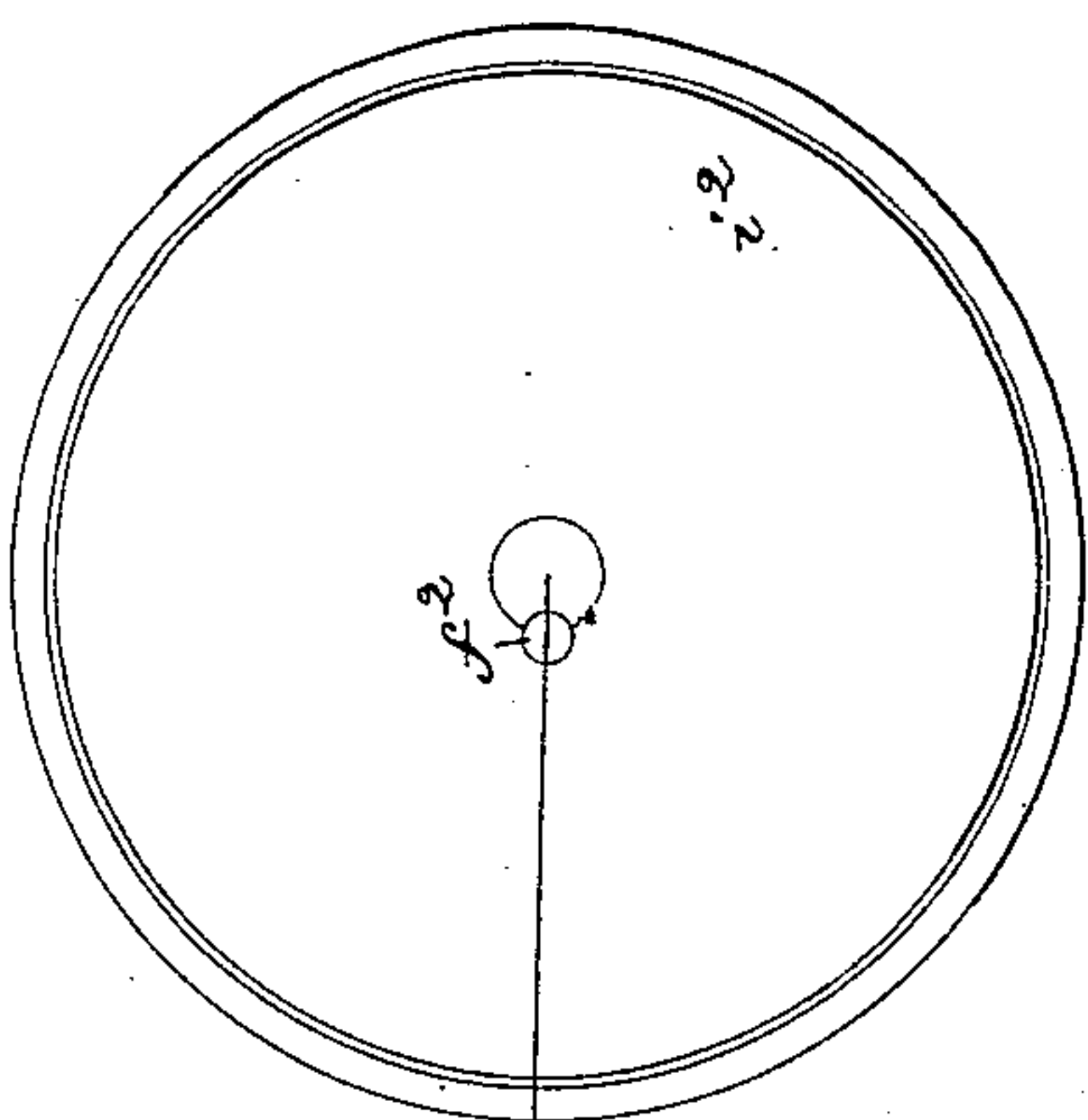


Fig: 6.

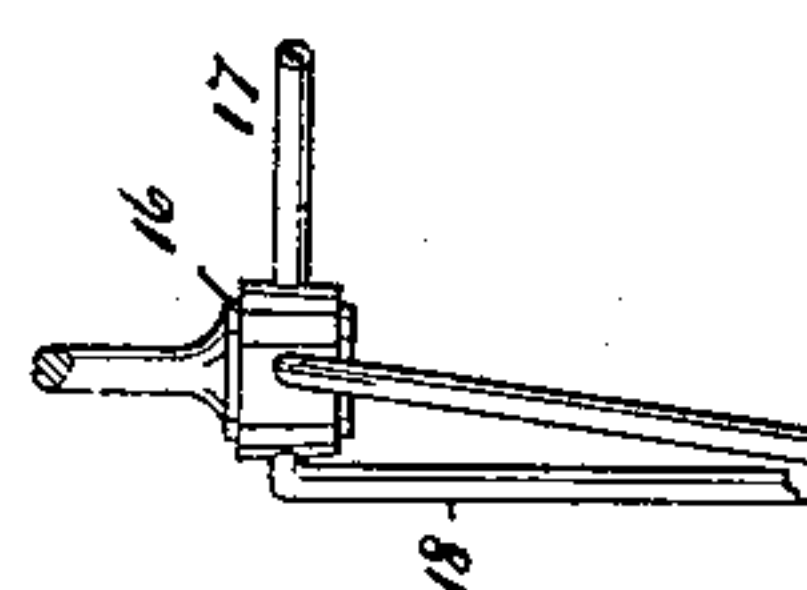
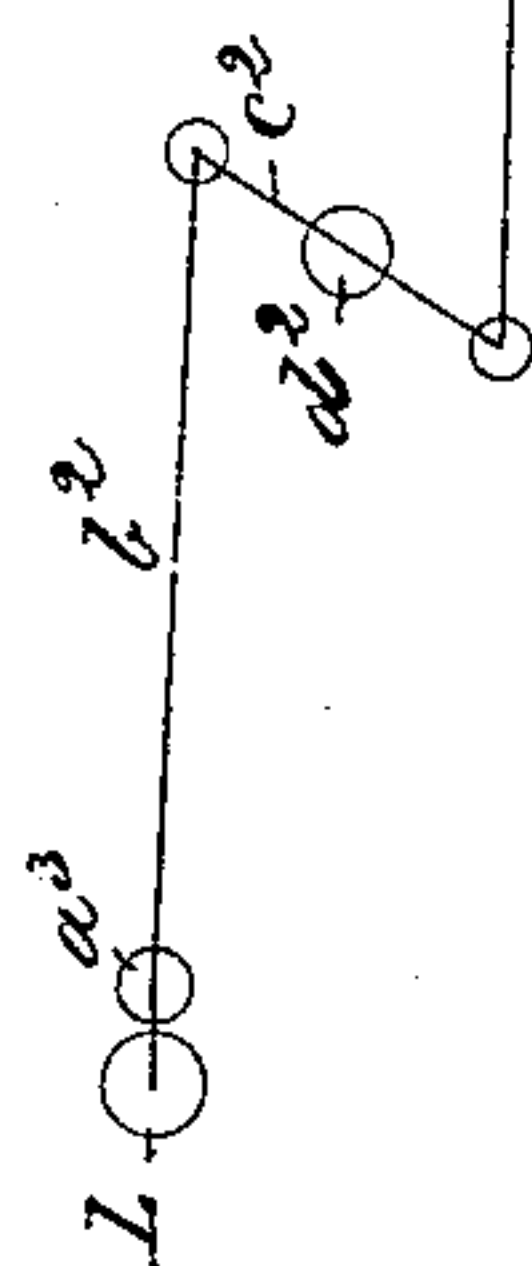


Fig: 3.

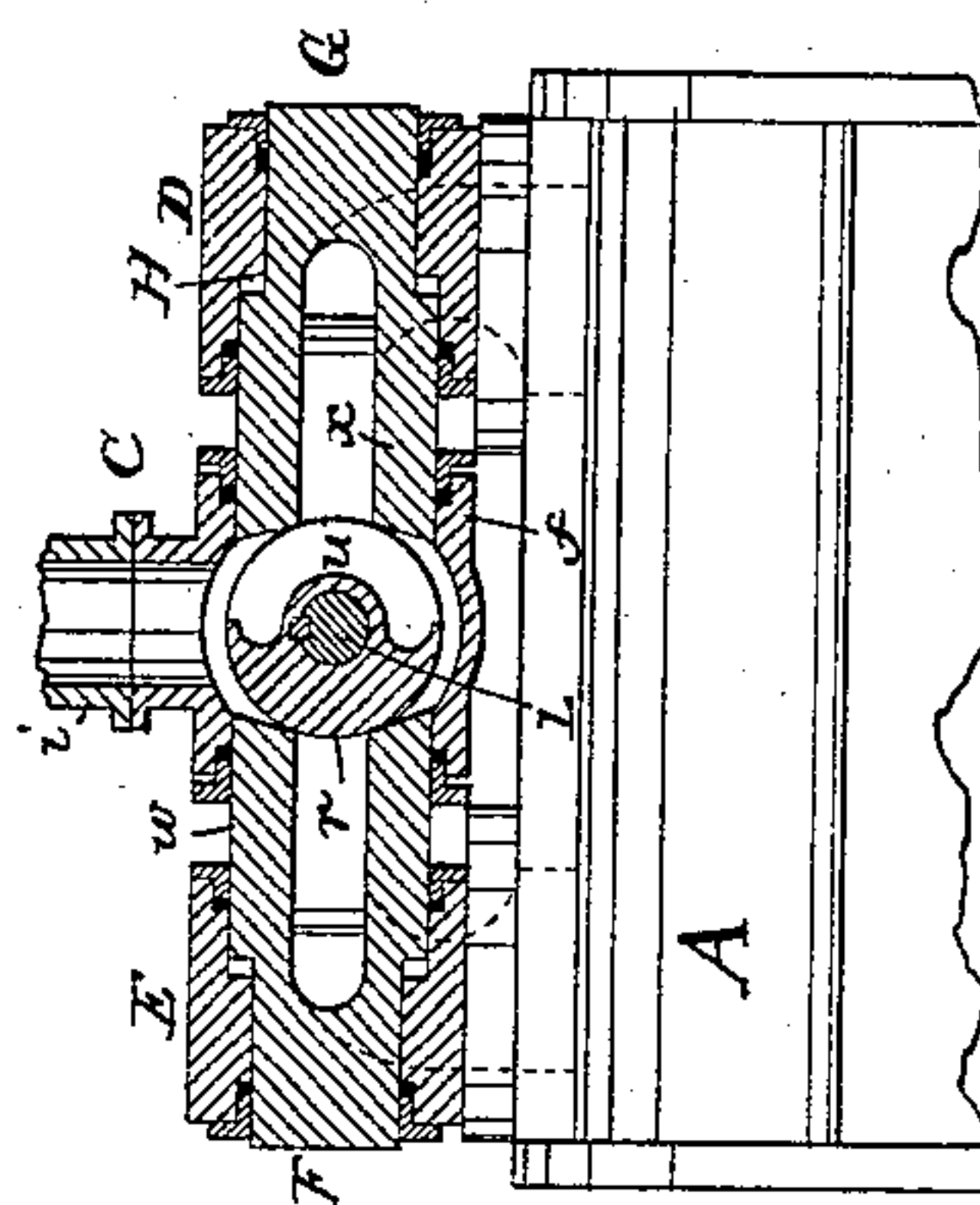
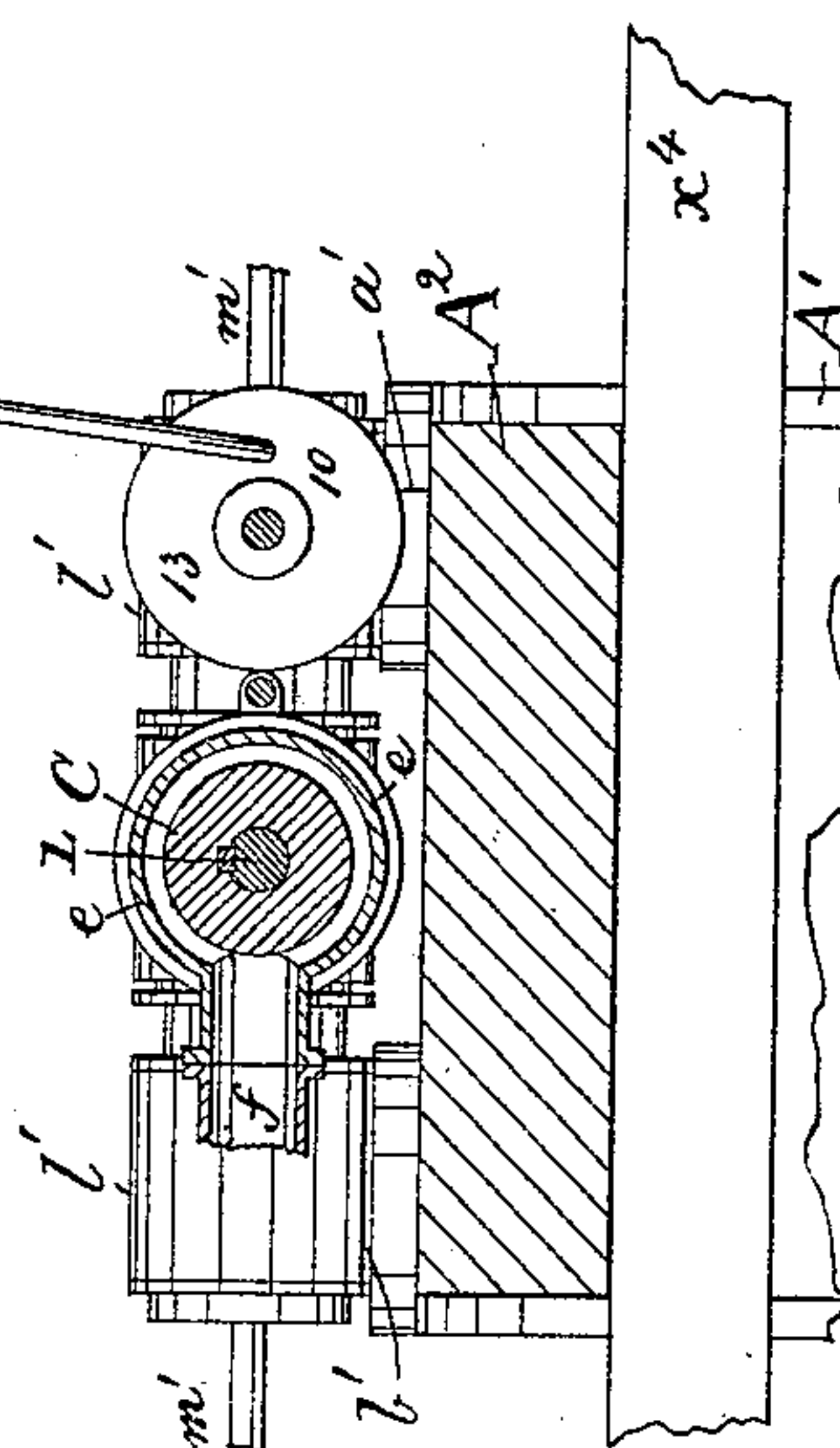


Fig: 4.



Witnesses.

Arthur Reynolds
L. F. Connor.

Inventor.
Frank M. Stevens
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UNITED STATES PATENT OFFICE.

FRANK M. STEVENS, OF CONCORD, NEW HAMPSHIRE.

VALVE MECHANISM FOR LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 246,236, dated August 23, 1881.

Application filed November 20, 1880. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. STEVENS, of Concord, Merrimack county, State of New Hampshire, have invented Improvements in
5 Valve Mechanism for Locomotives, of which the following description, in connection with the accompanying drawings, is a specification.

This invention relates to improvements in valve mechanism more especially designed for
10 locomotives, and has for its object to provide a valve mechanism which shall have the inlet and exhaust ports opened and closed at the proper times by means of a valve of sufficient length, and so shaped as to extend into both
15 the inlet and the exhaust chambers, they having made in them suitable ports. The valve for opening and closing the inlet and exhaust ports, as described, is so supported as to be moved longitudinally in one or the other di-
20 rection at the proper times to admit steam to run the locomotive forward or backward, or to close the inlet-ports to prevent the admission of steam while the exhaust-ports may be opened.

My invention consists, also, in various novel
25 features hereinafter more especially set forth.

Figure 1 represents my improved valve mechanism in longitudinal horizontal section. Fig. 2 is a front end view of Fig. 1. Fig. 3 is a vertical section on the dotted line *y y*, the top of
30 the steam-chest removed from Fig. 1 having been added for Fig. 3. Fig. 4 is a vertical section of Fig. 1 on the line *z z*, the parts removed from Fig. 1 above its section-line being, however, added. Fig. 5 is a plan view, showing the connecting mechanism to impart rotary
35 motion to the valve-rotating shaft; and Fig. 6 is a diagram, in side elevation, showing the connection between the driving-wheel and the rotating shaft.

40 The cylinders *A A'*, of usual construction, are connected by means of the cylinder bed-plate *A²*. The cylinder *A* at its top has two live-steam or inlet ports, *a b*, to conduct steam into the said cylinder in front and then at the
45 rear of the piston-head, and it also has two exhaust-steam ports, *c d*, to permit the passage of exhaust-steam from the said cylinder at the proper time. The live-steam ports *a b*, at their upper ends, are in communication with
50 the live-steam chest *e*, it being supplied through the pipe *f* with steam taken directly from any

suitable steam boiler or generator. The exhaust-ports *c d* are in communication at their upper ends with the exhaust-steam chest *f*. These two chests *e f* have their contiguous
55 ends packed steam-tight by packing held in place by a suitable metallic ring or collar, *h*. The live and exhaust steam chests, placed end to end, have made through them in line a series of circular openings to receive the rotat-
60 ing valve *C*, and form for it suitable bearings at proper points, as designated in Fig. 1.

Portions of the live-steam chest *e* are made enough larger than the valve to permit free passage of steam into the chest *e*, and from
65 the said chest into the steam-ports *a b* when the valve is in position to admit steam into the said ports. The exhaust-steam chest *f* is also made enough larger in area than the valve *C* to permit the free escape of exhaust-steam
70 from the cylinder through the exhaust-ports *c d*, and up along the exhaust-pipe *i* (see Fig. 2) into the atmosphere, as provided for in my United States Patent No. 232,776, September
75 28, 1880, to which reference may be had, the said pipe being entirely independent of the smoke-stack or chimney, to obviate the discharge of exhaust-steam into the stack or chimney, as now most commonly done in loco-
80 motive-engines.

In the live-steam chest *e*, I have placed movable ported seats *j k*, one being shown in longitudinal section, Fig. 1. The acting faces of these seats are extended into the chest *e* far
85 enough to bear against that part of the valve *C* opposed to it. The joint between the shank of each valve-seat and the chest *e* is provided with a stuffing-box, 2.

To counteract the outward pressure of the live steam on the faces of the seats *j k*, I have ex-
90 tended the shank of each seat outward through a suitable box in a bearing, *l*, and have covered its outward or rear end with a chambered cup, having joined with it a steam-conducting pipe, *m*, in communication with the boiler or
95 other supply for live steam.

When the valve *C* is in the position designated in Fig. 1, it then acting to prevent the admission of steam into the ported inlet-valve seats, only small parts of the faces of the said
100 seats are exposed to be acted upon by live steam in the steam-chest *e* and be pressed out-

ward. During this position of the valve C this outward pressure is a little more than counter-balanced by the pressure of live steam against the outward ends of the shanks of the seats, and I am thus enabled to maintain a tight joint between the faces of the seats and the valve. When the valve is moved longitudinally and rotated, together with its shaft L, to admit live steam into the ported seats and steam into ports *b c* the outward pressure of the ported seats is increased by the increase of area then exposed to steam in the chest *e*, and to compensate for this I have provided an annular space, *n*, around the shank of the seat, into which steam from the chamber *e* is permitted to enter.

The ports leading through the seats *j k* into the ports *a b* are alternately opened and closed by the rotation of the valve when the valve is in such position longitudinally as to admit steam, and the quantity of live steam admitted during each rotation of the valve, while the locomotive is being run forward, is made to depend upon the longitudinal position of the valve C in the live-steam chest *e*, and the location, with relation to the movable valve-seats therein, of the spiral opening *o*, which is extended substantially half-way around the said valve, the said spiral opening during the rotation of the valve cutting off admission of steam into said seats and ports *a b* sooner or latter during the stroke of the piston, as may be required.

The opening *p*, to admit steam for backing the locomotive, is extended substantially half-way about the opposite side of the valve, at a short distance along the said valve axially. This opening is of uniform width, as in most cases it is not considered necessary to vary the cut-off of the steam while running backward; but if it be desired to at that time vary the cut-off, then the opening *p* may be made spiral.

The valve C is made as a long sleeve extended through both the live and exhaust steam chests, and is provided with the openings or spaces *o* and *p*, as described, and with openings or spaces *q r*, the latter being located on that part of the valve inclosed within the exhaust-steam chest. The uncut or cylindrical portions of the valve C are of the same diameter and rotate in contact with the valve-seats, and slide over the said seats in the bearings made for the said valve in the chests *e f* as the valve is moved longitudinally. The cylindrical or uncut portions of the valve, according to the longitudinal position of the said valve in the said chests, act to either entirely or more or less close or uncover for a longer or shorter time the valve seats and ports by which steam is admitted to the cylinder, or by which it is permitted to escape therefrom. The full or uncut portion *s* of the valve C opens and closes the valve-seats leading into the admission-ports when the locomotive is running forward, the full or uncut portion *w* then opening and closing the openings in the valve-seats communicating with the exhaust-ports *c d*. The

full or uncut portion *l* opens and closes the valve-seats leading to the exhaust-ports *c d*.

The movable seats *w x*, placed in the exhaust-steam chest, having their shanks *F G* of greater or less area or diameter, are extended outward through suitable stuffing-boxes in bearings *E D*, and are there exposed to atmospheric pressure, to thus obviate undue pressure of the faces of the seats against the opposed parts of the valve, owing to the action of live steam within the cylinder against the said seats. The extent of inward pressure of each valve-seat *w* and *x* is herein regulated substantially by the area of the shouldered surface of the said seats exposed to the action of steam from the cylinder, it being admitted into the annular passage *H* between the shank and seat.

The full or uncut surface *s*, the valve C being in the position shown in Fig. 1, prevents the passage of steam from the live-steam chest into the cylinder A. This construction may, however, be varied—as, for instance, the spiral opening *o* may be prolonged in the direction of the axis of the valve to a point nearer the opening *p*. This would make a quicker cut-off, but under such construction it would be necessary to shut off steam by the usual throttle.

Thus far I have only described by letter the valve mechanism at the left-hand side of Fig. 1 for controlling the admission of steam into and from the cylinder A; but it will be understood, to control the admission of steam into and from the cylinder A', that the part C' of the valve (it being also made as a sleeve, and preferably as a one-piece continuation of valve C) must be provided with a like series of openings or spaces and full or uncut portions to control the admission of live steam through like movable seats into the cylinder A', and its exit therefrom through the like exhaust ports and seats. At the right of Fig. 1, I have therefore marked the various parts corresponding with those already described at the left of Fig. 1, with the same letters, accompanied with a dash or "prime mark," as, for instance, *a* and *a'*, *b* and *b'* are alike.

In order to utilize one sleeve for the two valves C C' in the two engine-cylinders A A', and have them by moving longitudinally together in unison bring into proper position its various openings and spaces to admit live steam into each cylinder A A', both to run the locomotive forward and backward, as desired, or to completely cut off the admission of steam into either cylinder A or A', I have been obliged to make the openings and spaces of valve C' in a different order from that shown in valve C, as will be seen by an inspection of valve C at the right hand of Fig. 1; and it will also be noticed that the spaces or openings of the valve C' commence and end at points ninety degrees beyond the commencement and ending of like spaces or openings of the valve C, such provision obviating a dead-point.

The valves C C' are feathered upon the ro-

tating shaft L, mounted at its ends in suitable bearings provided with stuffing-boxes, the said bearings and boxes being shown as connected with the exhaust-steam chests. This shaft, at
 5 its opposite ends, has attached cranks $a^2 a^3$, set at about ninety degrees apart, and their pins receive links b^2 , which are joined with the upper ends of levers c^2 , pivoted at d^2 , the lower
 10 ends of the said levers having pivoted to them connecting-rods e^2 , attached at their rear ends to pins or wrists f^2 of an auxiliary crank, g^2 , it being attached to the usual crank-pin, h^2 , of the
 15 driving-wheel i^2 , and having its crank-pin g^3 carried nearer the center of the said driving-wheel than is the said crank-pin h^2 , to thus reduce the throw of the connecting-rod. The
 20 crank-pin h^2 would give too much throw to the devices employed to rotate the shaft L, and consequently it could not be used for that purpose; but to utilize it in a measure, and avoid
 25 attaching another crank-pin outside the driving-wheel, I applied to the said crank-pin the auxiliary crank, this enabling me in a very simple manner to rotate the shaft L by a connection outside the driving-wheel. The cranks
 at each end of the shaft L are connected by like devices with the two driving-wheels, one only, however, being shown.

The sleeve composing the valves C C' has a
 30 groove, 6, to receive a fork, 7, connected with a slide-bar, 8, attached by screws 9 with a piston-rod, 10, the piston 12 of which is placed within a reversing-cylinder, 13. This cylinder
 35 has pipes 14 15 connected with its heads, and the said pipes are joined with the shell of a four-way cock, 16, having connected with it a live-steam pipe, 17, and an exhaust-steam
 pipe, 18.

When it is desired to shift the valves C C' it is only necessary to turn the four-way cock
 40 and admit steam into one of the pipes 14 or 15, according to the direction in which it is desired to move the said valves. Steam in the reversing-cylinder in advance of the piston 12
 45 will escape through one or the other of the said pipes 14 or 15 and a proper passage of the cock 16 into the exhaust-pipe 18.

I have so far described steam as the motive power to be controlled by the valve mechanism; but it is obvious, instead of steam, that I
 50 might employ compressed air or other motor.

I also desire it to be understood that this valve mechanism may be employed in connection with other than locomotive-engines.

55 If desired, I might use compressed air in the cylinder 13, for reversing the valves C C'.

I claim—

1. An organized valve mechanism substantially as described, it including chests with
 60 coincident openings for live and exhaust steam, ported valve-seats extended into the said chests, and a rotating longitudinally-movable valve extended into and through said chests, and provided with openings or spaces, and cylindrical
 65 portions to control the admission of steam into the engine-cylinder and the exit of

exhaust steam from the said cylinder, as and for the purpose set forth.

2. In a valve mechanism, live and exhaust steam chests in line with each other, the former being provided with two inlet and the latter
 70 with two exhaust valve seats and ports, combined with a rotating longitudinally-movable valve extended into both the said chests, and provided with openings to admit steam
 75 into the engine-cylinder to run the engine forward or backward, and with other openings to control the escape of exhaust-steam, substantially as described.

3. In a valve mechanism, live and exhaust steam chests in line with each other, the former being provided with two inlet and the latter
 80 with two exhaust valve seats and ports, combined with a rotating longitudinally-movable valve extended into both the said chests, and
 85 provided with openings to admit steam into the engine-cylinder to run the engine forward or backward, and with other openings to control the escape of exhaust-steam, and with an independent exhaust-steam pipe, i , to conduct
 90 the exhaust-steam into the atmosphere, as set forth.

4. The live-steam chest and the two movable valve-seats therein, having stems extended outward and acted upon by live steam to
 95 force them toward the rotating valve, combined with the said valve, substantially as described.

5. The rotating valve and the exhaust-steam chest, combined with the two movable valve-seats having shoulders to be acted upon by
 100 live steam in the cylinder, the said seats therein having their stems or rear ends uncovered and extended outward through bearings, where they are exposed to the action of atmospheric
 105 pressure to operate substantially as described.

6. In a valve mechanism for engines, a live-steam chest provided at opposite sides with movable ported seats, combined with a rotating and longitudinally-reciprocating valve provided
 110 with a spiral opening, o , to co-operate with the said seats and cut off the admission of steam into the cylinder at the desired time with relation to the stroke of the piston, substantially as described.

7. The live and exhaust steam chests, the movable valve-seats, and the rotating longitudinally-reciprocating sleeve-like valve extended into both chests, and provided with
 120 openings or passages to control the admission of steam into the cylinder, both to run the locomotive forward or backward, and to control the escape of exhaust-steam, combined with the rotating shaft upon which the said sleeve-like cam is feathered to slide, and with a piston and piston-rod, and intermediate connections to reciprocate the valve on the said shaft,
 125 substantially as described.

8. The sleeve-like valve and live and exhaust steam chests into which it is extended, and
 130 movable valve-seats in the said chests, and the valve-rotating shaft L, provided with cranks

at each end, combined with the driving-wheel,
its piston operating crank-pin, an auxiliary
crank supported thereby and extended toward
the center of the driving-wheel, a connecting-
5 rod, a pivoted lever, and a link between each
auxiliary crank and cranks at the ends of the
valve-rotating shaft, the combination being
and operating substantially as described.

In testimony whereof I have signed my
name to this specification in the presence of 10
two subscribing witnesses.

FRANK M. STEVENS.

Witnesses:

G. W. GREGORY,
ARTHUR REYNOLDS.