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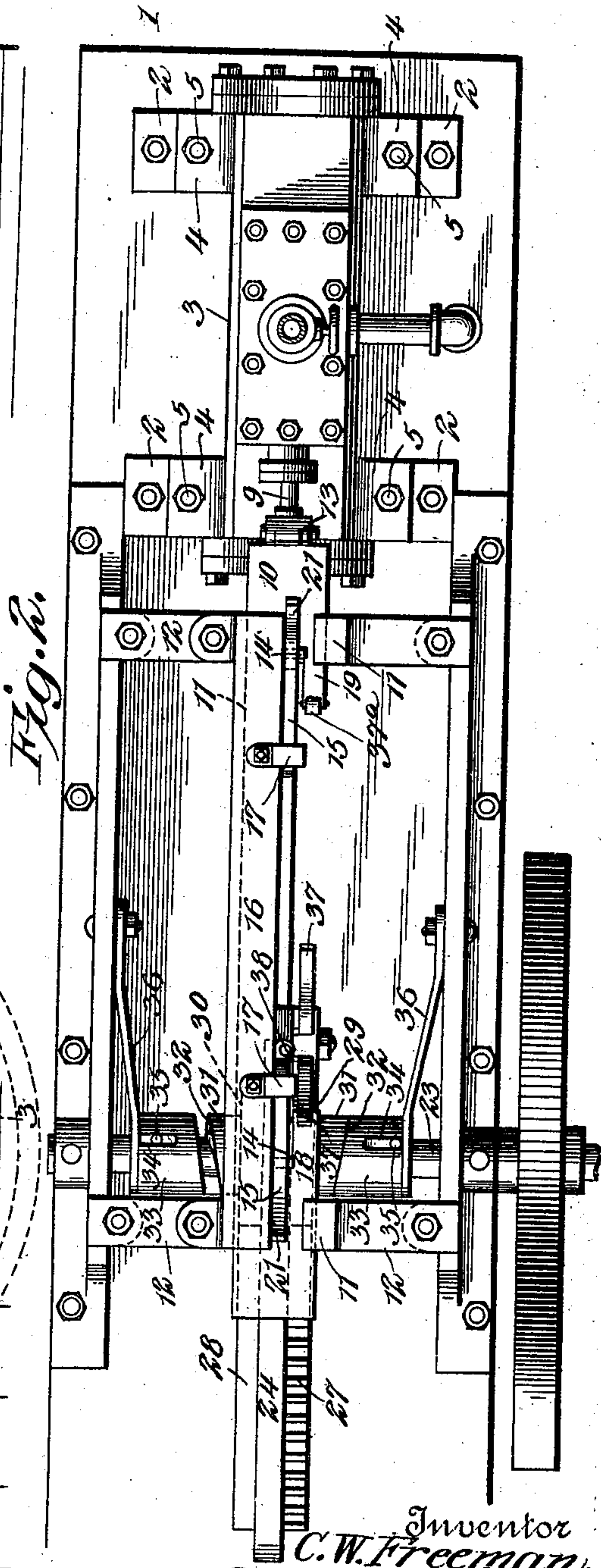
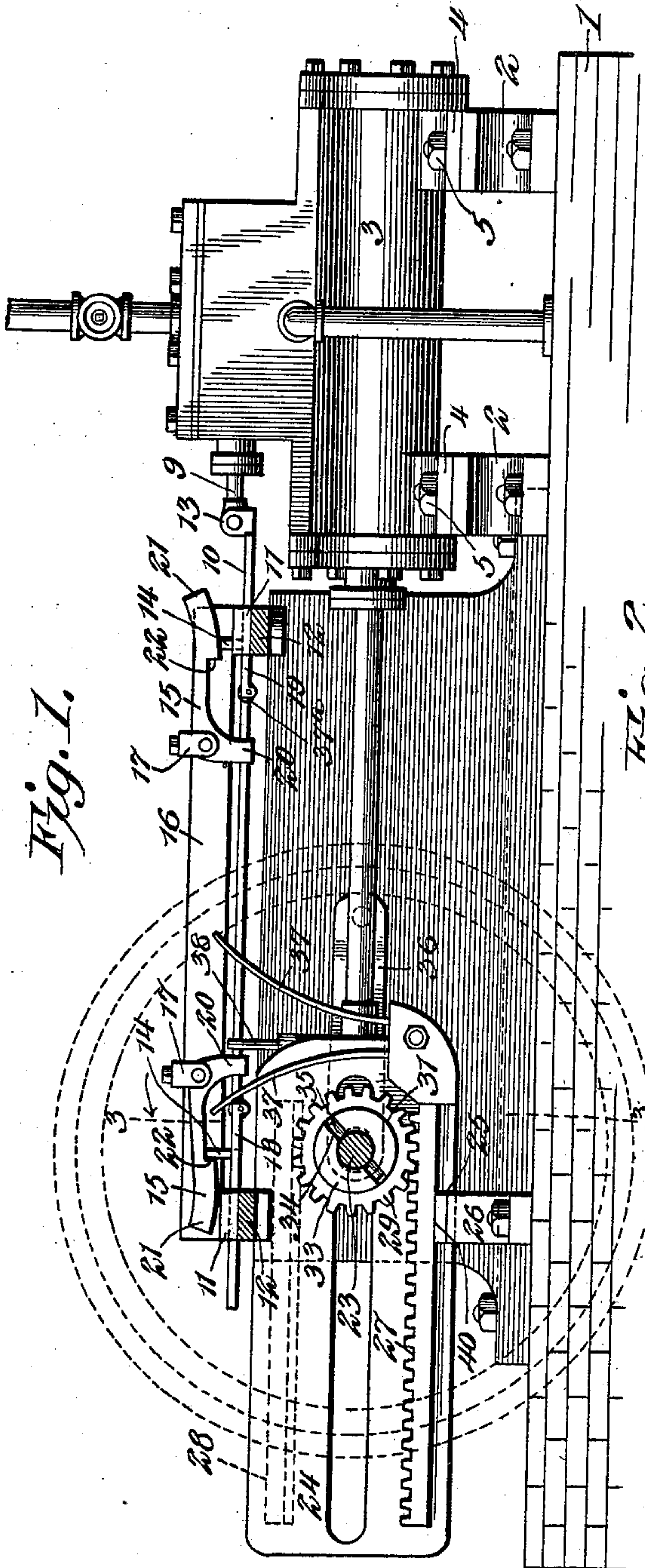
Patented Mar. 18, 1902.

C. W. FREEMAN.
VALVE GEAR FOR STEAM ENGINES.

(Application filed May 8, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses
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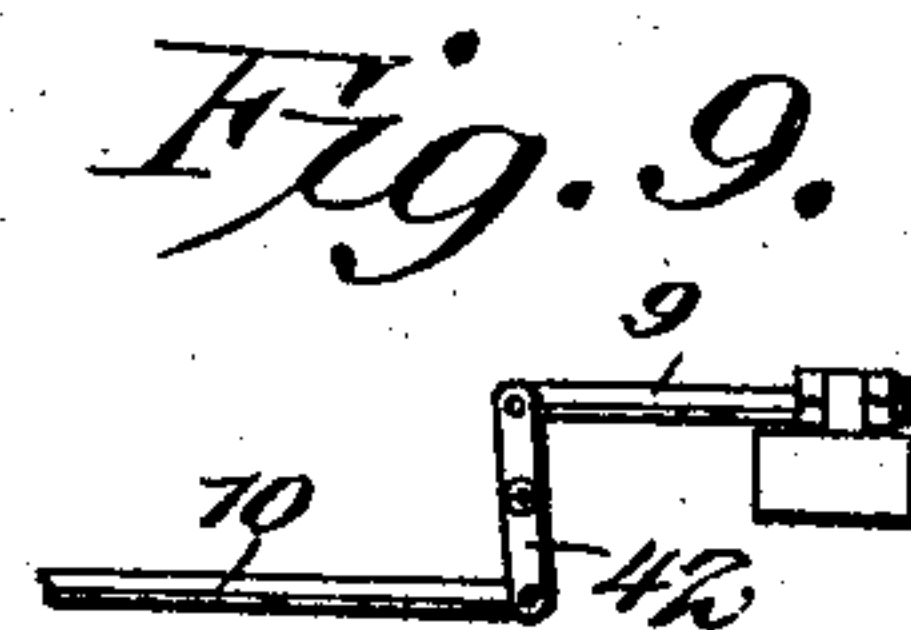
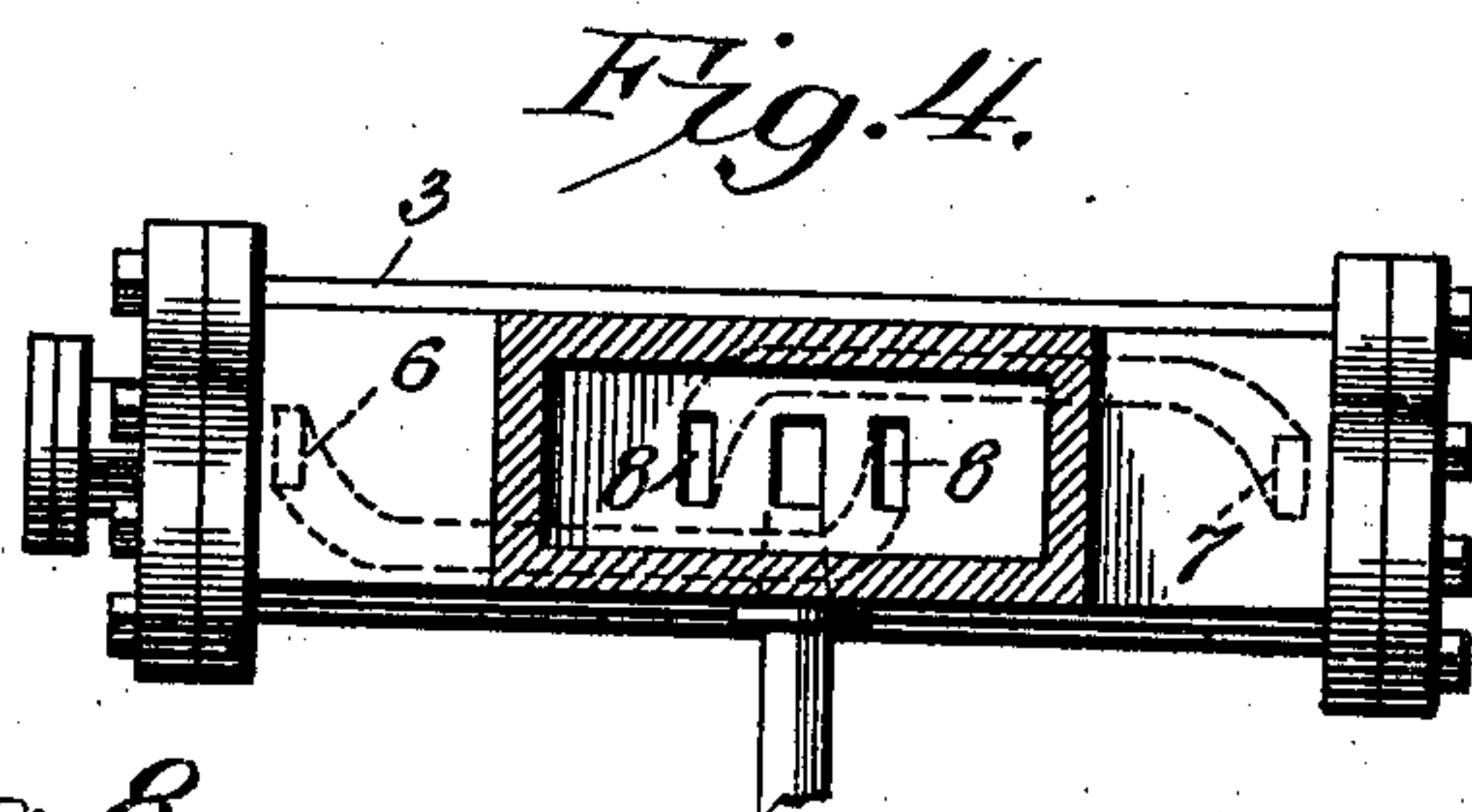
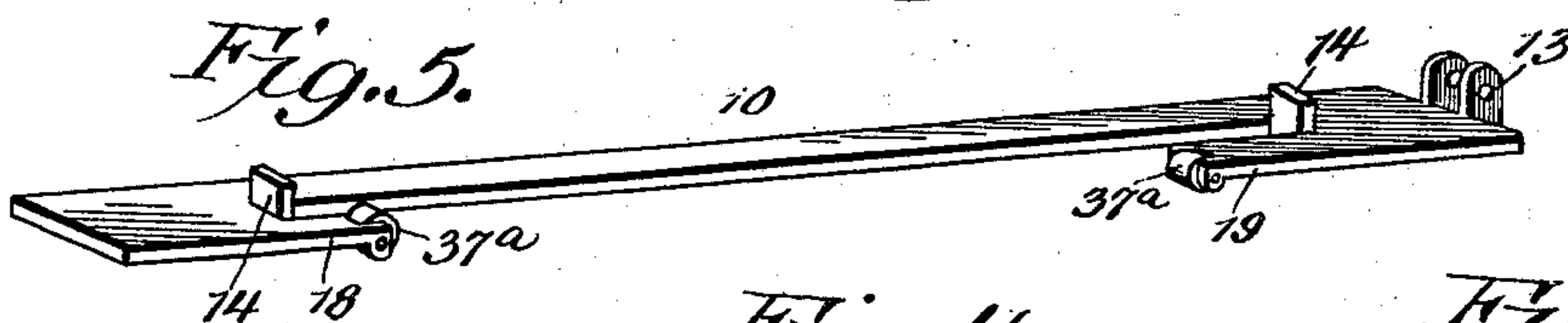
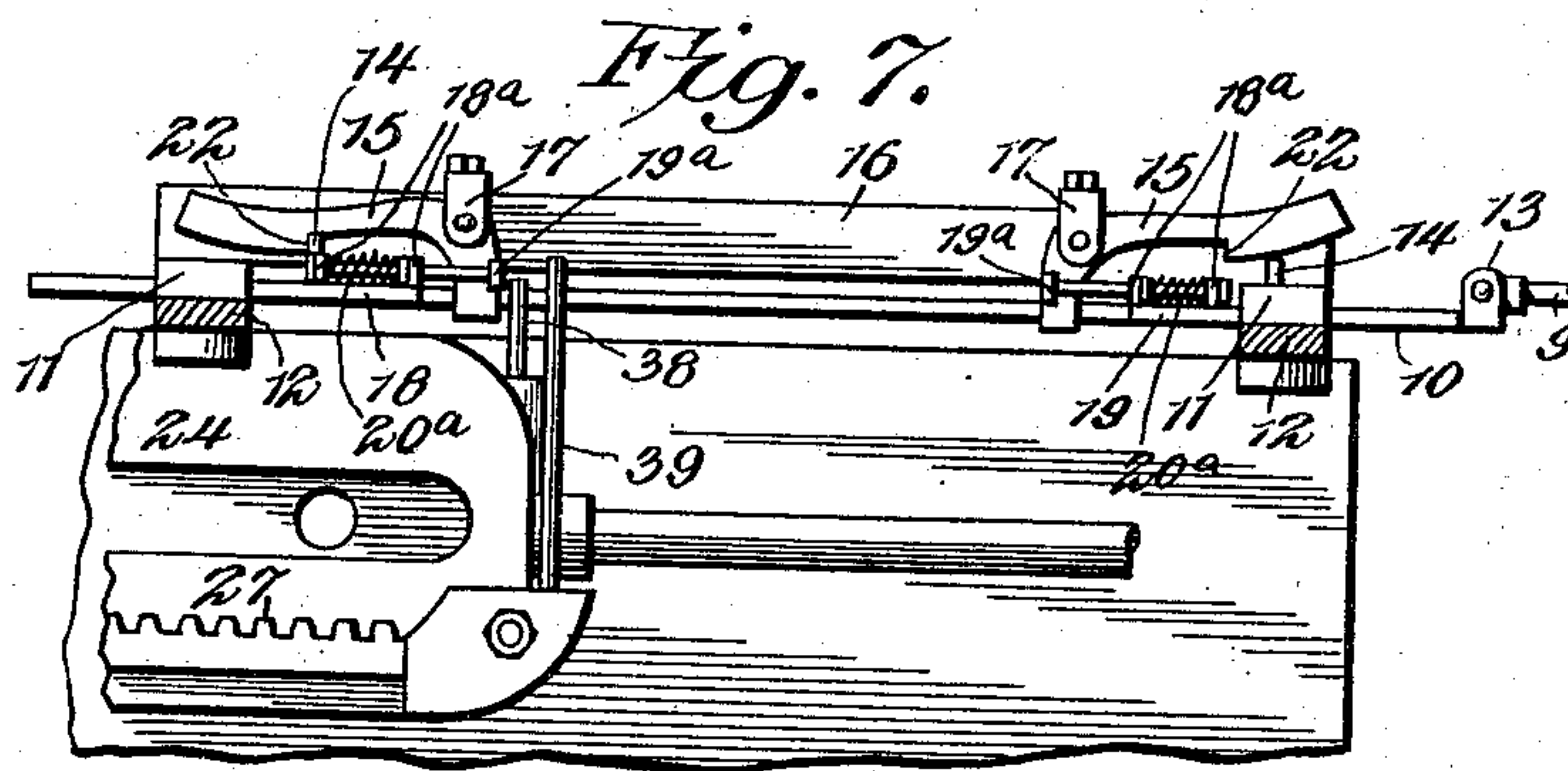
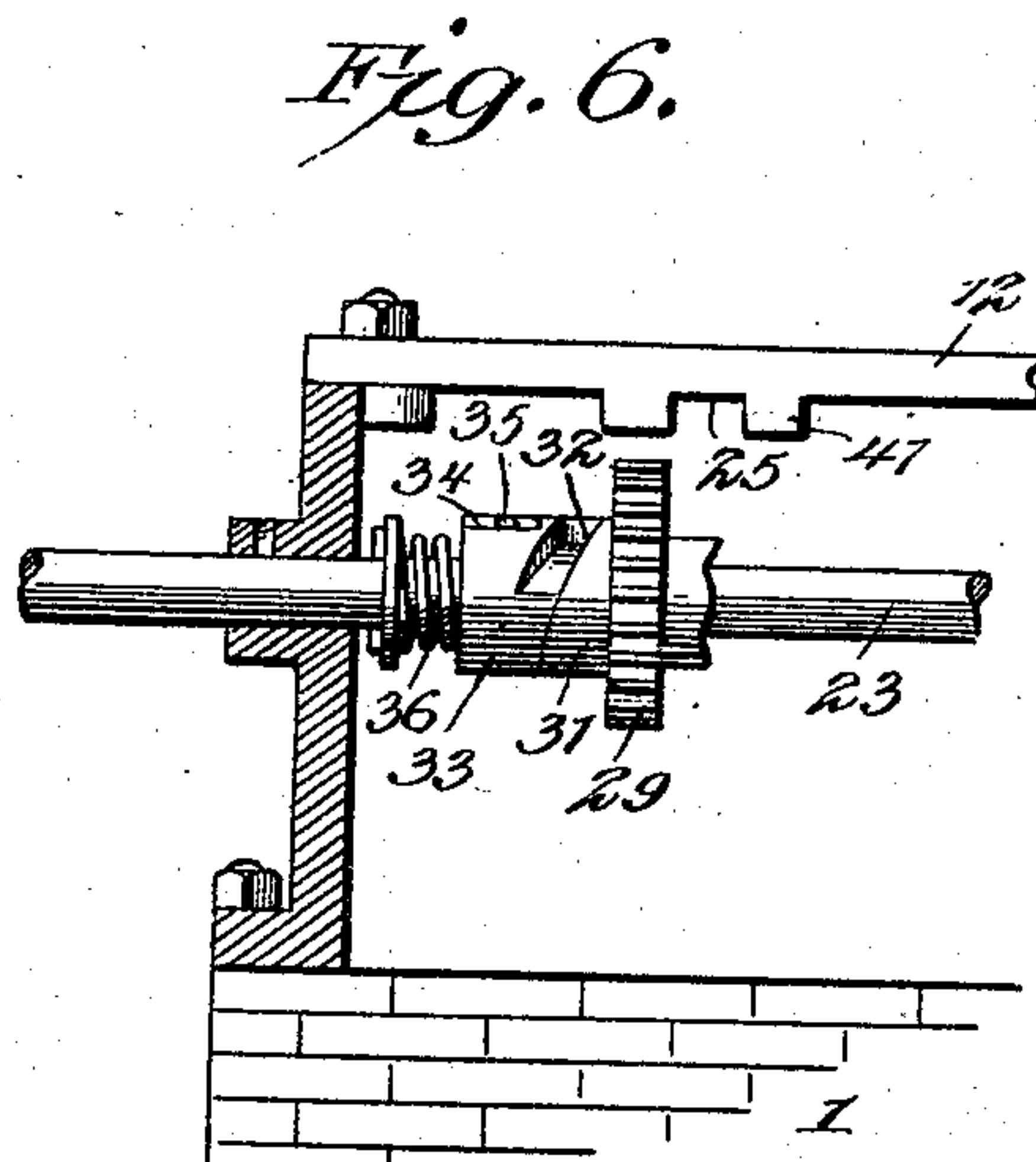
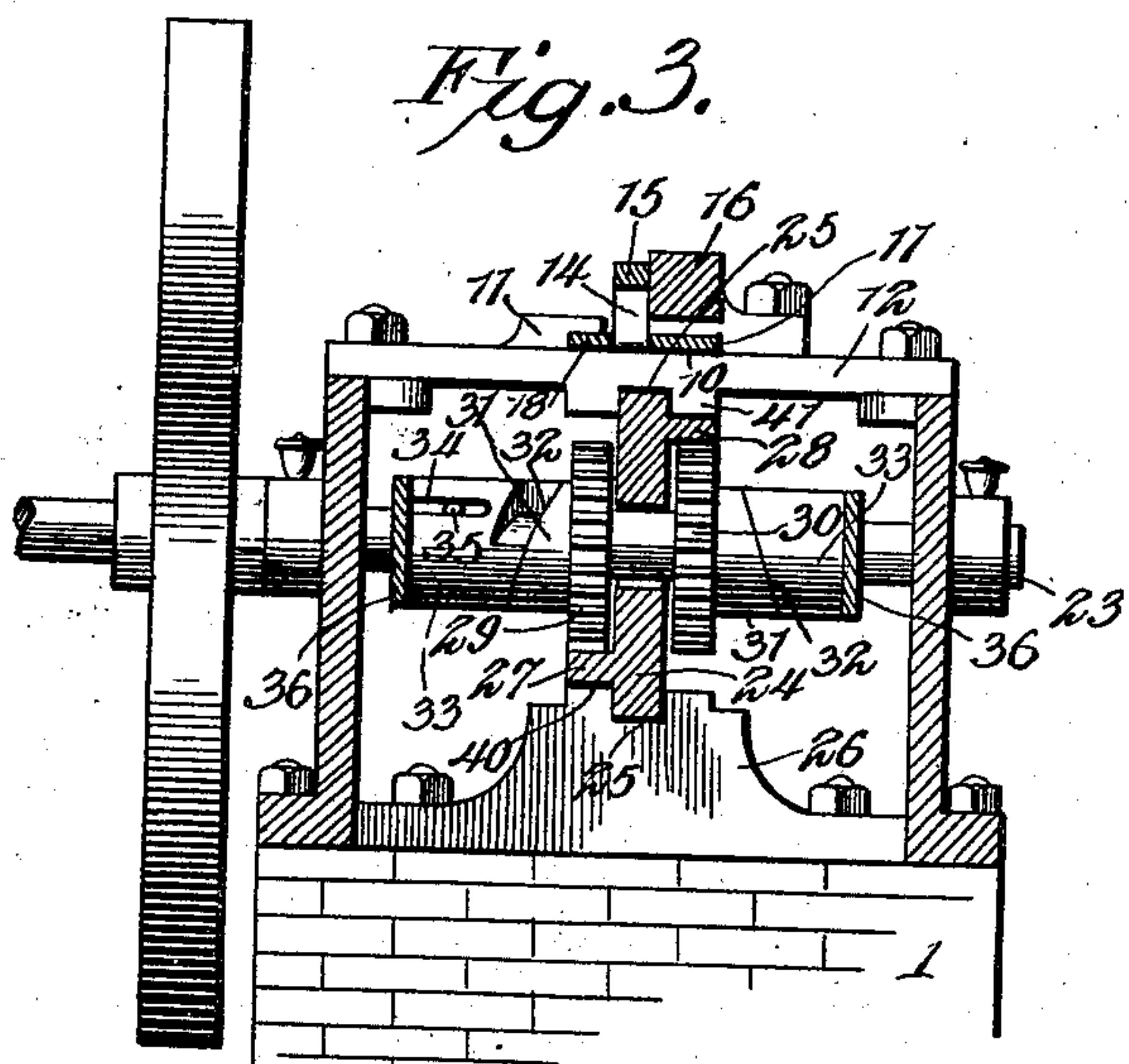
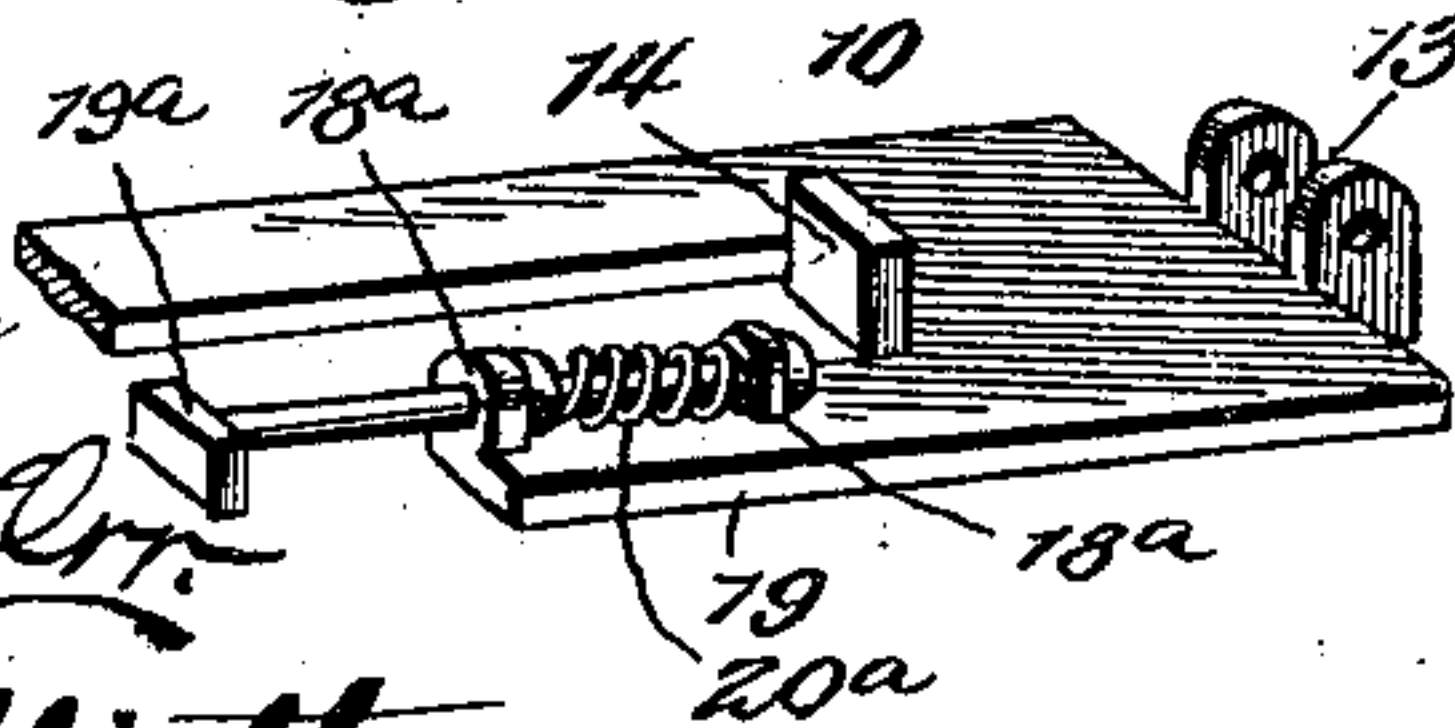


Fig. 8.



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UNITED STATES PATENT OFFICE.

CHARLES W. FREEMAN, OF MOUNT CARMEL, ILLINOIS.

VALVE-GEAR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 695,454, dated March 18, 1902.

Application filed May 8, 1901. Serial No. 59,258. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. FREEMAN, a citizen of the United States, residing at Mount Carmel, in the county of Wabash and State of Illinois, has invented a new and useful Improvement in Valve-Gears for Steam-Engines, of which the following is a specification.

This invention relates to steam-engines, and more particularly that class wherein reciprocating movement of the valve is obtained from the piston-rod.

The object of the invention is in a simple, effective, and direct manner to reciprocate the valve from the piston-rod and to hold the valve against movement except at proper times; furthermore, by the mechanism employed to prevent dead-centering.

With the above and other objects in view the invention consists, generally stated, in combining with the valve-stem a valve-rod and tappets to lock the rod at each reciprocation of the valve and in providing the piston-rod with spring-arms to engage with parts of the valve-rod to exert end thrust thereon, a projection carried by a part of the piston-rod operating to release the tappets to permit shifting of the valve through the spring-arms slightly in advance of the completion of the stroke, whereby there will always be a cushion of steam in front of the piston-head to effect requisite cushioning.

The invention consists, furthermore, in the novel construction and combination of parts of a valve-operating mechanism of an engine, as will be hereinafter fully described and claimed.

In the accompanying drawings, forming a part of this specification, and in which like numerals of reference indicate corresponding parts, I have illustrated a form of embodiment of my invention capable of carrying my ideas into effect, it being understood that the general construction and arrangement of parts therein exhibited may be varied or wholly changed without departing from the spirit or scope of the invention; and in these drawings—

Figure 1 is a view in side elevation with part of the supporting-framework being removed. Fig. 2 is a view in plan. Fig. 3 is a cross-section on the line 3-3 of Fig. 1 looking in the direction of the arrow. Fig. 4 is a sec-

tional detail view taken through the steam chest and cylinder, showing more particularly the arrangement of the ports. Fig. 5 is a detail view in perspective of the valve-rod. Fig. 6 is a detached detail view showing the modified form of spring to actuate the clutch. Fig. 7 is a detached sectional view showing the modified form of the valve-shifting mechanism. Fig. 8 is a detail view of a modified arrangement of valve-operating springs shown in Fig. 7. Fig. 9 is a detached detail view of a modified form of valve-operating rod.

Referring to the drawings, 1 designates the engine-base, the same to be of any preferred construction, and therefore needs no detailed description. Secured to or mounted upon the base are two bolsters 2 for supporting the cylinder 3. The cylinder is secured to the bolsters in any preferred manner, that herein shown being one of many ways of accomplishing this result and consisting in providing the casing of the cylinder with flanges or projections 4, through which pass bolts 5 into the bolsters. The valve is of the ordinary balanced slide type and the piston-head of the usual construction, and as these parts will be well understood detailed description is deemed unnecessary. The steam-ports 6 and 7 instead of passing from the port-holes 8 to the respective ends of the cylinder, as usual, are reversed in operation, the steam-port 6 leading from the front of the cylinder being carried back to the rear of the valve and the steam-port 7 at the rear end of the cylinder being carried forward to the front of the valve. This is rendered necessary for the reason that in the operation of the engine the valve is shifted from one extreme of the steam-chest to the other and remains stationary until the stroke has been completed and the piston has nearly reached the end of its return stroke, when the valve is instantly shifted and steam in advance of the valve passes through the port to the rear of the piston, and vice versa when the piston has nearly reached the limit of its stroke in this direction.

Connecting with the valve-stem 9 is a valve-rod 10, the same being mounted in suitable guides 11, carried by the cross-pieces 12 on the supporting-frame of the engine. The valve-rod 10, as herein shown, is provided at one end with a bifurcated lug 13, between the

members of which is pivoted one end of the valve-stem, the valve-rod being provided near each end with a lug or abutment 14 to be engaged by tappets 15, suitably supported above the valve-rod in this instance by a longitudinal plate 16, secured to the cross-pieces 12. The manner of supporting the tappets, as herein shown, is merely illustrative of one way of accomplishing this, as it is obvious that they may be supported in other ways and still be within the scope of my invention. To limit the arc of movement of the tappets, stops 17 are provided, these permitting free movement of the tappets, but preventing their being thrown out of engagement with the lugs or abutments 14 under the operation of the engine. The valve-rod 10, as herein shown, is composed of a flat piece of metal, although it is to be understood that it may be of other shapes than that shown, and is provided with two inwardly-projecting arms 18 and 19, respectively, extending parallel with the main portion of the valve-rod and forming at each end of the rod a recess in which the depending arms of the tappets work. As here shown, each tappet comprises an approximately L-shaped structure having a short arm 20 and a long arm 21, the long arm to rest upon the lugs or abutments 14 and the short arms, as above stated, to work in the recesses of the valve-rod. The underside of each tappet is provided with a shoulder 22 to interlock with the lugs 14, thereby to hold the valve-rod 10 and with it the valve in shifted position until released by mechanism to be described. As herein shown, the tappets are gravity-controlled; but it is to be understood that spring pull or pressure may be employed to cause their shoulders more firmly to engage with the lugs or projections. Mounted in suitable bearings in the side frame of the engine is a line-shaft 23, the same to carry a fly-wheel or not, as may be preferred. The line-shaft passes through or is straddled by a head or plate 24, suitably secured to the piston-rod, the plate working in suitable guides 25, arranged, respectively, on the under side of one of the cross-pieces 12 and a bolster 26, carried by the engine-base. The head or plate carries on opposite sides, one above and one below the line-shaft, two rack-plates 27 and 28, the same to engage with the gear-wheels 29 and 30, mounted loosely on the shaft and on opposite sides of the head 24. The hub 31 of each of these gear-wheels is formed into a clutch-face 32, forming one member of a clutch, the other member whereof is constituted by a collar 33, mounted on the shaft for limited lateral movement, but held from rotation thereon by any suitable means. As here shown, the collar is provided with longitudinal slots 34, engaged by a pin 35, passing through the shaft, and by this arrangement it will be readily understood that the collar will be free to have limited lateral play on the shaft, but will be held against rotary motion independent thereof.

The clutches of the two gears are alter-

nately operative—that is to say, when the piston is moved in one direction the members of one of the clutches are locked and the members of the other clutch unlocked, and vice versa.

To effect automatic locking of the collars with the clutch members of the gear-wheels, springs 36 are employed, which are in this instance shown as leaf-springs, secured to the inner sides of the support of the engine and straddling the shaft and bearing against the collars; but it is to be understood that instead of employing leaf-springs, as shown and mounted in the manner shown, I may employ coiled springs mounted on the shafts and interposed between the ends of the collar and a pin passing through the shaft, as shown in Fig. 6.

The mechanism for effecting shifting of the valve-rod 10 and lifting of the tappets from engagement with the lugs or abutments 14 comprises two leaf-springs 37, suitably secured to one side of the head or plate 24, as clearly shown in Fig. 1, these springs comprising upstanding members arranged in divergent relation to engage, respectively, with the arms 18 and 19 of the valve-rod. The arms 18 and 19 are preferably provided with a roller 37^a at the point where the springs contact, thereby to reduce friction and lengthen the life of the springs. The mechanism for lifting the tappets at each reciprocation of the piston consists of an arm or upright 38, carried by the head 24, this arm to engage with a short arm 20 of each of the tappets as the piston is reciprocated.

As will be observed by reference to Fig. 1, the arms of the springs diverge some distance beyond the arm 38, so that under reciprocation of the piston the springs will first contact with the roller either on the arm 18 or 19, as the case may be, thereby exerting end thrust on the valve-rod 10 in advance of the time in which the arm 38 engages the tappet, so that the instant the arm 38 engages with and lifts the tappet free from one of the lugs or abutments 14 the force of the spring will cause instant shifting of the valve, and thus reverse the feed of steam to the cylinder, causing opposite movement of the piston. The arm 38 contacts with the arms 20 of the tappet at the instant when the clutch-face of one of the collars engages with the clutch-face of the hub, so that a very slight movement of the arm toward the tappet will cause the long arm to be thrown out of engagement with the abutment on the valve-rod and permit shifting of the valve.

Instead of having the springs 37 for effecting shifting of the valve-rod 10 these may be dispensed with, and in lieu thereof a rigid upwardly-extending projection 39 will be secured to the head 24 in line with the arms 18 and 19, as shown in Fig. 7. The arms 18 and 19 will each be provided with guides 18^a, as shown in Fig. 8, in which will work a buffer-rod 19^a, and between the guides on the shank

of the buffer-rod will be arranged a spring 20^a, operating normally to hold the buffer-head projected. As the piston reciprocates the projection 39 will alternately engage with the buffer-heads and cause shifting of the valve in the same manner as that effected by the springs 36.

To reduce friction on the line-shaft due to the weight of the head 24, suitable guides 40 and 41, antifriction or other, will be provided on the upright 26 below the rack-bar 27 and on the cross-piece above the rack-bar 28, and by this arrangement a smooth and even movement of the piston will be effected.

Instead of arranging the steam-ports in the manner described they may be arranged as usual, but in that event the valve-stem would have connected with it a lever 42, pivoted intermediate of its ends, as shown in Fig. 9, the valve-rod 10 being connected with one end of the lever and the valve-stem the other. By this arrangement it will be obvious that the same result will be obtained as where the ports are arranged as shown and described in connection with Fig. 1.

As before pointed out, the particular manner in which the parts of my engine are constructed and assembled is not to be considered the only way in which the same is to be accomplished, as in constructing full-sized machines the various parts may be modified or wholly changed. Such changes, however, will not affect the broad and underlying principles of the invention as fully set forth.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described the invention, what I claim is—

1. In an engine, the combination with a reciprocatory piston-rod, of a reciprocatory valve-rod, locking means for holding the valve-rod against movement at the opposite ends of its stroke, a yielding operating device carried by the piston-rod and arranged to engage the valve-rod to move the same, and means separate from the operating device and mounted independently upon the piston-rod to move the locking means to an inoperative position.

2. In an engine, the combination with a reciprocatory piston-rod, of a reciprocatory valve-rod, devices for locking the valve-rod against movement at the opposite ends of its stroke, divergent springs carried by the piston-rod and arranged to engage the valve-rod to move the same in opposite directions, and means located between the divergent springs and movable with the piston-rod to alter-

nately engage the locking devices and throw them to inoperative positions.

3. In an engine, the combination with a reciprocatory piston-rod, of a reciprocatory valve-rod located above the piston-rod, pivoted tappets for locking the valve-rod against movement at the opposite ends of its stroke, divergent springs secured at their lower ends to the piston-rod and arranged to engage the valve-rod to move the same in opposite directions, and an upstanding arm rigidly mounted upon the piston-rod between the divergent springs, said arm being arranged to alternately engage the tappets and throw them to inoperative positions.

4. In a steam-engine, the combination with a valve-stem, of a valve-rod provided with two roller-bearing arms, tappets pivoted intermediate their ends above the rod, each tappet comprising a short depending arm and a long arm, the long arms having shoulders to engage with lugs or projections on the valve-rod, stops for limiting the swinging of the tappets, spring-arms carried by the piston-rod to engage alternately with the rollers of the valve-rod to engage the short arms of and exert end thrust thereon, and a projection carried by the piston-rod and operating to release the tappets to permit shifting of the valve through the agency of the spring-arms.

5. In an engine, the combination with a reciprocatory piston-head, of a reciprocatory valve-rod located adjacent to the piston-rod, bell-crank tappets pivoted contiguous to the valve-rod, one of the arms of each tappet being provided with a shoulder which is arranged to engage the valve-rod and prevent movement of the same, the other arm being free, means carried by the piston-rod and arranged to engage the valve-rod to move the latter, and a device also carried by the piston-rod and arranged to engage the free arms of the tappets to alternately move said tappets to inoperative positions.

6. In a steam-engine, the combination with a valve-stem, of a valve-rod guided for longitudinal movement, the rod being provided at opposite ends with an upwardly-extending lug, and with a roller-bearing arm adjacent to the lug, two tappets mounted for swinging movement above the rod, each tappet having a long arm provided with a shoulder for engaging a lug and with a depending short arm, a piston carrying two diverging springs adapted alternately to engage with the roller-bearing arms of the valve-rod, and a projection carried by the piston-rod and adapted alternately to engage with the short arms of the tappets.

7. In an engine, the combination with a reciprocatory piston-rod, of a reciprocatory valve-rod located above the piston-rod, bell-crank tappets pivoted above the valve-rod, one of the arms of each tappet being provided with a shoulder which is arranged to engage the valve-rod and prevent movement of the

same, the other arm being disposed in depending relation, means carried by the piston-rod and arranged to engage the valve-rod to move the latter, and an upstanding arm
5 also carried by the piston-rod and arranged to engage the depending arms of the tappets to alternately move said tappets to inoperative positions.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

CHARLES W. FREEMAN.

Witnesses:

M. H. MUNDY,

P. T. FARNSWORTH.