No. 652,228. Patented June 19, 1900.

J. B. KELLY.

VALVE REGULATING MECHANISM FOR ENGINES.

(Application filed Oct. 21, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

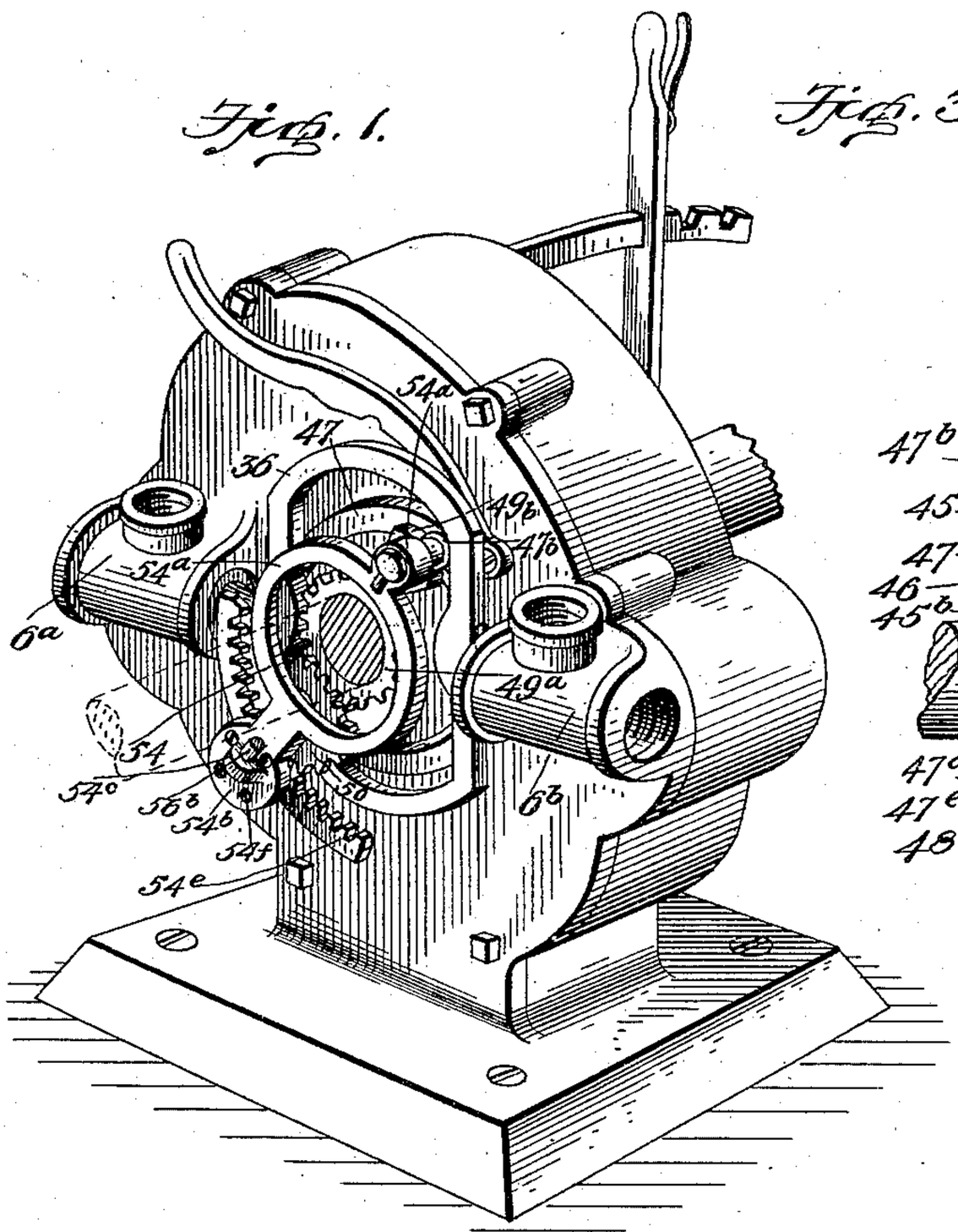

Fig. 3.

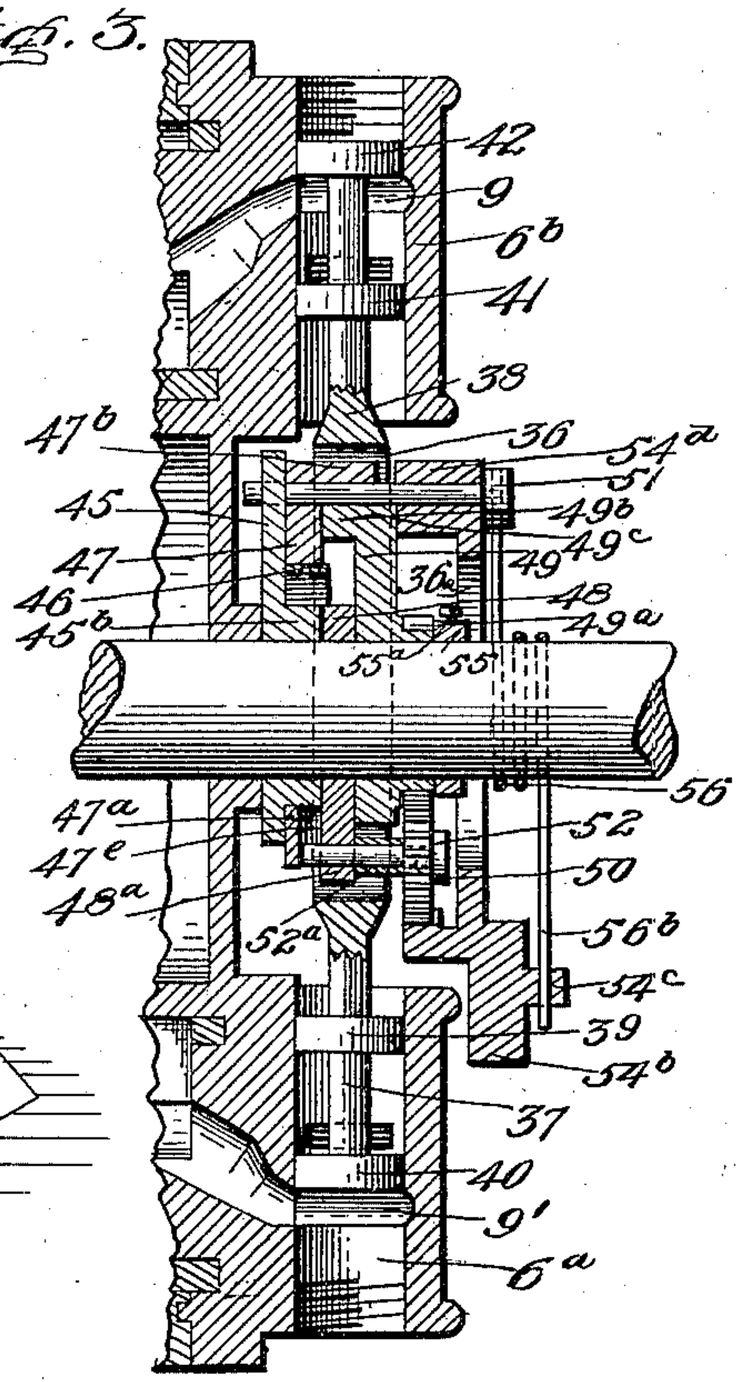

Fig. 2.

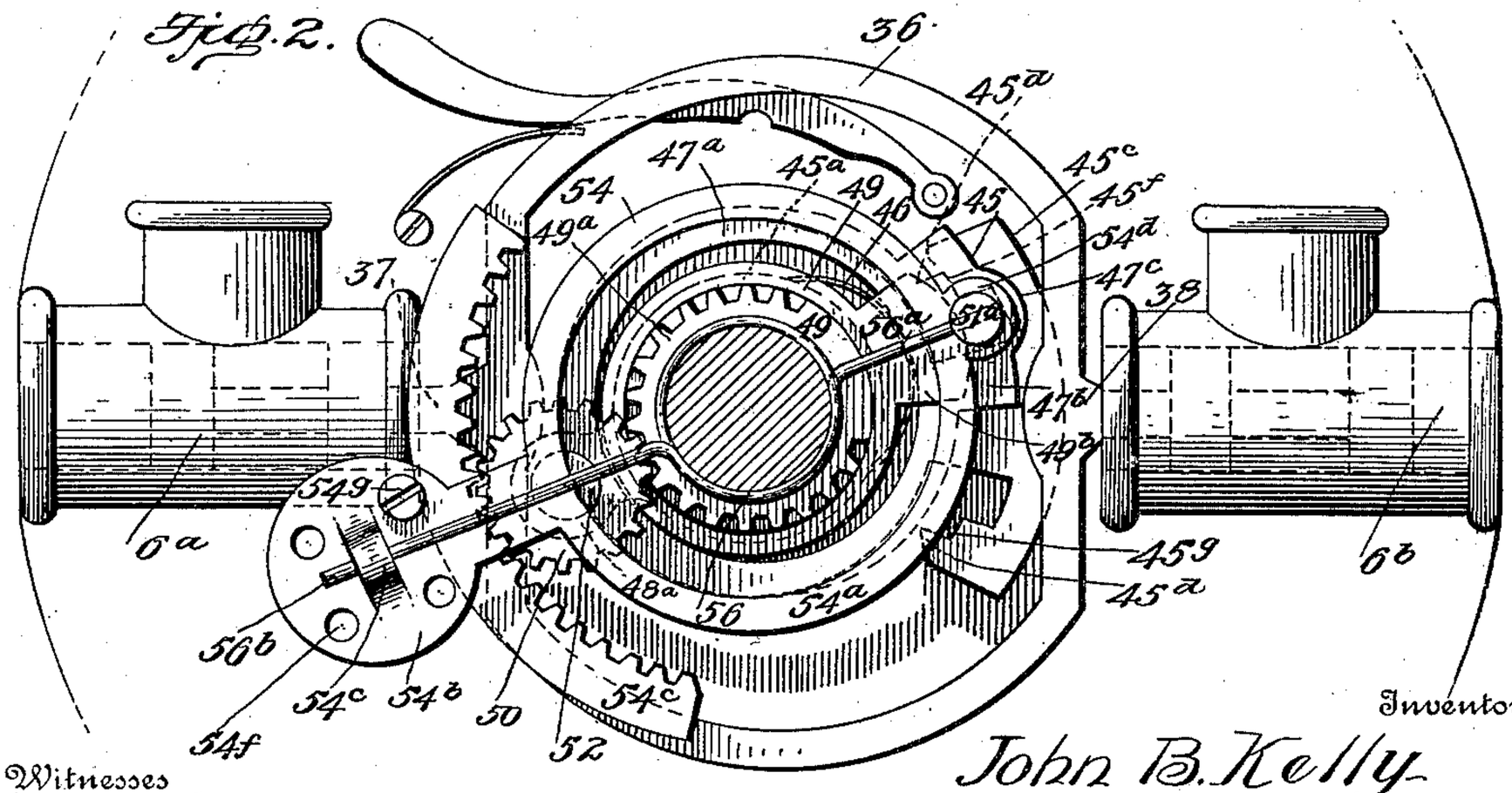

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Fig. 5.

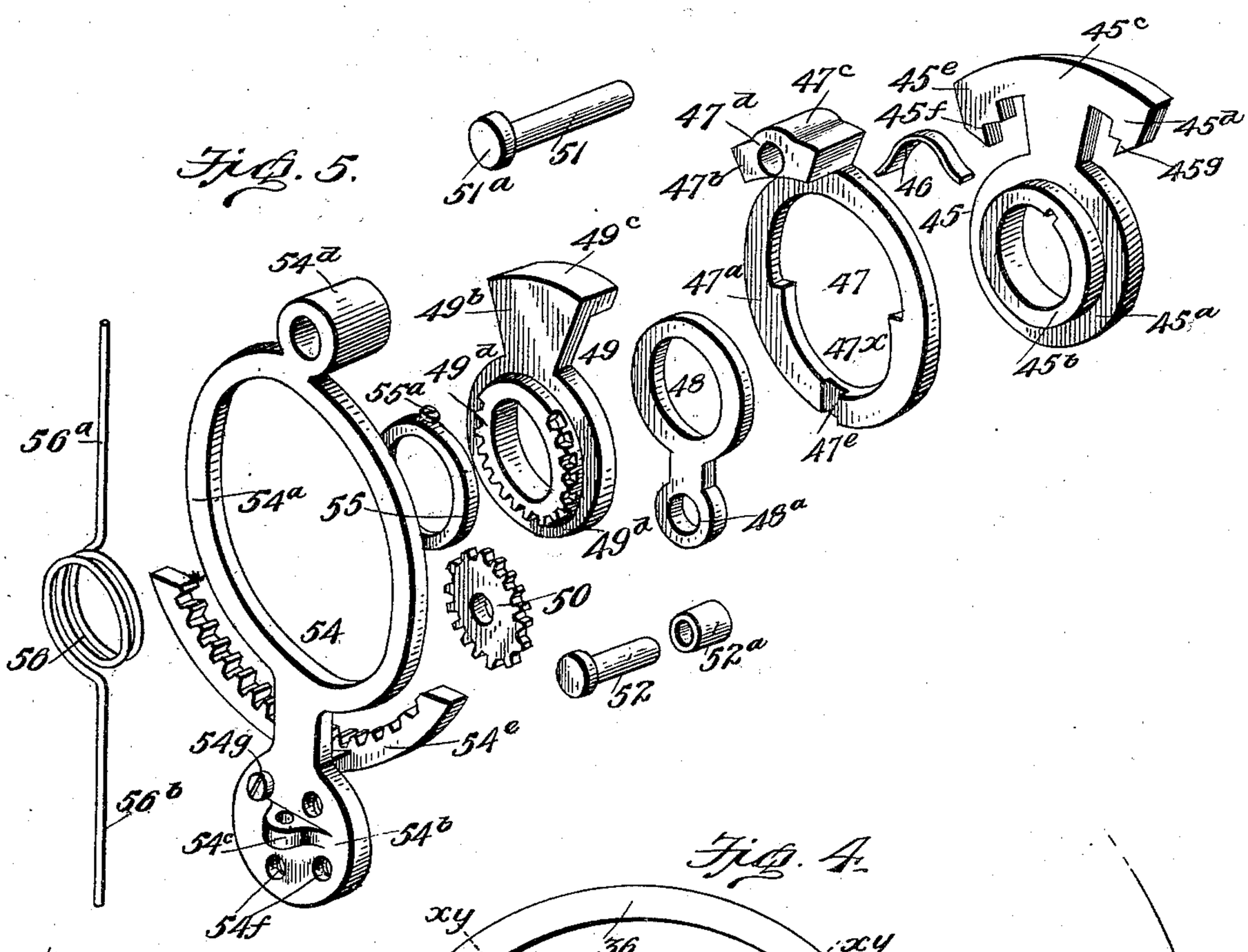
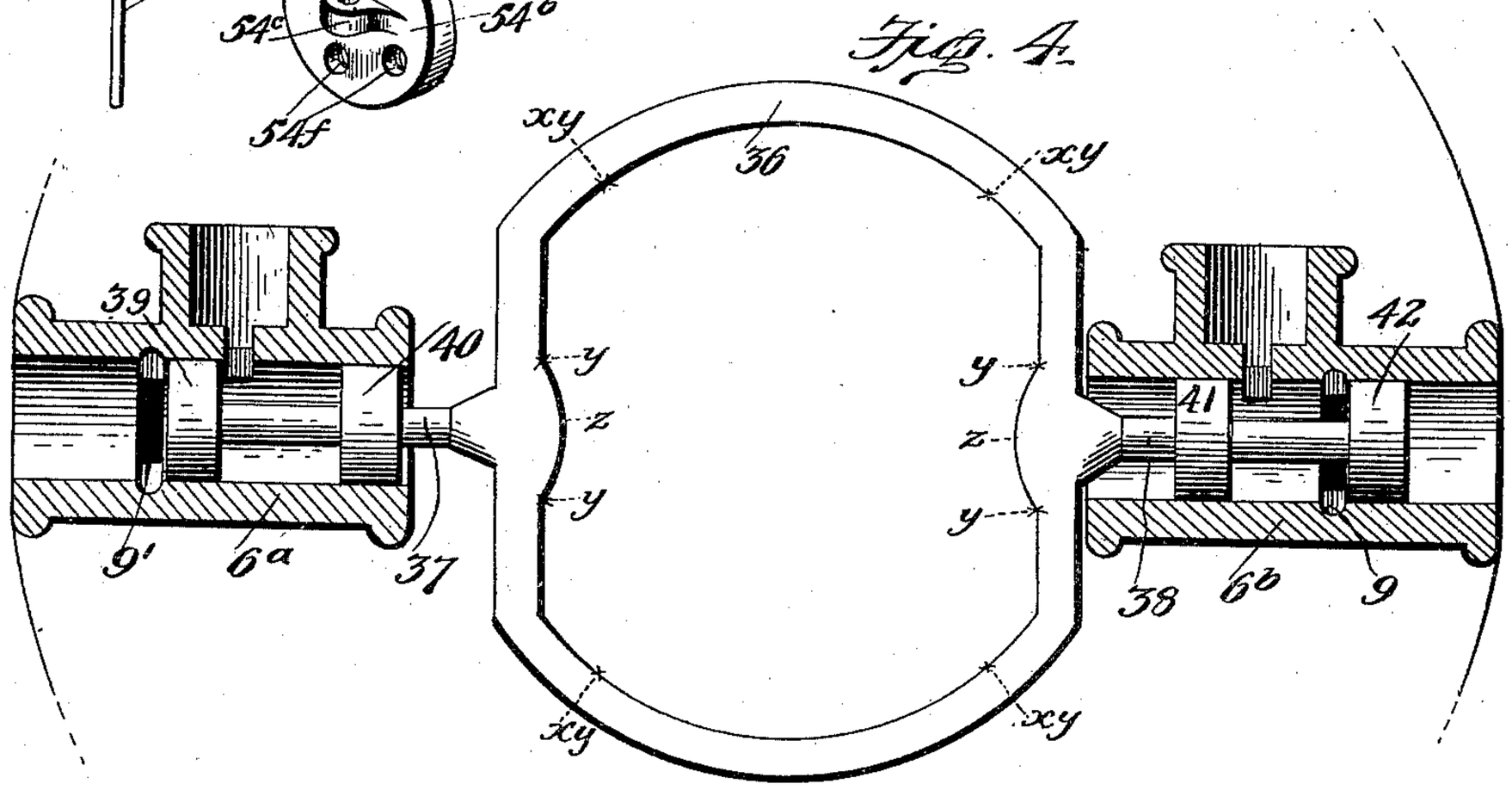


Fig. 4.



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UNITED STATES PATENT OFFICE.

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VALVE-REGULATING MECHANISM FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 652,228, dated June 19, 1900.

Application filed October 21, 1899. Serial No. 734,329. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. KELLY, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented certain new and useful Improvements in Valve-Regulating Mechanism for Steam-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to valve-regulating mechanism for steam-engines, and while primarily designed for use with engines of the rotary type—such, for instance, as that set forth in a companion application for patent filed of even date—is not necessarily limited to that style of engine, but, if desired, may be employed in connection with the ordinary reciprocating engine.

The object of the invention is to provide an improved form of valve-regulating mechanism by means of which the admission of steam to the engine will be positively controlled and regulated and by means of which it will be entirely cut off and remain cut off should any accident occur to the machinery—such, for instance, as the parting of the main belt.

With this and other objects in view the invention consists of certain features of construction and combination of parts, which will be hereinafter fully described.

In the accompanying drawings, in which I have illustrated the preferred embodiment of my invention, Figure 1 is a perspective view of a rotary engine, illustrating the application of my invention. Fig. 2 is a side elevation, on an enlarged scale, of the valve-regulating mechanism. Fig. 3 is a transverse sectional view through the mechanism and valve-chests of the engine. Fig. 4 is a vertical sectional view through the valve-chests. Fig. 5 is a detail view showing the different parts of the mechanism separated.

The valve-regulating mechanism consists of a cam-yoke 36, from the sides of which project the valve-stems 37 38, the former projecting into the valve-casing 6^a and carrying the valves 39 40 and the latter projecting into the valve-casing 6^b and carrying the valves 41 42 to open and close the ducts 9 9′, that lead to the engine-cylinder, the governor-weight 54, the variable valve-shifter 49, the pinion-hanger 48, pinion 50, with its pinion-stud 52, the positive valve-shifter 47, the lock 45, the lock-pin 51, and several minor details hereinafter described. The lock preferably consists of a ring 45^a, keyed to the drive-shaft of the engine and provided with a collar 45^b and a head 45^c, having hooks 45^d and 45^e, in the bills of which are formed notches 45^f and 45^g.

The positive valve-shifter preferably consists of a plate 47^a, having an elongated aperture $47^\times$. This plate is supported upon the collar 45^b of the ring 45 by a bow-spring 46. On the periphery of the plate 47^a is an overhanging shifting head 47^b, provided with a curved working face 47^c and a transverse aperture 47^d. In the front face of the plate at a point opposite the shifting head is formed a notch 47^e for a purpose hereinafter to appear.

The pinion-hanger 48 consists of a ring placed on the drive-shaft in advance of the plate 47^a and provided with an apertured ear 48^a.

The variable valve-shifter 49 consists of a ring 49^d, placed upon the drive-shaft in advance of the pinion-hanger and provided on its front face with a circular rack 49^a and on its periphery with a shifting head 49^b, having a curved overhanging shifting face 49^c, which projects toward the plate 47^a and travels under its overhanging shifting head.

The pinion 50 engages the circular rack 49^a and is connected to the perforated ear 48^a of the hanger 48 by a stud-bearing 52, which is tightly driven through said ear and extends through the pinion and the perforated ear and projects into the slot or recess 47^e in the face of the plate 47^a. A spacing-sleeve 52^a is placed upon said stud-bearing between the perforated ear 48^a and a pinion.

A stop-collar 55 is secured to the shaft by a set-screw 55^a and prevents the parts confined between it and the lock 45 moving lengthwise of the drive-shaft.

The governor-weight 54 preferably consists of a ring 54^a, having projecting from its periphery a weighted head 54^b, provided in its face with an apertured ear 54^c. To the rear

face of the head 54^b is secured a curved rack-bar 54^e, which meshes with the pinion 50. Projecting from the periphery of the ring at a point opposite to the weighted head is an overhanging perforated lug 54^d to receive the lock-pin 51, which is provided with a perforated head 51^a. This pin passes loosely through the lug to permit of a free swinging movement of the governor-weight and is driven tightly through the aperture 47^d of the plate 47^a, so that it will not become accidentally disengaged. The extreme rear end of the pin engages one of the hooks of the head 45^c of the lock-ring 45 and projects slightly beyond the same.

56 denotes a coil-spring loosely encircling the drive-shaft and provided with two oppositely-projecting arms 56^a and 56^b, the former of which projects through the perforated head 51^a of the lock-pin 51, and the latter of which projects through the perforated lug 54^c of the weighted head 54^b.

To vary the force of the governor-weight acting against the spring 56, I provide said weight with screw-threaded apertures 54^f to receive the threaded weight-plugs 54^g. To increase the weight of the governor-head against said spring, the plugs are screwed into the governor-head. To lessen the force, the plugs are removed. By referring to the drawings it will be noticed that the aperture in the plate 47^a and the ring 54^a have diameters greater than that of the shaft to permit of a free axial movement of the plate and ring with respect to the shaft. It should also be borne In mind that the ring 49^a is not keyed to the shaft, and while it has no axial movement with respect to the shaft it is free to turn thereon.

Having described the construction of the valve regulating or shifting mechanism, I will now proceed to describe the manner in which the steam is admitted to the cylinder and exhausted from the same by the said mechanism. Taking eighty revolutions a minute to be the desired speed at which the engine is to be run and to be cut off at three-fifths of every one-half revolution when working under a given load and a given head of steam, the engine is started by admitting the steam to the valve casings or chests. The steam passes through the open port into the cylinder at the rear end of the piston and sets the engine in motion with gradually-increasing momentum until the desired speed is reached. When the engine is first set in motion and until it gains a sufficient speed to affect the steam-regulating mechanism, the valves are shifted to their full movement by the positive valve-shifter, which in its revolutions around with the shaft within the cam-yoke engages said yoke at a point (marked *x y*) toward the latter end of each half-revolution of the piston and begins to move the yoke and valve-heads in the direction of the port toward which the piston is moving. Now when the vavle-shifter has reached a point on the cam-yoke (marked *y*) the piston is at that moment in a position to start on the second half-revolution, and at this point the port is quickly uncovered by the action of the positive valve-shifter acting against the bulged face *z*, (seen opposite the valve-stem on the inner surface of the cam-yoke,) thereby admitting the live steam to the second port and allowing the used steam to be exhausted from the cylinder back through the first port. The ports now remain wide open, one to admit steam to the cylinder and the other to exhaust the used steam from the cylinder until the positive valve-shifter has moved around with the engine and engages the cam-yoke toward the end of the second half-revolution, and the valves are again shifted in an opposite direction in like manner and with like results as before. Now when the speed of the engine has increased sufficiently to affect the steam-regulating mechanism then the governor-weights, acting against the coil-spring, cause it to give way and to allow the curved rack to swing backward and to rotate the pinion, and that in turn rotates the circular rack and variable valve-shifter, the latter moving around toward the way the engine is running. When the variable valve-shifter has moved out from under the positive valve-shifter and advancing ahead of the latter, said valve-shifter in its revolutions around with the engine engages the cam-yoke in advance of the positive valve-shifter and, being shorter and traveling on a shorter radius, moves the valves to such a position that the valve-heads rest directly over the ports to the cylinder, cutting off all the steam from the cylinder and allowing the engine to move under the expansion of the steam contained in the cylinder to the end of the half-revolution, when the positive valve-shifter engages the cam-yoke and moves the valves to a a full-open position, as has been described. As the speed of the engine increases the greater will be the force exerted against the coil-spring by the governor-weights, thus allowing the curved rack to swing farther back and likewise to move the variable valve-shifter farther in advance of the positive valve-shifter and to cut off the steam earlier until the engine is running at eighty revolutions and cutting off at three-fifths when working, as before specified. Now if for any reason the load of the engine should be increased or the steam-pressure should be decreased, thereby causing the engine to move slower, the governor-weights would then act with less force against the coil-spring and the curved rack would be drawn forward by the tension of the partially-released spring, and the variable valve-shifter would be drawn back and thereby effecting a later cut-off; but if, on the other hand, the load of the engine should be decreased or the steam-pressure should be increased, thereby causing the engine to run faster than desired, the force of the governor-weights would be increased and cause the

curved rack to swing farther back and to draw the variable valve-shifter farther ahead and to cut off the steam earlier until the governor-weight ring was brought to a rest against the shaft. Then if the speed should continue to increase the bow-spring will be compressed and allow the positive valve-shifter to drop down toward the same radius in which the variable valve-shifter is traveling, and thus to shorten the movement of the valves until both valve-shifters are traveling in the same line and the valves closed over the ports in the valve-chest, thus cutting off the steam for the entire revolution of the engine-piston. Should now the force exerted against the governor be so great as to compress the bow-spring still further, as in the case of an accident, such as the parting of the main belt while the engine was under a full head of steam, thus causing the engine to lunge forward with a jerk, then the lock-pin will move down and engage the notch 45^f of the lock and lock the head of the positive valve-shifter to turn in the same arc as the head of the variable valve-shifter. The positive valve-shifter now being locked and the steam being cut off, the engine will soon come to a stop.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a valve-regulating mechanism, the combination with a rotary drive-shaft, of a positive valve-shifter mounted to turn with said shaft and having an independent radial movement with respect to the same, a variable valve-shifter loosely mounted on said shaft to turn independently of the same and in a smaller arc of a circle, a governor-weight pivoted eccentrically to the positive valve-shifter and geared to the variable valve-shifter to rotate the same independently of the drive-shaft.

2. In a valve-regulating mechanism, the combination with a rotary drive-shaft, of a positive valve-shifter mounted to turn with said shaft and having an independent radial movement with respect to the same, a variable valve-shifter loosely mounted on said shaft and provided with a segmental gear, a governor-weight pivoted eccentrically to the positive valve-shifter and provided with a curved rack, and a pinion hung from the drive-shaft and in mesh with the curved rack and with the segmental gear.

3. In a valve-regulating mechanism, the combination with the rotary drive-shaft, of a positive valve-shifter mounted to turn with said shaft and having an independent radial movement with respect to the same, a variable valve-shifter loosely mounted on said shaft and provided with a segmental gear, a hanger fixed to turn with said positive valve-shifter, a governor-weight pivoted eccentrically to the positive valve-shifter by a pivot-pin and provided with a curved rack, a pinion journaled eccentrically to the pinion-hanger and engaging said curved rack and the segmental gear, and a spring having one end connected to the pivot-pin and the other end to the governor-weight.

4. In a valve-regulating mechanism, the combination with the rotary drive-shaft, of a lock keyed thereto and provided with a hooked head and a supporting collar or ledge, a positive valve-shifter supported upon said collar by an interposed spring and having an independent radial movement with respect to the shaft, a pinion-hanger mounted on said shaft, a pinion, a pin upon which the pinion is mounted, said pin passing through an ear of said hanger and engaging a notch in said positive valve-shifter, a variable valve-shifter mounted to loosely turn upon said shaft and provided with a segmental gear which meshes with said pinion, a governor-weight provided with a curved rack to engage said pinion, a pin pivotally connecting the governor-weight with the positive valve-shifter and having its inner end engaging the hooked head of the lock, and a spring having one end connected with the outer end of said latter pin and its other end connected to the governor-weight.

5. The combination with the reciprocating valves and a connecting-yoke, of a rotary drive-shaft, a positive valve-shifter mounted to turn with said shaft and engage the yoke and having an independent radial movement with respect to the shaft, a variable valve-shifter loosely mounted on said shaft to turn independently of the same and in a smaller arc of a circle and to engage the yoke, a governor-weight pivoted eccentrically to the positive valve-shifter and geared to the variable valve-shifter to rotate the same independently of the drive-shaft.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN B. KELLY.

Witnesses:
A. B. SUIT,
BENJ. G. COWL.