

(No Model.)

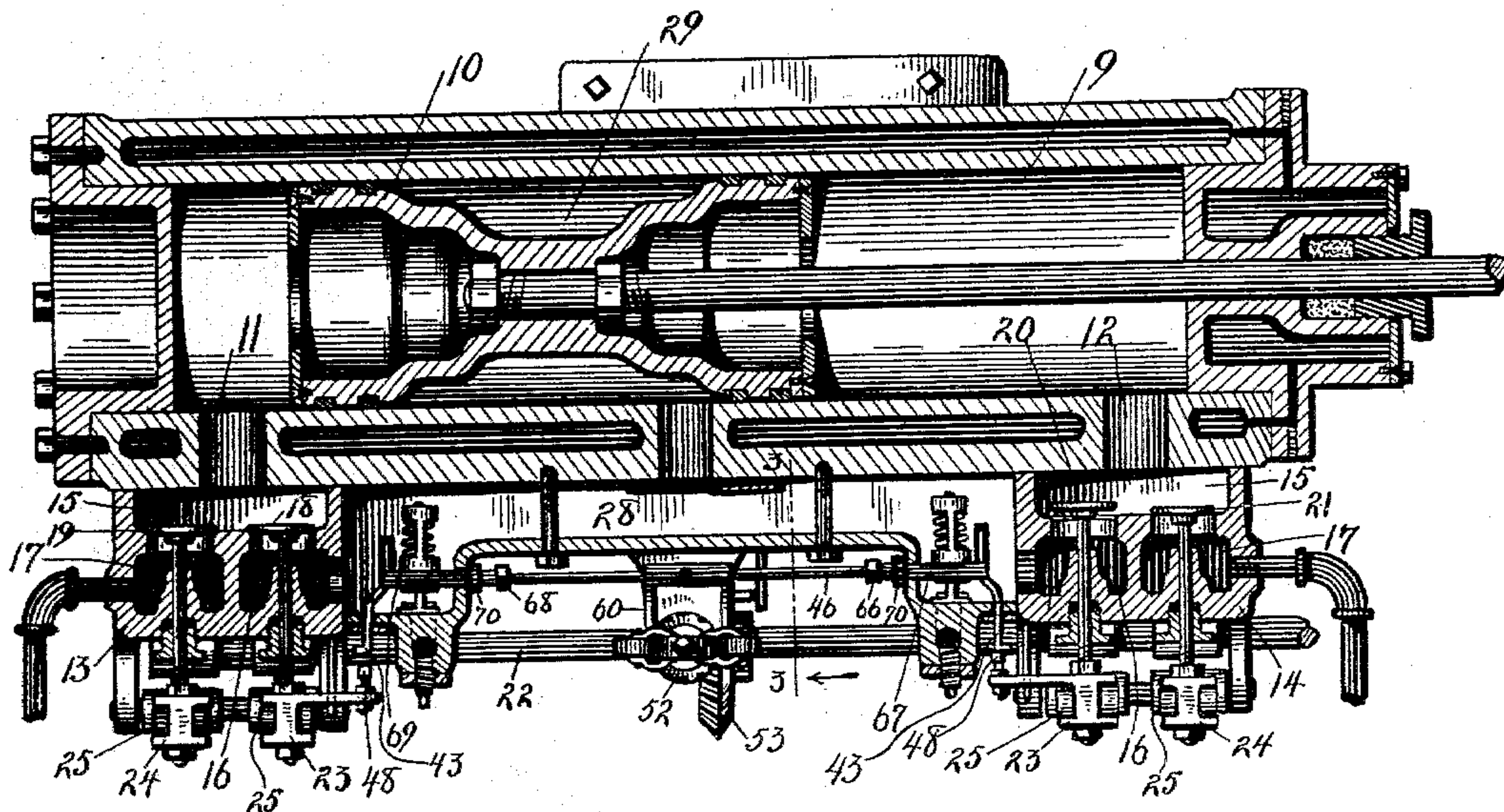
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F. W. SPACKE.  
GOVERNOR FOR GAS ENGINES.

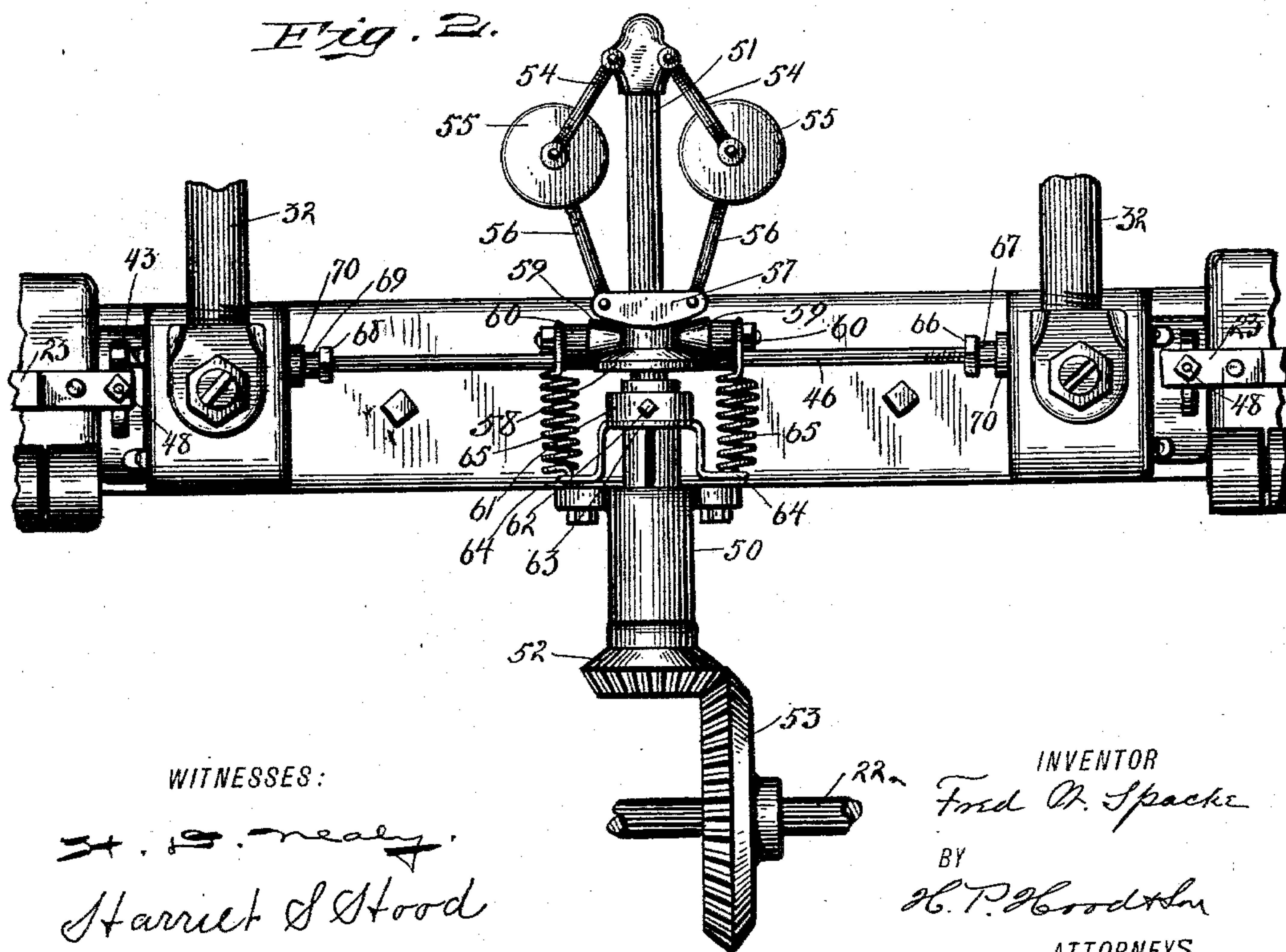
No. 589,583.

Patented Sept. 7, 1897.

*Fig. 1.*



*Fig. 2.*



WITNESSES:

*St. S. Neely,*  
*Harriet S. Hood*

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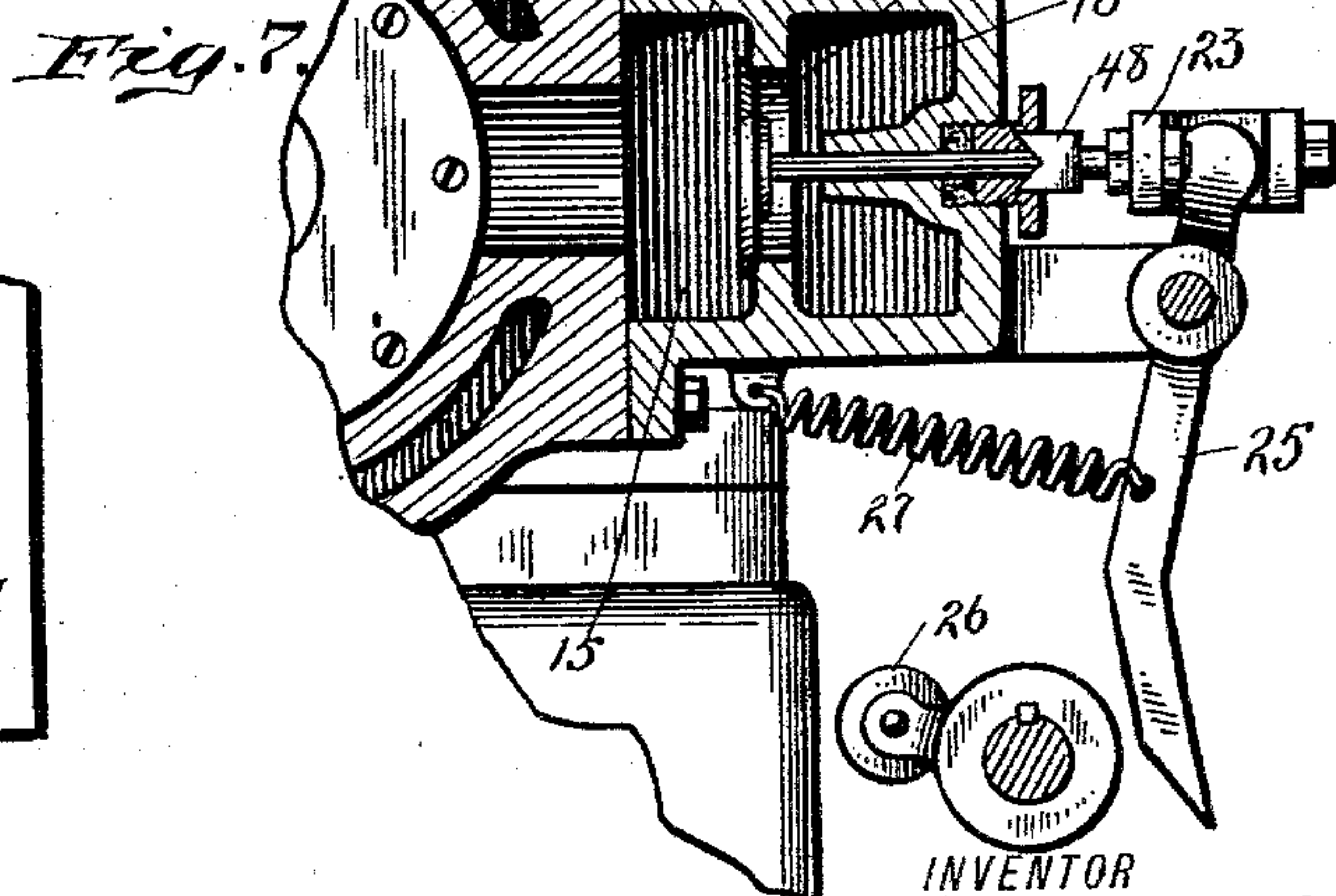
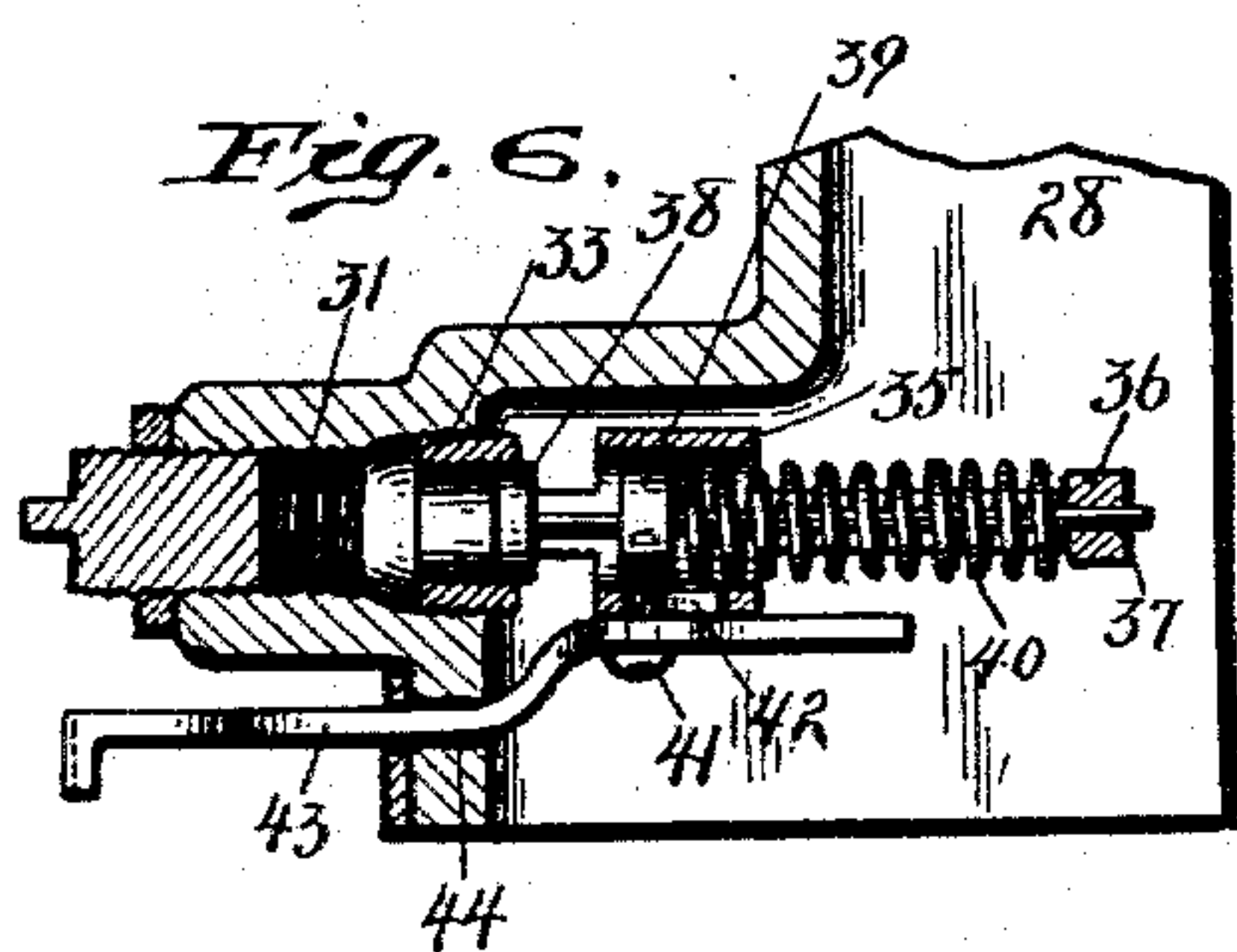
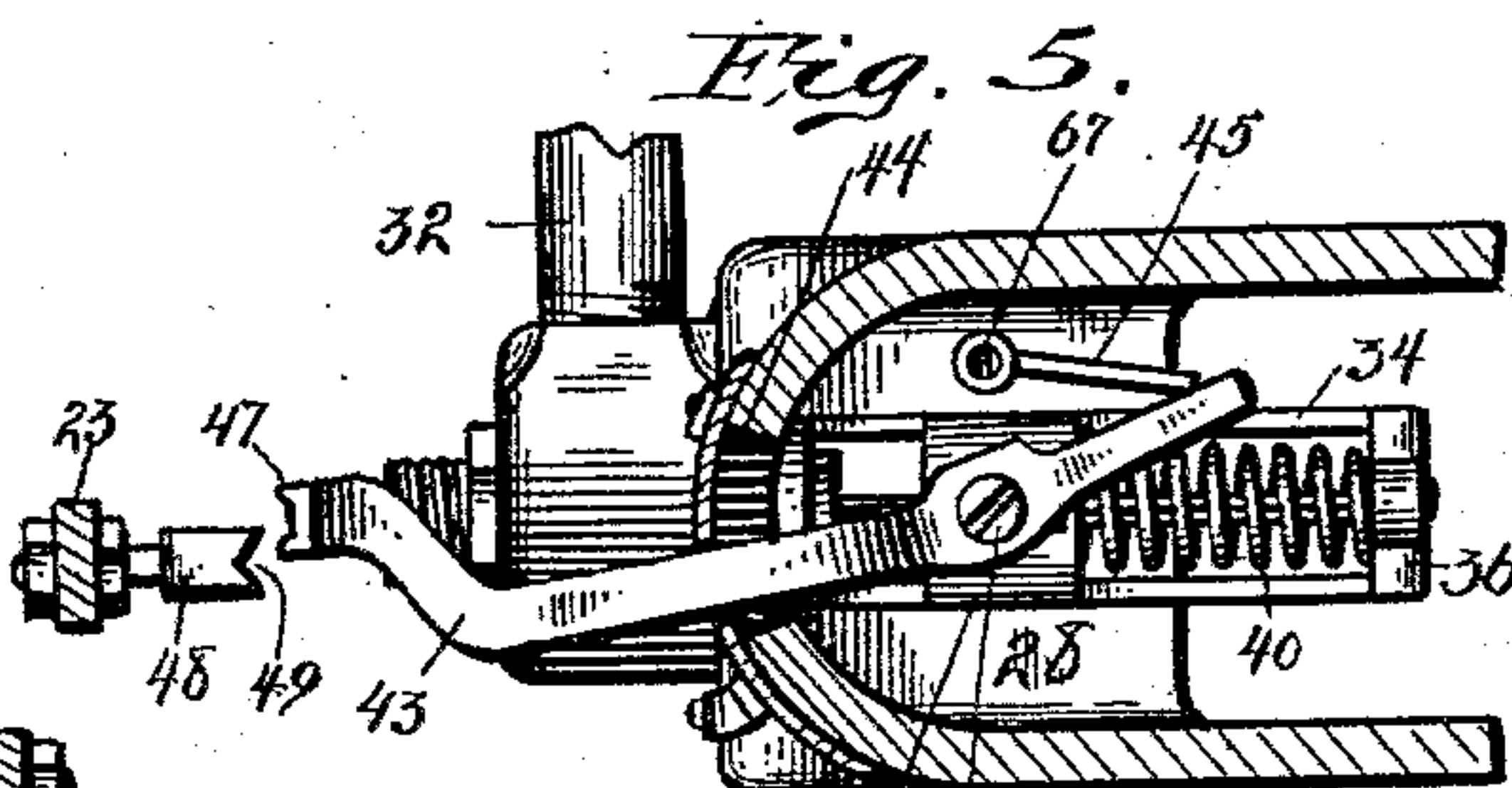
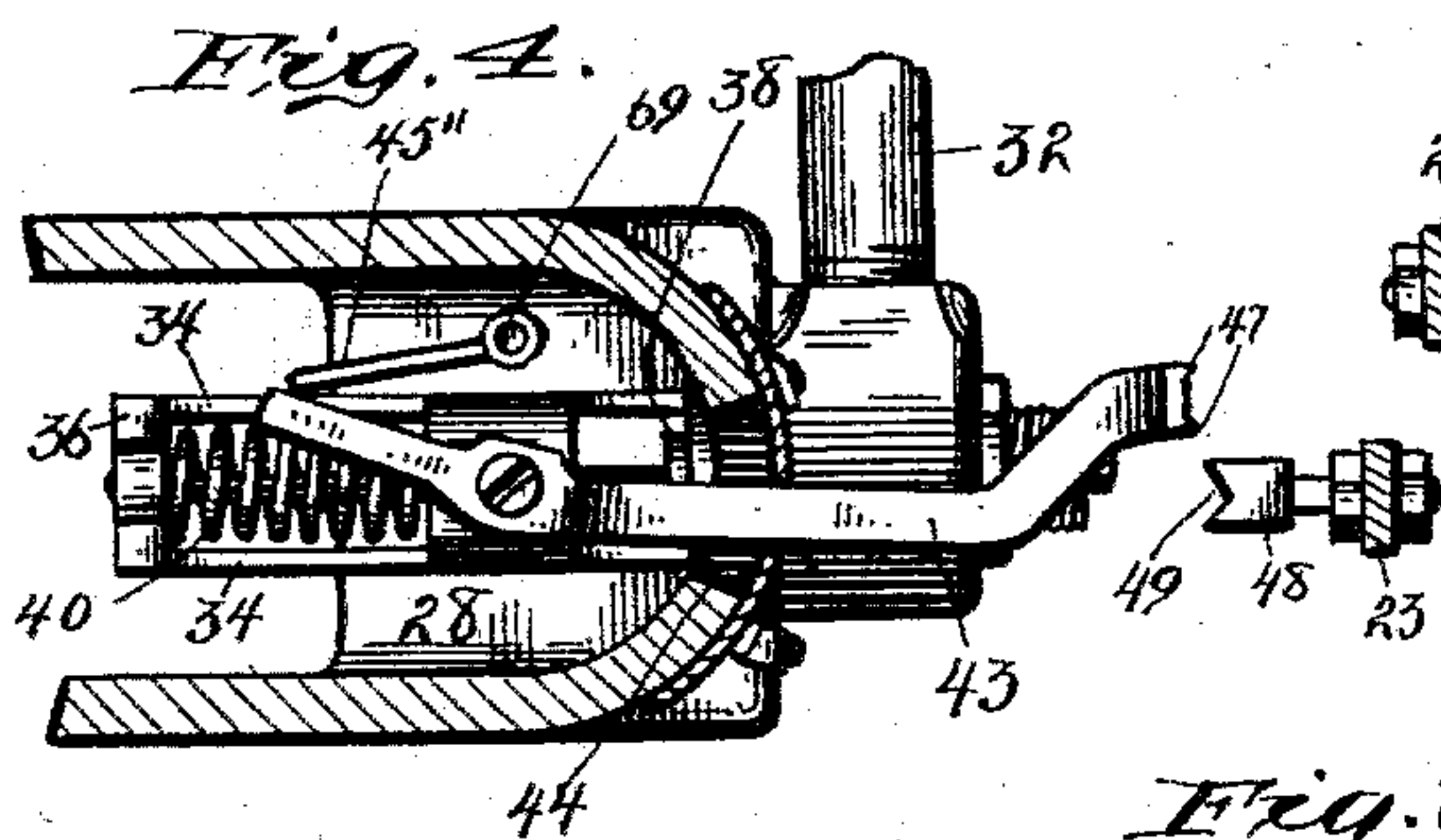
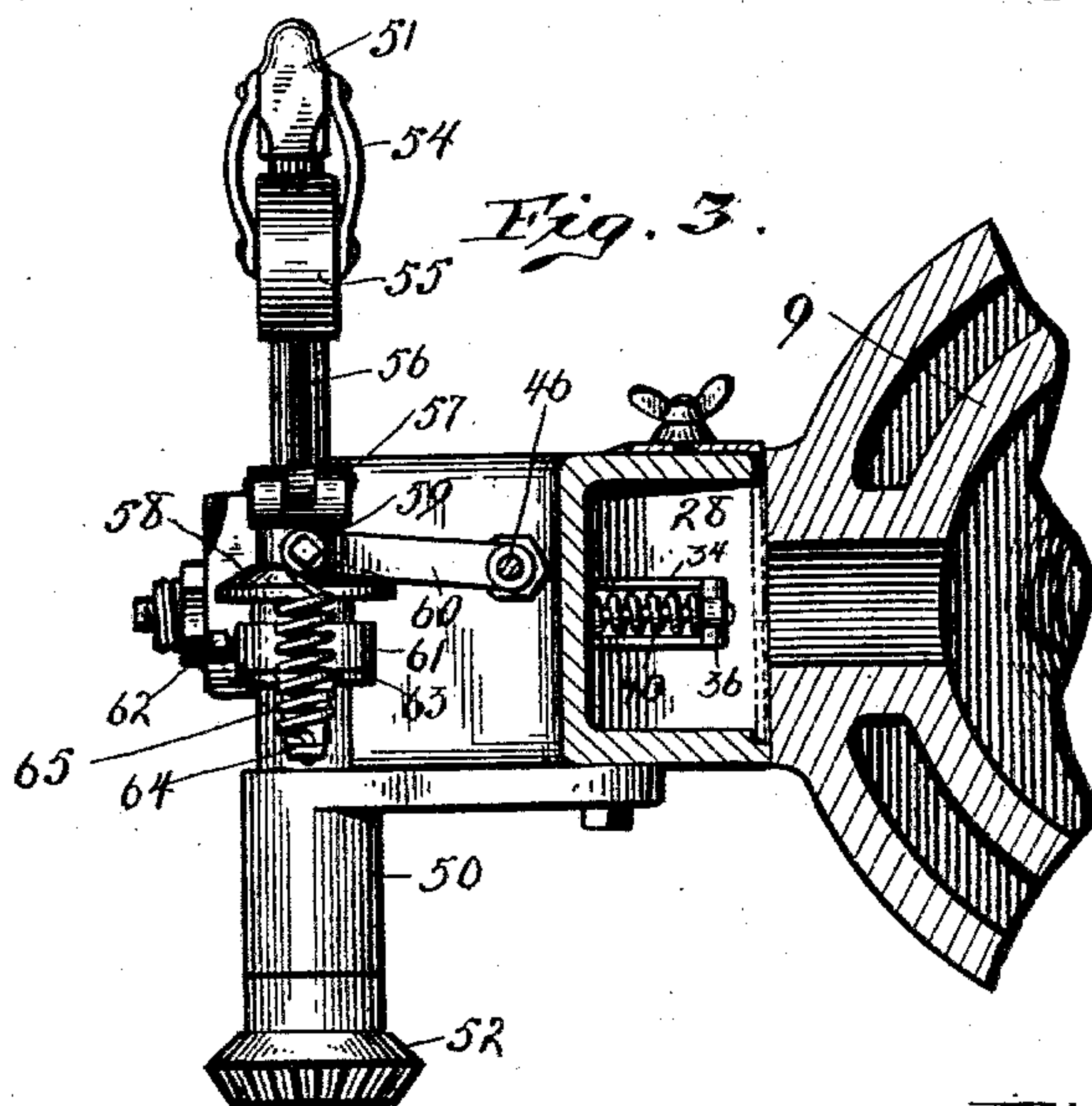
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WITNESSES:

H. L. Neely  
Harriet S. Hood

*Fig. 8.*



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# UNITED STATES PATENT OFFICE.

FRED W. SPACKE, OF INDIANAPOLIS, INDIANA.

## GOVERNOR FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 589,583, dated September 7, 1897.

Application filed April 7, 1896. Serial No. 586,570. (No model.)

*To all whom it may concern:*

Be it known that I, FRED W. SPACKE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Governor for Gas-Engines, of which the following is a specification.

My invention relates to an improvement in governors for gas-engines.

The object of my invention is to produce a governor which will be very sensitive to changes of load, and also to produce a governor which will be particularly adapted for use on double-acting gas-engines, more particularly the engine described and claimed in my pending application, Serial No. 586,572, filed herewith.

The accompanying drawings illustrate my invention.

Figure 1 is a plan view of the governor, showing also a central horizontal section of the engine shown in the above-mentioned application. Fig. 2 is a side elevation of the governor on a larger scale. Fig. 3 is a section on line 3 3 of Fig. 1. Fig. 4 is a section of one of the gas-inlet-valve-operating mechanisms. Fig. 5 is a similar view of the other gas-inlet-valve mechanism. Fig. 6 is a central horizontal section thereof. Fig. 7 is a detail of one of the admission-valves and its operating mechanism. Fig. 8 is a detail of a portion of the governor.

In the drawings, 9 indicates a cylinder in which is mounted a piston 10. A pair of ports 11 and 12 open one into each end of the cylinder, and over said ports are secured, respectively, the valve-boxes 13 and 14. Each of said valve-boxes is provided with a chamber 15, which communicates with the corresponding port 11 or 12 and is also provided with an admission-chamber 16 and an exhaust-chamber 17, each of said chambers communicating with chamber 15, and the communications therebetween being closed in box 13 by an admission-valve 18 and an exhaust-valve 19 and in box 14 by admission-valve 20 and exhaust-valve 21.

Mounted in suitable bearings on the engine-frame is a shaft 22, which is connected to the crank-shaft of the engine by suitable means to cause the said shaft to rotate at one-half of the speed of the said crank-shaft. Each

admission-valve stem is provided at its outer end with an I-shaped head 23, and each exhaust-valve stem is provided with a head 24, somewhat similar in shape.

Pivoted below each stem is a lever 25, the upper end of which is bifurcated and arranged to engage one of the I-shaped heads of the valve-stems. The lower ends of levers 25 are extended in position to be engaged each by a cam 26, carried by shaft 22, and one of a series of springs 27 is secured at one end to the lower end of each lever and at the other end to one of the valve-boxes, the whole arrangement being such that the movement of the piston will cause the valves to be intermittently opened, and the action of the springs will cause said valves to close.

Mounted between the admission-chambers of boxes 13 and 14 and communicating therewith is a mixing-chamber 28, into which is led any suitable supply of air, in the present case the said supply coming from a chamber 29, which is formed between the middle portion of the piston and the walls of the cylinder.

Each end of the mixing-chamber is enlarged, and opening into said enlarged portion is a passage 31, into which opens a suitable gas-inlet pipe 32. Mounted in the inner end of passage 31 by means of suitable screw-threads is a valve-seat 33. Formed integral with the inner end of said seat are a pair of arms 34, which carry about midway of their length a cylindrical guide 35, and connecting the ends of said arms is a cross-bar 36. A valve-stem 37 is mounted so as to slide through cross-bar 36, and the outer end of said stem is provided with a valve 38, which is adapted to fit into seat 33 and to thereby close the opening between the gas-inlet and the mixing-chamber. Secured to or formed integral with stem 37 is a collar 39, which is adapted to fit and to slide longitudinally in guide 35, and a spring 40, mounted between collar 39 and cross-bar 36, tends to keep the said valve closed. A pin 41 is secured to collar 39 and extends through a slot 42, formed in the guide. Pivoted to pin 41 is a lever 43, the outer end of which extends through a slot 44, formed in the outer wall of the mixing-chamber, and the inner end of said lever is adapted to be engaged either by an arm 45 or an arm 45', carried by a rock-shaft 46, which is mounted



in suitable bearings in the walls of the mixing-chamber and the ends of which project into said chamber. The outer end of lever 43 is provided at its upper and lower edges with a short spur 47. Secured to each I-shaped head 23 of each of the admission-valve stems is a pin 48, the inner end of which is notched, as at 49, the said pins being each arranged so as to be adapted to engage the outer end of one of levers 43 when the corresponding admission-valve is opened.

Mounted in a suitable bearing 50, secured to the walls of the mixing-chamber, is an upright governor-shaft 51, which is provided at its lower end with a gear 52, which meshes with a gear 53, carried by shaft 22. Secured to the upper end of shaft 51 at opposite sides thereof are a pair of links 54, to the lower ends of which are pivoted a pair of governor-balls 55, which are carried upon the upper ends of a pair of links 56, pivoted at their lower ends to a block 57, which is longitudinally movable on shaft 51. Block 57 is provided with a flange 58, the upper surface of which is adapted to be engaged by two rollers 59, which are carried at the outer ends of a pair of arms 60, which are secured to rock-shaft 46, the arrangement being such that a movement of the governor-balls away from the governor-shaft will cause block 57 to move upward upon shaft 51, and said movement of the block will cause shaft 46 to be rocked. Mounted upon the upper end of bearing 50 and arranged to be longitudinally movable thereon is a collar 61, provided with a set-screw 62, by means of which the collar may be secured at any desired position on bearing 50. Mounted on the upper end of bearing 50, below collar 61, and free to move on said bearing, is a plate 63, provided with a pair of oppositely-extending arms 64, to the outer end of each of which is secured one end of one of a pair of springs 65, the upper ends of said springs being secured one to each of arms 60, the said springs tending to restrain the outward movement of balls 55.

The ends of rock-shaft 46, which project into the mixing-chamber, are provided with suitable screw-threads, onto which is screwed at one end a check-nut 66 and a short rod 67 and to the other end of which is screwed a similar nut 68 and a rod 69. Secured near the outer end of rod 67 and substantially at right angles thereto is an arm 45, and similarly secured to rod 69 is an arm 45'', the arrangement being such that the inner ends of levers 43 will engage with the arms 45 and 45'' and will be held in contact therewith by means of the heavier outer ends of said levers. A pair of collars 70 are mounted, one on each rod 67 and 69, and are adapted to engage the outer walls of the enlarged portions of the mixing-chamber.

Arms 45 and 45'' are so adjusted, by means of the screw-threads on the ends of the rock-shaft and by means of the check-nuts 66 and 68, that when the engine is at rest arm 45 will

just be in engagement with its lever 43, while arm 45'' will be set somewhat lower, so that the outer end of its corresponding lever 43 will be slightly raised.

The operation is as follows: The movement of the piston causes shaft 22 to rotate, and the rotation of said shaft by means of gears 53 and 52 and shaft 51 causes the balls 55 to fly outward and thereby raise block 57, the movement of said block causing the outer ends of arms 60 to move upward and thereby rock shaft 46, said shaft in turn causing arms 45 and 45'' to press down upon the inner ends of levers 43 and thus raise the outer ends thereof. Under ordinary loads the outward movement of the governor-balls is sufficient to cause arm 45'' to so raise the outer end of its corresponding lever 43 that the said lever will be out of the path of movement of the corresponding pin 48, while arm 45 will raise the outer end of its corresponding lever 43, but will not raise the said end out of the path of movement of the corresponding pin 48. The inward-opening movement of the admission-valves, caused by the rotation of shaft 22, cam 26, and the movement of lever 25, will therefore cause one of the pins 48 to engage with the outer end of the lever 43, which is engaged by arm 45, and will press the said lever inward, thereby opening valve 38 against the action of spring 40 and thus allowing a certain portion of gas to pass into the mixing-chamber, where it is mixed with the required quantity of air and from there drawn through the admission-valve into the cylinder. The inward movement of the other admission-valve is precisely the same, but the outer end of the corresponding lever 43, which is controlled by arm 45'', being lifted out of the path of movement of pin 48, carried by said valve, the gas-inlet valve, which is operated by said lever, will not be opened, and therefore no new charge will pass into that end of the cylinder. Under ordinary loads, therefore, but one end of the cylinder is supplied with gas, and the engine operates as a single-acting engine. If the speed increases sufficiently, arm 45 will lift its lever 43 out of the path of the corresponding pin 48, and there will be no new charge supplied to either end of the cylinder. If the load becomes heavy, block 57 is dropped by the balls 55 far enough to allow the lever controlled by arm 45'' to drop down into the path of the corresponding pin 48, and gas will then be supplied to each end of the cylinder, this arrangement continuing as long as the load is heavy enough to require the extra power. As soon as the load lightens the outer ends of both levers 43 are raised and that one which is controlled by arm 45'' is again thrown out of the path of movement of its pin 48. Arms 45 and 45'' may be set at any desired angle relatively to each other, so that any desired increase of load will cause gas to be admitted to both ends of the cylinder, and said arms may be so set that both ends of the cylinder will work even, if desired. It will be



noticed that there is no positive connection between the governor-balls and the gas-inlet-valve-operating mechanism, and that the pivot-point of levers 43 being lower than the pivot-point of arms 45 and 45" the inner ends of said levers 43 move out of engagement with arms 45 and 45" when pins 48 press the said levers inward, so that the governor-balls are not hampered in their movement by the engagement of either one of pins 48 with its corresponding lever 43. This open connection between the gas-valve and the governor enables the governor to act upon each gas-valve entirely independently of the other, so that it is very sensitive to any changes of speed of the engine which may occur while one of the said valves is being operated by the corresponding admission-valve.

The outer ends of levers 43 are provided with spurs 47 and the inner ends of pins 48 are notched, so that said pins will continue to engage with said levers until the said levers are entirely out of the path of movement of the pins. By this construction the upper and lower edges of the outer ends of the levers will not become rounded off and thus cause the pins to miss the levers before they should do so. In order to increase the average speed of the engine, collar 61 is moved down upon the upper end of bearing 50, thereby increasing the stiffness of springs 65.

I claim as my invention—

1. In a governor for gas-engines, the combination with the gas-inlet valve thereof, a lever pivoted to said valve, and means for operating said valve through the medium of said lever, of a rock-shaft, an arm carried by said rock-shaft and adapted to engage with one end of the gas-valve lever but independent thereof, and means controlled by the speed of the engine for operating said rock-shaft, the arrangement being such that, when the gas-valve lever is moved so as to open the valve, the said lever will be moved out of engagement with the arm carried by the rock-shaft, substantially as and for the purpose specified.

2. In a double-acting gas-engine, the combination with a pair of gas-inlet valves, and means for opening said valves, of a governor-shaft mounted in suitable bearings and provided with governor-balls, and intermediate connecting mechanism between said balls and the gas-valve-operating means, whereby the movement of said balls from the governor-shaft will cause one of said valve-operating means to become inoperative while the other of said means still remains in operative position, the arrangement being such that, as each of the means for opening the valves is operated to open its valve, the said means will be moved out of engagement with said intermediate connecting mechanism, as and for the purpose described.

3. In a governor for gas-engines, the combination with the gas-inlet valve thereof, a lever pivoted to said valve, and means for open-

ing said valve through the medium of said lever, of a governor-shaft mounted in suitable bearings and having governor-balls secured thereto, a rock-shaft, intermediate connecting mechanism between said rock-shaft and the governor-balls whereby the movement of said balls toward and from the governor-shaft will cause a rocking movement of said rock-shaft, an arm carried by said rock-shaft and adapted to engage with one end of the gas-valve lever but independent thereof, the arrangement being such that, as the gas-valve lever is moved so as to open the valve, the said lever will be moved out of engagement with said arm, all combined and arranged to cooperate in such a manner that a movement of the governor-balls toward or from the governor-shaft will cause the said gas-valve lever to swing upon its pivot, as and for the purpose set forth.

4. In a governor for gas-engines, the combination with the gas-inlet valve thereof, a lever pivoted to said valve, and means for opening said valve through the medium of said lever, of a governor-shaft mounted in suitable bearings, a link pivoted to said shaft, a block longitudinally movable on said shaft, a link pivoted thereto, a governor-ball mounted between the free end of said links, a rock-shaft, an arm carried by said rock-shaft and adapted to be engaged by said longitudinally-movable block, and an arm secured to said rock-shaft and adapted to engage with one end of the gas-valve lever but independent thereof, the arrangement being such that, as the lever is moved so as to open the valve, the said lever will be moved out of engagement with said last-mentioned arm, all combined and arranged to cooperate substantially as and for the purpose set forth.

5. In a governor for gas-engines, the combination with the gas-inlet valve thereof, a lever pivoted to said valve, and means for opening said valve through the medium of said lever, of a governor-shaft mounted in suitable bearings, a link pivoted to said shaft, a block longitudinally movable on said shaft, a link pivoted thereto, a governor-ball mounted between the free ends of said links, a rock-shaft, an arm carried by said rock-shaft and adapted to be engaged by said longitudinally-movable block, a spring secured at one end to said arm and at the other end to a fixed point, and an arm secured to said rock-shaft and adapted to engage with one end of the gas-valve lever but independent thereof, the arrangement being such that, as the lever is moved so as to open the valve, the said lever will be moved out of engagement with the said last-mentioned arm, all combined and arranged to cooperate as and for the purpose set forth.

6. In a double-acting gas-engine, the combination with a pair of gas-inlet valves, and independent means for operating each of said valves, of means controlled by the speed of the engine and connected to said gas-valve-



operating means, whereby the movement of said speed-controlled means will cause one of the valve-operating means to become inoperative while the other of said valve-operating means still remains in operative position, the arrangement being such that, as each of the means for operating the valves is operated so as to open its valve, the said means will be moved out of engagement with said speed-controlled means, as and for the purpose set forth.

7. In a governor for a double-acting gas-engine, the combination with the pair of gas-inlet valves, a lever pivoted to each of said valves, and means for independently opening each of said levers through the medium of its respective lever, of a governor-shaft mounted in suitable bearings and having governor-balls secured thereto, a rock-shaft, intermediate connecting mechanism between said rock-shaft and the governor-balls whereby the movement of said governor-balls toward and from the governor-shaft will cause a rocking movement of said rock-shaft, and two arms carried by said rock-shaft and rotatively adjustable thereon, each of said arms being adapted to engage with one of the gas-valve levers, but each of said arms being capable of a movement independent of the gas-valve levers all combined and arranged to cooperate in such a manner that a movement of the governor-balls toward or from the governor-shaft will cause the said gas-valve levers to swing upon their pivots.

8. In a governor for a double-acting gas-engine, the combination with the pair of gas-inlet valves, a lever pivoted to each of said valves, and means for independently opening each of said valves through the medium of its

respective lever, of a governor-shaft mounted in suitable bearings, two links pivoted to said shaft, a block longitudinally movable on said shaft, two links pivoted thereto, two governor-balls mounted one between each pair of links, a rock-shaft, a pair of arms carried by said rock-shaft and adapted to be engaged by said longitudinally-movable block, a collar longitudinally movable toward and from said block, two springs each secured at one end to said collar and at the other end to one of said arms, and two arms secured one at each end of the rock-shaft and rotatively adjustable thereon, each of the said arms being adapted to engage one end of one of the gas-valve levers, substantially as and for the purpose set forth.

9. In a governor for gas-engines, a gas-inlet valve therefor which consists of a valve-seat secured in the gas-inlet, a guide carried by said valve-seat, a cross-bar also carried by said valve-seat, a valve-stem mounted in a bearing in said cross-bar and provided with a valve adapted to close the opening in the valve-seat, a collar carried by said valve-stem and adapted to move in said guide, a spring mounted between the collar and the cross-bar, a lever pivoted to said collar, means for engaging one end of said lever and thereby opening the said valve, and means for engaging the other end of said lever and thereby lifting the said lever out of the path of movement of the valve-operating means, substantially as set forth.

FRED W. SPACKE.

Witnesses:

A. M. HOOD,  
M. V. HOOD.