No. 741,977. PATENTED OCT. 20, 1903.

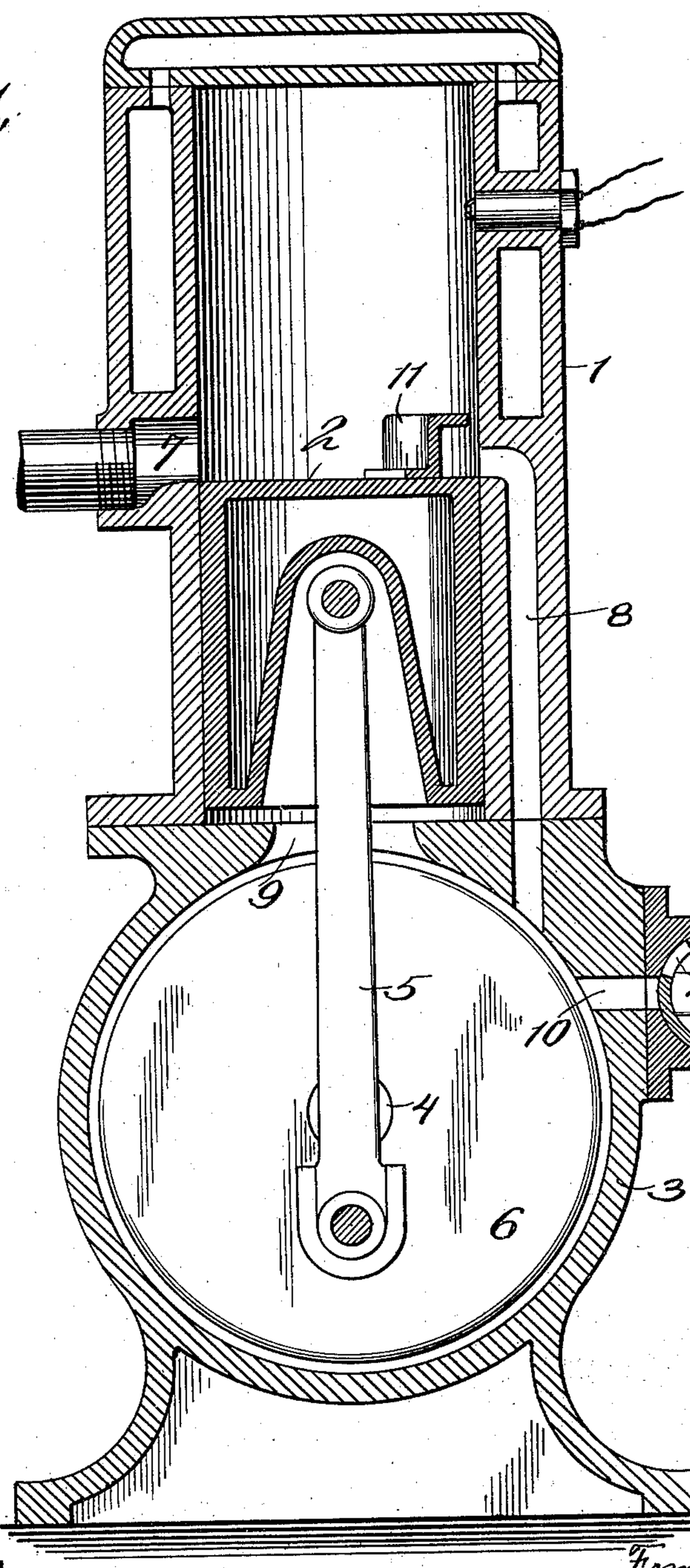
F. M. RITES.

VALVE GEAR FOR EXPLOSIVE AND INTERNAL COMBUSTION ENGINES.

APPLICATION FILED FEB. 27, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.

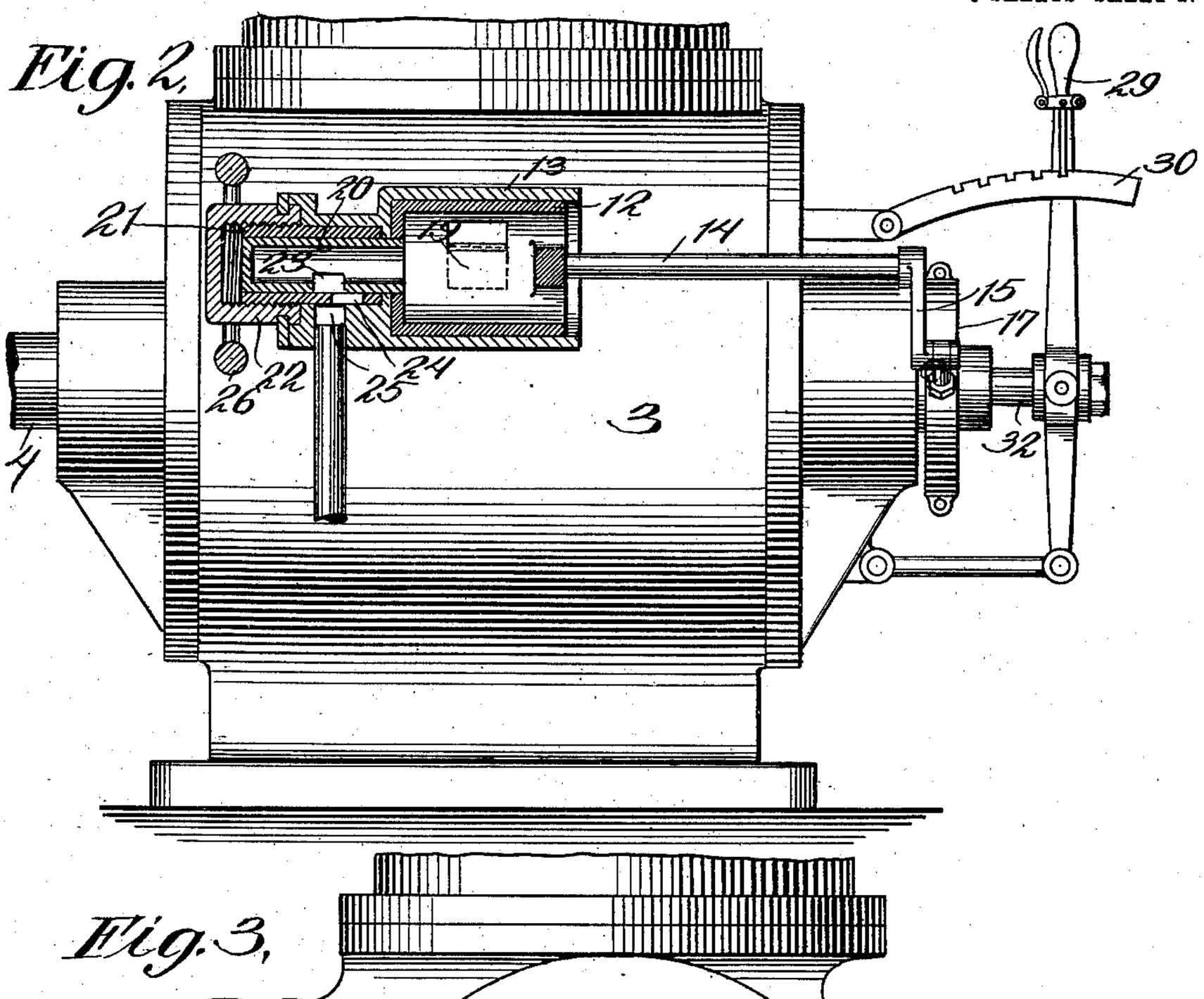
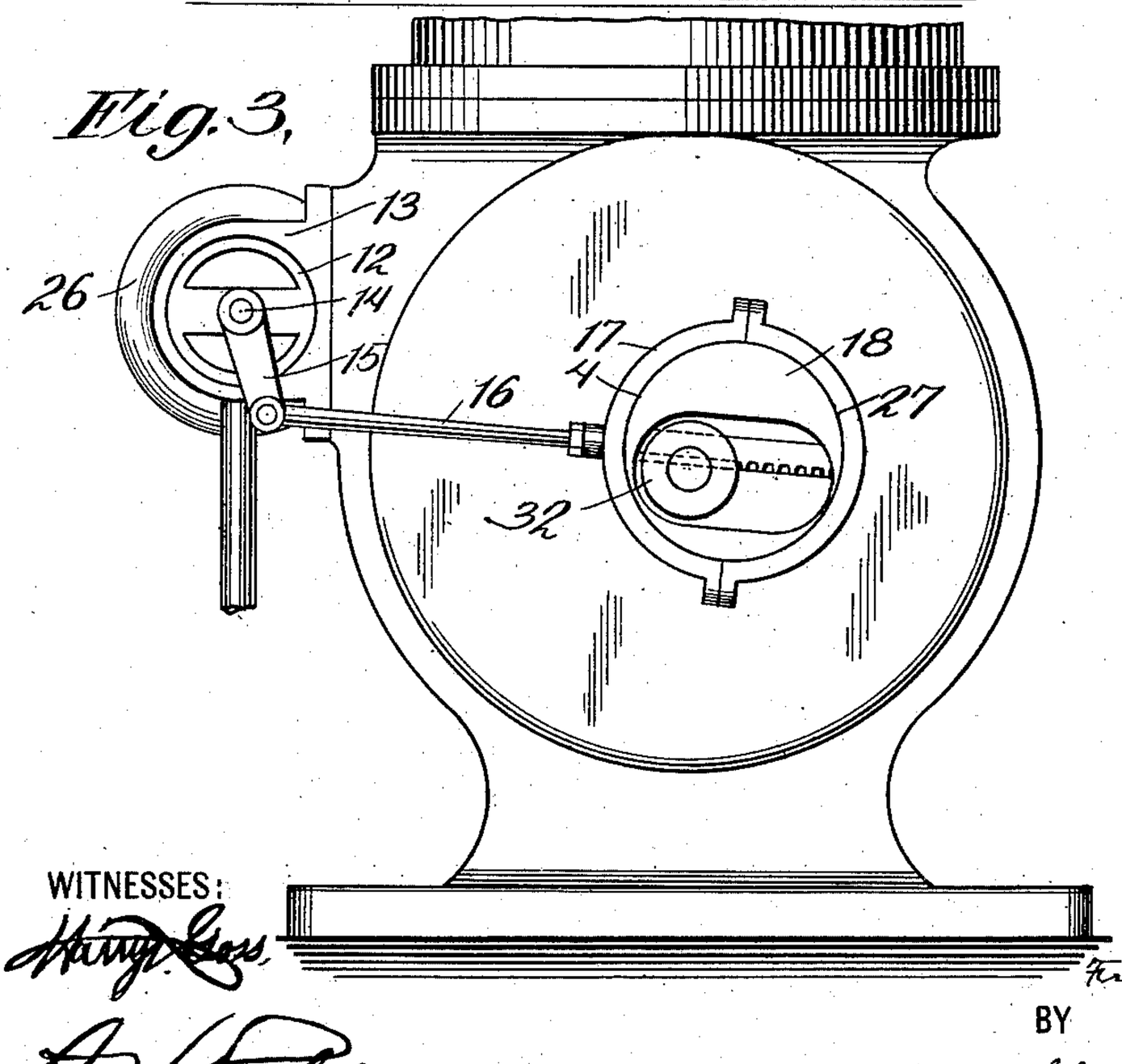


Fig. 3.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 5

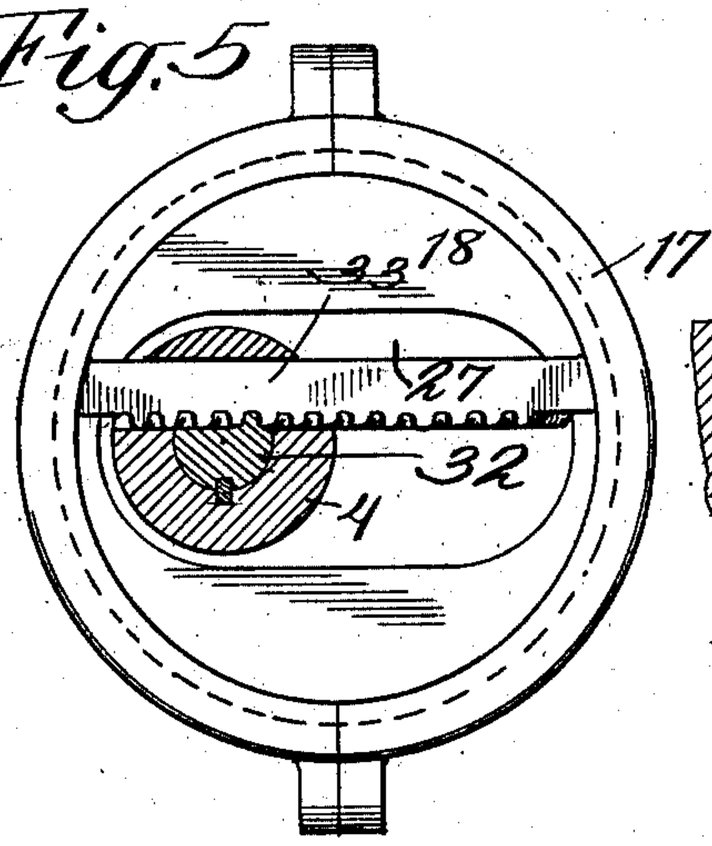


Fig. 6,

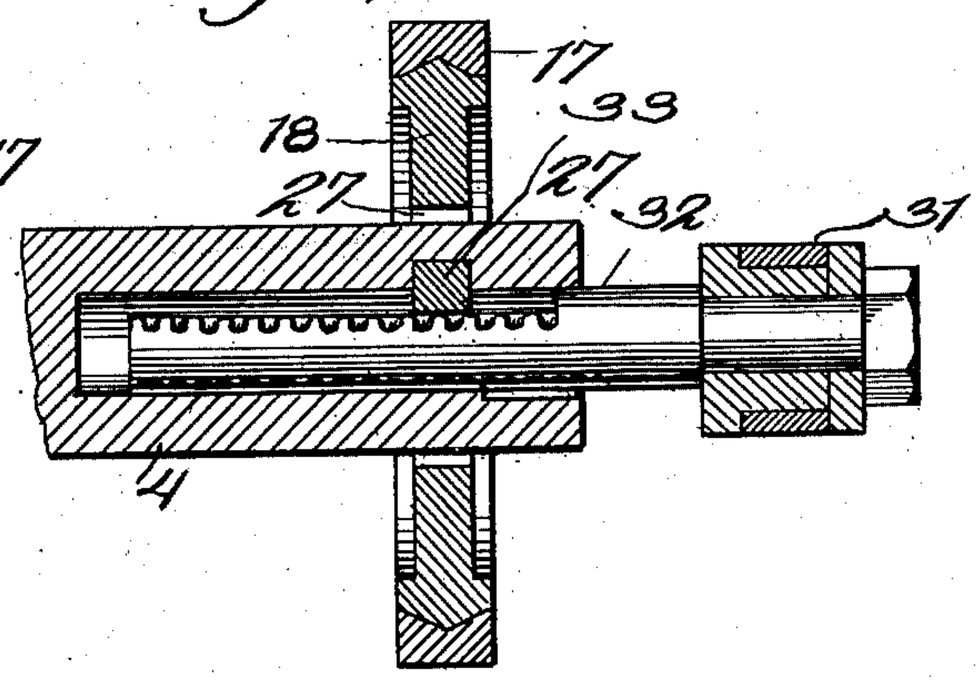
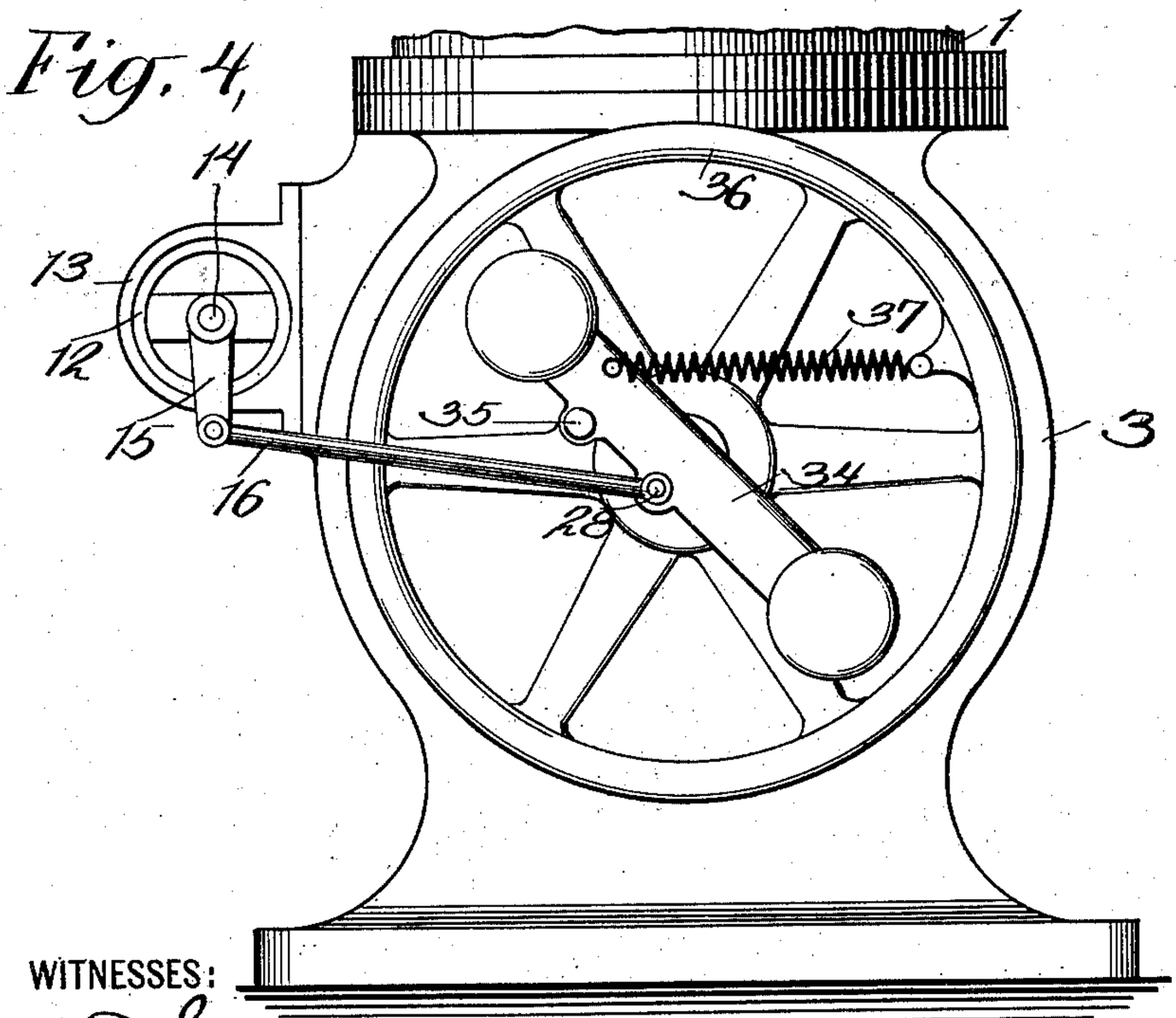


Fig. 4,



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No. 741,977. Patented October 20, 1903.

UNITED STATES PATENT OFFICE.

FRANCIS M. RITES, OF ITHACA, NEW YORK.

VALVE-GEAR FOR EXPLOSIVE AND INTERNAL-COMBUSTION ENGINES.

SPECIFICATION forming part of Letters Patent No. 741,977, dated October 20, 1903.

Application filed February 27, 1902. Serial No. 95,875. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. RITES, a citizen of the United States, residing in Ithaca, in the county of Tompkins and State of New York, have invented certain new and useful Improvements in Valve-Gear for Explosive and Internal-Combustion Engines; and I do hereby 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.

My invention relates to improvements in valve mechanism for explosive and internal-combustion engines, and more especially for engines of what are known as the "two-cycle" type; and my invention consists in a novel valve-gear controlling the admission of an explosive charge to the compression-chamber of such an engine, in the novel adjustable mixing-valve employed, in the novel construction of a deflecting-vane and the relation of an igniting device thereto, and in other features of combination, construction, and arrangement of the parts, as hereinafter pointed out in the claims.

The objects of my invention are to increase the efficiency of explosive and internal-combustion engines of the type mentioned, to improve the mechanism employed for regulating or varying the speed thereof, to render the engine reversible, to provide improved means for regulating the proportions of the charge and for varying such proportions while the engine is in operation, to render ignition more certain and thorough, to avoid pounding of the valves, and generally to make the mechanism of the engine as simple, compact, and reliable as possible.

I will now proceed to describe my invention with reference to the accompanying drawings, which illustrate certain forms of the invention, and in which—

Figure 1 shows a central vertical section of a two-cycle gas-engine embodying my invention. Fig. 2 is a side elevation of the base of such an engine, the mixing-valve being sectioned longitudinally and means being shown for shifting the eccentric by hand and thereby for changing the direction of motion of the engine. Fig. 3 is an end elevation of the base of such an engine. Fig. 4 is a similar view showing an engine provided with an automatic speed-governor. Fig. 5 is a detail face view, on a larger scale, of the eccentric and parts connected therewith, showing the means for shifting the eccentric by hand. Fig. 6 is a section of the same parts on a plane at right angles.

The engine shown in the drawings comprises a jacketed working cylinder 1, piston 2, closed crank-case 3, crank-shaft 4, connecting-rod 5, and crank-disks 6. The cylinder is provided with an exhaust-port 7 and with an inlet-port 8, connecting said cylinder with the crank-case. The crank-case communicates with the portion of the cylinder lying beneath the piston by opening 9. It is also provided with an admission-port 10, the entrance of air and gas through which into the crank-case is controlled by the hereinafter-mentioned mixing-valve. The piston is provided with a deflecting-vane 11, which while performing the usual functions of such a vane is of special construction for a special purpose, as herein described. Ports 7 and 8 are arranged to be uncovered successively by the piston in its downward movement, the exhaust-port being first uncovered, so as to release the gases remaining in the cylinder, and then the port 8 being uncovered, so that the charge under pressure in the crank-case may pass through said port into the cylinder and, being deflected by the vane 11, may be deflected so as to sweep through the cylinder and drive therefrom the remaining products of combustion.

Heretofore the inlet-valves of engines of this type have usually been suction-operated puppet-valves, which are lifted and then caused to seat violently each time the crank-shaft revolves. Power is lost by lifting the valve against its spring, while the hammering of the valve against its seat causes noise and deformation of the valve and its seat. In the engine herein illustrated and described I employ a valve, preferably of the rotary oscillatory type, which passes over its port so as to positively open and close the same without pounding and without the exercise of undue force.

In engines of this type the amount of the charge has usually been controlled by throttling the admission of the charge to the crank-case or to the engine-cylinder. In this engine

I accomplish the same purpose by varying the duration of opening of the admission-valve. I thereby avoid waste of power by throttling the charge.

12, Figs. 1 and 2, is the aforesaid admission and mixing valve. It is a cylindrical valve within a valve-chamber 13 and is oscillated by means of a shaft 14, having an arm 15 connected by an eccentric-rod 16 to the strap 17 of an eccentric 18, mounted on the crank-shaft. It is provided with a port 19, adapted to register at proper times with the admission-port 10 of the crank-case. One end of the valve 12 is open for the admission of air. At the other end said valve is provided with a hollow cylindrical extension 20, mounted within a sleeve 21, itself mounted in a reduced portion of the valve-chamber 13 and adapted to be moved longitudinally by means of a screw-nut 22, secured to the valve-casing. In said tubular extension of the valve 20 there is a port 23, and the valve-sleeve 21 is provided with a corresponding port 24, adapted to register more or less completely with such port and with a gas-supply port 25, according to the position of the sleeve. A hand-wheel 26 is provided for rotating the nut 22, and thereby moving the sleeve 21 back and forth, and this hand-wheel may be operated while the engine is running. The duration of the time of opening of the valve is arranged to be varied by shifting the eccentric 18 across the shaft. For this purpose if a disk eccentric be employed, as shown in Fig. 3, the said eccentric may have a slot 27. In the case of an overhung eccentric, as shown in Fig. 4, the eccentric may be a pin 28. The two types of eccentrics are equivalents of each other. Adjustment of the eccentric may be effected either by hand-operated means, as shown in Fig. 2, or by an automatic speed-governor, as shown in Fig. 4. If shifted by hand, the direction of rotation of the engine may be changed by shifting the eccentric past the dead-point, a great advantage for marine and automobile engines. The hand-operated means for doing this comprise a hand-lever 29 and a notched sector 30. The hand-lever is connected to a block 31, mounted upon a stem 32, longitudinally movable in an axial recess of the crank-shaft, but arranged to rotate with such crank-shaft. Block 31 is arranged to impart axial movement to the stem 32, while permitting rotary movement thereof. The eccentric 18 is not mounted directly upon the crank-shaft, but is mounted thereon by means of a rack 33, having a sliding bearing in said crank-shaft, but secured to the eccentric and having inclined rack-teeth engaging corresponding rack-teeth of stem 32. It is obvious, therefore, that by moving said stem in or out the eccentric may be moved across the shaft in either direction, and thereby the degree of eccentricity of said eccentric and the travel of the valve 12 may be varied without varying the time of opening of said valve, the time of closing the valve, however, varying with its throw, and it is also obvious that by moving the eccentric past the dead-point the direction of rotation will be reversed, the suction and compression strokes being transposed.

The governor (shown in Fig. 4) is of ordinary type, and consists of a weight 34, pivoted at 35 to a carrying-wheel 36, mounted upon the crank-shaft, centrifugal motion of said weight being resisted by spring 37.

The operation of this engine is as follows: On the upstroke of the engine the valve 12 is opened, and the mixture of air and gas is drawn into the compression-chamber 3 through the suction produced by the upward movement of the piston. The admission-valve closes at a point determined by the position of the eccentric. At the same time another charge, which has entered the cylinder previously from the crank-case 3 in a manner hereinafter described, is compressed and at or near the end of the upstroke is ignited. On the downstroke the charge so ignited expands, and at the same time the charge drawn into the crank-chamber 3 is compressed. Near the end of the stroke the exhaust-port 7 is uncovered, and the gas under pressure remaining in the cylinder is released, and shortly thereafter the inlet-port 8 is opened, and the compressed gas within the crank-case rushes through the said port into the cylinder 1, being deflected by the vane 11 in such manner that the burned gases are swept from the cylinder into the exhaust-port. On the next succeeding stroke the operation above described is repeated. If the engine is provided with an automatic speed-governor, said governor will adjust the point of closing of the mixing-valve so as to admit to the crank-case the proper amount of mixed air and gas required to maintain uniform speed of the engine. If the engine is provided with hand-operated means for shifting the eccentric, the latter may be adjusted by hand, and thereby the speed of the engine may be varied within wide limits or the engine adjusted for varying load or the direction of rotation changed. To change the direction of rotation, the hand-lever is moved far enough to shift the eccentric from one side of the shaft to the other. This reverses the eccentricity of the eccentric, and therefore reverses the direction in which the engine will run. If the stored pressure in the crank-case is not sufficient to start the engine in the new direction after reversal in this manner, it may be started by hand. It is preferable to vary the proportions of the charge somewhat as the point of cut-off is varied, and this may be done by operating the hand-wheel 26. By means of this wheel the speed of the engine provided with hand-operated eccentric-shifting mechanism may also be varied.

One feature of my invention resides in the shape of the deflector 11. It is bent over at the top, so as to form a pocket in which a portion of the rich gases from the crank-case re-

main free from contamination with any of the products of combustion in the cylinder. At or near the conclusion of the upstroke this pocket is opposite the igniter 38. Ignition takes place at this time, the spark from the igniter encountering first the rich gases inclosed by the said pocket. This insures ignition, and the flame thus produced will spread without difficulty through the cylinder. By this means the ignition is rendered very certain.

In another application I have claimed a valve controlling admission to the engine, provided with means for adjusting the proportions of the mixture during the operation of the engine and operated by variable-cut-off mechanism. Such invention I do not claim, broadly, herein.

It is obvious that my invention is susceptible of many variations and modifications, and I do not limit myself to the details of construction, arrangement, and operation herein illustrated and described.

What I claim is—

1. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a compression-chamber, and a piston for compressing a charge therein, of a valve controlling admission to said compression-chamber, and variable-cut-off operating mechanism therefor comprising a valve-operating device which opens said valve at the beginning of the suction-stroke of said piston and closes the same at a variable point in said suction-stroke.

2. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a compression-chamber, and a piston for compressing a charge therein, of a valve controlling admission to said compression-chamber, and variable-cut-off operating mechanism therefor comprising a shifting eccentric which opens said valve at the beginning of the suction-stroke of said piston and closes the same at a variable point in said suction-stroke, and means for shifting said eccentric.

3. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a shaft, a compression-chamber, and a piston for compressing a charge therein, of a valve controlling admission to said compression-chamber, and variable-cut-off operating mechanism therefor comprising a shifting eccentric movable across said shaft but to one side of the axis thereof, and arranged to open said valve at the beginning of the suction-stroke of the said piston and to close the same at a variable point in such suction-stroke, and means for shifting the eccentric.

4. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a closed crank-case, and a piston forming both a power and a compression piston, of a valve controlling admission to said crank-case, and variable-cut-off operating mechanism therefor, comprising a valve-operating device which opens said valve at the beginning of the suction-stroke and closes said valve at a variable point in said suction-stroke.

5. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a closed crank-case, and a piston forming both a power and a compression piston, of a mixing-valve controlling admission to said crank-case, and variable-cut-off operating mechanism therefor, comprising a valve-operating device which opens said valve at the beginning of the suction-stroke and closes said valve at a variable point in said suction-stroke.

6. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder having an admission-port adapted to be opened and closed by the piston, a piston, and a compression-chamber connected to the cylinder by said admission-port, of an admission-valve controlling admission to said compression-chamber, and variable-cut-off operating mechanism therefor, comprising a valve-operating device which opens said valve at the beginning of the suction-stroke and closes the same at a variable point in said stroke.

7. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a closed crank-case, and a piston forming both a power and a compression piston, of an oscillatory valve, controlling admission to said crank-case, and variable-cut-off operating mechanism therefor, comprising a valve-operating device which opens said valve at the beginning of the suction-stroke and closes the same at a variable point in said suction-stroke.

8. In an explosive or internal-combustion engine, the combination with a cylinder having an admission-port, of a piston having a deflecting-vane thereon, which is opposite the admission-port when the latter is open, and is provided with a cavity adapted to retain a portion of the rich entering gases, clearance being provided between the deflector and the cylinder-walls, and igniting means arranged to register with said cavity in one position of the piston.

9. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a compression-chamber, and a piston for compressing a charge therein, of a valve-chamber, a rotary valve therein controlling admission to said compression-chamber, arranged to open and close a port leading thereto, having an opening for the entrance of air, and having also a cylindrical extension having a port in registry with a gas-admission port in said valve-chamber, a regulating valve-sleeve interposed between said extension of the rotary valve and the sides of the valve-chamber, and a rotary cap held against longitudinal motion but having screw-threads engaging said regulating valve-

sleeve and arranged by its rotation to move said sleeve longitudinally to regulate the admission of gas.

10. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder, a closed crank-case, and a piston forming both a power and a compression piston, of a valve controlling admission to said crank-case, and variable-cut-off operating mechanism therefor comprising a shifting eccentric adapted to swing across the shaft from one side of the center thereof to the other, and means for moving said eccentric.

11. In a valve-gear for explosive and internal-combustion engines, the combination with an engine-cylinder having an admission-port adapted to be opened and closed by the piston, a piston, and a compression-chamber connected to the cylinder by said admission-port of an admission-valve controlling admission to said compression-chamber, and variable-cut-off operating mechanism comprising a shifting eccentric adapted to swing across the shaft from one side of the center thereof to the other, and means for so moving said eccentric.

In testimony whereof I affix my signature in the presence of two witnesses.

FRANCIS M. RITES.

Witnesses:
HARRY M. MARBLE,
A. H. PERLES.