

928,299.

H. M. YAGER.
GAS ENGINE.
APPLICATION FILED JAN. 29, 1908.

Patented July 20, 1909.
2 SHEETS—SHEET 1.

Fig. 1.

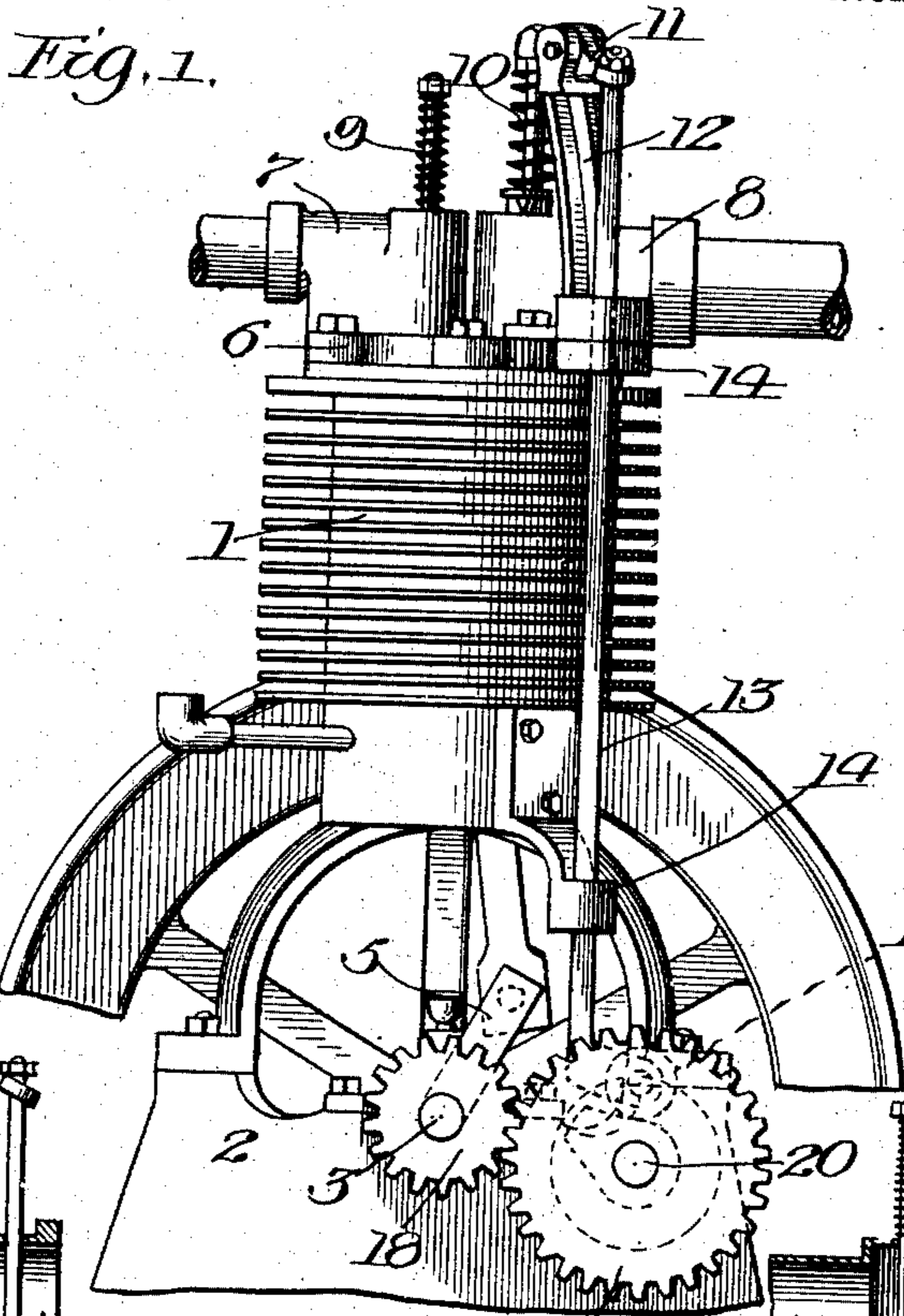


Fig. 2.

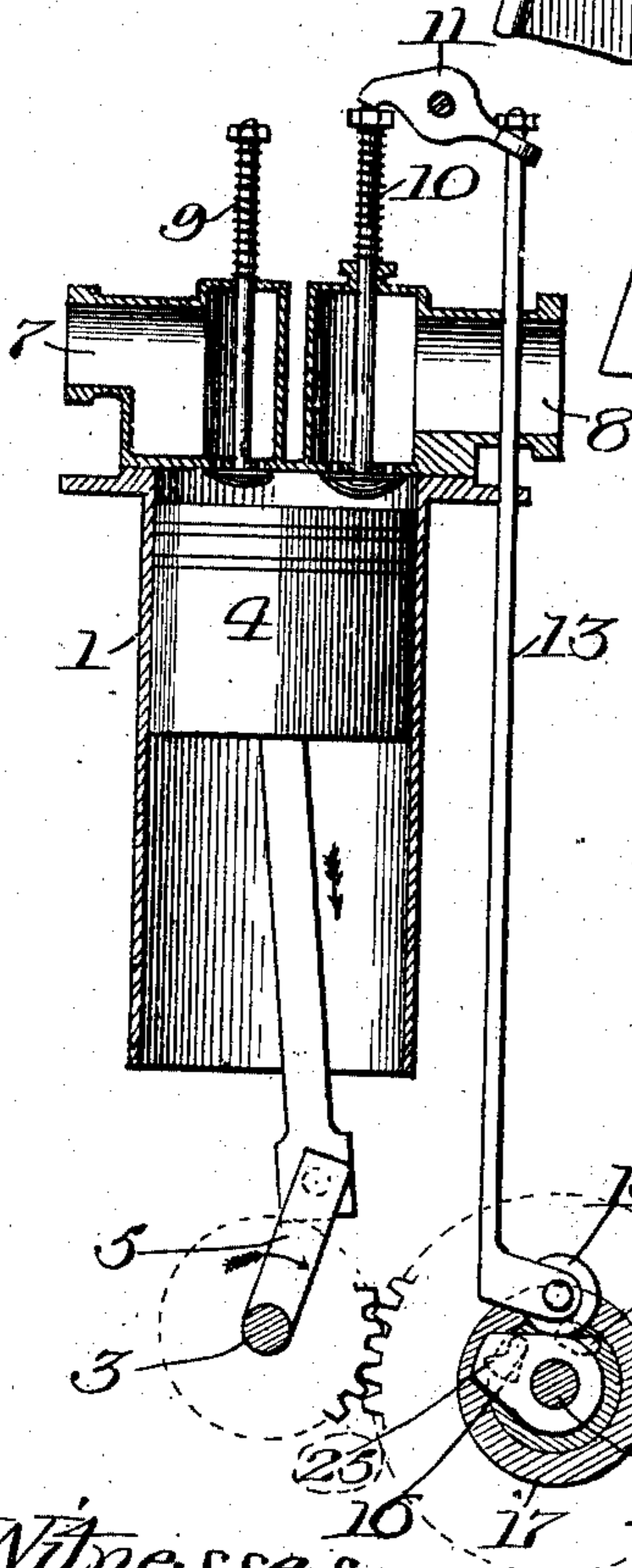


Fig. 3.

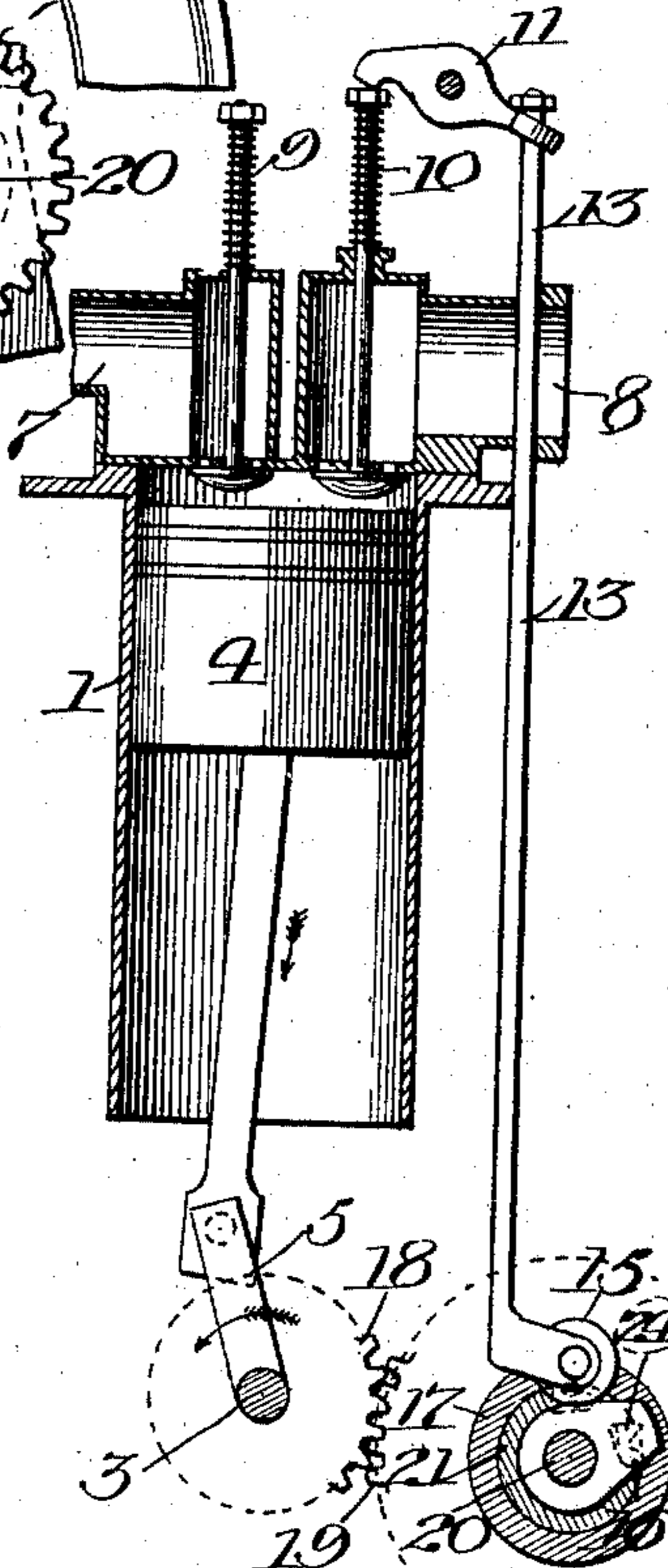


Fig. 4.

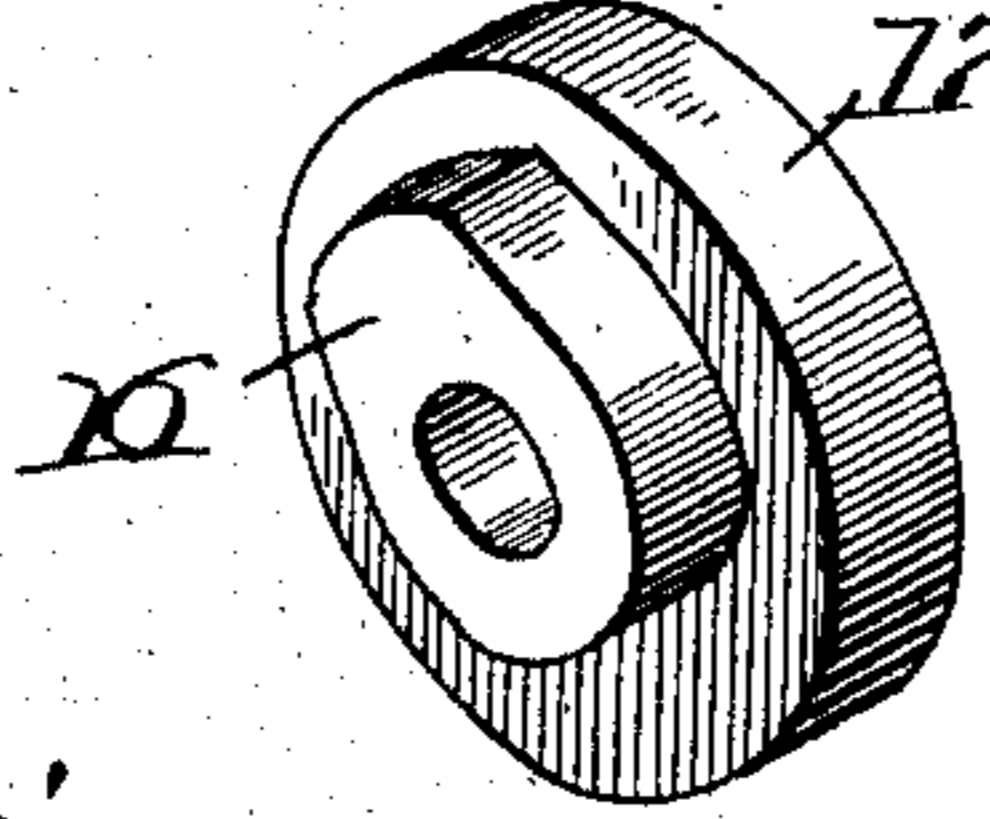
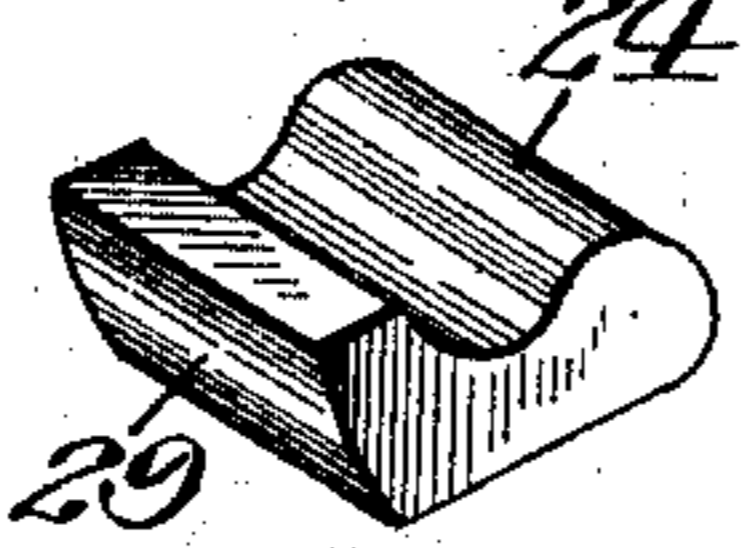


Fig. 5.



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Fig. 5.

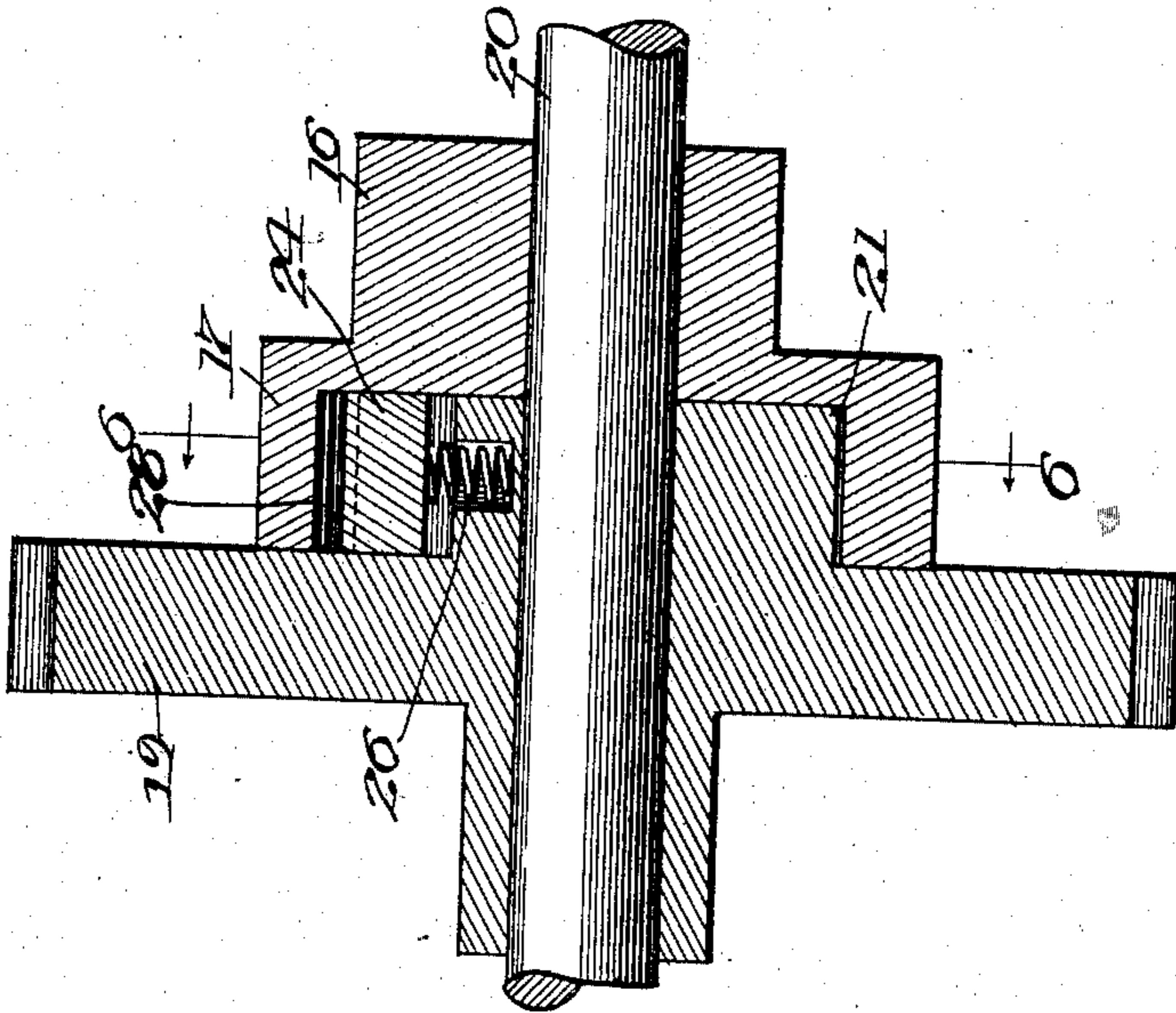
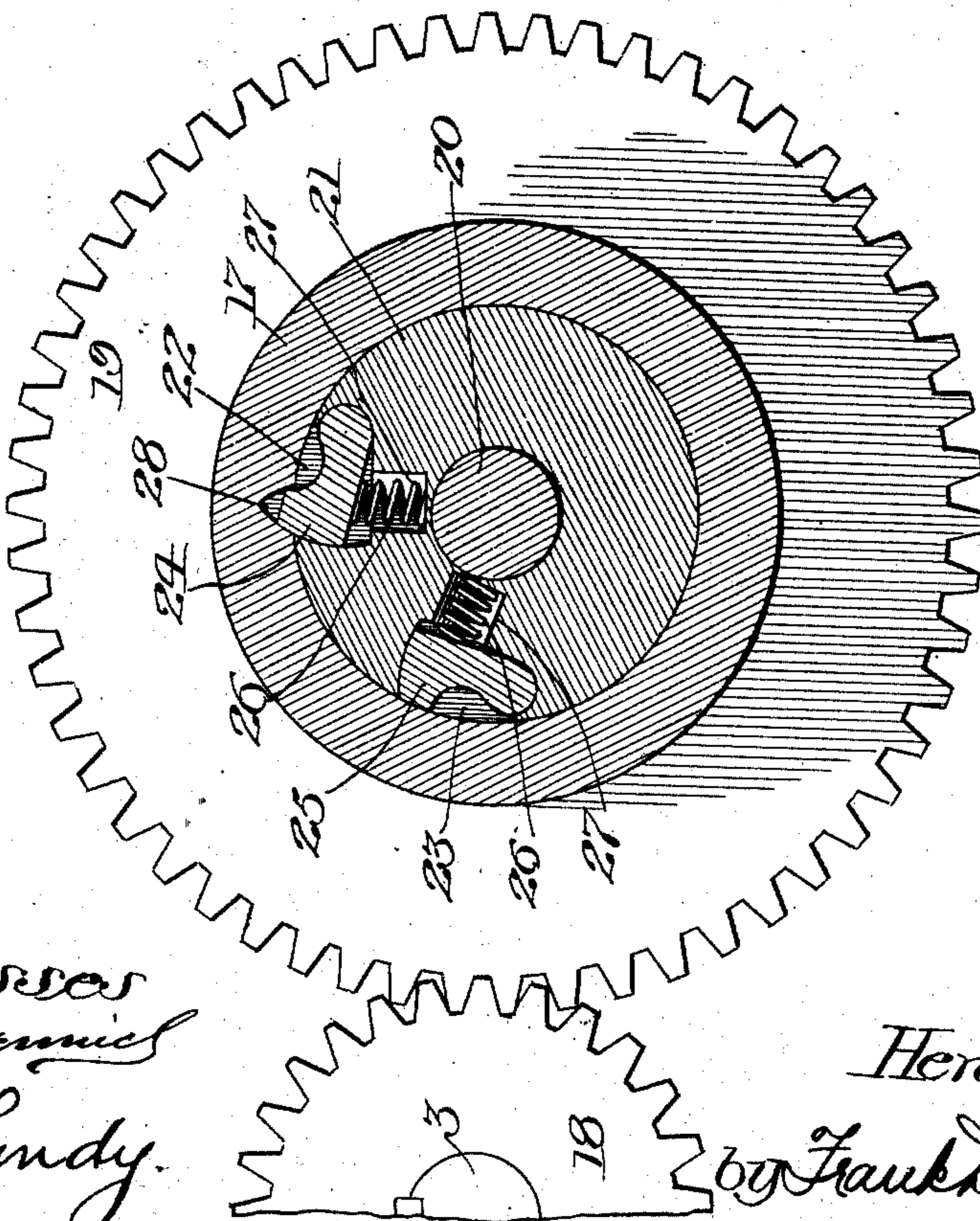


Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY M. YAGER, OF DAVENPORT, IOWA.

GAS-ENGINE.

No. 928,299.

Specification of Letters Patent.

Patented July 20, 1909.

Application filed January 29, 1908. Serial No. 413,228.

To all whom it may concern:

Be it known that I, HENRY M. YAGER, a citizen of the United States, and a resident of Davenport, in the county of Scott and State of Iowa, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact description.

My invention relates to hydro-carbon or explosive engines of either the two cycle or the four cycle type, and its object is to provide simple and efficient means for automatically reversing the direction of movement of the drive-shaft thereof. In order to accomplish this object, a novel arrangement of the parts is provided whereby the cycle or period of exhaust will be changed so that it will be timed to occur at one side or other of the "dead-center" of the crank and piston. Thus, if the engine is running forward and the shaft turning from right to left the exhaust will occur on the left side of the "dead-center" and when reversed by turning in the opposite direction past the "dead-center" the exhaust will occur on the right side of the "dead-center". I accomplish this by the means hereinafter fully described and as more particularly pointed out in the claims.

In the drawings:—Figure 1 is a side elevation of a single cylinder engine preferably of a four cycle type, having my improvements applied thereto. Figs. 2 and 3 are diagrammatical views showing the relative position of the piston and valve mechanism of the engine at the point where the explosion occurs and just preceding the exhaust stroke, the former figure showing the position thereof during the forward movement from right to left, while the latter illustrates the reversal movement or from left to right. Fig. 4 is a detail perspective view of the cam and disk employed to operate the exhaust valve. Fig. 5 is an enlarged section taken through the reversing mechanism on the vertical longitudinal plane of the spindle thereof. Fig. 6 is a vertical section thereof taken on dotted line 6—6, Fig. 5. Fig. 7 is a detail perspective view of one of the dogs used in connection with the reversing means of my invention.

Reference being had to the drawings, 1 represents a suitable vertically disposed cylinder, which is supported on an open base 2, in which the drive-shaft 3 of the engine is journaled. This shaft is provided on one end with a suitable balance-wheel, and is ac-

tuated in the usual manner by a pitman connected at its upper end to the piston-head 4 within the cylinder, and at its lower end is secured to the crank 5 of said drive-shaft.

The upper end of the cylinder is preferably closed by a head 6, that has a supply and exhaust port 7 and 8, cast integral therewith. The vertical cylindrical portions of these elbows are provided with bearings for journaling the spindles of mushroom shaped valves 9 and 10, that are kept normally closed by suitable expansion springs surrounding said spindles outside of said elbows and pressing upward against the nuts on the ends thereof. The inlet-valve is, preferably, opened automatically by the vacuum caused by the down stroke of the piston in the cylinder. The exhaust-valve is, in this instance, opened every second stroke of the piston by means of a rocking-lever 11, fulcrumed mediate its ends in the bifurcated upper end of a supporting-bracket 12, secured to and arising from head 6. One end of this rocking-lever engages and presses down on the top of the spindle of exhaust-valve 10, while its opposite end is engaged by the upper end of a vertically reciprocal operating bar 13. This bar is slidably mounted in bearings 14, 14, secured to and projecting laterally out from the upper and lower end of the cylinder and its lower end is provided with a deflected extension in which a suitable roller 15 is journaled. The timing of the exhaust stroke is preferably accomplished by means of a cam 16 projecting from the outer face of a suitable sleeve 17, which rotates with a gear 19 once every two revolutions of the drive-shaft. As the apex of the cam comes under roller 15 bar 13 is raised and the exhaust valve 10 is opened through the medium of the rocking-bar 11. Gear 19 preferably meshes with and is driven by a pinion 18 keyed on the extended end of the drive-shaft, and said gear has twice as many teeth as said pinion so that the latter makes two revolutions to each rotation of the gear. This causes the exhaust to occur at the proper moment during the cycles of the engine, which, in the four cycle type, is on the up-stroke of the piston following the explosion, and in the two cycle type on a portion of the downward stroke following the explosion.

In the diagrammatic illustration in Fig. 2 the piston of a four-cycle engine is shown on the downward stroke immediately after an explosion has taken place, and as soon as said piston has reached the lowermost point

of its stroke the cam 16 will have opened valve 10 so that the exhaust may be accomplished on the upward movement thereof. This operation will continue at every second 5 reciprocation of the piston in the manner described when the shaft is revolving to the right.

In order to adjust the cam and sleeve on gear 19, and reverse the exhaust stroke so 10 that it will occur on the opposite side of the engine, said gear is provided with a boss 21 that, preferably, fits into the sleeve 17 and has two peripheral seats 22 and 23. These seats are each provided with oppositely facing 15 dogs, 24 and 25 respectively, that are kept normally pressing out of their seats by coil expansion-springs 26, fitted in wells 27 cut in the bottoms of said seats. A suitable transverse-slot 28 is formed in the inner cir- 20 cumference of the sleeve, so that either one or the other of said dogs 25 may fit therein when the boss is moved circumferentially so as to bring either dog into register therewith. Said dogs are preferably so constructed that 25 their blunted face 29 will, when moved to the limit of its outer movement, enter the slot and lock the boss and cam together and cause the cam and casing to revolve with gear 19.

The dogs are so located that by moving 30 the boss independently of the cam for a short distance, either to the right or left, the exhaust stroke can be made to occur on one side or the other of the "dead-center" of the piston and crank, thus when it is desired to 35 reverse the movement of the engine, the same is stopped and if the shaft has been running to the right it is turned in the opposite direction. This will cause the dog 24 to move backward out of the slot 28 and cause 40 dog 25, facing in the opposite direction, to come into engagement with said slot, whereupon the cam and sleeve will revolve together in the opposite direction, and bring the exhaust stroke to the opposite side of the 45 engine so that the explosions will then occur when the cylinder is commencing its down stroke while the shaft is moving to the left and cause said shaft to continue to revolve in

that direction. All that it is necessary to do is to move the shaft in the opposite direction 50 when it is desired to reverse the engine.

What I claim as new is:—

1. In a gas engine, a cylinder, a piston reciprocal therein, a crank operated by said piston having a pinion and fly-wheel thereon, 55 inlet and exhaust valves opening into said cylinder, mechanism operatively engaging said pinion for controlling the periodical opening of said exhaust-valve, and dogs loosely carried by said mechanism that are 60 automatically shifted by the reversal of the fly-wheel and are adapted to time the opening of said exhaust-valve on either side of the dead-center of said crank and piston.

2. In a gas engine, a cylinder, a piston reciprocal therein, a crank operated by said piston having a pinion and fly-wheel thereon, 65 inlet and exhaust valves opening into said cylinder, a gear engaging said pinion, mechanism carried by said gear for controlling the 70 periodical opening of said exhaust-valve, and dogs loosely carried by said mechanism that are automatically shifted by the reversal of the fly-wheel and are adapted to time the opening of said exhaust-valve on either side 75 of the dead-center of said crank and piston.

3. In a gas engine, a cylinder, a piston reciprocal therein, a crank operated by said piston having a pinion and fly-wheel thereon, inlet and exhaust valves opening into said 80 cylinder, a gear engaging said pinion, a pawl and ratchet mechanism carried by said gear for controlling the periodical opening of said exhaust-valve, and dogs loosely carried by said mechanism that are automatically shift- 85 ed by the reversal of the fly-wheel and are adapted to time the opening of said exhaust-valve on either side of the dead center of said crank and piston.

In testimony whereof I have hereunto set 90 my hand and seal this 7th day of January, A. D., 1907.

HENRY M. YAGER. [L. s.]

Witnesses:

A. F. VICTOR,

HARRY L. STANFORD.