H. L. FLOOD.

RACK AND PINION MECHANISM FOR ENGINES.

APPLICATION FILED APR. 24, 1917.

**1,316,437.**

Patented Sept. 16, 1919.

2 SHEETS—SHEET 1.

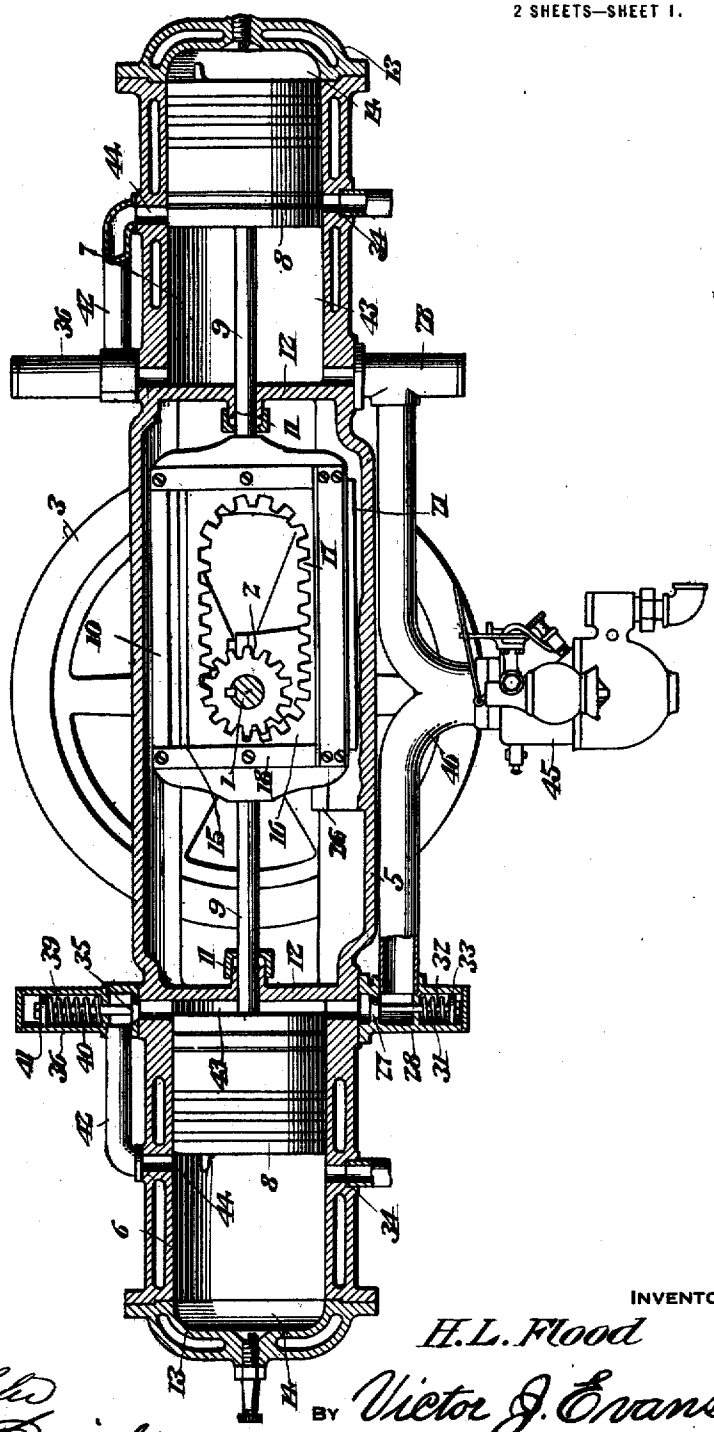


Fig. 1.

WITNESSES

M. D. Shipley

R. M. Smith.

INVENTOR

H. L. Flood

BY Victor J. Evans

ATTORNEY

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

H. L. FLOOD.

RACK AND PINION MECHANISM FOR ENGINES.

APPLICATION FILED APR. 24, 1917.

1,316,437.

Patented Sept. 16, 1919.

2 SHEETS—SHEET 2.

Fig. 3.

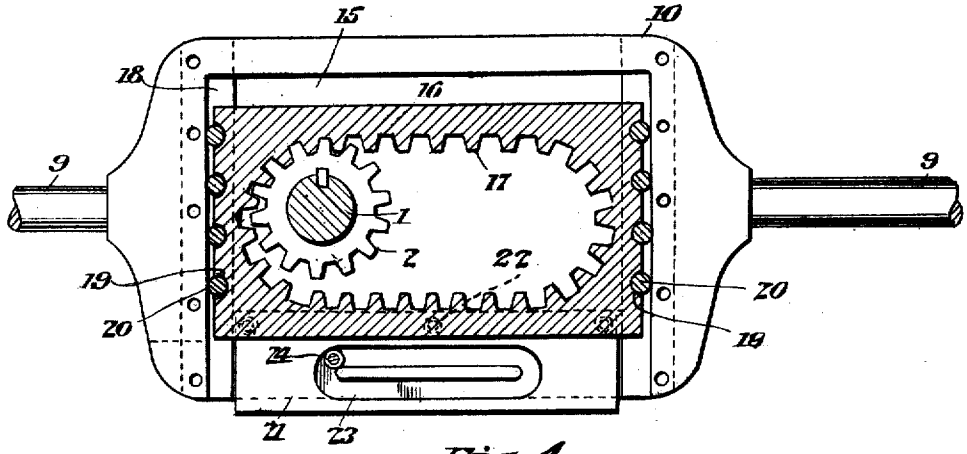



Fig. 4.

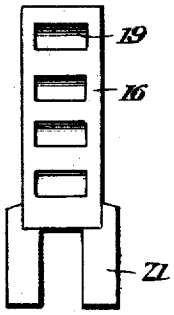



Fig. 5.

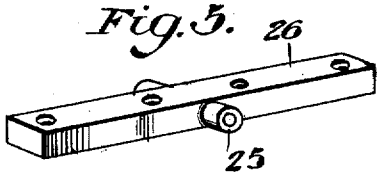
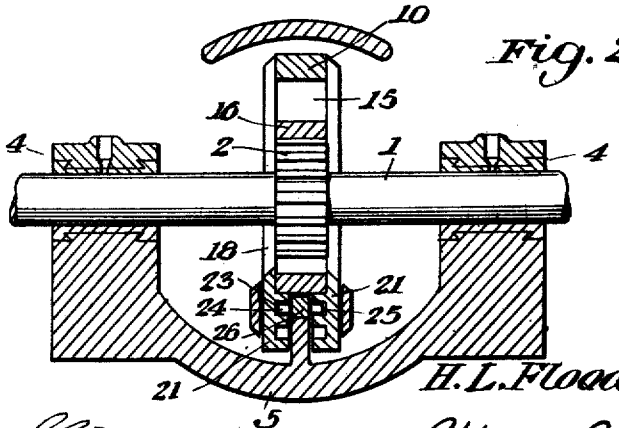



Fig. 2.




WITNESSES

M. D. Lufy.

P. M. Smith.

INVENTOR

H. L. Flood

BY Victor J. Evans

ATTORNEY

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

HENRY LEE FLOOD, OF PONCA CITY, OKLAHOMA.

## RACK AND PINION MECHANISM FOR ENGINES.

1,316,437. Specification of Letters Patent. Patented Sept. 16, 1919.

Application filed April 24, 1917. Serial No. 164,227.

*To all whom it may concern:*

Be it known that I, HENRY LEE FLOOD, a citizen of the United States, residing at Ponca City, in the county of Kay and State of Oklahoma, have invented new and useful Improvements in Racks and Pinion Mechanism for Engines, of which the following is a specification.

This invention relates to gas engines or engines of the internal combustion type, the main object of the invention being to provide in connection with a plurality of cylinders and pistons, novel rack and pinion means for transmitting the motion of said pistons to the engine shaft in such manner as to produce a practically continuous torque, at the same time eliminating the use of a crank shaft, cam shaft, cam gears, loose connecting rods, wrist pins and a number of bearings incident to the use of the parts just mentioned. Under the arrangement herein shown and described, a complete revolution of the engine shaft and fly-wheel is obtained for each explosion in each cylinder thus obtaining a great advantage over the ordinary types of internal combustion engines in which only one-half of a revolution is obtained for each stroke in a two-cycle engine, and only one-quarter of a revolution is obtained for each stroke in a four-cycle engine.

With the above and other objects in view, the invention consists in the novel construction, combination and arrangement of parts herein described, illustrated and claimed.

In the accompanying drawings:—

Figure 1 is a vertical longitudinal section through an engine embodying the present invention.

Fig. 2 is a vertical cross section taken adjacent to the engine shaft.

Fig. 3 is a fragmentary longitudinal section showing the controlling or guiding means for the slidable oblong gear.

Fig. 4 is an end elevation of the sliding gear detached.

Fig. 5 is a detail view showing the support for the rollers which coöperate with the sliding gear.

Referring to the drawings 1 designates the engine shaft, 2 a spur gear fast thereon, the shaft also having fast thereon one or more fly-wheels 3 and said shaft being journaled in bearings 4 on the engine frame indicated at 5.

Arranged at opposite sides of the engine shaft 1 are opposed cylinders 6 and 7. These cylinders are arranged with their longitudinal axes in alinement with each other and each cylinder contains a reciprocatory piston 8. Each piston 8 has fixedly secured thereto a piston rod 9 which extends inwardly toward the engine shaft 1, the inner ends of the rods 9 being fixedly connected to a reciprocatory yoke 10. All of the parts 8, 9 and 10 reciprocate practically as a unit. The rods 9 operate through stuffing boxes 11 in the inner heads 12 of the cylinders 6 and 7. The outer ends of the cylinders are closed by heads 13 forming the combustion chambers 14.

The yoke 10 is in the form of a substantially open center rectangular frame and within the rectangular space 15 of said yoke is mounted a sliding gear 16 the same being formed with internal teeth 17 arranged in a continuous series as illustrated in the drawings and adapted to coöperate with the gear 2 on the engine shaft 1. The space 15 is of greater width than the gear 16 so that the latter may slide transversely with respect to its length and the length of the yoke 10 in order that when the gear 16 is moving in one direction, the upper teeth thereof will engage the gear 2 and when moving in the opposite direction, the lower teeth will engage said gear, motion being thus transmitted to the gear 2 and the shaft 1 in each back and forth movement of the sliding gear, the yoke 10 and the pistons 8.

The sliding gear 16 is held in place in the yoke 10 by means of retainers 18 shown in the form of metal strips secured to the yoke and overlapping the ends and opposite side faces of the sliding gear 16. To enable the gear 16 to operate with a minimum amount of friction, the opposite ends thereof are provided with semi-cylindrical recesses 19 in which are placed anti-friction rollers 20 which work in contact with the opposing end walls of the yoke 10. Any desired number of such rollers 20 may be used in connection with each end of the sliding gear.

The means for guiding and shifting the sliding gear comprises a pair of guides 21 of substantially the same length as the sliding gear 16 and secured thereto by fastening means 22. As shown in the drawings, the guides 21 extend below the bottom of the sliding gear 16 and the inner faces of said guides are arranged in spaced relation to each other. Each of the guides 21 is formed in the inner face thereof with an

endless oblong guide-way 23 to receive one of a pair of guide rollers 24. These guide rollers are journaled upon studs 25 extending in opposite directions from a support 26 secured in fixed relation to the frame of the engine. The rollers 24 are thus mounted upon fixed journals or studs and said rollers simultaneously traverse the endless oblong guide-ways 23 in the guides 21, causing the teeth of the sliding gear 16 to always remain in mesh with the teeth of the spur gear 2 on the engine shaft 1. The length of the gear 16 is preferably such that in each complete stroke thereof, one complete revolution is imparted to the engine shaft. Therefore each explosion in each cylinder results in a complete revolution of the engine shaft.

Each cylinder 6 and 7 is provided with an intake valve 27. Said valve 27 is mounted in a valve casing 28 connected to the respective cylinder by fastening means. The valve opens inwardly and is yieldingly held against its seat by means of a spring 31. The stem 32 of the valve 27 works through a suitable guide 33 within the valve casing, said guides being so arranged as to prevent leakage in case the valve 27 should not seat properly at any time. Each cylinder is also provided with an exhaust port 34 which is covered and uncovered by the respective piston 8 in the back and forth movements of the latter.

In connection with each cylinder I also employ a compressed mixture outlet valve 35 which is contained within an individual valve casing 36 secured to the respective cylinder by fastening means. The valve 35 is yieldingly held against its seat by means of a spring 39. The stem 40 of the valve 35 is slidable through a guide 41 which prevents leakage of the compressed mixture.

Extending from each of the valve casings 36 is a by-pass 42 which carries the mixture compressed in one of the compression chambers 43 of the cylinders 6 and 7 to the opposite end or combustion chamber of the same cylinder, where it is admitted through an inlet port 44 covered and uncovered by the respective piston 8 in the back and forth movements of the latter. A carbureter 45 is shown as connected by a manifold 46 to the intake valve casings 28.

In operation, there is an explosion first in one cylinder and then in the other cylinder. As the piston 8 in one cylinder is driven inwardly toward the engine shaft by an explosion occurring in the combustion chamber 14 of that cylinder, the mixture contained in the compression chamber 43 of that cylinder, which has previously been drawn into the cylinder by the outward suction movement of the piston, is compressed and forced by the compression releasing valve 35 into the by-pass 42 leading to the combustion chamber of the same cylinder. When the inlet port 44 of said cylinder is uncovered by the piston of said cylinder just as it reaches the inward limit of its movement, the compressed mixture is released into the combustion chamber where it is again compressed by the last named piston in the outward movement thereof preparatory to its next working stroke. The mixture is thus compressed at one side of each piston and transferred to the opposite side it being understood with respect to each piston that when an explosion is occurring at one side of the piston, a compressing action is taking place at the opposite side of the same piston. By reason of the length of the sliding gear, a full revolution of the engine shaft may thus be obtained for each stroke of the yoke 10 and the pistons 8. This gives a practically continuous torque for the engine shaft 1, or two complete revolutions of the engine shaft for each complete cycle of operation of the engine, under the illustrated and described embodiment thereof.

I claim:—

Means for transmitting motion from a reciprocatory piston to an engine shaft, comprising a reciprocatory yoke movable in a rectilinear path connected with said piston and embracing the engine shaft, a gear on the engine shaft operating within said yoke, a sliding gear shiftable transversely of and within said yoke and embodying an endless oblong series of teeth meshing continuously with the teeth of the gear on the engine shaft, means for automatically shifting said sliding gear transversely of the yoke to maintain the teeth thereof in continuous engagement with the gear on the engine shaft, the last named means comprising parallel guides having a fixed relation to said sliding gear and a spaced relation to each other and formed in their inner faces with endless oblong guide-ways, the latter being located at one side of the sliding gear, and rollers mounted on fixed journals and arranged to traverse said guide-ways.

In testimony whereof I affix my signature.

HENRY LEE FLOOD.

Witness:
R. E. ONSTOT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."