L. S. NASH.

CONVERTIBLE CYCLE MOTOR.

APPLICATION FILED SEPT. 26, 1907.

1,077,363.

Patented Nov. 4, 1913.

2 SHEETS—SHEET 1.

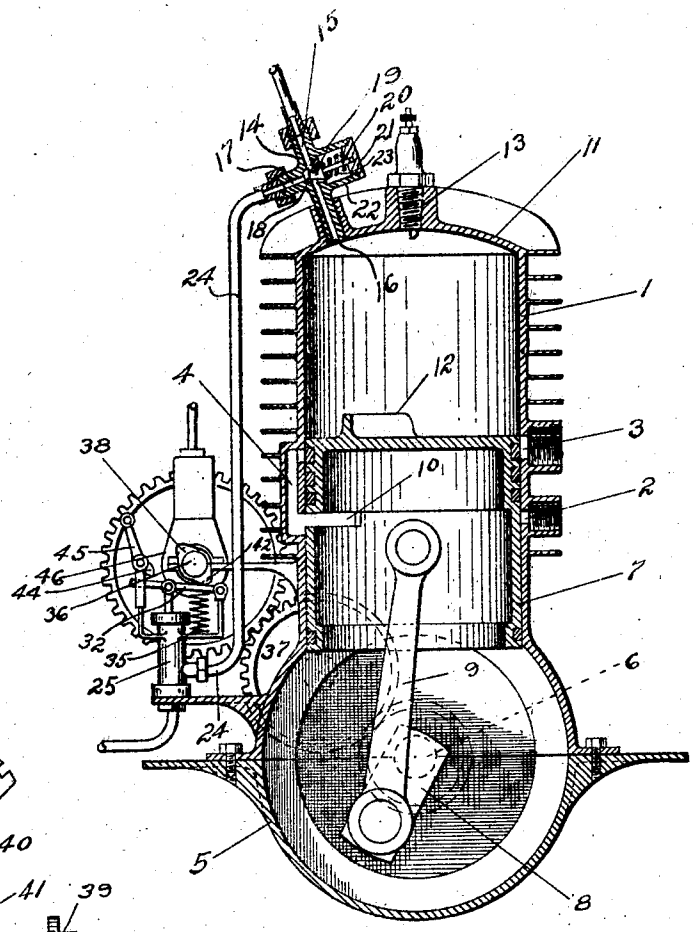


Fig. 1.

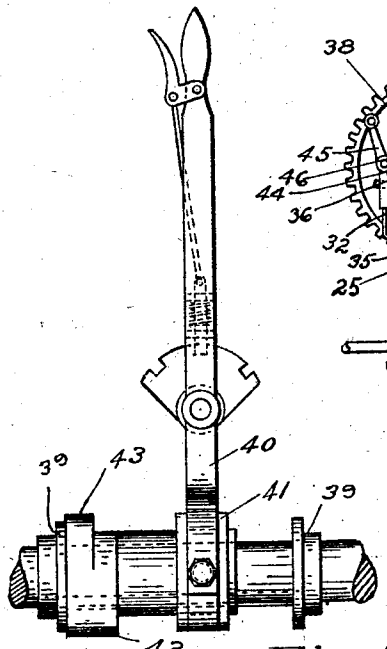


Fig. 3.

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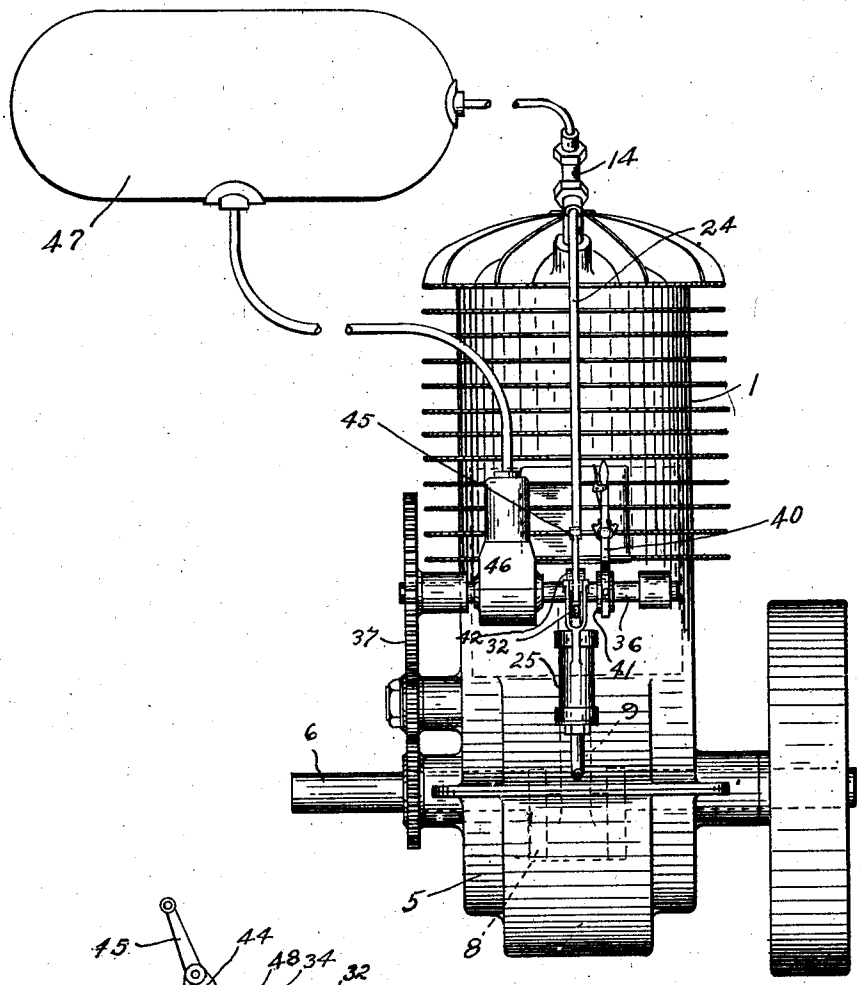


Fig. 2.

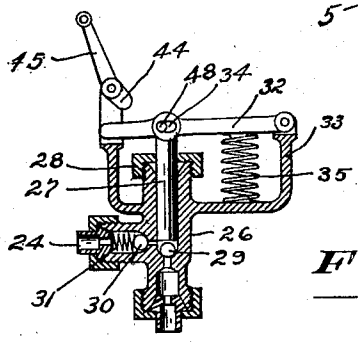


Fig. 4.

WITNESSES:

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UNITED STATES PATENT OFFICE.

LAWRENCE S. NASH, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO OLIVER MOTOR CAR CO., OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

CONVERTIBLE CYCLE-MOTOR.

1,077,363. Specification of Letters Patent. Patented Nov. 4, 1913.

Application filed September 26, 1907. Serial No. 394,622.

To all whom it may concern:

Be it known that I, LAWRENCE S. NASH, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Convertible Cycle-Motors, of which the following is a specification, reference being had therein to the accompanying drawings.

In automobile and boat motors of the internal combustion type, it is desirable that the fuel supply be under the operator's control that it may be regulated to suit working conditions and variation of load while running, and it is further advantageous to have the motor adapted to be changed from two-cycle to four-cycle or the reverse, to give further range of action which may more fully meet the requirements of service.

This invention relates to internal combustion motors and especially to such engines provided with means whereby the mode of operation of the engine may be determined and the engine made to work either upon a two-stroke or a four-stroke cycle, together with controlling mechanism whereby the fuel supply may be positively varied in accordance with the engine load.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

Referring to the drawings, Figure 1 is a view in vertical section transversely to the main shaft, of an internal combustion motor embodying features of the invention. Fig. 2 is a view in side elevation of the motor. Fig. 3 is a view in detail of a pump cam. Fig. 4 is a view in section of a fuel pump and shifting lever.

In the drawings, 1 represents a cylinder having an inlet port 2, an exhaust port 3 above it, and a by-pass 4 opposite the ports, as usually disposed for a two-cycle motor. The cylinder is supported on a crank case 5 which forms an air compression chamber, and a main shaft 6 journaled therein operates a piston 7 through the usual crank 8 and rod 9. The piston has a port 10 adapted to communicate with the by-pass, the several ports in the cylinder and piston being arranged to obtain the usual compression and scavenging on each revolution of the engine.

The cylinder head 11 is preferably concave and coöperates with a baffle 12 on the piston head opposing the outlets of the by-pass to throw the incoming air from the by-pass around the cylinder. An aperture 13 is provided in the cylinder head for a spark plug, and the usual provisions for cooling and lubricating are also supplied, the details of actual construction following the usual lines of good shop practice.

A vaporizing valve casing 14 is secured in the upper part of the cylinder over the by-pass outlet. A direct air passage 15 through the casing piped to a suitable supply of compressed air terminates in a jet nozzle 16 adapted to project a spray into the cylinder across the air currents from the by-pass and baffle. A fuel duct 17 opens transversely into the passage near its center through an apertured valve seat 18. A closure 19 is secured on a stem 20 which is in alinement with the fuel duct, and slides in a guide aperture in a plug 21 screwed into a nipple 22 in the casing and is held on the seat by a spring 23, simultaneously closing both the passage 15 and the duct 17 when so seated.

The vaporizing valve is connected by a pipe 24 to the discharge of a feed-pump 25 mounted suitably on the engine base. The pump, in its preferred form, consists of a cylinder 26 with a solid plunger 27 reciprocable therein through a suitable packing gland 28, a ball-check 29 at the foot of the cylinder acting as an inlet valve, and a second ball-check 30, inwardly seated by a spring 31, forming a discharge valve opening into the pipe 24, the lower end of the cylinder being piped to a suitable source of supply. The upper end of the plunger is connected by a cross-pin 48 to a lever 32 pivoted at its outer end to an extension 33 of the pump casing, transversely to the main shaft, a longitudinal slot 34 affording the necessary play for the pin, and a spring 35 between the casing and lever holding the plunger normally at the upper end of its stroke.

The pump operating mechanism, in its preferred form, consists of a shaft 36 parallel to the main shaft, either specially provided or else the regular commutator shaft of the engine ignition system, and in either case driven by the main shaft through suitable connections, such as a gear train 37, at half the engine speed. A cam 38 is keyed to the shaft over the pump lever 32 and may

be reciprocated longitudinally between suitable stops 39 by a forked shifting lever 40 interlocking with peripheral parallel flanges 41. The cam comprises two parts, one part 42 depressing the pump lever 32 in opposition to the spring 35 once during each revolution, and the other part 43 adapted to push it down twice, the shifting lever 40 holding either one or the other cam section in the desired operative relation to the lever. The upward movement of the plunger is determined by a stop 44 on a rock-arm 45 pivoted to the casing and by which the stop may be manipulated. When another source of air supply is not available, an air pump 46 of any standard, conventional type, is operatively connected to the cam shaft 36, and piped to a pressure tank 47 from which the atomizing valve is supplied.

In operation, the cams are timed to momentarily depress the lever 32 and pump plunger at the instant the piston has covered the by-pass and exhaust port on its up-stroke, thereby forcing the vaporizing valve open and injecting fuel which is projected by the compressed air thus simultaneously released by the same closure 19 in a spray into the cylinder, the piston afterward compressing the charge which is then ignited as usual. The amount of fuel injected is determined by the stroke allowed the plunger by the manipulation of the lever stop 44 by the operator, who can likewise shift the pump cam so that the charge is injected either on each up-stroke or on alternate ones, thereby making the engine in effect operate either on the two-cycle or four-cycle plan.

One of the chief features of the invention is the economy in fuel consumption gained by the absolute control of the fuel supply by the operator who can vary it in accordance with the work to be done through the stroke-changing mechanism of the pump.

Another feature is the efficiency of the motor when running on the four-cycle plan, because of the pure air twice forced through the cylinder, so that there is complete scavenging while the internal cooling effect is greatly increased.

Another of the important features is the adaptability of the engine for different fuels which are readily sprayed and atomized for ignition.

While the form of fuel pump herein shown is preferable, any conventional pump may be used which has provisions that meet the requirements of the variable discharge under pressure; a vaporizing valve of any suitable design adapted to be operated automatically as shown may be substituted for the preferred form described, and any mechanism which affords the properly timed variable intermittent stroke to the plunger may be used although the shifting cam and lever with its stop are extremely simple and are readily constructed and adjusted.

Obviously, other details of construction may be varied without departing from the spirit of the invention and I do not care to limit myself to any particular form or arrangement of parts.

What I claim as my invention is:—

1. A convertible cycle motor comprising a compression chamber, a crank shaft journaled therein, a cylinder having an air-inlet port connected with said chamber, and an exhaust port, a piston controlling said ports, a cam shaft operated by the crank shaft, a two-part cam on the shaft, one part having a single lifting point, and the other part having two lifting points, a vaporizing valve opening into the explosion end of the cylinder, a pump for forcing liquid fuel through said valve, a member operable by either part of said cam to impart a stroke to the pump during the up-stroke of the piston once or twice during each revolution of the cam shaft, and means for moving either part of the cam into engagement with said pump-operating member.

2. The combination in a two-cycle engine, of a compression chamber, a crank shaft journaled therein, a cylinder having an air-inlet port connected with said chamber, and an exhaust port, and a piston controlling said ports, with a vaporizing valve discharging into the explosion-end of the cylinder, a fuel pump discharging into said valve, a cam shaft operated by the crank shaft, a lever for operating the pump, a cam on the cam shaft adapted to impart a stroke to said lever during the up-stroke of the piston either once or twice during each revolution of the cam shaft, and means for shifting the cam into either said single or double engagement with the lever.

3. In a two-cycle motor, the combination with a compression chamber, a crank shaft provided therein, a cylinder having an air inlet port connected with said chamber, and an exhaust port, and a piston controlling the ports of the cylinder, of a cam shaft exterior to the compression-chamber and operatively connected to the main shaft, a fuel pump comprising a plunger reciprocable transversely of the cam shaft, a lever articulated to the plunger and oscillatable transversely of the cam shaft, a cam shiftable longitudinally of the shaft and provided with two cam faces one of which is adapted to momentarily depress the lever once during each revolution of the cam shaft, and the other of which is adapted to momentarily depress the lever twice during each revolution of the said shaft, a stop oscillatable in the path of the lever and adapted to vary the stroke thereof, and a lever adapted to shift the cam on the shaft.

4. Means for supplying fuel to the cylin-

der of a conventional two-cycle compression engine during either each up-stroke or during alternate up-strokes of the piston, said means comprising a vaporizing valve discharging into the explosion end of the motor, a jet nozzle in said valve discharging into the cylinder, an air passage through the valve adapted to be connected to a supply of compressed air, a fuel-duct opening into said passage, a spring-pressed closure controlling the air passage and also said fuel duct, a fuel-pump mounted on the motor and piped to discharge into said duct, a cam shaft geared to the motor shaft to operate at half the speed of the latter, a cam shiftable on the cam shaft adapted to operate either once or twice during one revolution of the cam shaft, a lever for operating the pump adapted to be oscillated by the cam, and means for shifting the cam to operate the lever either once or twice during each revolution of the cam shaft.

5. Means for supplying fuel to the cylinder of a two-cycle engine during either each up-stroke or during alternate up-strokes of the piston, comprising a vaporizing valve discharging into the explosion-end of the motor, a jet nozzle in said valve discharging into the cylinder, an air-passage through the valve adapted to be connected to a supply of compressed air, a spring-pressed closure simultaneously controlling the air passage and said fuel duct, a fuel-pump, a pipe connecting the outlet of the pump with the fuel duct of the valve, a plunger reciprocable in the pump, a cam shaft operated by the motor at half the motor speed, a cam reciprocable on the shaft and provided with a single and a double acting face, a lever for operating the plunger adapted to be depressed by the cam, means for moving the cam to operate either singly or doubly on the plunger-lever, and a stop limiting the return throw of the plunger-lever.

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

LAWRENCE S. NASH.

Witnesses:
C. R. Stickney,
Otto F. Barthel.