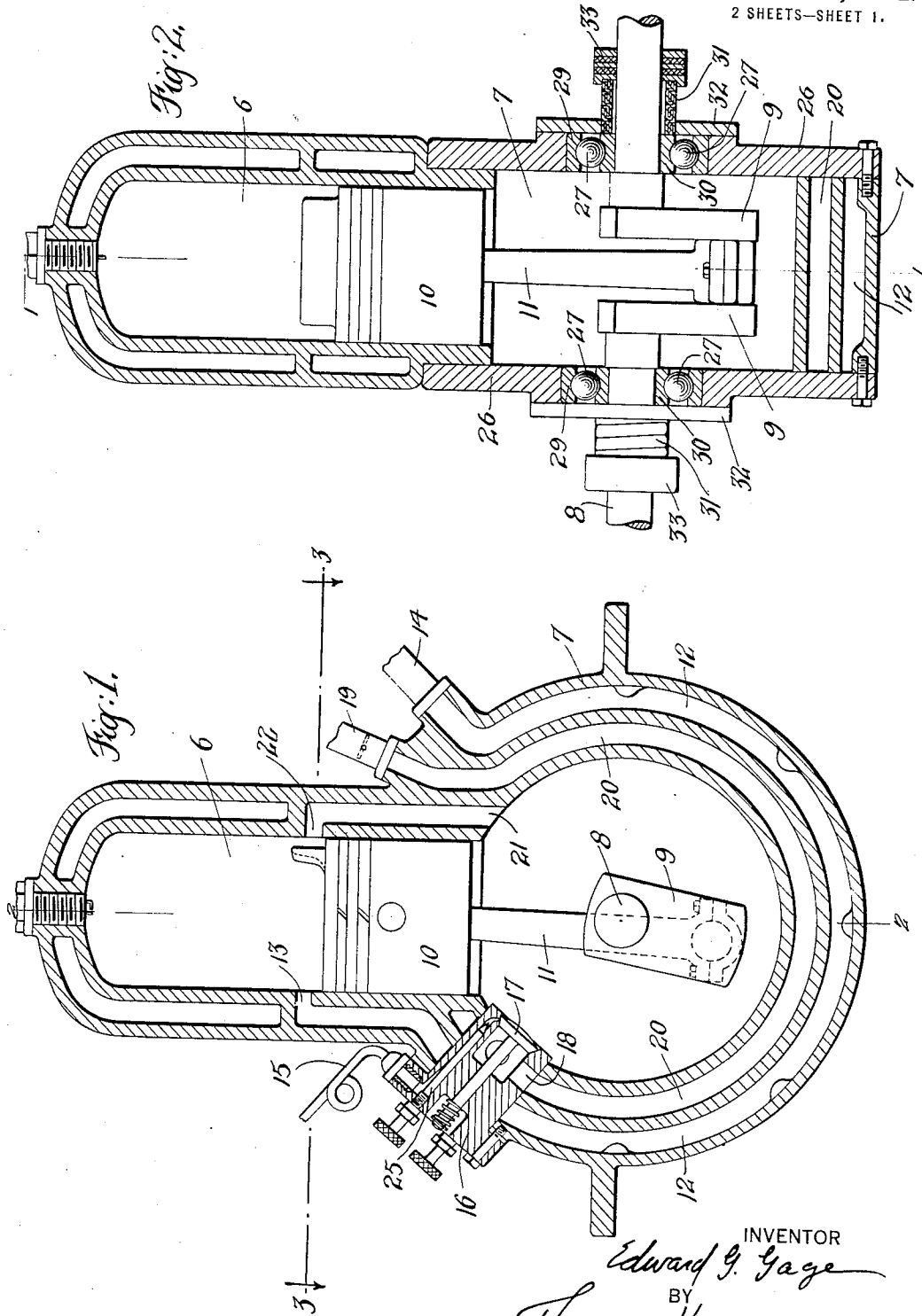


E. G. GAGE,
OIL ENGINE.
APPLICATION FILED NOV. 20, 1917.

1,366,530.

Patented Jan. 25, 1921.
2 SHEETS—SHEET 1.

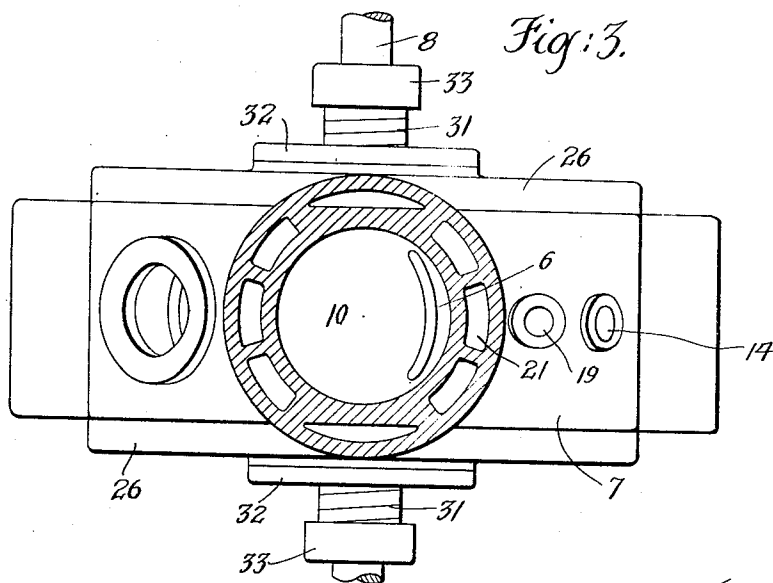
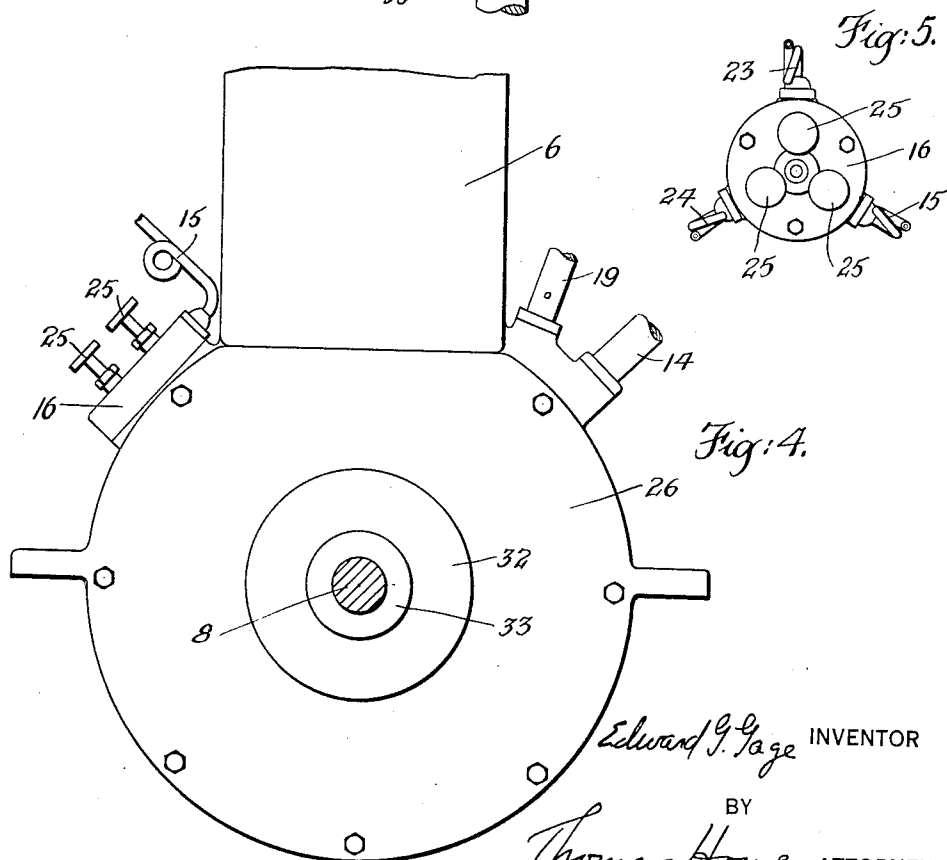


INVENTOR
Edward G. Gage
BY
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UNITED STATES PATENT OFFICE.

EDWARD G. GAGE, OF SOUTH NORWALK, CONNECTICUT.

OIL-ENGINE.

1,366,530.

Specification of Letters Patent.

Patented Jan. 25, 1921.

Application filed November 20, 1917. Serial No. 202,940.

To all whom it may concern:

Be it known that I, EDWARD G. GAGE, a citizen of the United States, residing at South Norwalk, county of Fairfield, State of Connecticut, have invented new and useful Improvements in Oil-Engines, of which the following is a specification.

My invention relates to internal combustion engines, and particularly to that type or class of internal combustion engines commonly known and referred to as oil engines and in which a liquid fuel which requires the use of a considerable amount of heat to accomplish its vaporization and gasification is employed as a source of power, such, for example, as benzole, kerosene, crude oil, etc.; and the object of my invention is to provide an engine in which the crank case thereof is heated by exhaust gases flowing from the working cylinder, and which crank case is utilized to accomplish the vaporization and gasification of the liquid fuel employed; whereby the liquid fuel is supplied to the working cylinder in a completely vaporized and gasified condition, instead of in the liquid form or but partially or incompletely vaporized and converted into a gas as has heretofore usually been the case in internal combustion engines employing a heavy and difficultly vaporizable liquid fuel as a source of power. It therefore follows that the working cylinder of an engine in which my invention is embodied may be operated at a much lower temperature than has heretofore been the case in internal combustion engines operating upon a liquid fuel; because of the fact that no heat has to be furnished by the said cylinder to vaporize or gasify the liquid fuel, as has heretofore commonly been the case.

With the above and other objects of invention in view, my invention consists in the improved internal combustion engine illustrated in the accompanying drawings and hereinafter described and claimed, and in such variations and modifications thereof as will be obvious to those skilled in the art to which my invention relates.

The drawings accompanying and forming a part of this specification illustrate the preferred embodiment of my invention; although it will be appreciated that the same may be embodied in various other specific forms, and that all such forms, variations, and modifications of the particular form of

my invention illustrated as come within the scope of the concluding claims are comprehended in my invention and form a part thereof, and are intended to be included in and secured by the patent to be obtained therefor.

Referring to the drawings wherein like reference numerals are employed to designate the same parts in the several views—

Figure 1 is a view illustrating a section of my improved internal combustion engine taken upon a vertically extending central plane at right angles to the crank shaft, and indicated by the line 1, 1, Fig. 2;

Fig. 2 is a view showing a section upon a vertically extending central plane at right angles to the plane of Fig. 1, and indicated by the line 2, 2, Fig. 1;

Fig. 3 is a view showing a section upon a horizontally extending transverse plane indicated by the line 3, 3, Fig. 1, looking down;

Fig. 4 is a view illustrating my invention in elevation; and,

Fig. 5 is a view showing certain details in and relating to the fuel supply conduits, and to the controlling valves for the fuel.

In the drawings, the reference numeral 6 designates the working cylinder of my improved internal combustion engine, the same as well also as the head thereof being shown as provided with a suitable water jacket or other cooling means, as the fact that the vaporization and gasification of the fuel is accomplished outside of or without the working cylinder permits the use of a comparatively cool cylinder; whereas such prior schemes as have contemplated the supply of fuel to the working cylinder in a liquid form, or but partially vaporized and gasified, have necessitated the use of a cylinder having an uncooled head, and have in general required that the working cylinder be operated at a much higher temperature than is the case in my invention. The reason for this is that in such prior devices the heat of the working cylinder has commonly been relied upon to accomplish in whole or in part the vaporization and gasification of the liquid fuel; whereas in my invention the vaporization and gasification of the liquid fuel is accomplished by the heated crank case, and before the combustible mixture reaches or is supplied to the working cylinder.

The crank case of my improved engine is

designated by the reference numeral 7, and 8 designates the crank shaft thereof; the crank 9 of said shaft being operatively connected with the working piston 10 through a connecting rod 11, all as shown.

The crank case 7 is heated by means of exhaust gases flowing from the working cylinder 6, this end being preferably accomplished by providing a passage 12 in the peripheral wall of the crank case through and along which the exhaust gases flow from the overrun exhaust port 13 of the engine in the particular two-stroke cycle type or form of engine illustrated in the drawings, and from which passage the said gases finally flow through the exhaust pipe 14. My invention is, however, equally applicable to engines in which the exhaust gases flow from the working cylinder through a valve controlled port, as is usual in engines operating upon a four-stroke cycle; as the valve mechanism, the cycle of operation, and the particular form, arrangement, and other features of the passage or chamber through which the exhaust gases flow to heat the crank case, may be varied and modified without departing from the spirit of my invention.

The liquid fuel whereby the engine is operated is preferably supplied through a conduit 15 leading into the body 16 of a mixing valve, the valve proper 17 of which controls the flow of fuel and of air into the interior of the crank case. The said valve body is shown as heated in an opening provided for it in the side wall of the crank case, and as extending across the exhaust conduit 12 so as to be heated by the exhaust gases flowing therethrough; from which it follows that the liquid fuel is heated as it passes through the valve body and before it is mixed with air to form a combustible mixture.

The air which is mixed with the liquid fuel to form a combustible mixture flows through a port or ports 18 provided in the valve body 16, and past the seat of the valve 17, which valve controls the supply of both air and liquid fuel to the interior of the crank case, as will be appreciated; and the said air is preferably heated before it reaches the mixing valve as by causing it to pass from an air inlet conduit 19 along and through a passage 20 likewise provided in the said wall of the crank case and concentric with reference to the exhaust conduit 12, whereby the air flowing along said passage is heated by heat derived from the exhaust gases, as will be appreciated.

In the embodiment of my invention illustrated the air and liquid fuel are drawn into the interior of the crank case by suction upon the upward movement of the working piston 10, and are compressed therein upon the downward movement of said piston and

flow through the passage 21 and overrun inlet port 22 shortly after the said piston has overrun the exhaust port 13; although the mixture may flow to the engine through a valve controlled port, as my invention is not limited to an engine operating upon a two-stroke cycle as is the case with the engine chosen for the purpose of explaining my invention.

In addition to the liquid supply conduit 15 hereinbefore referred to and best shown in Fig. 1 of the drawings and through which the liquid fuel whereby the engine is operated is supplied, two other similar supply conduits 23, 24 are preferably provided, as shown in Fig. 5; one of said conduits being for the purpose of supplying gasoline or a similar easily vaporizable fluid when the engine is being started, and the other being used as a water supply conduit through which water may be supplied to the mixing valve; so that there will be a certain amount of steam in the combustible mixture produced, as has commonly been deemed desirable in oil engines. These additional conduits lead into passages provided in the mixing valve body 16, the same as in the case of the main fuel supply conduit 15 and as shown in Fig. 1; and suitable needle or other form of valves 25 are provided for controlling the flow through said several conduits. The flow of liquid through all the conduits is controlled by the single valve 17, as will be understood, which valve also controls the flow of air into the interior of the crank case.

The ends of the crank case 7 are closed by heads 26 which support suitable bearings for the crank shaft 8, as best shown in Fig. 2; the said bearings being preferably of the type commonly referred to as ball bearings and comprising a series of balls 27 held in place between annular races 29, 30, one of which is supported within an opening provided in said heads, while the other of said races is carried by the crank shaft; this type of bearing being used because it is a form which will operate satisfactorily under the high temperature conditions existing in the crank case in my improved engine. Such bearings, however, are apt to be deficient in tightness; and, in order to prevent the escape of combustible mixture from the crank case through the bearings, I provide flexible members in the form of short sections of flexible tubing 31 which surround the crank shaft and the inner ends of which sections are connected with stationary cover plates 32 fitting over the bearings, as shown, while the outer ends of said sections are connected with collars or rings 33 fitting tightly about the shaft so as to prevent the flow of mixture from the crank case through or past the ball bearings, and through the flexible tubing sections 31; and which collars or rings are located far

enough away from the crank case to be unaffected by the high temperature present within and to which the crank case is subjected.

5 Having thus described and explained my invention, I claim and desire to secure by Letters Patent—

1. An internal combustion engine of the class described comprising a working cylinder; a crank case having a passage through which exhaust gases may flow from said working cylinder to thereby heat said crank case; a piston operating in said cylinder and operatively connected with a crank operating in said crank case; means for supplying a mixture of air and a liquid fuel to the interior of said crank case; and means for conducting the combustible mixture from said crank case to said working cylinder.

20 2. An internal combustion engine of the class described comprising a working cylinder; a crank case; means whereby said crank case is heated by exhaust gases flowing from said working cylinder; a piston operating in said cylinder and operatively connected with a crank operating in said crank case; means for supplying a mixture of air and a liquid fuel to the interior of said crank case; and means for conducting the combustible mixture from said crank case to said working cylinder.

3. An internal combustion engine of the class described comprising a working cylinder; a crank case having an annular passage through which exhaust gases may flow from said working cylinder, and a second annular air supply passage concentric with reference to said exhaust passage and through which air may flow into said crank case; a mixing valve body extending through said exhaust passage and having a port communicating with said air supply passage; a fuel supply passage formed in said valve body; a valve

carried by said valve body and adapted to control the flow of air and fuel into said crank case; a piston operating in said cylinder and operatively connected with a crank operating in said crank case; and means for conducting the combustible mixture from said crank case to said working cylinder.

4. An internal combustion engine, comprising a working cylinder, a crank case having a passage through which heated gases may flow, said passage extending below the axis of the crank shaft, a crank shaft extending through said case, a piston operating in said cylinder and operatively connected with said crank shaft, means for supplying a mixture of air and fuel to the interior of said crank case and means for conducting the combustible mixture from said crank case to said cylinder.

5. An internal combustion engine comprising a working cylinder, a crank case having a passage through which heated gases may flow to heat said crank case, a piston operating in said cylinder, a crank shaft in said crank case operatively connected with said piston, means for supplying air and fuel to the interior of said crank case and means for conducting the combustible mixture from said crank case to said working cylinder, the said passage extending annularly about the crank case and beneath the crank shaft.

6. An internal combustion engine of the class described having in combination a crank case, means for producing a combustible mixture in said crank case, means for heating the crank case, a cylinder and means for passing the mixture from the crank case to the cylinder.

In testimony whereof I have signed this specification this 16th day of November, 1917.

EDWARD G. GAGE.