

A. J. LAVOIE.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED AUG. 21, 1911.

1,044,198.

Patented Nov. 12, 1912.

2 SHEETS-SHEET 1.

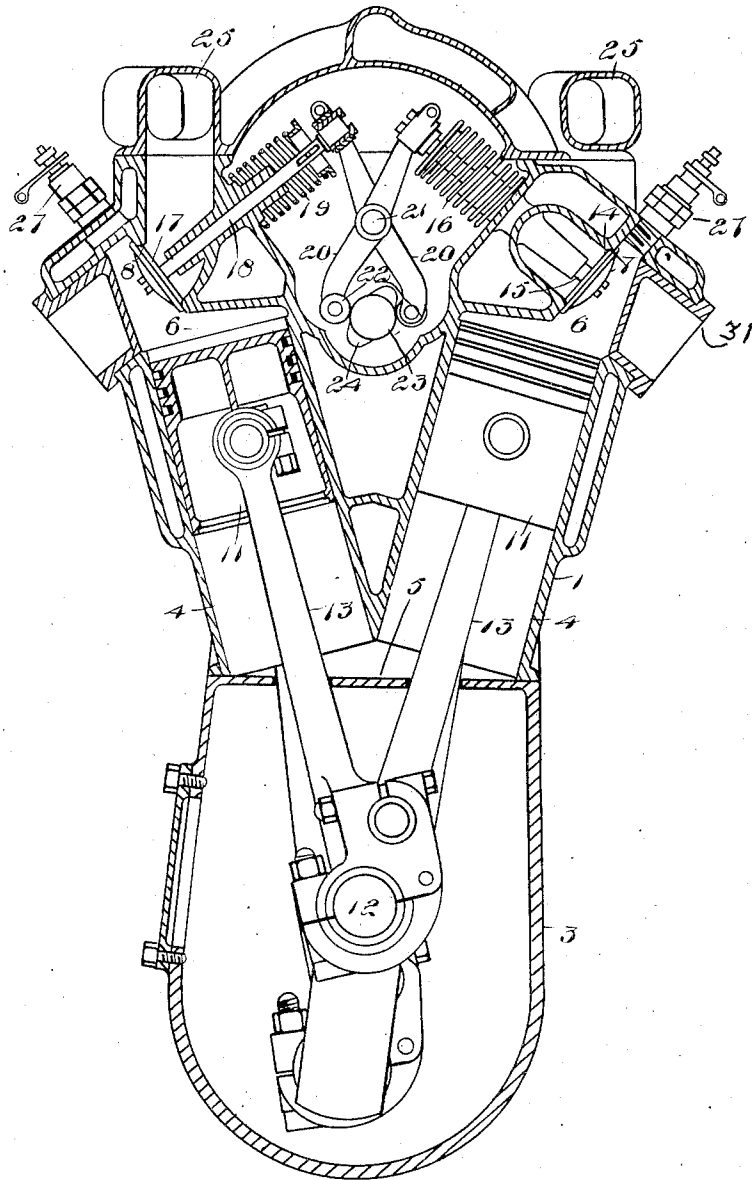


Fig. 1.

Inventor

A. J. Lavoie,

Witnesses

New A. Lavoie

G. H. Trevellick

By Herbert L. Lavoie, Attorney

Attorneys

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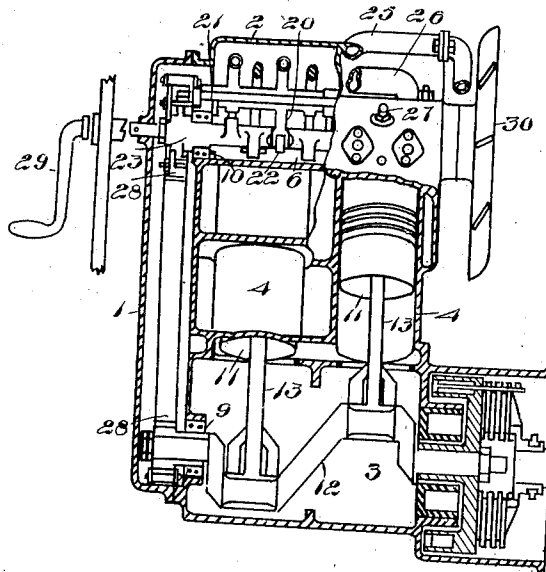


Fig. 2.

Witnesses
H. A. P. Gould
G. H. Tredder

Inventor
A. J. Lavoie,
By J. H. Lavoie, Attorney

UNITED STATES PATENT OFFICE.

ALPHONSE JOSEPH LAVOIE, OF OUTREMONT, QUEBEC, CANADA.

INTERNAL-COMBUSTION ENGINE.

1,044,198.

Specification of Letters Patent.

Patented Nov. 12, 1912.

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To all whom it may concern:

Be it known that I, ALPHONSE JOSEPH LAVOIE, resident of 24 Querbes avenue, in the town of Outremont, in the Province of Quebec, Dominion of Canada, a subject of the King of Great Britain, have invented certain new and useful Improvements in Internal-Combustion Engines; and I do hereby declare that the following is a full, clear, and exact description of the same.

The invention relates to improvements in internal combustion engines, as described in the present specification and illustrated in the accompanying drawings that form part of the same.

The invention consists essentially in the novel construction and arrangement of parts, whereby outwardly disposed valves are operated by a simple form of valve gear completely inclosed at the head portion of the cylinders and the general arrangement of the engine plant is freed from complications.

The objects of the invention are to devise a form of internal combustion engine, particularly for motor cars, flying machines or motor boats, which will be easy to operate and of comparatively light weight, to eliminate the occurrence of misses in the firing, as far as possible, and generally to provide comparatively cheap and durable forms of motive power machines.

In the drawings, Figure 1 is an end view in vertical section. Fig. 2 is a side view in vertical section.

Like numerals of reference indicate corresponding parts in each figure.

Referring to the drawings, 1 is the casing having the removable cover 2 at the top thereof, the crank casing 3 at the lower end, the cylinders 4 in V-shape arrangement divided from the crank casing by the partitions 5, the compartments 6 at the upper end of said cylinders and communicating therewith, the inlet valve seats 7 within said compartments and the exhaust valve seats 8, the crank shaft bearings 9 in the end walls toward the lower end and the cam shaft bearings 10 in the end walls at the upper end.

31 are plugs closing the corresponding openings in the casing 1 opposite the said inlet and exhaust valve seats, said seats being readily accessible for grinding and cleaning purposes on the removal of said plugs.

11 are pistons operating in the cylinders 4 connected to the cranks of the crank shaft 12 by the rods 13.

14 are inlet valves engaging the seats 7 and having the stems 15 extending inwardly through the wall of a compartment 6 in an inclined and slightly upward direction, said valves being held to their inner position and in engagement with the seats 7 by the springs 16.

17 are exhaust valves having the stems 18 and the springs 19 holding them to their seats 8 and in the same arrangement as the inlet valve, each cylinder having its set of valves, that is an inlet and exhaust.

20 are rocker arms mounted on the rocker arm shaft 21, each of said rocker arms 20 at its upper end engaging a valve 14 or a valve 17, as the case may be.

22 are rollers journaled at the lower end of the rocker arms 20.

23 is a cam shaft, journaled in the cam shaft bearings 10, extending between the lower extending ends and the rocker arms 20.

24 are cams mounted on the cam shaft 23 and arranged on said shaft so that in the rotation of said shaft, said cams will engage the rollers 22, the said cams being placed so as to time the operation of the inlet and exhaust valves.

25 are the exhaust passages in the cover 2 connected to and communicating with the exhaust ports surrounded by the seats 8.

26 are the inlet passages connected to and communicating with the ports surrounded by the seats 7.

27 are the spark plugs projecting through the outer casing 1 adjacent to the inlet valves.

28 is a ratchet and chain connection between the crank shaft 12 and the cam shaft 23.

It will be thus seen that there is a very positive connection for the operation of the valves and crank shaft and cam shaft and the latter through its cams must at each revolution engage a rocker arm and in a case where there are several cylinders more of the rocker arms than one are engaged, but always an inlet in one cylinder and an exhaust in the other, therefore, the gas is let into one cylinder while it is being expelled from the other.

29 is a hand crank secured on the projecting end of the cam shaft 10, thus avoiding

the direct connection of said hand crank with the crank shaft, making it a far simpler matter to crank up the machine. 30 is a cooling fan, mounted on the other end of said cam shaft 10.

The operation of said engine is very simple as will be seen from the drawings and description in detail of the parts, as the cranking up can be done as explained in the upper end of the machine and thus avoid getting down to the crank shaft. Once the engine has been started, the combustible mixture enters a port or ports on one side of the machine and that mixture receives its compression stroke and is fired, the exhaust stroke now begins, with the result that the exhaust valve opens by means of the cam shaft and the rocker arm, thereby sweeping all the exploded gases away into the exhaust passages. The inlet valves now open by means of the said cam shaft and rocker arms and the fluid enters through the inlet passages and valve openings, being drawn in by the suction stroke, as customary. The next is the compression stroke again and the firing, this operation continuing, as usual in internal combustion engines.

Among the salient features of this invention are the compartment formations in the interior of the outer casing, which give an opportunity to so place the valves as to permit journaling the cam shaft centrally between the plurality of rocker arms and to cover all of these parts in completely, instead of having the exposed cam shaft operating in a different manner, besides, there is a direct operation from the end of the rocker arm engaged to the valve and this can only be accomplished by some such arrangement as I have described, wherein the valves point outwardly in relation to the gear for operating said valve, this being an extremely important point.

It must be understood that while I have described the several cylinders, only one cylinder may be used in somewhat the same arrangement, very little modification being required to produce a like operation, also that the general form of the engine may be changed so long as there is what is practically an overhead cam shaft and rocker arm shaft completely inclosed.

What I claim as my invention is:

1. In an internal combustion engine, a pair of cylinders set slightly off the perpendicular in a position leaning from one another, valve chambers formed at the upper ends thereof having inlet and exhaust valve seats, a valve gear chamber formed between said valve chambers and said cylinders and suitably inclosed, valves resting on said seats, valve stems projecting into said valve chamber from said valves, springs retaining said valves to their seats and encircling said stems, a rocker arm shaft supported in

said valve chamber, rocker arms mounted on said rocker arm shaft, engaging said valve stems at their upper ends and at their lower ends, engaged by the cam shaft and operating on the one side an inlet valve and on the other side an exhaust valve coincidently by a trip hammer motion imparted to the two rocker arms, pistons operated in said cylinders, and piston rods operatively connected with said pistons and the crank shaft.

2. In an internal combustion engine, a crank case and a shaft journaled in said crank case, a pair of cylinders slightly off the perpendicular and leaning outwardly, pistons traveling in said cylinders, piston rods operatively connecting said pistons and said crank shaft, valve chambers rigid with said cylinders at the upper ends thereof having inlet and exhaust valve seats, a valve gear chamber formed between said valve chambers and said cylinders and suitably inclosed, inlet and exhaust valves arranged on said seats, valve stems projecting from said valves in each of said cylinders in a line of direction at an angle to the line of direction of the stems from the other cylinder, a cam shaft suitably journaled and situated in the lower end of said valve gear chamber, and rocker arms engaging said valve stems and operating said valves by means of a trip hammer motion imparted thereto at the lower end of said arms by said cam shaft.

3. In an internal combustion engine, a crank chamber, a crank shaft suitably journaled and extending through said crank chamber, piston rods extending from the cranks of said shaft, a pair of cylinders set slightly off the perpendicular, immediately above said crank chamber and forming an opening therebetween, pistons traveling in said cylinders, valve chambers formed at the upper ends of said cylinders and rigid therewith and having seats therein, directly opposite openings in the walls of said chambers and plugs closing said openings, a valve gear chamber formed between the inner walls of said valve chambers and the inner upper ends of said cylinders and suitably inclosed, a cam shaft journaled at the lower end of said valve gear chamber, a rocker arm shaft journaled in said valve gear chamber above said cam shaft, valves engaging said valve seats, valve stems projecting outwardly from said valves, and rocker arms mounted on said rocker arm shaft, at their lower ends engaged by said cam shaft and at their upper ends engaging said valve stems and operating said valves by means of a trip hammer motion.

4. In an internal combustion engine, an outer casing having a removable cover, a crank casing at the lower end, cylinders in V-shape arrangement immediately above said crank casing, valve compartments immediately above said cylinders and commu-

5 communicating therewith and inlet and exhaust
ports in substantially vertical arrangement
in relation to said cylinders, spring-held
valves closing said ports, a rocker arm
10 shaft, rocker arms mounted on said shaft,
stems extending inwardly from said valves
to the ends of said rocker arms, a cam shaft
suitably journaled and arranged between
the other ends of said rocker arms and hav-
15 ing cams engaging said rocker arms in alter-
nate arrangement, spark plugs extending
through said outer casing adjacent to the
inlet valves, a crank shaft operatively con-
nected to said cam shaft, and pistons travel-
20 ing in said cylinders having rods connecting
them to said crank shaft.

5. In a device of the class described, a cas-
ing having a removable cover at the top
thereof, a crank casing at the lower end, cyl-
20 inders in pairs in V-shaped arrangement
slightly off the perpendicular, divided from
the crank casing by suitable partitions, com-
partments at the upper ends of said cylin-
ders inclosing inlet and exhaust valve seats,
25 crank shaft bearings in the end walls of

said crank casing, cam shaft bearings to-
ward the upper end between the top end of
said cylinders, a crank shaft journaled in
said crank shaft bearings, a cam shaft jour- 30
naled in said cam shaft bearings and having
suitably finished ends for the mounting of a
starting crank and fan respectively, a rocker
arm shaft secured in said casing above said
cam shaft, inlet and exhaust valves on said
35 seats, valve stems projecting into the cham-
ber, under said removable cover, from said
valves, springs retaining said valves to the
seats and encircling said stems, a rocker
arm engaging said valve stems at one end
40 thereof and engaged by said cam shaft at
the other section and alternately, from side
to side, operating said valves by means of a
trip hammer motion.

Signed at the city and district of Mon-
45 treal, Quebec, Canada, this eighteenth day of
August, 1911.

ALPHONSE JOSEPH LAVOIE.

Witnesses:

G. H. TRESIDDER,
DAN A. PIGEON.