Dec. 11, 1956 W. C. ESTES 2,773,489

INTERNAL COMBUSTION ENGINE

Filed May 2, 1955

Fig. 1.

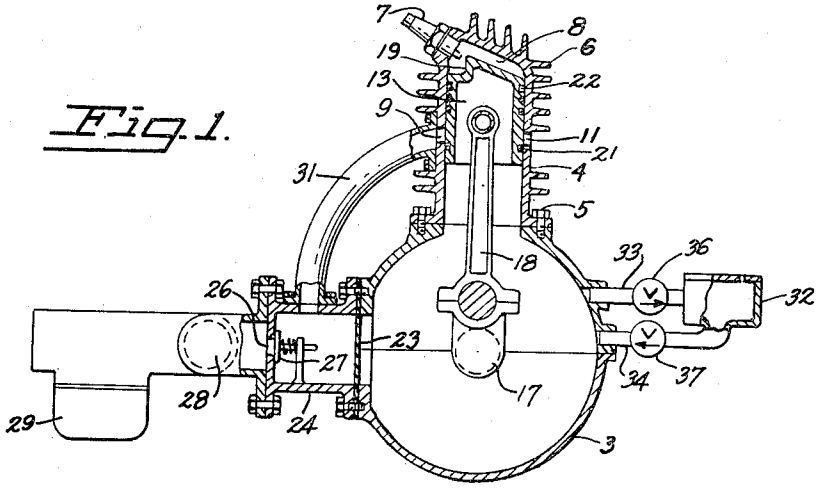
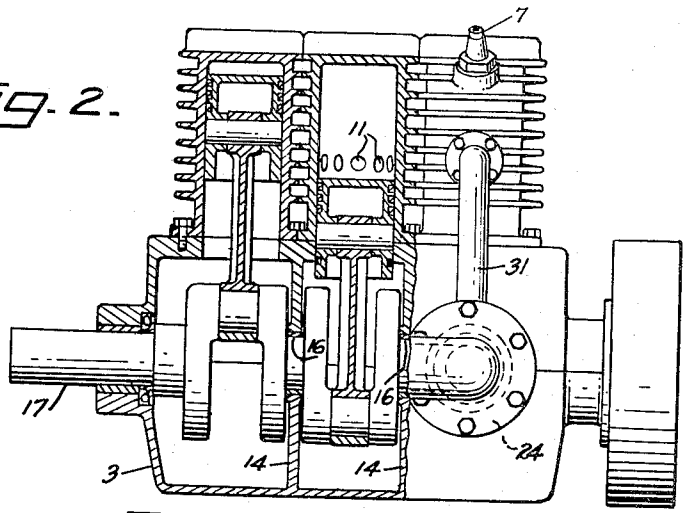


Fig. 2.



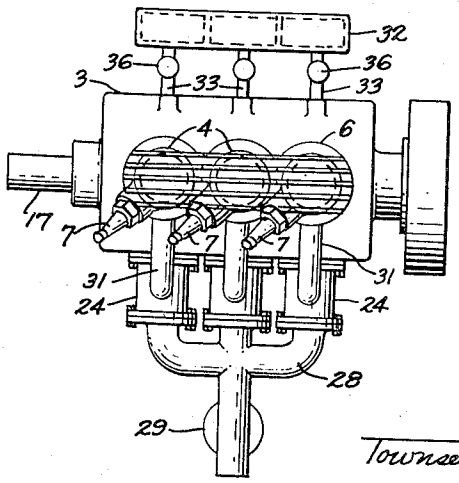


Fig. 3.

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INTERNAL COMBUSTION ENGINE

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3 Claims. (Cl. 123—59)

This invention relates to new and useful improvements in internal combustion engines and in particular provides a simple means for supplying carbureted air to the combustion chamber of a cylinder in a two-cycle engine.

One object of this invention is to provide a fuel supplying means which is operated by and solely dependent on pressure differentials within the crankcase of the engine, thereby dispensing with unnecessary parts and separate power means.

Another object of this invention is to maintain fuel separate from the lubricating oil within the crank case, affording efficient combustion and economy of operation.

It is also an object of this invention to provide an improved engine which may be utilized in both single and multiple-cylinder engines.

A further object is to space the said fuel supplying means from other working parts of the engine such that each part can work without interfering with the operation of another part.

This simple and reliable design and construction has particular application to two-cycle engines affording excellent economy and dependability of operation in such engines. The construction includes an auxiliary pressure regulator which prevents undue pressures within the crankcase and also maintains the said pressure differentials within a constant range.

The foregoing and other objects of this invention will appear from the following written description of one embodiment of the invention as illustrated in the accompanying drawings, wherein—

Fig. 1 is a side elevation of an internal combustion engine shown substantially in section and disclosing a preferred embodiment of the invention;

Fig. 2 is a side elevation shown partly in section of a three-cylinder engine taken at 90 degrees to Fig. 1; and

Fig. 3 is a plan view of Fig. 2 shown on a smaller scale.

The engine comprises a closed crankcase **3** and a plurality of cylinder blocks **4** hermetically sealed thereto as by bolts **5**.

For simplicity of illustration the engine is represented as being air-cooled, cooling fins **6** being provided for this purpose.

Each cylinder block **4** is provided at its top with a spark plug **7**, the igniting terminals (not illustrated) of which terminate inside the combustion chamber **8** of the cylinder **4**. The cylinder is apertured at **9** and **11** to provide respectively intake and exhaust ports. The said apertures or ports **9** and **11** are normally closed by the skirts of the piston **13**, but are spaced downwardly from the top of the cylinder **4** a distance substantially equal to the stroke of the piston **13**, such that the combustion chamber **8** can communicate with the exterior through the said ports only when the piston **13** is substantially at the bottom of its down stroke.

The crank case **3** is partitioned into separate units or compartments by walls or partitions **14** (Fig. 2) depending upon the number of cylinders. Each partition **14** is in

substantially vertical alignment with the above separation between cylinders, and each partition is centrally apertured and provided with a bearing **16**. The crankshaft **17** passes through the partition **14**, and is supported by the bearings **16**, the latter effecting a substantially airtight seal between the formed crankcase compartments.

A connecting rod **18** slidably mounts the piston **13** in each cylinder **4** in a conventional manner. The piston **13** is provided with the usual deflect **19** and with oil and compression rings **21** and **22**, as required.

The crankcase **3** is apertured transverse to the crankshaft **17**, or at its left side as it appears in Fig. 1, to receive a diaphragm **23** which is composed of a resilient and durable material such as neoprene which is not deleteriously affected by fuel and oil. The dimension of the crankcase spaces the diaphragm **23** from the crankshaft **17** such that neither interferes with the operation of the other. A short cylinder **24** having an open end and a closed end and a diameter substantially equal to that of the said aperture in the crankcase **3** is secured at its open end in registry with aperture, and the peripheral edges of flexible diaphragm **23** are secured between the cylinder **24** and the crankcase **3**. The closed end of the cylinder is centrally apertured to form an inlet **26**, and a uni-directional valve such as a flap valve **27** is secured over the interior end of the said inlet. Secured to the exterior side of the closed end is a manifold **28** communicating with a carburetor **29**.

A mixture passage or vapor conduit **31** communicates with cylinder **24** with the inlet port **9** of the cylinder **4**.

The pressure regulator comprises a pressure relief chamber **32** vented at its top and secured exteriorly to the crank case **3** by 1st and 2nd pipes or conduits **33** and **34**. The said pipes individually communicate the pressure relief chamber **32** with the interior of the crank case **3**. Both pipes **33** and **34** are preferably situated above the lubricating oil line (not illustrated) within the crank case **3**. 1st pipe **33** is provided with an exhaust check valve **36** and terminates within the pressure relief chamber **32** adjacent the latter's top; 2nd pipe **34** is provided with an intake check valve **37** and is upwardly bent to terminate in the bottom of the pressure relief chamber **32**. The tension springs on the exhaust and intake check valves **36** and **37** are adjusted for the valves to open respectively at predetermined maximum desirable pressure and minimum desirable pressure, i. e., at maximum vacuum.

Operation

On the down or power stroke the descending piston **13** compresses air within the crank case **3**. The compressed air distends the diaphragm **23** outwardly or away from the crank case which causes valve **27** to close and compresses the carbureted air within the chamber **24** and communicating vapor conduit **31**, which fuel has entered the chamber **24** as below described.

As the descending piston **13** uncovers the intake and exhaust ports **9** and **11** the exhaust gases escape through the exhaust ports **11**, and the carbureted air, compressed in the vapor conduit **26**, enters the combustion chamber **8** and is deflected upward, away from the descending exhaust gases.

Substantially simultaneously the pressure in the crank case **3** reaches a predetermined desirable maximum, overcoming the tension spring in the exhaust check valve **36** and exhausting therethrough. The exhausted air escapes through the vent in the pressure relief chamber **32**, and any lubricating oil which may have been exhausted drains to the bottom of the container to return to the crank case **3** through the inlet check valve **37**.

Completing the cycle, on the upward stroke the rising piston **13** creates a partial vacuum within the crank case. The vacuum distends the diaphragm **23** inwardly or to-

ward the crank case. This in turn creates a partial vacuum in the chamber **24**, opening the flap valve **27** and drawing carbureted air therethrough. Near the top of the stroke the carbureted air which entered the combustion chamber on the down stroke is ignited by the spark plug **7**, and substantially simultaneously the partial vacuum within the crank case reaches a predetermined desirable minimum pressure, overcoming the tension spring on the intake check valve **37** and drawing air and any lubricating oil in the pressure relief chamber **32** into the crank case.

The cycle then repeats as above described.

It will thus be evident that the means supplying the fuel to the combustion chamber is exclusively dependent on pressure differentials within the crank case. Should a greater or lesser supply of fuel be desired per revolution, the intake check valve **36** may be adjusted to open respectively nearer or more distant in point of time from the peak of the stroke. Adjustment of the intake check valve **36** determines the length of the period that the diaphragm **23** is distended toward the crank case, which in turn controls the flap valve **27** and quantity of carbureted air passed to the chamber **24** for supplying the combustion chamber **8**. Additionally, the exhaust and check valves prevent harmful extremes of pressure within the crank case and consequent improper operation and damage to the diaphragm and other parts.

The diaphragm is spaced from the crankshaft such that neither interferes with the other and guards or other parts are unnecessary to protect the diaphragm. Fuel and lubricating oil are at all times separate, facilitating efficiency and economy of operation and economizing on oil consumption and reducing engine wear. Finally, the invention may be utilized equally satisfactorily on single or multiple-cylinder engines.

The foregoing description has been in some detail by way of illustration and example to augment clarity. It will be understood that certain changes and modifications may be made without departing from the spirit of the invention or scope of the appended claims.

I claim:

1. An internal combustion engine comprising a cylinder; a crank case; a crankshaft; a piston slidably mounted in the cylinder and working off the crankshaft; intake and exhaust ports located in the cylinder to permit communication from the interior of the cylinder to the exterior thereof only when the piston is substantially at its lowest stroke position; one wall of the crank case transverse to the longitudinal axis of the crankshaft formed with an aperture, a flexible pressure responsive diaphragm sealing said aperture; a chamber formed interiorly of a housing secured on the exterior wall of said crank case; said diaphragm forming a portion of one wall of said chamber; valve means operable to admit carbureted air to said chamber; a conduit communicating the chamber with the intake port of said cylinder; a pressure relief chamber formed interiorly of a second housing; said second housing positioned exterior of the crank case with said chamber above the normal level of oil in said crank case; said chamber vented to the atmosphere adjacent the top portion of said second housing; a first pipe communicating with said crank case at a point substantially above the oil level in said crank case and connected to said relief chamber in fluid communication therewith at a point substantially above the bottom of said relief chamber; a second pipe communicating with said crank case and connecting with said relief chamber in fluid communication at a point substantially below the point of connection of said first pipe with said relief chamber; said first pipe provided with a check valve adjusted to open when the pressure in the crank case reaches a predetermined maximum; and said second pipe provided with a check valve adjusted to open when the pressure in the crank case falls below a predetermined minimum.

2. An internal combustion engine comprising a plurality of cylinders disposed in a single row; a crank case divided into separate pressure compartments by walls; each said compartment aligned with one said cylinder; a common crankshaft disposed within each said compartment; a piston slidably mounted in each cylinder and working off the crankshaft; intake and exhaust ports located in each of the cylinders to permit communication from the interior of the cylinders to the exterior only when the pistons are substantially at their lowest stroke position; each compartment of said crank case formed with an aperture; each said aperture disposed on the side of said crank case transverse to the longitudinal axis of the crankshaft; a flexible pressure responsive diaphragm sealing each said aperture; housing members forming the walls of a plurality of chambers secured on the exterior wall of said crank case and aligned with each said compartment; a portion of one wall of each said chamber comprising a said diaphragm; valve means operable to admit carbureted air into each said chamber and a conduit connecting each said chamber in fluid communication with the intake port of the cylinder aligned therewith.

3. An internal combustion engine comprising a plurality of cylinders disposed in a single row; a crank case divided into separate pressure compartments by walls; each said compartment aligned with one said cylinder; a common crankshaft disposed within each said compartment; a piston slidably mounted in each cylinder and working off the crankshaft; intake and exhaust ports located in each of the cylinders to permit communication from the interior of the cylinders to the exterior only when the pistons are substantially at their lowest stroke position; each compartment of said crank case formed with an aperture; each said aperture disposed on the side of said crank case transverse to the longitudinal axis of the crankshaft; a flexible pressure responsive diapragm sealing each said aperture; housing members forming the walls of a plurality of chambers secured on the exterior wall of said crank case and aligned with each said compartment; a portion of one wall of each said chamber comprising a diaphragm; valve means operable to admit carbureted air into each said chamber; a conduit connecting each said chamber in fluid communication with the intake port of the cylinder aligned therewith, a plurality of pressure relief chambers formed by walls positioned exteriorly of the crank case with the chambers disposed above the normal level of oil within the said crank case; each chamber formed with a vent to the atmosphere proximate the top wall of said chamber; a plurality of first pipes with each said pipe connected with said crank case in fluid communication with one compartment at a point substantially above the oil level within the compartment and joining the compartment in fluid communication with a relief chamber at a point near the top wall of the relief chamber; a plurality of second pipes each connected with said crank case communicating in fluid communication with a compartment of said crank case and joining the compartment in fluid communication with a relief chamber at a point substantially below the point of connection of said first pipe; a check valve for each first pipe with each valve adjusted to open fluid communication through the first pipe when pressure in a compartment reaches a predetermined maximum and a second check valve for each second pipe with each second check valve adjusted to open fluid communication through the second pipe when the pressure in a compartment falls below a predetermined minimum.

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