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INTERNAL COMBUSTION ENGINE

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Fig. 1.

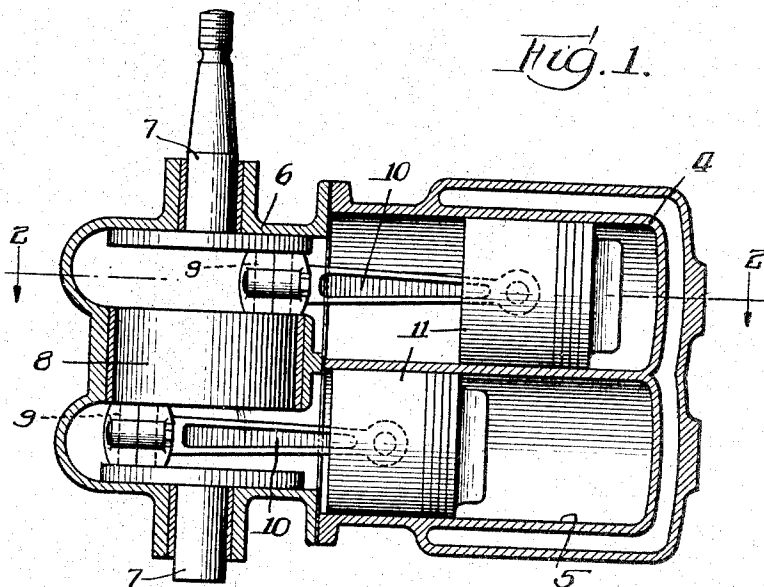


Fig. 2.

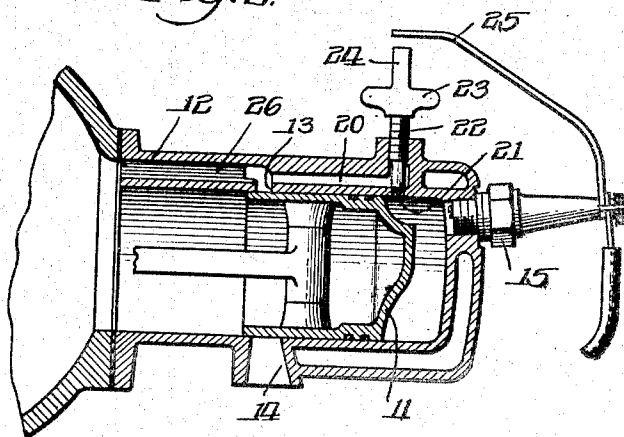
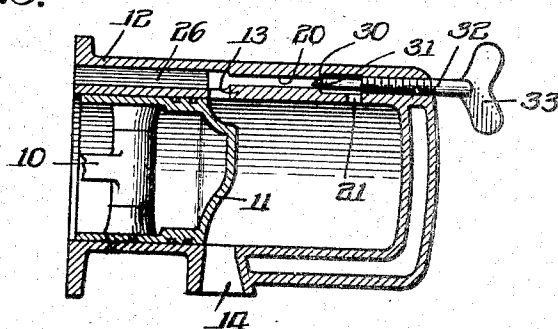


Fig. 3.



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INTERNAL COMBUSTION ENGINE

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5 Claims. (Cl. 123-73)

This invention relates in general to an engine of the internal combustion type and has more particular reference to a compression bypass around one of the pistons of a multi-cylinder engine for the purpose of cutting out that cylinder for certain conditions of operation.

An important object of the invention is in the provision of a suitable bypass from the compression end of the cylinder of an engine to release the compression thereof for running the engine at slow speed, to assist in starting a multi-cylinder engine and to produce a surge of gas in the cylinder thus cut out for adding a retarding effect in running the engine more slowly.

A still further object of the invention is in the provision of a compression bypass in one of the cylinders of an engine in connection with a spark cut-out for that cylinder.

Other objects of the invention will appear hereinafter.

In the drawing illustrating the invention,

Fig. 1 is a sectional view of a tandem alternate firing type of engine to which the invention is applicable;

Fig. 2 is a transverse sectional view of a portion of one cylinder to which the invention is applied; and

Fig. 3 illustrates a modified form in which the spark plug cut-out is omitted.

In operating a high speed engine particularly of the multi-cylinder two-cycle type in which the fuel is first partially compressed in the crank case and is led through a bypass around the piston to the outer end of the cylinder for firing, it is often difficult to sufficiently reduce the speed of the engine for a certain class of useful service. For example, when such an engine is incorporated in an outboard motor, it is frequently desirable to run the motor at slow speed for trolling and fishing. With all cylinders in operation the motor propels the boat too rapidly through the water and if an attempt is made to run the motor too slowly the cooling water does not circulate properly, the engine becomes too hot and does not operate in a satisfactory manner.

The present invention proposes to cut out one cylinder by relieving the compression at the time of firing and shortly prior thereto, thereby causing an idle surge of gas back and forth in this cylinder, adding opposition to the movement of the piston and thereby producing a certain load on the other cylinder or cylinders which has a retarding effect.

Referring now more particularly to the drawing, a two-cycle engine of the type to which this invention is particularly applicable is shown in cross section in Fig. 1 having tandem cylinders 4 and 5 at one side of a closed crank case 6 in which an explosive mixture is drawn by the operation of the engine in a well known manner. In the crank case is a crank shaft 7 having a central bearing member 8 forming a partition in the crank case and connected crank arms 9 to which piston rods 10 are connected. A piston 11 is secured to the outer end of each of the piston rods and is movable alternately in accordance therewith in adjacent cylinders. In the wall of each cylinder as shown more clearly in Figs. 2 and 3, is a fuel passage 12 leading from the crank case through a port 13 to the interior of the cylinder and opposite the inlet port is an exhaust port 14 for the discharge of the exhaust gas therefrom.

At the outer end of the cylinder is a spark plug 15 for producing a spark at each outward movement of the piston in the cylinder. All of this structure and operation is well known in the gas engine art.

The improvement to which this invention relates consists in providing a bypass 20 preferably formed as a continuation of the fuel passage 12 and leading therefrom through a port 21 to the outer end of the cylinder. This bypass if left open at all times would simply cause a surge of gas back and forth from the outer end of the cylinder to the crank case through the fuel passage 12. A valve 22 is therefore provided to close the port 21 when desired so that the engine may be used and operated as an ordinary two-cycle engine. The outer end of this valve may be provided with a thumb screw portion 23 for turning it when desired and in the form shown by Fig. 3, an extension 24 is provided which is moved in engagement with a fixed contact 25 extending from the spark plug 15 and forming a short circuiting electrical connection therewith so that when the valve 22 is moved outwardly to open the bypass the extension 24 will engage with the conductor 25, thereby short-circuiting the spark plug.

In practice it has been found that the short-circuiting device is not necessary in connection with the spark plug for even though the gas surges back and forth through the bypass 20 the fuel passage 12 is commonly provided with an anti-backfire screen 26 which prevents an ignited charge from passing rearwardly there-through into the crank case.

In the modification shown in Fig. 3 the bypass 20 has a valve seat 30 at its outer end closed by a valve 31 at the end of a threaded stem 32 having a thumb screw 33 at its outer end for operating it. With this construction there is no short-circuiting of the spark plug and as in the other form the fuel compressed in the outer end of the cylinder simply surges back and forth through the bypass 20, the fuel passage 12, and the port 21.

10 I claim:

1. The combination in an internal combustion engine with a plurality of cylinders, pistons movable therein and a common chamber for admitting a combustible mixture under pressure to the explosion end of the cylinders, means forming a bypass in the wall of the cylinder from the combustion end of one or more of the cylinders to the common chamber, a spark plug at the outer end of each cylinder, and manually operated valved means for the bypass and a conductor to extend therefrom to short circuit the spark plug for that cylinder when it opens the bypass.

2. A multi-cylinder internal combustion engine having reciprocating pistons and spark plugs at the outer ends of the cylinders, means forming a bypass in the wall of the cylinder from the compression end of one or more of the cylinders around the piston to produce a surge of gas therein as the piston is reciprocated, and valved means in the bypass engageable with a conductor extend-

ing to the spark plug for also eliminating the spark at the spark plug of that cylinder when the valve is operated to open the bypass.

3. A structure in accordance with claim 1 in which a spark plug having a projecting conductor is provided for each cylinder with a bypass and the valve which controls the bypass short circuits the spark plug through said conductor for that cylinder when the valve is opened so that the compressed charge in that cylinder will not be ignited.

4. In an internal combustion engine of the two-cycle type having a closed crank case, reciprocating pistons, a spark plug at the outer end of the cylinder, and a passage from the crank case to supply fuel around the piston to the cylinder; and an extension of said passage to the outer end of the cylinder, a valve for said extension, and means to short-circuit current to the spark plug when the valve is operated to open said extension.

5. In an internal combustion engine of the two-cycle type having a fuel compression crank case, a spark plug at the outer end of the cylinder, and means forming a passage from the outer end of the cylinder to the crank case; a valve for controlling said passage, and means associated with the valve for short-circuiting the spark plug when the valve is moved to open the passage.

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