(12) UK Patent Application (19) GB (11) 2 142 085 A

(43) Application published 9 Jan 1985

(21) Application No 8311610

(22) Date of filing 28 Apr 1983

(51) INT CL³
F02B 33/04

(52) Domestic classification
F1B 1D10 1G4A 2A10B 2A13B

(56) Documents cited
GB A 2022699

(58) Field of search
F1B

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(54) Two-stroke crankcase compression engine

(57) At least one first transfer duct (K) and further transfer passage (B-B') extend between the crankcase chamber (L) and the cylinder. The passage (B-B') communicates with the cylinder between the point of discharge thereinto of the first transfer duct (K) and at least one exhaust port (J). In operation air/fuel mixture is drawn into both the crankcase chamber (L) and the first transfer duct (K) with a large percentage of the associated fuel, which is in liquid form, tending to enter the first transfer duct (K) with the remainder drawn into the crankcase chamber (L). On the downward movement of the piston, the leaner mixture enters the cylinder from passage (B-B') and the richer mixture enters the cylinder from the first transfer duct (K).

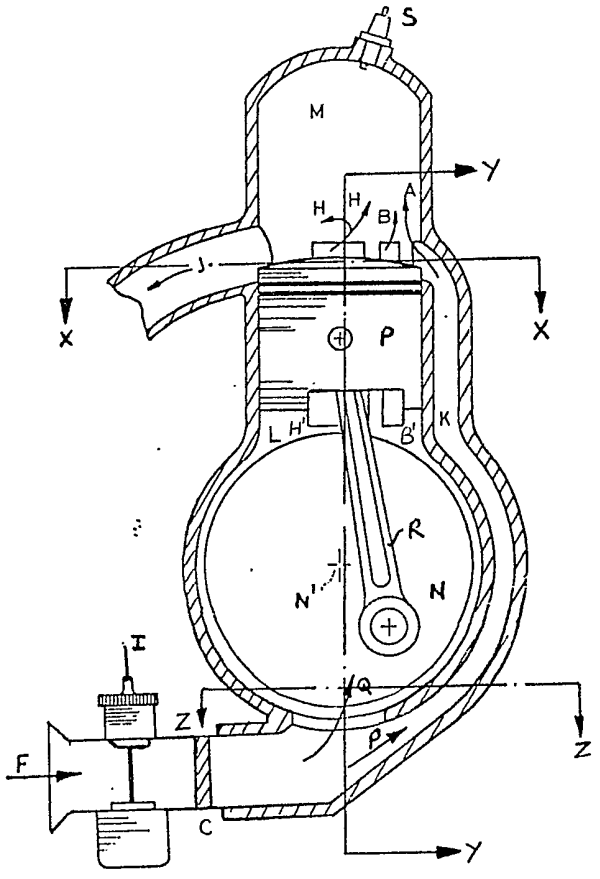

Fig. 1.

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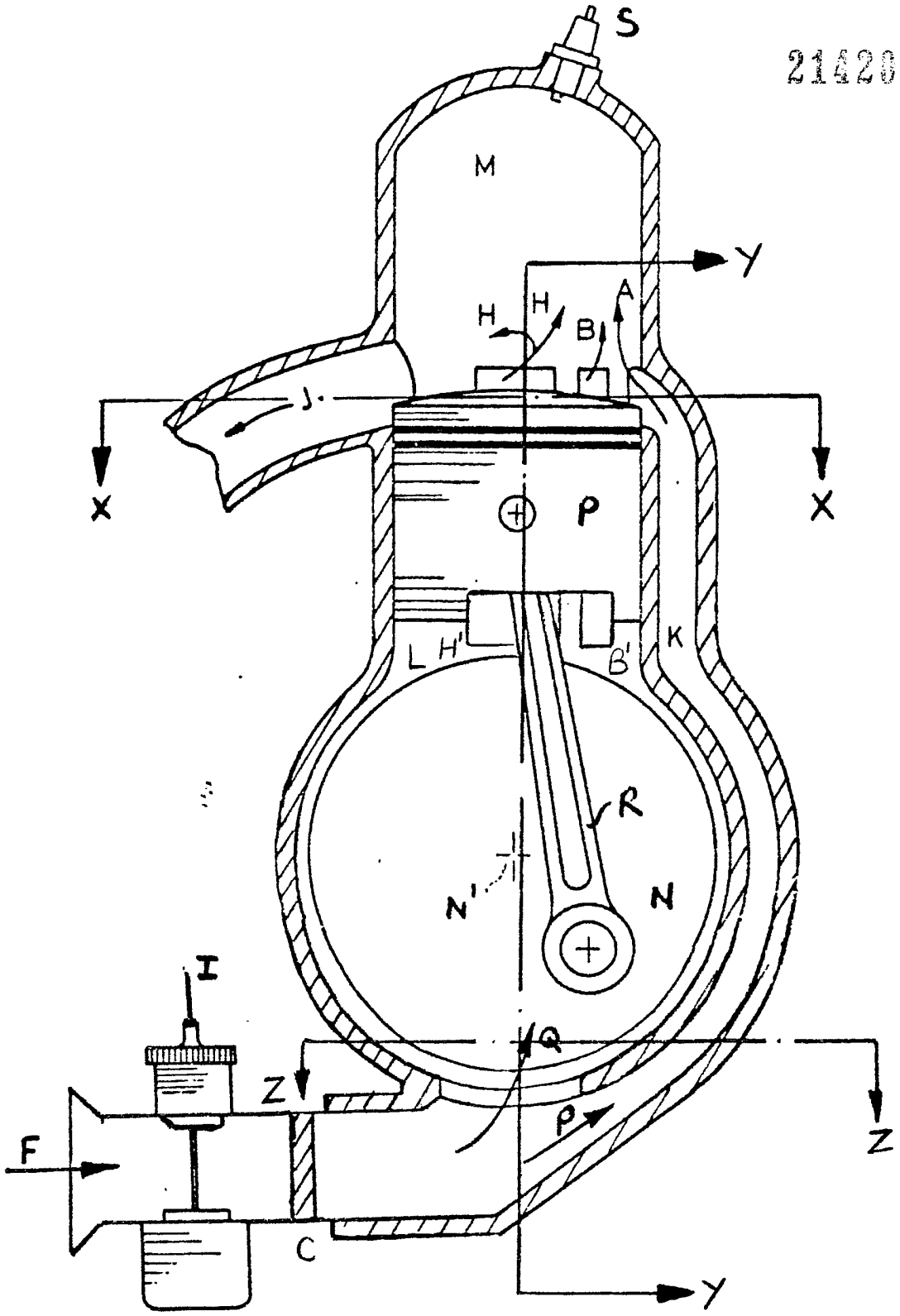

Fig. 1

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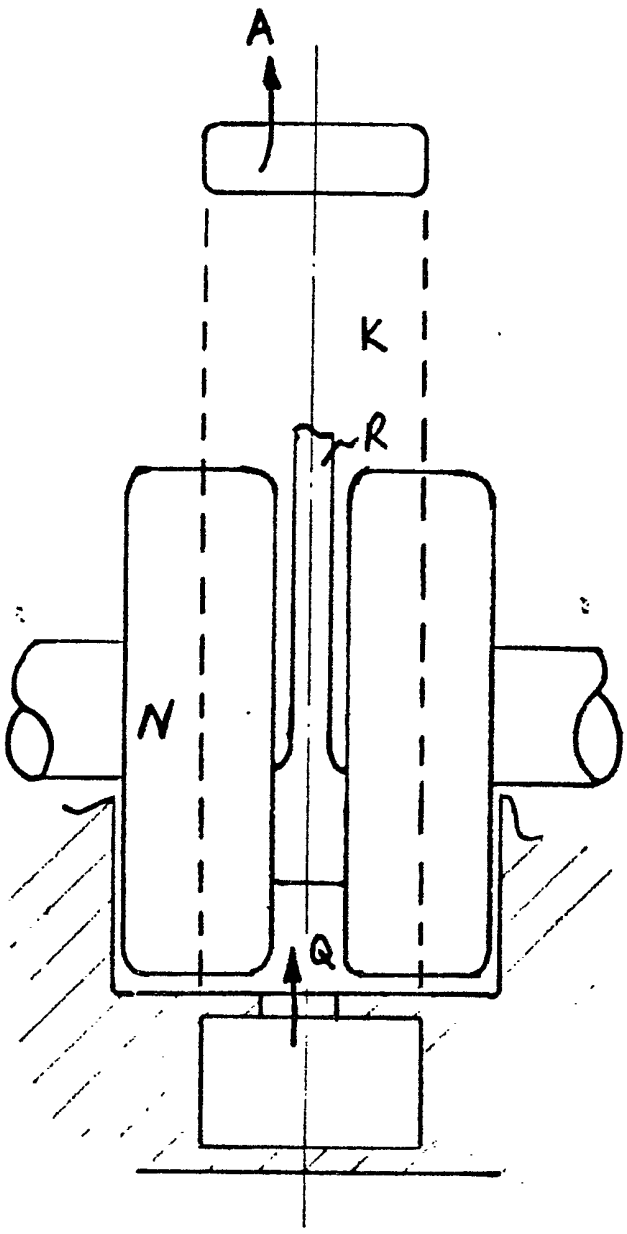

SECTION Y-Y

Fig 3

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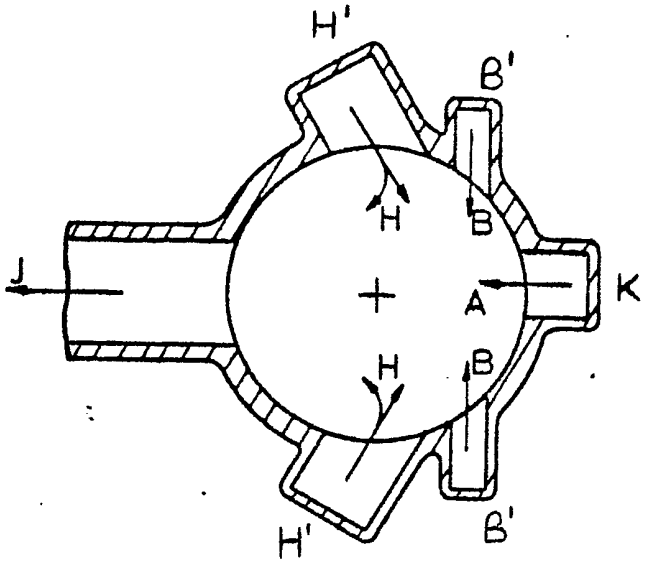
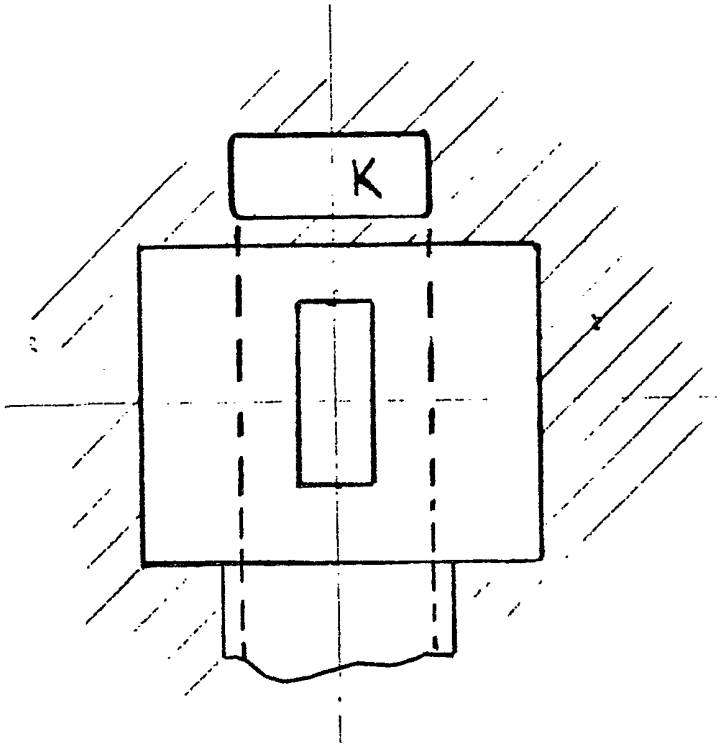


SECTION X-X

Fig. 2.



SECTION Z-Z

Fig. 4.

SPECIFICATION

Two-stroke internal combustion engine

This invention relates to an internal combustion engine of the two-stroke cycle type commonly used to power motorcycles, mopeds, outboard marine engines, chainsaws, drone aircraft engines and in many industrial applications where the power unit is of crankcase compression type. An induced fuel/air mixture is compressed in the crankcase and then, being forced via transfer ducts into the cylinder, the combustion of the fuel and air mixture is initiated by an electric spark discharge. The fuel used is commonly a liquid and of the hydrocarbon type.

In our British Patent No. 2022699 there is described such an engine wherein a gas transfer duct extends from a combustion chamber of the engine to a part of the crankcase remote from the combustion chamber, a first admission port provided to admit a fuel/air mixture to the transfer duct, and a second admission port being provided to admit air to the crankcase. This engine has improved properties compared with previous engines, but the provision of the two admission ports and necessary associated gas flow control means is relatively expensive.

An object of the present invention is to provide an engine which has the advantages of the engine of our Patent No. 2022699, but is cheaper to manufacture and is less complicated.

Accordingly the invention provides a two-stroke internal combustion engine comprising: a combustion chamber having an exhaust port, a first inlet port, and a second inlet port positioned closer to the exhaust port than the first inlet port; a piston reciprocable in the cylinder and combustion chamber; a crankcase chamber; a first transfer duct extending from the first inlet port in the combustion chamber to a position in the half of the crankcase chamber remote from the combustion chamber and also to an admission port where an air/fuel mixture is induced; a second duct extending from the second inlet port in the combustion chamber to a position in that half of the crankcase chamber adjacent to the combustion chamber.

The invention will be described further, by way of example, with reference to the accompanying drawings, wherein:-

Figure 1 is a longitudinal section through a single cylinder two-stroke cycle engine conforming to the invention;

Figure 2 is a cross-section on the line XX of Figure 1;

Figure 3 is a cross-section on the line YY of Figure 1; and

Figure 4 is a cross-section on line ZZ of Figure 1.

A preferred two stroke cycle internal combustion engine of the invention is similar to that described in our aforementioned patent in that a gas transfer port K extends from a combustion chamber M to a part of a crankcase chamber L remote from chamber M. The admission end of transfer port K (remote from combustion chamber M) is disposed adjacent a single fuel/air mixture admission port provided with a valve C and throttle I controlling a carburettor or fuel-injection arrangement. The fuel/air mixture admission port also communicates with the crankcase adjacent to the admission end of transfer port K, the inflowing streams of mixture being indicated by arrows P (flow to transfer duct K) and Q (flow into the crankcase chamber L). The orientation of streams P and Q with respect to direction F is such that the fuel element of the air/fuel mixture tends to be propelled preferentially in direction P.

During the scavenge or transfer portion of the engine cycle the fresh charge is expelled from crankcase chamber L by the pumping or compression movement of the piston and this charge enters the cylinder M via streams A, B and H respectively through the transfer ducts K, B', H'. The stream of rich fuel and air mixture labelled A emanates from the transfer duct K and as this stream A is at the farthest distance from the exhaust port J then it can be expected that little or none of this stream A will exit from the cylinder via exhaust port J before the piston P seals the exhaust port J.

The other streams of fresh charge B and H, containing a greater proportion of the induced air and the lesser portion of the total fuel required for correct or optimum operation of the engine, enter cylinder M in such a manner that the major proportion of these streams will be retained in the cylinder M for the combustion process. In the event that these streams B and H be short-circuited into the exhaust port J, then, as they consist of a leaner mixture of air/fuel than the stream A, a smaller portion of total fuel quantity supplied will be lost to the exhaust system than if streams B, H and A consisted of identical proportions of air/fuel as is the case in a conventional two-stroke cycle engine.

The supply of fuel to port F can be via a carburettor.

Lubricant could be conveniently admitted through port F.

There can be one, two or more exhaust ports J generally opposite duct K.

There could be one, two or more ducts K, these being generally opposite the exhaust port or ports.

Referring to Figures 1, 2, 3 and 4, the engine is of the crankcase compression type in which the piston P pumps fresh charge from the crankcase chamber L to the combustion chamber of cylinder M, the crankshaft N and connecting rod R being shown diagramatically. Spark discharge means S are provided in the normal way.

The engine includes a transfer duct K communicating at its lower end with the crankcase chamber L and with the admission port F and at its other end with the combustion chamber M at a location diametrically opposite to the exhaust port J. The engine is shaped to provide passages B', H' which provide communication between the crankcase chamber L and the combustion chamber M when the piston is at the lower end of its movement and these are nearer to the port J than is passage K.

The engine has an admission port F which communicates directly with duct K.

It is proposed that the air for combustion shall be induced into the sealed crankcase chamber L (direc-

tion Q) and duct K (direction P) in the ratio of approximately two-thirds to one-third through valve C which can be either of the automatic type such as a reed valve or can be controlled by the rotation of the crankshaft. The air entering aperture F shall induce or have inserted into it the required fuel quantity for correct or optimum operation of the engine. The metering of the total air quantity into the engine is by a throttle I.

It is known that a larger percentage of fuel entering an induced air stream remains as liquid fuel and it is proposed that the majority of this fuel will be oriented to move in direction P into duct K while the minority proportion of the fuel, will enter the chamber L by direction Q.

The foregoing discussion has been applied to a single cylinder engine but it is equally applicable to an engine unit of the two-stroke type consisting of one, two or more cylinders in any arrangement of these two or more cylinders. The described engines are of the loop scavenging type but the invention is also applicable to the cross-scavenging kind which also have a duct or ducts K.

CLAIMS

1. A two-stroke internal combustion engine comprising: a combustion chamber having an exhaust port, a first inlet port, and a second inlet port positioned closer to the exhaust port than the first inlet port; a piston reciprocable in the cylinder and combustion chamber; a crankcase chamber; a first transfer duct extending from the first inlet port in the combustion chamber to a position in the half of the crankcase chamber remote from the combustion chamber and also to an admission port where an air/fuel mixture is induced; a second duct extending from the second inlet port in the combustion chamber to a position in that half of the crankcase chamber adjacent to the combustion chamber.

2. An engine as claimed in claim 1 wherein an outlet of the admission port is arranged so that gas flow therefrom is directly towards an inlet to the first transfer duct so that a greater percentage of fuel, which is in liquid form, enters the first transfer duct and the remainder is drawn into the crankcase chamber.

3. A two-stroke internal combustion engine as claimed in claim 1 or 2 in which there are a plurality of first inlet ports and ducts.

4. A two-stroke internal combustion engine as claimed in claim 1, 2 or 3 in which there are a plurality of second inlet ports and ducts.

5. A two-stroke internal combustion engine as claimed in any of claims 1 to 4, in which at least two exhaust ports lead from the combustion chamber.

6. A two-stroke internal combustion engine as claimed in any preceding claim which is a single cylinder engine.

7. A two-stroke internal combustion engine as claimed in any of claims 1 to 5 which is a multi-cylinder engine.

8. A two-stroke internal combustion engine as claimed in any preceding claim which includes means for admitting lubricant through the admission port or admission ports.

9. A two-stroke cycle internal combustion engine substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Printed in the UK for HMSO, D8818935, 11/84, 7102.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.