

PATENT SPECIFICATION



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COMPLETE SPECIFICATION

Improvements in or relating to Two-Stroke Internal Combustion Engines

We, SULZER FRÈRES SOCIÉTÉ ANONYME, a Company organised under the Laws of Switzerland, of Winterthur, Switzerland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to two-stroke internal combustion engines of the kind having a closed crank chamber in open communication with the "inner" end of the cylinder bore. The term "inner" end of the cylinder bore employed in this specification is to be interpreted as referring to the end of the cylinder bore lying on that side of the associated piston remote from the working chamber.

With engines of this type, and particularly when twin opposed pistons execute their expansion strokes simultaneously, the resulting pressure fluctuations in the crank chamber tend to force lubricant not only from the crankshaft bearings but also past the piston or pistons, and the present invention has for its object to overcome this difficulty.

To this end a two-stroke internal combustion engine according to the invention is furnished with a scavenging and charging pump comprising a piston reciprocating in a cylinder with the "inner" end of the bore of the pump cylinder in open communication with the said crank chamber, the pump piston being so dimensioned and driven in synchronism with the engine piston or pistons that during any given displacement or vacuation of the effective volume of the crank chamber by the engine piston or pistons an approximately equal part of the effective volume of the crank chamber is simultaneously vacated or displaced by the pump piston.

In this way pressure oscillations within the crank chamber, and therefore the tendency for lubricant to be forced through the crank shaft bearings and past the pistons into the combustion chamber or chambers, are reduced as also vibrations ("breathing") in the walls of the crank chamber which can thus be lightened.

The invention is particularly though

not exclusively applicable to internal combustion engines of the kind comprising at least one pair of opposed pistons arranged to reciprocate in a common cylinder and having transmission mechanism comprising two oscillating levers through which power is transmitted from the two opposed pistons respectively to the crankshaft. A pump piston for each pair of opposed pistons is then conveniently driven from the said transmission mechanism, say, from one of the oscillating levers, so as to reciprocate in a direction transverse to the reciprocation of the engine pistons. The pump piston may be stepped so that whilst the part of the effective volume of the crank chamber displaced or vacated by the side of the pump piston next the crank chamber is approximately equal to that vacated or displaced in the crank chamber by the engine piston or pistons the volume of air delivered at each delivery stroke by the opposite side of the pump piston is approximately equal to the volume of air to be delivered in each cycle of operations.

One construction according to the invention as applied to a twin opposed piston engine, is illustrated somewhat diagrammatically and by way of example in the accompanying drawing. In this construction fuel is supplied through a valve *a* and air is supplied through a conduit *b*, the exhaust gases being discharged through an exhaust pipe *c* from the cylinder *d*. The power is transmitted from the pistons *e*₁, *e*₂ through connecting rods *f*₁, *f*₂, rocking levers *g*₁, *g*₂ and connecting rods *h*₁, *h*₂ and opposed cranks *i*₁, *i*₂ to a crankshaft *k*. The pivot of the rocking lever *g*₁ is provided with a crank which transmits reciprocating movement through a rod *l* to a scavenging and charging piston *n* within a cylinder *m*.

The closed crank chamber *o* is in open communication not only with the inner ends of the bore of the cylinder *d* but also with the inner ends of the bore of the cylinder *m* as shown. The scavenging pump piston *n* is thus driven in synchronism with the pistons *e*₁ and *e*₂ so that the down-strokes

of the pump piston n coincide with the compression strokes of the pistons e_1, e_2 whereas the upstroke of the pump piston n coincides with the expansion stroke
 5 of the pistons e_1, e_2 . In this way whilst the pistons e_1, e_2 , are moving on their expansion stroke so as to tend to decrease the effective volume of the crank chamber o as shown dotted,
 10 the pump piston n moves so as correspondingly to increase the effective volume of the crank chamber o , and conversely. The scavenging pump piston n thus serves
 15 to reduce pressure fluctuations within the crank chamber o thereby tending to reduce the forcing of lubricant from the crank chamber o through the crankshaft bearings and past the pistons e_1, e_2 into the combustion chamber.

20 In the case of multi-cylinder engines, two or more scavenging and charging pumps as above described will be provided for the purpose above indicated. Similarly the scavenging and charging
 25 pump piston or each scavenging and charging pump piston may be so constructed, for example by stepping the piston, that whilst the pump will deliver
 30 a volume of air exceeding the stroke volume of the engine cylinders, it will vacate or displace within the crank chamber only a volume equal to that displaced or vacated by the engine pistons in this
 35 crank chamber.

It will be understood that though the invention has been described as applied to an engine of the twin opposed piston type, it is also applicable to other forms of internal combustion engine of the kind
 40 having a closed crank chamber in open communication with the inner end of the bore of the engine cylinder or of each such cylinder.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In a two-stroke internal combustion engine the combination with a closed crank chamber in open communication with the
 50 "inner" end of each cylinder bore, of a scavenging and charging pump comprising a piston reciprocating in a cylinder with the "inner" end of the bore of the
 55 pump cylinder in open communication with the said crank chamber, the pump piston being so dimensioned and driven in synchronism with the engine piston or
 60 pistons that during any given displacement or vacation of the effective volume of the crank chamber by the engine piston

or pistons an approximately equal part of the effective volume of the crank chamber is simultaneously vacated or displaced by 65 the pump piston.

2. In a two-stroke internal combustion engine the combination with at least one pair of opposed pistons arranged to reciprocate in a cylinder, of a closed crank
 70 chamber in open communication with the opposite ends of the cylinder bore remote from the combustion chamber, and a scavenging and charging pump for each pair of engine pistons and comprising a
 75 piston arranged to reciprocate in a cylinder the inner end of the bore of which is in open communication with the said crank chamber, the pump piston being so dimensioned and driven in synchronism
 80 with the two engine pistons that during any given displacement or vacation of the effective volume of the crank chamber by the engine pistons an approximately equal part of the effective volume of the crank
 85 chamber is simultaneously vacated or displaced by the pump piston.

3. A two-stroke internal combustion engine as claimed in Claim 1 or Claim 2, in which the closed crank chamber serves
 90 as such both for the engine and for the scavenging and charging pump.

4. A two-stroke internal combustion engine as claimed in Claim 2, having transmission mechanism comprising two
 95 oscillating levers through which power is transmitted from the two opposed pistons respectively to the crankshaft, the pump piston being driven from the said transmission mechanism so as to reciprocate in
 100 a direction transverse to that in which the engine pistons reciprocate.

5. A two-stroke internal combustion engine as claimed in any one of the preceding claims, in which the scavenging
 105 and charging pump piston is stepped so that whilst the part of the effective volume of the crank chamber vacated or displaced by the side of this piston next the crank chamber is approximately equal to that
 110 displaced or vacated by the engine piston or pistons, the volume of air delivered at each delivery stroke by the opposite side of the pump piston corresponds to the volume of air which is to be delivered
 115 in each cycle of operations.

6. The two-stroke internal combustion engine furnished with a scavenging and charging pump arranged and operating as described with reference to the accom-
 120 panying drawing.

Dated this 26th day of March, 1936.

KILBURN & STRODE,
 Agents for the Applicants.

[This Drawing is a reproduction of the Original on a reduced scale.]

