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ALBRECHT-WOLFGANG MANTZEL
FOUR CYLINDER TWO-STROKE OPPOSING PISTON
INTERNAL COMBUSTION ENGINE

3,359,957

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2 Sheets-Sheet 1

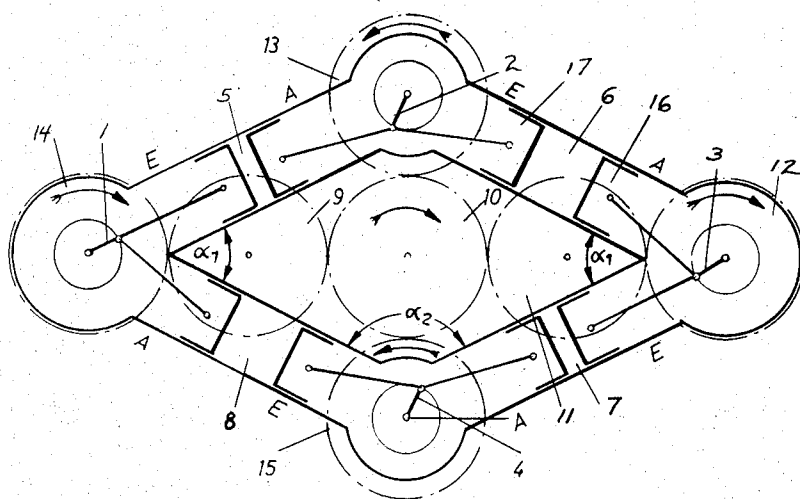


Fig. 1

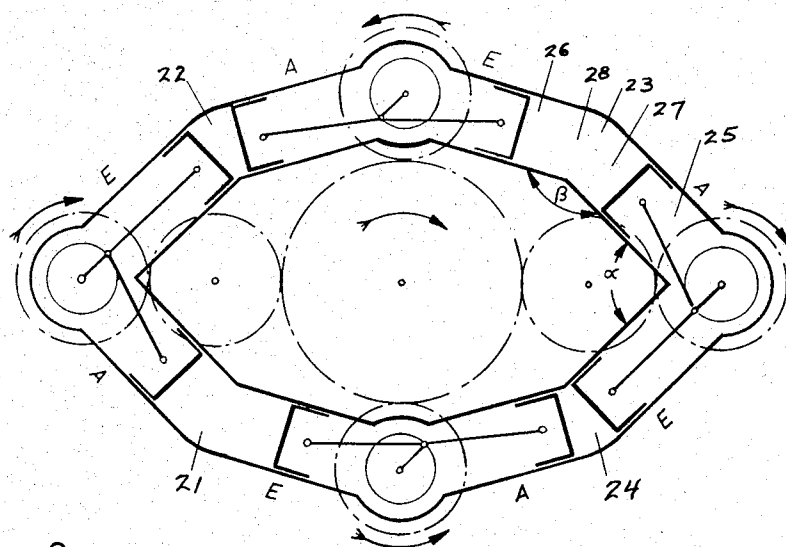


Fig. 2

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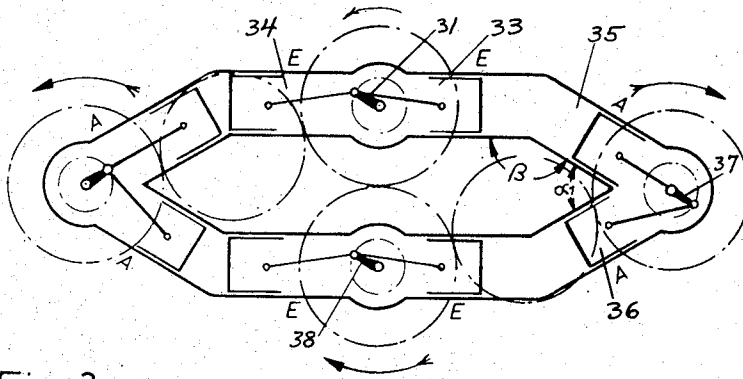


Fig. 3

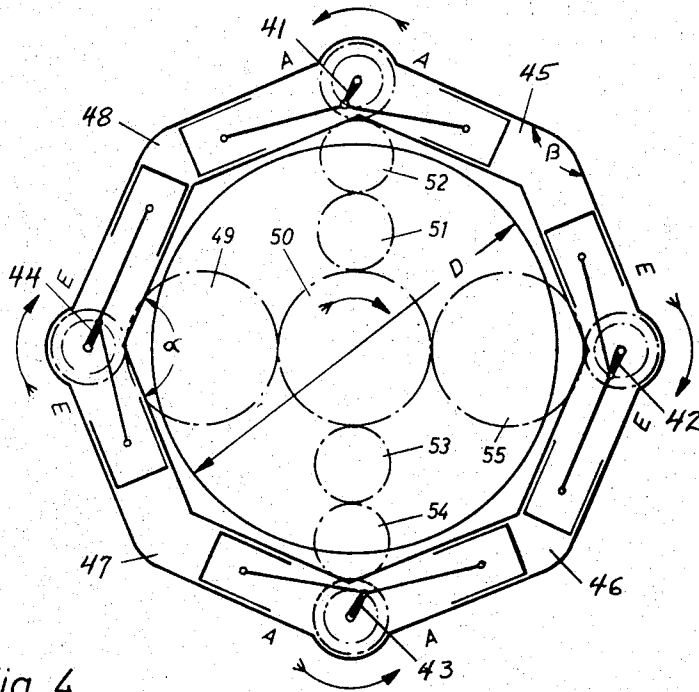


Fig. 4

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FOUR CYLINDER TWO-STROKE OPPOSING PISTON INTERNAL COMBUSTION ENGINE

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5 Claims. (Cl. 123—53)

ABSTRACT OF THE DISCLOSURE

A four cylinder, two-stroke opposing piston, internal combustion engine with four symmetrically arranged crankshafts on each crankshaft of which two of the pistons act. The cylinders containing adjacent, opposed pistons may be formed at an angle relative to one another.

The invention concerns a four cylinder two-stroke opposing piston internal combustion engine having four symmetrically arranged crankshafts, on which two pistons act, the cylinders of which are arranged at an angle relative to one another. Such engines are already known and have the exclusive shape of a square, since the centres of the crankshafts are arranged in a square relative to one another.

Other opposing pistons two-stroke internal combustion engines are shown in different embodiments in the form of series engines. They are constructed either with two crankshafts at the ends of the cylinders or they are made with a common crankshaft and push-rods and opposing pistons.

In two-stroke opposing piston engines it is moreover known to produce an asymmetric control by advancing the piston controlling the exhaust port.

The object of the invention is the improvement of the engine referred to above in such a manner that it may be adapted to spatial requirements. More especially an overall extremely flat engine is intended which for example is well suited for underfloor engines in automotive vehicles. It is also intended to accommodate gear boxes and other units in a space saving manner within the outlines of the engine.

To solve this problem provision is made in accordance with the invention for the angle between two cylinders appertaining to the same crankshaft to be made smaller and/or larger than 90° .

According to the present invention a four cylinder two-stroke opposing piston internal combustion engine having four symmetrically arranged crankshafts, on which two pistons each act, the cylinders of which are arranged at an angle to one another, characterised by the feature that the angle between two cylinders appertaining to the same crankshaft may be smaller and/or larger than 90° .

Among other things this has the advantage that two opposite crankshafts rotating in opposite directions are adapted to be connected, for example, by only a few gear wheels. This method of construction also has a better compensation of mass than the known square engine.

Furthermore the invention permits the construction of particularly compact engine shapes adapted to the requirements of automotive vehicles if the shorter of the two crankshaft connecting lines are arranged at right angles, so that the overall height of the engine is smaller than its width in that the angles between two cylinders operating on one crankshaft are partly smaller, partly larger than 90° .

It has also been proved that the constructional space required per volumetric capacity due to the invention results in a minimum, i.e. the known square engine re-

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quires comparatively more structural space, because among other things it is made possible by the invention to accommodate the charging blower in the engine interior. The blower may thus be driven directly by the centrally arranged driven shaft.

In further development of the invention provision is made for the cylinder each accommodating two pistons to be bent at an angle, so that each cylinder is divided into two cylinder sections located at an angle to one another and receiving a piston. This causes a triangular combustion chamber to be formed, and the space enclosed by the cylinders and crankshafts, for example becomes larger for receiving a charging blower.

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

FIG. 1 is a rhomboidal engine;

FIG. 2 is an engine similar to that of FIG. 1 but having a bend in the cylinders in accordance to the invention;

FIG. 3 is a further embodiment of the engine according to FIG. 2, the angle between the cylinders in two crankshafts amounting to 180° ;

FIG. 4 is a further embodiment, in which the angles α have the same overall size.

FIG. 1 shows an engine in which the cylinders 5 and 8 appertaining to a crankshaft, e.g. the crankshaft 1 encloses an angle α_1 , which is smaller than 90° , whilst the angle α_2 between the cylinders 5 and 6 appertaining e.g. to crankshaft 2 is larger than 90° . Owing to the symmetrical design a rhomboidal shape is created. Three gear wheels 9, 10 and 11 connect the gear wheels 12, 13, 14 and 15 connected with the crankshafts. The direction of rotation of the gear wheels is indicated by arrows. Two opposite shafts extend in an opposite direction of rotation relative to the two other shafts, whereby a better compensation of mass of the reciprocating masses is obtained in comparison with the known square engine.

Inlet and exhaust ports are designated E and A. In known manner the piston, e.g. 16 controlling the exhaust port A, is in advance of for example the piston 17 controlling the inlet E, whereby an asymmetrical control diagram is obtained.

FIG. 2 shows an engine of similar arrangement of the crankshafts as illustrated in FIG. 1, in this case however the cylinders in the region of the combustion chambers 21, 22, 23 and 24 are bent in accordance with the invention and thus the bend in this embodiment faces outwards relative to the engine centre by forming an angle of bend b between the two cylinder parts 25 and 26. Thus, therefore the axes 27 and 28 of both cylinder parts 25 and 26 intersect enclosing the angle b . This permits the combustion chambers to be better developed than hitherto and a large utilizable interior engine space results with the same height/depth of engine. Due to the angular combustion chambers the engine now has numerous corners the polygonal engine is also to be mentioned. Such an engine permits a particularly good cooling effect owing to the outwardly arranged combustion chambers of the cylinders.

FIG. 3 shows a flat design polygonal engine in which the cylinder parts 33 and 34 arranged in the center and e.g. acting on the shaft 31 enclose an angle of 180° . This creates in the center an H-shaped arrangement with horizontally opposed cylinders, as known in connection with four stroke engines with single pistons. The invention here-with however permits to join V-shaped arrangement of cylinder parts, e.g. 35 and 36 to the H-shape, which act on the crankshaft 37. Without the angle of bend b this is not possible. E and A designate again inlet and exhaust ports. In this case the exhaust ports are arranged on the outer side of the engine, whilst the inlet ports are located in the region of the shafts 31 and 38 arranged at right

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angles one above the other. This permits in underfloor engines for the exhaust pipes and silencers to be arranged within the height of the engine.

FIGURE 4 illustrates a symmetrical polygon motor having a specially large inside space of a diameter D, e.g. for accommodating a complete drive as used in vehicles where the space requirements are to be a minimum, such as caterpillar track vehicles, tanks or the like. As a rule, such motors are supercharged by an exhaust gas supercharger, a mechanical supercharger thus not being necessary.

In that case all angles *a* and all angles *b* at the points of discontinuity 45, 46, 47, 48 of the cylinders are greater than 90°, the motor thus being mountable of similar components or elements. The pistons cooperating with the inlet slots E act upon the crankshafts 42 and 44, while the pistons associated with the outlet slots A cooperate with the crankshafts 41 and 42. The crankshaft 41 meshes with the central gear 50 through the gears 51 and 52. The crankshaft 42 meshes with the central gear 50 through the intermediate gear 55. The crankshaft 44 engages with the central gear 50 through the intermediate gear 49, while the crankshaft 43 acts upon the central gear 50 through the intermediate gears 53 and 54.

What is claimed is:

1. A four cylinder two-stroke opposing piston internal combustion engine having four parallel arranged crankshafts arranged about a central axis, including a first two opposite crankshafts being closer together than the second two opposite crankshafts, two pistons acting on each crankshaft and the cylinders of which are arranged at an angle

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to one another, characterised by the fact that the angle between the two cylinders associated with the said first two opposite crankshafts being greater than 90° and the angle between the two cylinders associated with the said second two opposite crankshafts being less than 90°.

2. An engine as claimed in claim 1, in which the cylinders and the crankshafts are arranged relative to one another in the form of a rhombus.

3. An engine as claimed in claim 1, in which the cylinders, each of which receiving two pistons, are bent in the region of their combustion chambers opposite their crankshaft ends, so that each cylinder is divided in two cylinder parts each receiving a piston arranged at an angle relative to one another.

4. An engine as claimed in claim 1, in which a charging blower is arranged in the space enclosed by the cylinders and crankshaft.

5. An engine as claimed in claim 3, in which the said angle greater than 90° amounts to 180°.

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