United States Patent

Cookson

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[54] **REVERSIBLE ENGINE MOUNT**

[72] Inventor: **Cecil T. Cookson,** 918 Cornell Drive, Burbank, Calif. 91504

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[21] Appl. No.: **68,349**

[52] **U.S. Cl.**.....**123/73 A,** 123/73 R, 123/193 C, 123/DIG. 1, 123/DIG. 6, 123/DIG. 7

[51] **Int. Cl.**.....**F02b 33/04**

[58] **Field of Search**.....123/DIG. 1, DIG. 6, DIG. 7, 123/193 C, 73 R, 73 A

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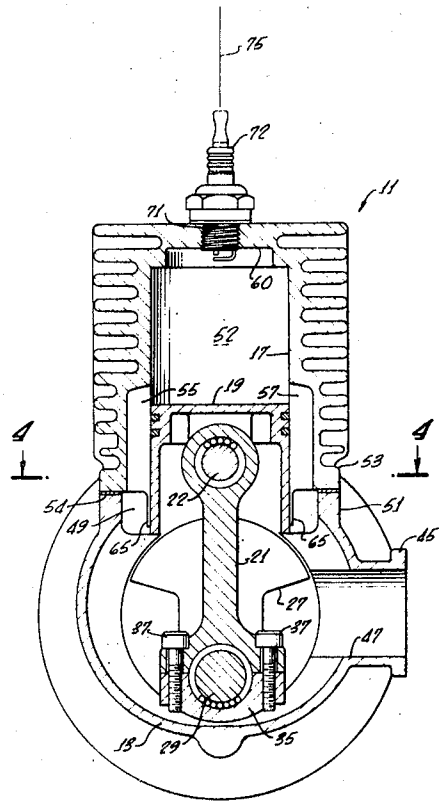
Primary Examiner—Wendell E. Burns

Attorney—Fowler, Knobbe & Martens

[57] **ABSTRACT**

A two-cycle gasoline engine having a cylinder block mountable in several alternative positions about its axis so as to allow variable orientations of its exhaust.

4 Claims, 9 Drawing Figures



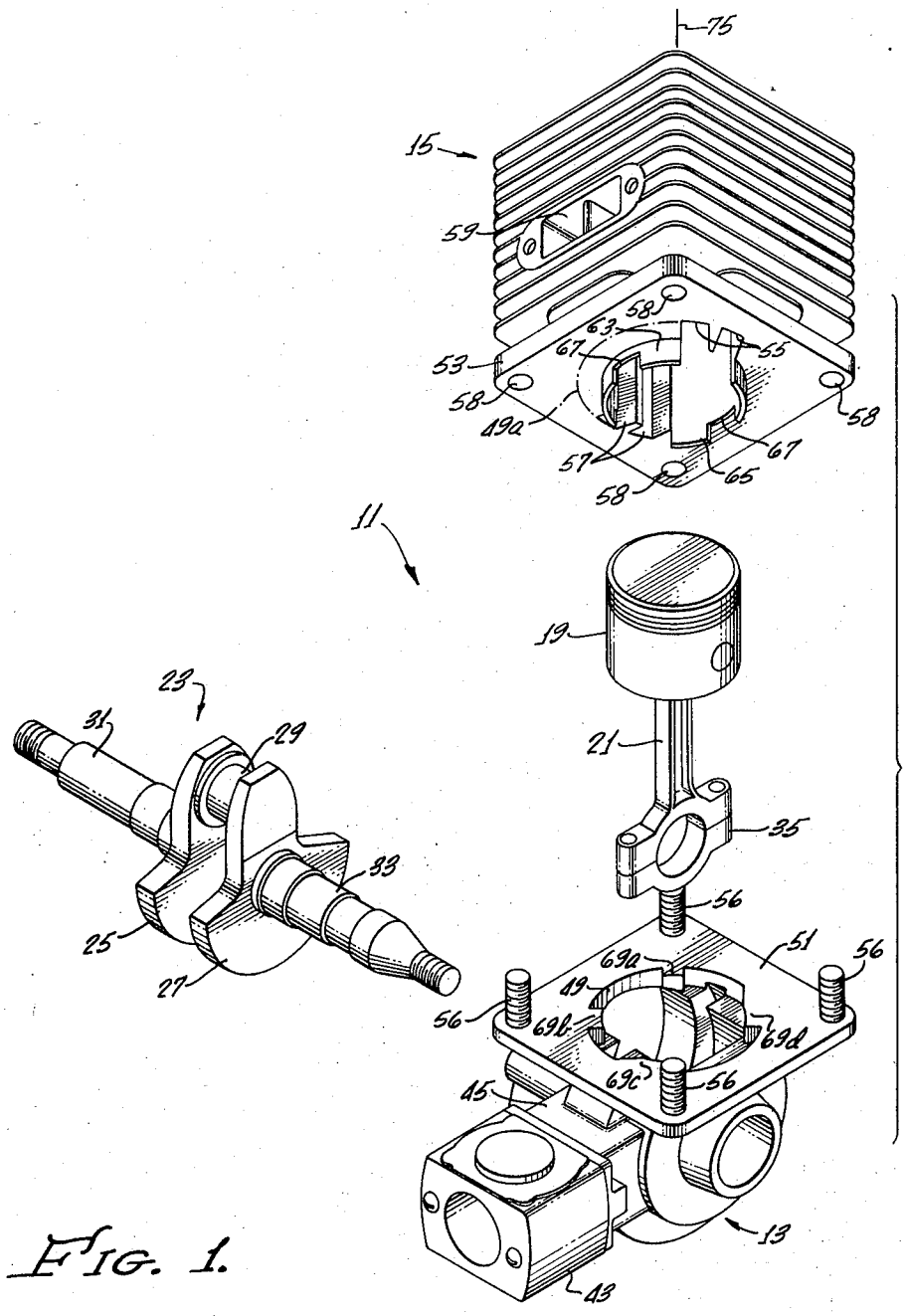


FIG. 1.

INVENTOR.
CECIL T. COOKSON

BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.

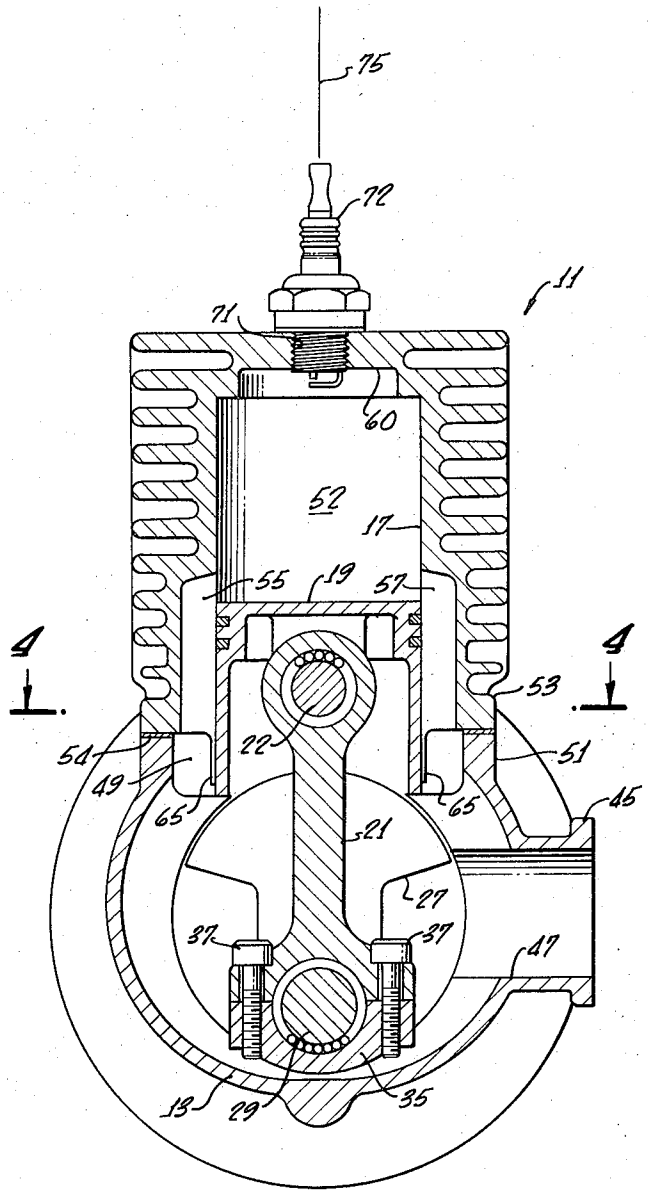


FIG. 2.

INVENTOR.
CECIL T. COOKSON

BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.

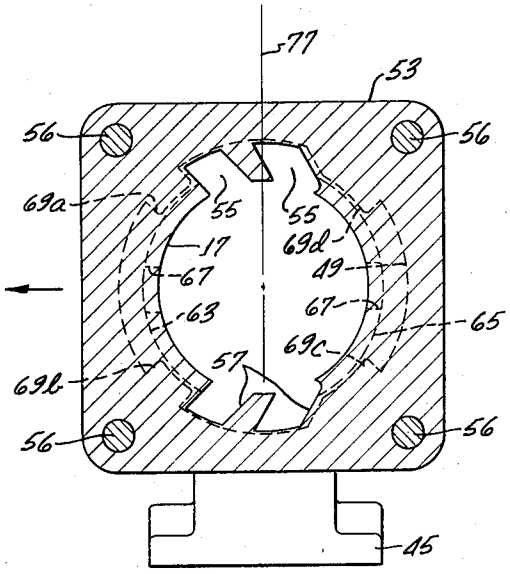


FIG. 4a

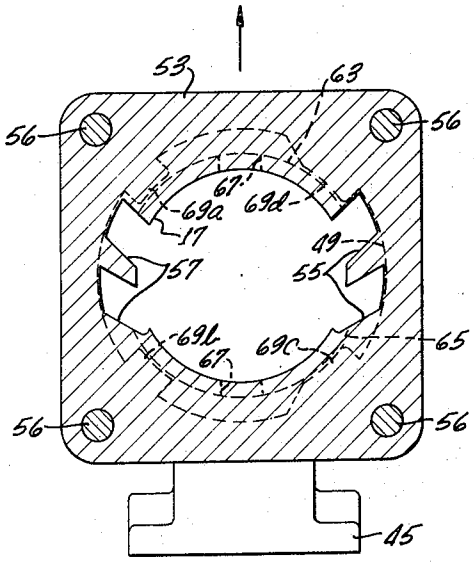


FIG. 4b

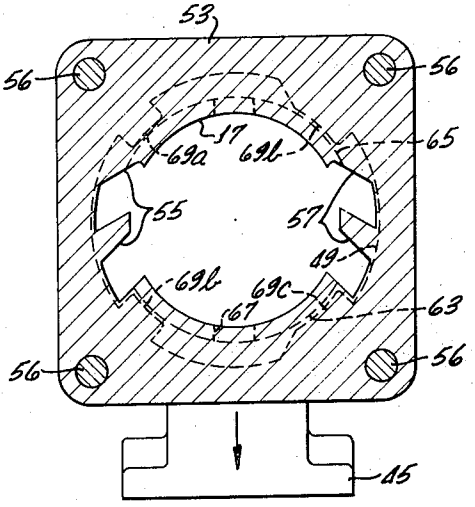


FIG. 4c

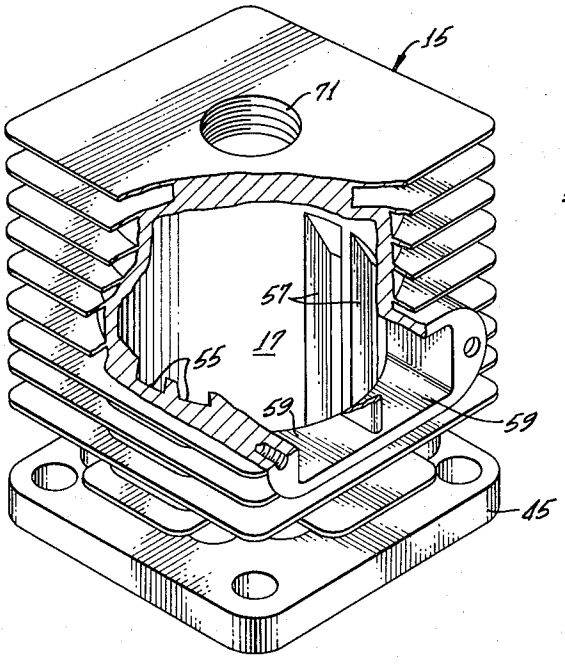


FIG. 3.

INVENTOR.
CECIL T. COOKSON

BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.

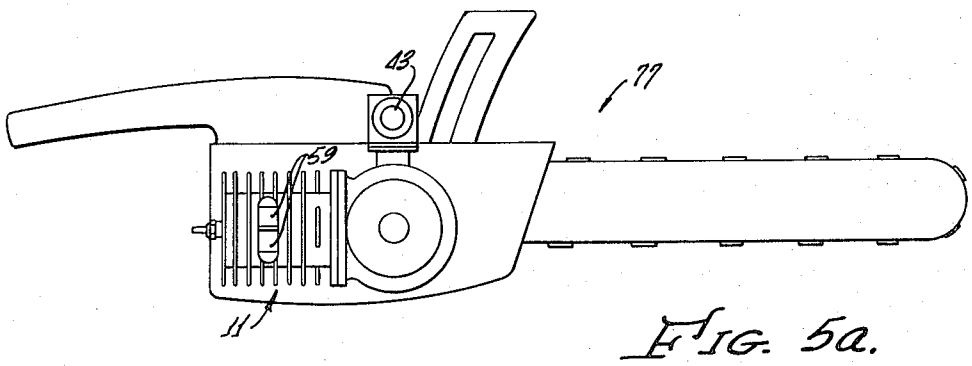


FIG. 5a.

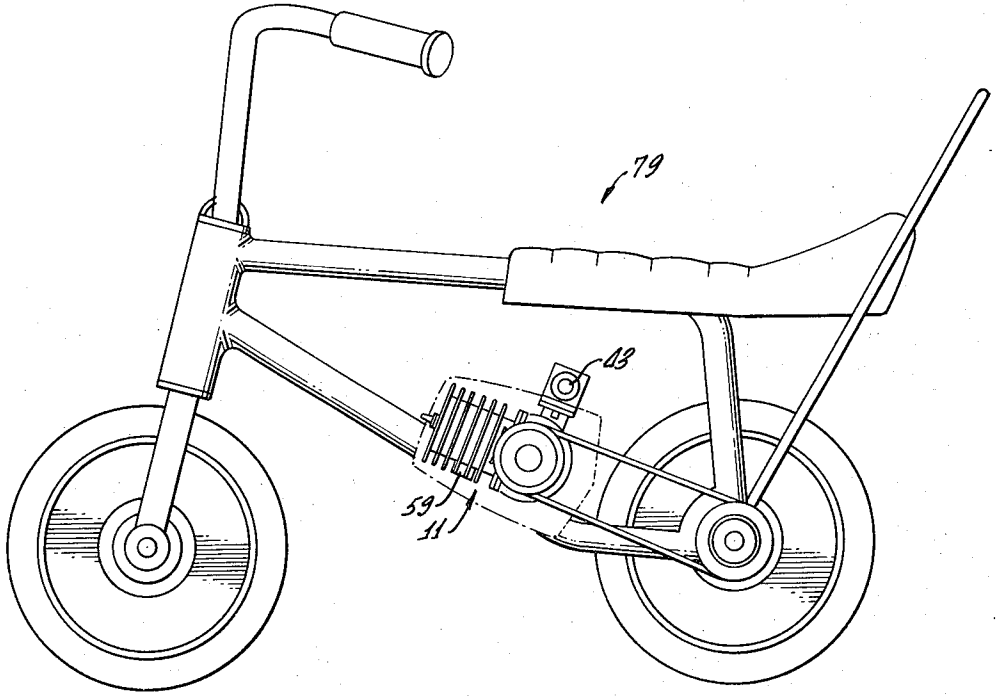


FIG. 5b.

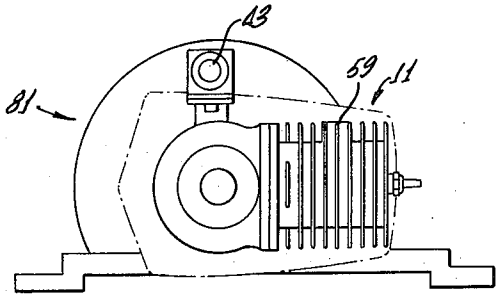


FIG. 5c.

INVENTOR.
CECIL T. COOKSON

BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.

REVERSIBLE ENGINE MOUNT

Small two-cycle gasoline engines having a power output of the order of one or two horsepowers can be used to drive many different types of machines, such as pumps, hand-held chain saws and minibikes. Usually, although not necessarily, the engine is oriented on its side, or slightly inclined from the horizontal, with its carburetor extending upward for convenience in making fuel mixture adjustments. Exhaust gases leave the engine through an exhaust port which extends through the wall of its cylinder. Depending upon the type of apparatus with which the engine is being used, it may be desirable to lead the exhaust gases away, above, below, or along the side of the engine. For example, in the case of a minibike, the exhaust pipe should extend preferably below the engine, away from the rider. If, on the other hand, the engine is used with a pump, the exhaust pipe should extend upward, to prevent scorching the surface upon which the pump rests. And, if the engine is used on a hand-held chain saw, the preferred direction for the passage of exhaust gases will be sideways.

If the location of the exhaust relative to the location of the carburetor is fixed and the carburetor is to extend upward, the designer of the equipment which is to be driven by the engine must lead his exhaust pipe to wherever the engine exhaust port happens to be. In accordance with the present invention, a gasoline engine is made more versatile by permitting the relative location of its carburetor and its exhaust port to be changed depending upon the desired application of the engine. In carrying out the invention, the engine block through which the exhaust port extends and the crankcase upon which the carburetor is mounted are so configured as to permit the engine block to be mounted on the crankcase in several alternative positions, thereby permitting several different orientations of the exhaust port relative to the carburetor.

In accordance with a more specific feature of the invention, provisions are made to allow the combustible mixture which is fed from the carburetor into the crankcase to flow unimpeded from the crankcase into transfer passages in the wall of the cylinder unobstructed, regardless of the position in which the block is mounted upon the crankcase. In particular, positioning elements extend from the bottom of the cylinder block and from the edge of an opening in the crankcase upon which the block is seated. These positioning elements serve to determine the lateral position of the cylinder block upon the crankcase and, in accordance with the invention, are in registry in all alternative positions of the block upon the crankcase. Moreover, regardless of the position of the block upon the crankcase, none of the positioning elements which extend from the crankcase obstruct the entry of the combustible mixture from the crankcase into the transfer passages which are in the side of the cylinder.

The present invention and its advantages will be more clearly understood with reference to the following description of a preferred embodiment thereof taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a simplified exploded perspective view of a two-cycle gasoline engine incorporating the present invention;

FIG. 2 is a cross section through the engine illustrated in FIG. 1, shown mounted upon a starter housing;

FIG. 3 is a perspective view of the cylinder block, partially cut away to show the transfer passages in the wall of the block;

FIGS. 4*a*, *b*, and *c* are cross sections taken along line 4—4 of FIG. 2 illustrating the manner in which the positioning bosses which extend inwardly from the crankcase, clear the transfer passages in the wall of the cylinder block in each of three alternative positions of the cylinder block upon the crankcase; and

FIGS. 5*a*, *b* and *c* illustrate the manner in which the engine incorporating the present invention might be mounted on three different machines, with the exhaust port of the engine being oriented differently relative to the carburetor in each of the three engine applications.

An exemplary two-cycle gasoline engine **11** incorporating the present invention is illustrated in FIGS. 1–3. Only its principal components are shown, these including a crankcase **13**, a cylinder block **15** having walls defining a cylinder **17** therein, and a piston **19** adapted to move within the cylinder. Power is transferred from the piston **19** through a connecting rod **21** to a crankshaft assembly **23** which is mounted for rotation within the crankcase by a pair of bearings (not shown). The crankshaft assembly **23**, which may be of the type more completely described in U.S. Pat. No. 3,147,638 issued to H. T. M. Rice on Sept. 8, 1964, includes a pair of crank disks **25** and **27** connected by a crank pin **29** with individual crankshaft sections **31** and **33** extending in opposite directions from respective ones of the crank disks to be supported by the respective bearings. The connecting rod **21** is coupled at one end to the piston **19** by a pin **22** and at the other end to the crank pin **29** by means of a clamp **35** and a pair of bolts **37**, bearings being provided at both ends of the crankshaft to reduce friction.

When the engine is operating, the crankshaft assembly **23** is turned by the piston **19** through the connecting rod **21** and power is usually taken from the end of the crankshaft section **31**, while a flywheel is usually mounted at the end of the other crankshaft section **33**.

To produce the combustible mixture of gasoline and air a carburetor **43** is mounted on the side of the crankcase **13** upon a flange **45**. An opening **47** is provided through the flange **45** and through the side of the crankcase **13** to allow passage of the combustible mixture from the carburetor to the inside of the crankcase. Once inside the crankcase, the combustible mixture is spun around and is propelled upward toward an opening **49** which is also through the side of the crankcase but which with reference to FIGS. **1** and **2**, will be referred to as being through the top of the crankcase. Surrounding the opening **49** is a square mounting flange **51** adapted to receive a similar mounting flange **53** on the bottom of the cylinder block **15**. When the cylinder block is mounted on the crankcase **13** the cylinder block flange **53** is securely bolted to the crankcase flange **51** so that the two flanges are juxtaposed as seen in FIG. **2**. For better sealing, a gasket **54** is normally provided between them. The means whereby the cylinder block is bolted onto the crankcase **13** is shown as a set of four bolts **56** anchored upon the crankcase flange **51** and a corresponding set of four openings **58**

which extend through the cylinder block flange **53** in registry with the bolts **56**. A set of four nuts (not shown) are threaded on top of the bolts **56** once the block **15** has been seated upon the crankcase **13** to complete the mounting process.

To permit the combustible mixture to pass from the crankcase **13** through its opening **49** into the combustion chamber **52** between the top of the piston **19** and the top of the cylinder **17**, two sets of transfer passages **55** and **57** are provided in the walls of the cylinder. The transfer passages **55** and **57** are spaced apart on opposite sides of a pair of exhaust ports **59** which also extend through the walls of the cylinder. In the illustrated embodiment, the passages **55** and **57** are in the shape of grooves which run axially along the side wall of the cylinder **17** from the cylinder block flange **53** toward the opposite end **60** of the cylinder sufficiently far to establish communication between the combustion chamber **52** and the interior of the crankcase **13** when the piston **19** is close to its bottom dead center. The grooves, or passages, **55** and **57** are recessed in the cylinder block **15** to a depth defined by a circle **49***a* which is concentric with the cylinder **17** and which is substantially of the same size as the circular opening **49** in the crankcase **13**. Through an opening **71** a spark plug **72** is screwed into the top of the cylinder.

In operation, the combustible mixture is scavenged by the rotating crank disks **25** and **27** from the carburetor through the crankcase **13** and through the transfer passages **55** and **57** into the combustion chamber **52**. There it is ignited by the spark plug **72**, propels the piston **19** toward the crankcase **13**, and exits through the exhaust ports **59**.

As mentioned previously, it is an important feature of the present invention that the engine may be assembled in several different ways, in each of which its exhaust ports **59** point in a different direction relative to the crankcase **13**, and in particular relative to the carburetor **43**. This is achieved partly by positioning the mounting bolts **56** and the mounting apertures **58** in the respective flanges **51** an **53** symmetrically, thereby to permit the cylinder block **15** to be mounted in several different orientations about the axis **75** of the cylinder **17**. Yet the engine components are so configured that the transfer passages **55** and **57** are operative to carry the combustible mixture from the crankcase **13** to the combustion chamber **52** in each of several positions of the cylinder block **15** relative to the crankcase **13**.

In particular, certain positioning means which are provided at the interface of the cylinder block **15** and the crankcase **13** to determine the lateral position of the cylinder block upon the crankcase are so placed that they permit free passage of the combustible mixture through the passages **55** and **57**, regardless of the position of the cylinder block upon the crankcase. As best seen in FIG. **1**, a pair of arcuate positioning lips **63** and **65** extend from the bottom of the cylinder **17** between the transfer passages **55** and **57**. As seen in FIG. **2**, the positioning lips **63** and **65** extend into the crankcase opening **49** facing one another from opposite sides of the cylinder **17** from between the passages **55** and **57**. Extending radially inwardly from the walls of the crankcase opening **49** toward the positioning lips **63** and **65** are a set of positioning bosses **69***a*–**69** which together with the positioning lips **63** and **65** serve to limit, and thereby define, the lateral movement of the block **15** upon the crankcase **13**. The positioning bosses **69***a*–**69***d* are so distributed around the periphery of the opening **49** that all of them register with the positioning lips **63** and **65** and none of them project into one of the groove-like passages **55** and **57** regardless of the alternative position in which the cylinder block **15** is mounted upon the crankcase **13**.

FIG. **4***a* shows how the positioning bosses may be distributed in accordance with the invention. The figure also shows the distribution of the transfer passages **55** and **57** relative to the bosses **69** when the cylinder block **15** is so mounted that its exhaust ports are oriented 90° clockwise from the carburetor when viewed from above. FIGS. **4***b* and **4***c* show the location of the transfer passages **55** and **57** when the block **15** is mounted in its second and third positions respectively, in which the exhaust ports **59** are directed opposite to and in line with the carburetor **43**. As clearly seen in FIGS. **4***a*–**4***c*, the transfer passages **55** and **57** are clear of the positioning bosses **69***a*–**69***d* in all three of the illustrated positions of the cylinder block **15**. With the exemplary embodiment shown herein, no attempt was made to enable the engine to operate with the fourth possible engine mounting arrangement in which the exhaust ports **59** would be directed at 270° clockwise relative to the carburetor. This is so because in practice the exemplary engine always has a starter housing attached to its side into which housing the crankshaft section **33** extends. Had a provision been made to have the exhaust ports **59** extend in this additional direction, it would have been useless since there would have been no room between the cylinder block **15** and the housing to lead the exhaust gases away.

The crank disks **25** and **27** rotate in a plane indicated by the axis **77** in FIG. **4***a* and project slightly above the bottom edges of the positioning lips **63** and **65**. This presents no problem when the cylinder block **15** is in the position shown in FIG. **4***a*, since there is a clearance for them between the positioning lips **63** and **65**. In order to provide a similar clearance when the block **15** is in its position shown in FIGS. **4***b* and **4***c*, the positioning lips are notched substantially at their centers, as shown at **67**.

FIGS. **5***a*, **5***b*, and **5***c* show the three applications of the engine corresponding to the three orientations of the cylinder block illustrated in FIGS. **4***a*, **4***b*, and **4***c* respectively. Thus, when the exhaust ports **59** are at 90° with the carburetor mounting flange **45**, the engine is adapted to be mounted upon a hand-held chain saw **77** so as to extend parallel to its blade with the carburetor **43** pointing up and the exhaust ports **59** directed sideways, as shown in FIG. **5***a*. When, on the other hand, the exhaust ports **59** and the carburetor mounting flange **45** are diametrically opposite, as in FIG. **4***b*, the engine is suitable for mounting on a minibike **79** with the carburetor still directed upward, but the exhaust ports **59** now being directed directly downward as seen in FIG. **5***b*. Finally, the configuration shown in FIG. **4***c*, wherein the exhaust ports **59** and the carburetor mounting flange **45** are directed in the same direction, is shown to be of the one most suitable when the engine is used with a pump **81** on which both the carburetor **43** and the exhaust ports **59** are directed upwardly.

From the above it is apparent that there has been disclosed a technique for making a single engine adaptable to several applications by the expedient of so building the engine as to allow it to be assembled in several different configurations, each of which is particularly adapted to a different application. Yet this is achieved without a significant increase in the cost of manufacturing the engine and with no adverse effects upon engine operation.

What is claimed is:

1. In a two-cycle gasoline engine the combination comprising:

a. a crankcase having an intake port for receiving a combustible mixture and a side wall portion terminating in a mounting flange and having a circular opening centered in said flange;

b. a block having walls defining a cylinder with an exhaust port through its side, said block terminating in a mounting flange at its bottom;

c. passages open to said cylinder, running axially in the wall of said block from said flange;

d. positioning means, integral with said block, extending axially from said flange and around said cylinder between said passages;

e. means for mounting said block upon said crankcase in alternative positions about the axis of said cylinder in each of which their flanges are juxtaposed and said positioning means extend into said crankcase opening; and

f. second positioning means integral with said crankcase and extending inwardly from the walls of said opening toward said first positioning means, said second positioning means being spaced to register with said first positioning means and to clear said passages in all positions of said block so as to permit combustible gases to pass into said passages from said crankcase unobstructed by said second positioning means.

2. A combination in accordance with claim 1 and characterized further in that:

a. there are two sets of passages in the wall of said block, said sets being spaced apart on opposite sides of said exhaust port; and

b. said first positioning means is comprised of two symmetrical arcuate portions facing each other from between said sets of passages, both said portions being notched substantially at their centers to provide clearance for a crank rotating within said crankcase when the said block is in two of its alternative positions.

3. In a two-cycle gasoline engine the combination comprising:

a. a crankcase having an intake port for receiving a combustible mixture and a circular opening surrounded by a flange;

b. a cylinder block having walls defining a cylindrical chamber open at one end to admit a piston and having a flange surrounding said open end, said cylinder also having an exhaust port through its side and a plurality of circumferentially spaced apart grooves running axially along its side wall from said flange toward the opposite end of said cylinder, said grooves being recessed in said side wall to a common depth defined by a circle concentric with said cylinder and substantially of the same size as the circular opening in said crankcase flange;

c. a pair of arcuate positioning lips extending from the open end of said cylinder between said grooves;

d. means for mounting said cylinder block upon said crankcase in any of several alternative positions in each of which said mounting flanges are juxtaposed and said positioning lips extend into the opening in said crankcase flange; and

e. a set of centering bosses extending radially inwardly from the walls of said crankcase opening toward said positioning lips, said bosses being so distributed that all of them register with said positioning lips and none of them extend opposite one of said grooves regardless of the alternative position in which said cylinder block is mounted upon said crankcase, whereby said combustible mixture can flow unobstructed from said crankcase and through said grooves to the said opposite end of said cylinder regardless of the particular position in which said cylinder block is mounted.

4. In a two-cycle gasoline engine the combination comprising:

a. a crankcase having an opening and an intake port in its side;

b. a carburetor mounted upon said crankcase at said intake port;

c. a block having walls defining a cylinder with an exhaust port through its side;

d. means for mounting said block upon said crankcase at said opening in alternative positions about the axis of said cylinder, thereby to permit different orientations of said exhaust port relative to said carburetor;

e. a piston within the cylinder defining a combustion chamber with the end of the cylinder remote from the crankcase;

f. means defining passages in the wall of said block open to said cylinder and open to the interior of the crankcase for permitting the combustible mixture to flow into the combustion chamber; and

g. means on said block and said crankcase for laterally positioning the cylinder with respect to said crankcase opening, said positioning means being arranged to clear the passages in all positions of the block so as to permit the combustible mixture to pass through the passages from the crankcase unobstructed by the positioning means.

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