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CRANKCASE INDUCTION SYSTEM FOR ALTERNATE-FIRING TWO-CYCLE ENGINES

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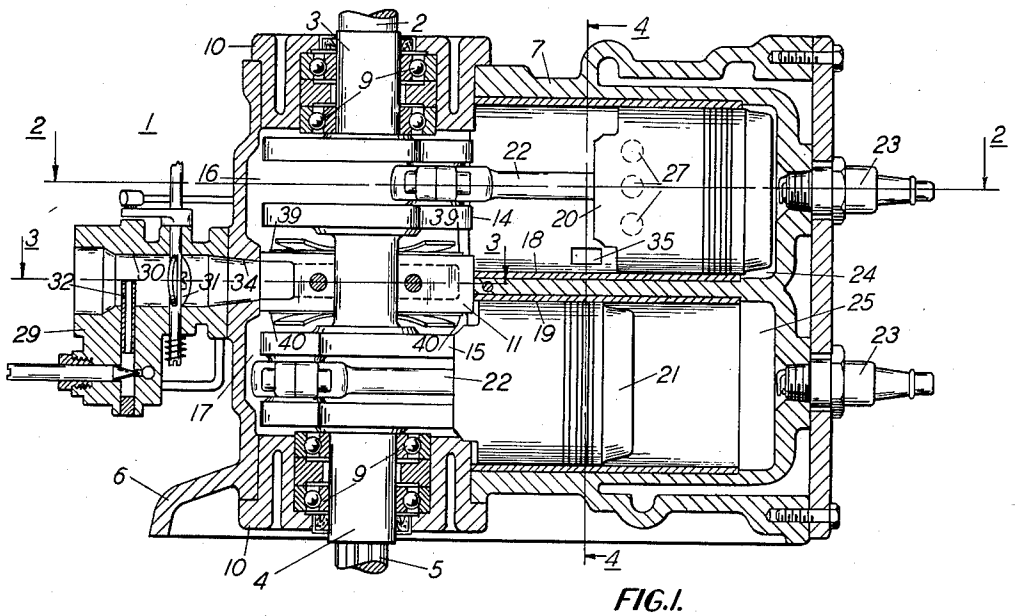


FIG. 1.

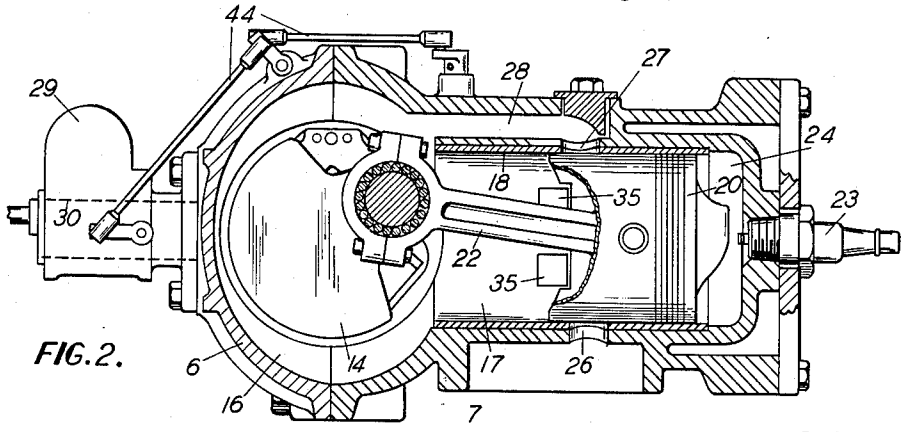


FIG. 2.

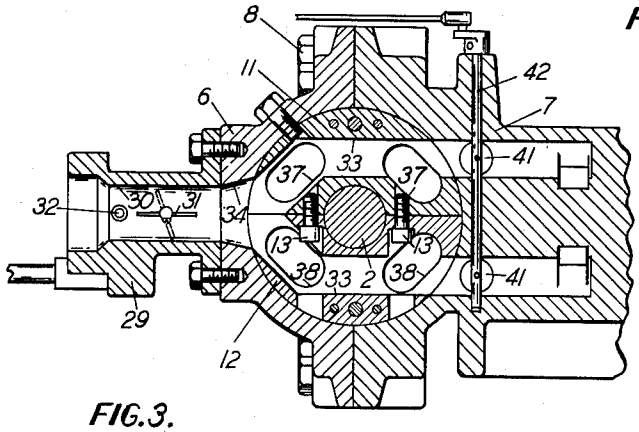


FIG. 3.

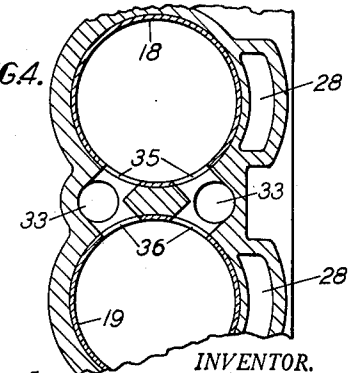


FIG. 4.

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CRANKCASE INDUCTION SYSTEM FOR ALTERNATE-FIRING TWO-CYCLE ENGINES

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5 Claims. (Cl. 123—59)

This invention relates to two-cycle engines and particularly to crankcase induction systems for alternate-firing two-cylinder engines and the like.

The invention provides an induction system which extends from the carburetor on opposite sides of the main crankshaft bearing to cylinder ports below and controlled by the pistons. Reed-controlled ports from the passages adjacent to the carburetor are combined with the more remote piston-controlled ports to provide greater and more consistent fuel induction of the engine at all speeds.

An object of the invention is to increase the volumetric efficiency of the crankcase induction cycle of the engine for increased power output at high speeds.

Another object is to improve the operation of the engine by providing valve means which open first in response to crankcase pressure and mechanically controlled valve means which close last at a predetermined position of the piston.

Another object is to assure the maximum induction of the fuel mixture at high speeds and the controlled induction at intermediate and lower speeds for uniform scavenging and recharging of each cylinder, consistent firing and smooth engine operation.

These and other objects and advantages will be set forth in the following description of a preferred embodiment of the invention as illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a vertical longitudinal section of a two-cycle alternate-firing two-cylinder internal-combustion engine employing a crankcase induction of the fuel and air mixture and embodying the present invention;

Fig. 2 is a section taken on line 2—2 of Fig. 1;

Fig. 3 is a section taken on line 3—3 of Figure 1; and

Fig. 4 is a section taken on line 4—4 of Figure 1.

The engine 1 shown in the drawings includes the vertical crankshaft 2 having an upper end 3 for carrying a flywheel, not shown, and a lower end 4 fitted to receive the drive shaft 5.

The crankcase member 6 is joined to the cylinder block 7 by the bolts 8 to comprise the crankcase which is closed at its upper and lower ends by the bearing members 9 and 10 journally supporting the corresponding ends of the crankshaft. The bearing members 11 and 12 joined by the bolts 13 assembled on crankshaft 2 intermediate the upper and lower cranks 14 and 15 of the crankshaft fit within the crankcase to divide the same into the corresponding upper and lower crank chambers 16 and 17, respectively.

The upper and lower cylinders 18 and 19 within block 7 are open at one end to communicate directly with the corresponding crank chambers 16 and 17 and respectively carry the pistons 20 and 21 connected by the rods 22 with cranks 14 and 15. The spark plugs 23 carried at the closed end of the cylinders provide ignition of the compressed charge in the corresponding combustion chambers 24 and 25.

The exhaust and recharging of the combustion chambers is provided by cylinder ports controlled by the respective pistons. As shown in Fig. 2, the exhaust ports 26 and intake ports 27 are covered and closed by the skirt of piston 20 during the compression and power stroke of the piston. As piston 20 approaches the end of the power stroke, exhaust ports 26 are uncovered for discharge of the burned gases. Shortly after the initial opening of ports 26, intake ports 27 are similarly uncovered to allow the fuel and air mixture within crank chamber 16 as compressed by piston 20 to enter from the chamber 16 through passage 28 communicating therewith.

The fuel and air mixture introduced into the combustion chambers of the cylinders displaces the remaining burned gases therein and provides the fuel charge for the succeeding compression and power stroke of the pistons.

The fuel and air mixture is supplied to crank chambers 16 and 17 by the carburetor 29 which includes the mixing passage 30 controlled by the valve shutter 31. One end of passage 30 is open to receive the air which carries the carbureted fuel supplied by the jet 32 within the passage. The fuel and air mixture is supplied to the two passages 33 which are formed in bearing members 11 and 12 and extending into block 7. Passages 33 communicate jointly at one end through the opening 34 in crankcase member 6 with the corresponding end of passage 30 of the carburetor and extend in parallel relation between crank chambers 16 and 17 and cylinders 18 and 19 to the ports 35 and 36 which open into cylinders 18 and 19.

The ports 37 and 38 formed in bearing members 11 and 12, respectively, and opening into the upper and lower crank chambers 16 and 17 are controlled by the reeds 39 and 40 secured respectively to the upper and lower faces of members 11 and 12 to close the ports. The movement of pistons 20 and 21 alternately drawing the air and fuel mixture into crank chambers 16 and 17 effects the lifting of the reeds to open the respective ports.

Ports 35 and 36 are covered by pistons 20 and 21 and alternately opened as the respective piston approaches the end of the movement drawing the fuel and air mixture into the corresponding crank chambers through ports 37 and 38. Ports 35 and 36 are reclosed by the respective piston as the movement of the other piston opens the corresponding other ports controlled by reeds 40 or 39.

As port 35 or 36 associated with one crankcase is reclosed by the piston the inertia of the gases within passages 33 creates a pressure which provides the initial lifting of the reeds to open the ports 37 and 38 opening into the other crankcase.

The combination of reed and mechanically controlled ports thus opening from the passages 33 in sequence provides a sustained flow of the fuel and air mixture in the passage which is particularly advantageous at high speeds.

At high speeds the induction cycle begins with the opening of upper and lower ports 37 and 38 only in response to a pressure differential. The mechanically controlled ports open during the period when the pressure differential diminishes to a point where the reeds would ordinarily closes off the corresponding ports 37 and 38. The opening of ports 35 and 36 allows the reeds to close ports 37 and 38 without interrupting the flow of the fuel and air mixture in passages 33 and the induction is continued through ports 35 and 36 particularly by reason of the ram effect or inertia of the gases moving at high speeds in the passages.

The closing of ports 35 and 36 is timed with respect to crankshaft rotation and to the volumetric efficiency of the compression in the crankcase whereby the ports are maintained open providing predetermined maximum fuel and air intake at a given speed.

The relative location of the reed and mechanically controlled ports allows the valve shutters **41** to be located therebetween in passages **33** and controlled by the shaft **42** so that at low engine speeds ports **35** and **36** may be closed off to prevent flow-back and to allow engine operation at low speeds only with reeds **39** and **40**. Reeds **39** and **40** may therefore be of lighter weight for improved idling and without disadvantages at high speeds as when the lighter reeds have a tendency to stay open too long. The linkage **44** connecting shaft **42** and the valve shutter **31** of carburetor **29** provides their coordinated opening and closing.

As employed in engine **1**, ports **35** and **36** are referred to as third ports, and the portions of the engine defining ports **37** and **38** and the respective reeds **39** and **40** comprise reed valves.

Various embodiments of the invention may be employed within the scope of the accompanying claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In an alternate-firing reciprocating piston two-cycle engine having adjacent cylinders with intake and exhaust ports controlled by the respective pistons and employing crankcase induction and precompression of the fuel mixture, a crankcase and cylinder block having formed therein an induction passage receiving the fuel and air mixture at one end and extending directly between the crankchambers and cylinders of the engine, said induction passage having reed-controlled ports opening oppositely into the crank chambers and piston-controlled third ports opening oppositely into the cylinders, said third ports being located at the other end of said passage, and said reed-controlled ports opening in advance of said third ports and being located in advance thereof respecting the flow of fuel and air whereby the velocity of the fuel and air mixture is maintained relatively constant.

2. In an alternate-firing reciprocating piston two-cycle engine having adjacent cylinders with intake and exhaust ports controlled by the respective pistons and employing crankcase induction and precompression of the fuel mixture, a crankcase and cylinder block having formed therein an induction passage receiving the fuel and air mixture at one end and extending directly between the crank chambers and cylinders of the engine, said induction passage having reed-controlled ports opening oppositely into the crank chambers and piston-controlled third ports opening oppositely into the cylinders, said third ports being located at the other end of said passage, and valve means disposed in said passage intermediate the ports thereof and operable to close the passage at lower engine speeds and render the third ports inoperative, whereby at low speed the induction of the fuel and air mixture proceeds only through the reed-controlled ports.

3. In a two-cycle engine employing crankcase induction and precompression of the fuel and air mixture which is transferred to the combustion chamber of the cylinder through intake ports to displace the burned gases through other exhaust ports after each power stroke, a cylinder block having adjacent cylinders and the intake and exhaust ports referred to, a crankcase joined to said cylinder block to define separate closed crank chambers associated with the corresponding cylinders, a crankshaft carried by said crankcase and having pistons connected thereto for opposite reciprocation in the corresponding cylinders, each piston being disposed to uncover and open the ports referred to during a period following the power stroke for recharging of the combustion chamber of the respective cylinder, an induction passage formed in said crankcase and cylinder block and extending between the crank members and cylinders, piston-controlled third ports opening oppositely from one end of said passage into said cylinders, the other end of said passage being disposed to receive the fuel and air mixture, and reed-controlled ports opening from said passage intermediate the ends thereof and oppositely into said crank chambers, the induction of the fuel and air mixture into each crank chamber through said reed-controlled ports being effected by movement of the respective piston and being continued by inertia of the gases during the opening of the corresponding third port, the subsequent opening of the corresponding other reed-controlled ports providing the sustained velocity of the fuel and air mixture for maximum specific induction.

4. The engine of claim 3 which further includes valve means disposed in said passage intermediate the ports thereof and operable to close the passage at lower engine speeds and render the third ports inoperative, whereby at lower speed the induction of the fuel and air mixture proceeds only through the reed-controlled ports.

5. In an engine, a crankshaft having spaced cranks, a cylinder block having two adjacent cylinders and corresponding pistons connected to said cranks for opposite reciprocation, a crankcase secured to said block and providing therewith separate crank chambers associated with the corresponding cylinders for fuel induction and precompression therein with reciprocation of the respective pistons, a carburetor secured to said crankcase generally between said chambers and oppositely of said cylinders and having a fuel mixing passage, fuel induction passages in said crankcase and cylinder block and jointly communicating at one end with the mixing passage of said carburetor and extending substantially rectilinearly between said chambers on opposite sides of the crankshaft and between the cranks thereof, said passages terminating between said cylinders, each of said passages having ports progressively spaced from said carburetor and opening oppositely into the adjacent upper and lower crank chambers and cylinder, valve reeds normally closing said crankcase ports and disposed for opening to allow induction of the fuel, said pistons being disposed and operable to open the respective cylinder ports alternately and to reclose the same upon movement in the direction effecting precompression of the fuel mixture, said cylinder ports being the more remote from the carburetor and remaining open subsequent to the closing of the corresponding crankcase ports located less remote from the carburetor.

No references cited.