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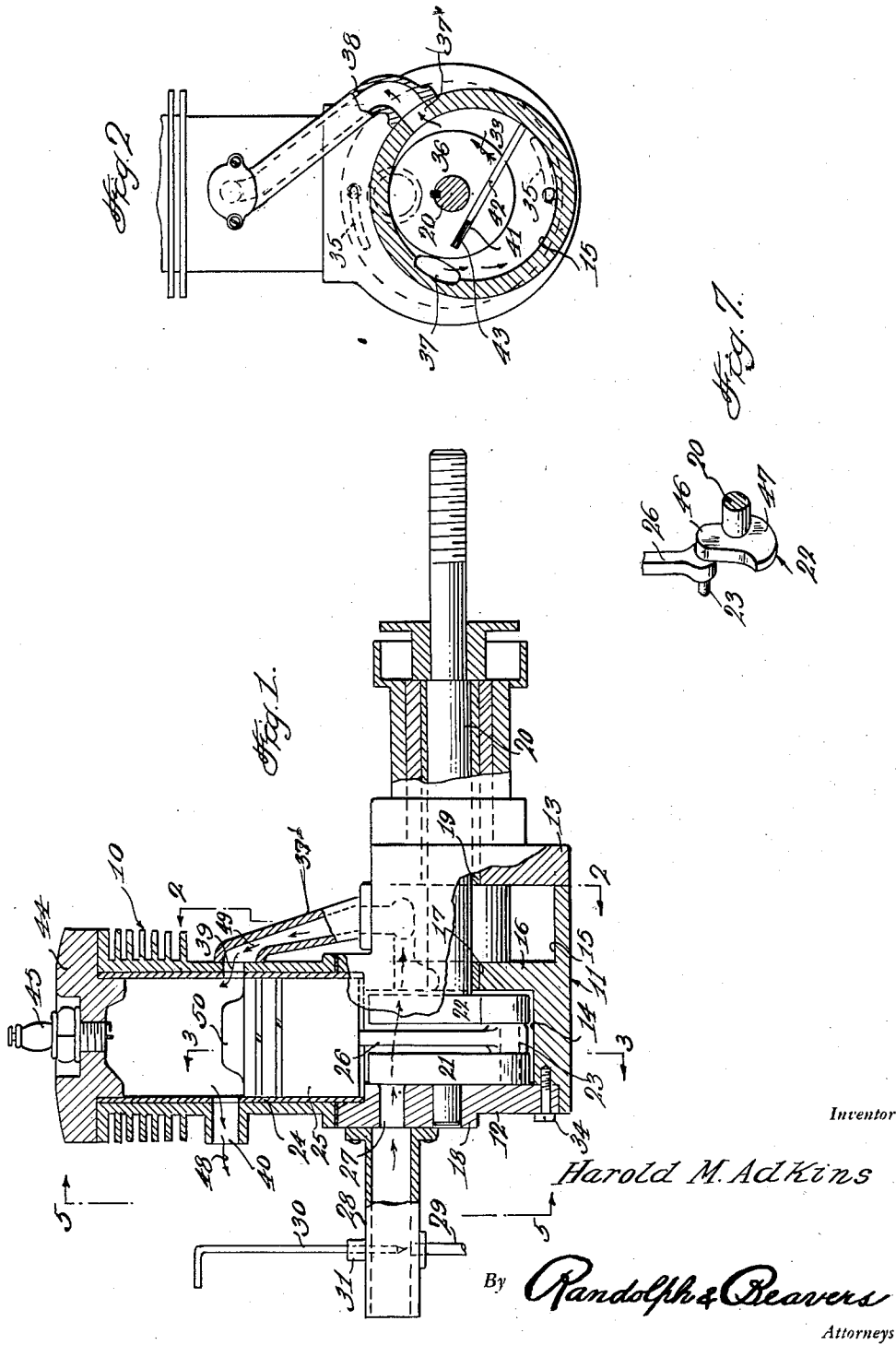
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SUPERCHARGING THE CRANKCASE OF TWO-CYCLE ENGINES

Filed Feb. 24, 1947

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

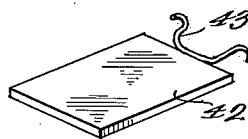
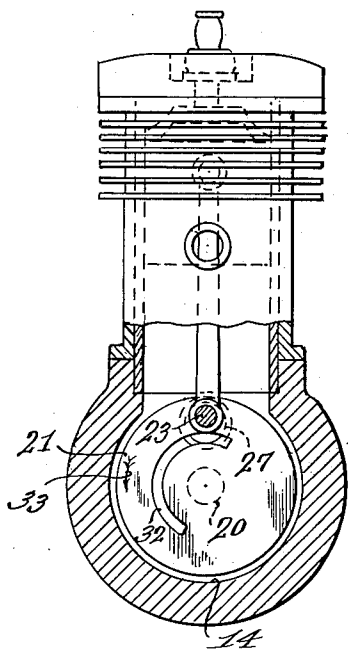
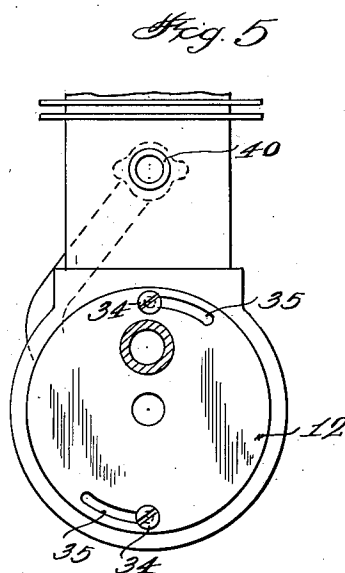
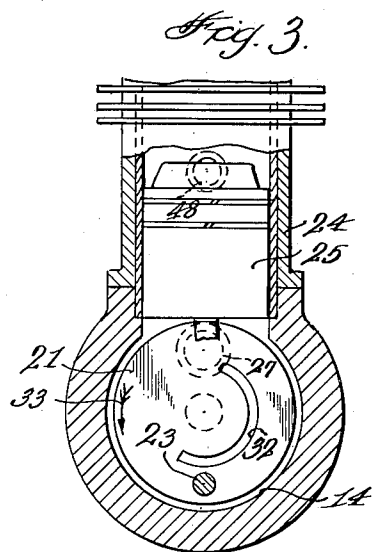


Fig. 4

Fig. 6.

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SUPERCHARGING THE CRANKCASE OF
TWO-CYCLE ENGINES

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6 Claims. (Cl. 123—73)

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This invention relates to an improved construction of two-cycle internal combustion engine and more particularly has reference to a super charging means especially adapted for use in miniature internal combustion engines whereby the fuel charge will be forced under pressure into the cylinder or cylinders by means of a pump operated from the engine crankshaft.

Still a further object of the invention is to provide an internal combustion engine wherein the movement of the pistons will be utilized for conveying the fuel mixture to the pump chamber and preparatory to its being compressed and injected into the cylinder or cylinders.

Still a further object of the invention is to provide an internal combustion engine wherein the use of valves in regulating the intake and exhaust of an internal combustion engine will be eliminated and whereby one or more of the crank arms of the crank shaft will function for controlling the flow of the fuel mixture to the pump chamber.

Still a further object of the invention is to provide a crankcase having an adjustable section or plate through which the fuel mixture is admitted thereto and which may be circumferentially adjusted for varying the timing of the admittance of the fuel charge to the crankcase to compensate for variations in loads, including variations in the pitches of propellers, and to facilitate starting and idling of the engine.

Still another object of the invention is to provide an internal combustion engine including super-charging means of extremely simple construction capable of being economically manufactured and sold and which is especially efficient and adaptable to small miniature engines, especially because of the small number of parts embodied therein.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating a preferred embodiment thereof, and wherein:

Figure 1 is a longitudinal substantially central sectional view, partly in side elevation illustrating the invention embodied in a preferred form and constituting a one-cylinder two-cycle internal combustion engine;

Figures 2 and 3 are cross sectional views of the engine taken substantially along planes as indicated by the line 2—2 and 3—3, respectively, of Figure 1;

Figure 4 is a view similar to Figure 3, but showing the piston in approximately a top dead center position;

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Figure 5 is an end view in elevation and partly in cross section of the engine taken substantially along a plane as indicated by the line 5—5 of Figure 1;

5 Figure 6 is a perspective view of the rotor pump blade and its activating spring;

Figure 7 is a perspective view of one of the crank arms and its associated parts.

Referring more specifically to the drawings, the improved engine in its entirety and designated generally 10 has been illustrated as a one-cylinder two-cycle engine but it will be readily obvious as the description proceeds that the invention is equally well adapted to multiple cylinder engines.

15 The internal combustion engine 10 includes a housing, designated generally 11 having detachable end walls 12 and 13 and which is recessed to combine with said end walls 12 and 13 to form a crankcase 14 and a pump chamber 15, respectively. The chambers 14 and 15 are separated by a wall 16 constituting an integral part of the casting of the housing 11 and which is provided with a bearing opening 17 which aligns with 20 bearing openings 18 and 19 of the end walls 12, and 13, respectively, for journaling a portion of a crankshaft 20 which extends longitudinally through the housing 11 and which is concentrically disposed relatively to the crankcase 14 and eccentrically of the pump chamber 15.

30 The crankshaft 20 is provided with crank arms 21 and 22 which are eccentrically connected by a wrist pin 23 and which are disposed within the crankcase 14.

35 A cylinder 24 is suitably secured to and projects outwardly from a portion of the housing 11 and has the inner end thereof opening into a portion of the crankcase 14, as clearly illustrated in Figures 1, 3 and 4. The cylinder 24 contains 40 a piston 25 which is reciprocally mounted therein and which is provided with a piston rod 26 which projects from the inner end thereof into the crankcase 14, between the crank arms 21 and 22 and the free end of which is turnably connected to the wrist pin 23, in a conventional 45 manner.

The end wall or cap 12 is provided with an eccentrically disposed opening 27 which communicates at its outer end with the bore of a tube or pipe 28 having a flanged head which is bolted or otherwise fastened to the outer side of the cap or wall 12, around said opening 27. A tube or conduit 29 connected to a suitable source of fuel supply, not shown, such as gasoline, opens 55 transversely into the pipe or tube 28, interme-

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diate of its ends, and a needle valve 30 is reciprocally disposed in a boss 31 of the pipe 28 and in substantially diametrically opposed relationship to the tube 29 whereby the inner conical end of said valve 30 may be adjusted relatively to the discharge end of the conduit 29 for regulating the flow of the fuel to said pipe 28. The outer end of the pipe 28 is preferably open for the admittance of air therethrough to be mixed with the liquid fuel to form the combustible mixture for the engine 10, as will hereinafter become more readily apparent.

The crank arm 21, as seen in Figs. 3 and 4, is disk-shaped and the outer side thereof engages substantially flush against the inner side of the cap or end wall 12 and overlies the inner end of the fuel intake port 27. Said disk is provided with an arcuate slot 32 disposed so that various portions thereof are in communication with the intake port 27 during a period of more than one-half of each revolution of said disk or crank arm 21 and which is so constructed that the slot or passage 32 moves out of registry with the port 27 at a predetermined point beyond the top dead center position of the wrist pin 23 and the piston 25 and while said piston is on its down stroke, said disk or crank arm 21 and the shaft 20 revolving in the direction as indicated by the arrow 33 in Figures 3 and 4.

As best seen in Figure 5, the end wall or cap 12 is secured to the casting of the housing 11 by bolts 34 which extend through corresponding arcuate slots 35 in the cap 12 so that by loosening the bolts 34, the cap 12 can be turned relatively to the housing 11 for varying the location of the intake port 27 relatively to the crankcase 14 so that the arcuate passage 32 of the disk 21 will move into and out of registry with said intake port 27 at different positions of the piston 25 and of the crank arms 21 and 22 and wrist pin 23, all for a purpose which will hereinafter become apparent.

As best seen in Figure 2, the pump chamber 15 is likewise cylindrical and is provided with a rotor 36 which is disposed therein and keyed to the crankshaft 20 so that said rotor is also disposed eccentrically of the cylindrical wall of the pump chamber 15 and bears thereagainst only in the upper part thereof or the part most adjacent to the cylinder 24. The pump chamber 15 is provided with a relatively large port or passage 37 which opens therein through the partition 16 from the crankcase 14 and on one side of and adjacent the point where the rotor contacts the cylindrical wall of the chamber 15, and said chamber is provided with an outlet port 37' on the opposite side thereof and adjacent to the point at which the rotor contacts the cylindrical wall of the pump chamber. The outlet port 37 opens into a passage or conduit 38, the opposite end of which communicates with an intake port 39 of the cylinder 24 which is located intermediate the ends thereof and above and adjacent the head of the piston 25 when the latter is in its lowermost position, as illustrated in Figure 1. The cylinder 24 is also provided with an exhaust port 40 which is disposed substantially in diametrically opposed relationship to its intake port 39.

The rotor 36 is provided with a recess 41 having an outer end opening into a portion of the periphery thereof and which is of a width substantially corresponding to the width of the pump chamber 15, as seen in Figure 1, to receive a blade or vane 42 of substantially the same width, which is reciprocally disposed therein and normally

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urged outwardly by a spring 43, as best seen in Figure 6, which is interposed between the inner end of the vane or blade 42 and the bed of the groove or recess 41, for retaining the outer end of said blade in engagement with the interior of the cylindrical wall of the pump chamber 15. The blade 42 extends from side to side of the chamber 15 so as to form a movable partition within the portion of the chamber 15 unoccupied by the rotor 36, as said rotor revolves.

The cylinder 24 is provided with a head 44 containing a spark plug or similar means 45 which extends into the upper end thereof and which is adapted to be actuated by a suitable ignition means, not shown, as the piston 25 reaches its top dead center position or almost immediately thereafter, for igniting the compressed combustion charge contained within said cylinder and above the piston 25 for driving the piston downwardly on its power stroke, in a conventional manner.

Assuming that the engine 10 is in operation and that the parts are just passing their bottom dead center position, as seen in Figures 1 and 3, as the piston 25 begins to move upwardly in the cylinder 24 a suction will be created thereby in the crankcase 14 and the upper end of the arcuate fuel intake port 32 of the disk or crank arm 21 will move into registry with the intake port 27 of the cap 12 so that the fuel mixture can be drawn from the pipe or tube 28, through port 27 and port 32 into the crankcase 14 and cylinder 24, beneath the piston 25. This will create a suction in the tube 28 to cause air to be drawn inwardly through the outer end thereof and to mix with the liquid fuel entering said tube through the conduit 29 to form the fuel mixture. The arcuate port 32 will remain in registry with the intake port 27 until the piston 25 has reached its top dead center position of Figure 4 and preferably until it has moved approximately 30° therebeyond in a direction as indicated by the arrow 33, at which time the intake port 27 will be closed by the disk 21. As seen in Figure 7, the other crank arm 22 includes a relatively narrow portion 46 which extends radially from the crankshaft 20 and to which the wrist pin 23 is connected and a wider, substantially semi-circular portion 47 on the opposite side of the crankshaft 20. As seen in Figure 1, the outer side of the crank arm 22 is spaced slightly from the partition 16 so that on the down or power stroke of the piston 25 the fuel compressed within the crankcase 14 will be forced through the port 37 into the expanding compartment or chamber of the pump chamber 15, located behind the vane 42, which moves past the intake port 37 thereof, in the direction as indicated by the arrow 33 in Figure 2, shortly after the piston 25 begins its downstroke, for sealing the combustion charge previously admitted to said chamber. Accordingly, as the vane or blade 42 moves away from the port 37 in the direction of the arrow 33 of Figure 2, the chamber or compartment therebehind is enlarged for creating a vacuum for drawing the fuel therein and the downward movement of the piston 25 creates a pressure in the crankcase for forcing the fuel therefrom through the passage 37 and into said expanding chamber of the pump. It will likewise be readily apparent that on the previous down stroke of the piston 25, the parts function in a similar manner so that a charge of the fuel mixture is also disposed in the chamber 15 in front of the vane 42 and which is therefore compressed in advance of the vane after it passes the port 37 and forced under pressure through the conduit

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38 and retained therein due to the fact that the piston 25 is in a raised position for closing the intake port 39. Accordingly, on the down or power stroke of the piston 25, as said piston clears the ports 39 and 40 the burned gases or products of combustion, not shown, will be released through the exhaust port 40 as indicated by the arrows 48 and the compressed fuel mixture will flow into the upper portion of the cylinder 24 as indicated by the arrows 49 and be deflected away from the exhaust port 40 by the baffle 50 on the upper end of the piston 25. On the next upstroke of the piston 25, fuel will again be admitted through the port 27 and arcuate port 32, as previously described, and the vane 42 continuing to move beyond its position of Figure 2, wherein the piston is substantially in a bottom dead center position, will continue to expand the chamber behind said vane for drawing additional fuel into the pump chamber 15 as the fuel is replenished in the crankcase 14. Obviously, the upstroke of the piston 25 constitutes a compression stroke for compressing the fuel mixture and for closing the ports 39 and 40 and so that the fuel mixture can be utilized after the piston reaches its top dead center position for driving the piston downwardly on its power stroke.

It will be readily apparent that by adjusting the end wall or cap 12 through provision of the bolts 34 and slot 35, the point of travel of the piston and crank arm 21 when the port 32 moves into and out of registry with the intake port 27 can be varied to thereby compensate for variations in loads on the crankshaft 20 and to facilitate starting and idling of the engine 10. Obviously, if desired, a second rotor vane or blade could be mounted in the rotor 36 for closing the chamber 15 behind a fuel charge, previously admitted behind the vane 42 as illustrated, or a plurality of the vanes or blades 42 could be provided to operate in conjunction with additional cylinders and pistons of a multiple-cylinder engine. Also, the spring 43 could be omitted behind the blade 42 as centrifugal force will maintain the blade 42 in an extended position in engagement with the cylindrical wall of the chamber 15 when the rotor 36 is revolving at a normal speed.

The portion 47 counter-balances the wrist pin 23 and connecting rod 26 so that the crank arm 22 forms a flywheel for the crankshaft 20. If desired, the pump chamber could be disposed on the opposite or intake side of the crankcase 14 and driven directly by the crankshaft or at an increased ratio through a gear chain thus eliminating the function of the crank arm 21 as an intake valve.

Various other modifications and changes are likewise contemplated and may obviously be resorted to, without departing from the spirit and scope of the invention as hereinafter defined by the appended claims.

I claim as my invention:

1. In an internal combustion engine, a pump chamber, a rotor concentrically mounted therein and actuated by the crankshaft of the engine, a passage connecting said pump chamber to the crankcase of the engine, a fuel intake port of the engine opening into said crankcase through which fuel is drawn into the crankcase by the suction created by an outward movement of a piston of the engine relatively to said crankcase, said rotor having a vane or blade movable in the pumping chamber and in working engagement with the exposed portions of the walls thereof, said vane or blade being arranged for drawing

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the fuel mixture into the pump chamber on the downstroke of the piston and behind said blade and being adapted to compress the fuel mixture within the pump chamber and in front of the blade, and a passage leading from said pump chamber to the cylinder through which the fuel is forced under pressure and ejected into the cylinder above the piston, when the passage is uncovered by the downward movement of the piston.

2. An internal combustion engine as in claim 1, said crankshaft containing a crank disposed within the crankcase and including a disk-shaped crank arm having an arcuate slot therein disposed for movement into and out of registry with the fuel intake port of the crankcase for admitting fuel into the crankcase during a portion of each cycle of operation of the crank and piston and for closing the fuel intake port of the crankcase during the remainder of each cycle of operation of said parts, and means for adjustably positioning the fuel intake port of the crankcase for varying the time and the cycle of operation of the piston and crank when said intake port will be opened and closed.

3. In a super-charger for two-cycle internal combustion engines, a pump chamber containing a rotor adapted to be actuated by the crankshaft of the engine, an outlet passage leading from said pump chamber to a cylinder of the engine, an intake passage connecting the pump chamber to the crankcase of the engine and spaced from said outlet passage, means whereby the fuel mixture will be admitted to the crankcase by suction in response to the compression stroke of a piston of the engine and drawn into the pump chamber by the vacuum created behind the rotor vane and forced into the pump chamber on the power stroke of the piston to be compressed in front of the rotor vane and to be forced into the cylinder, outwardly of the piston through the outlet passage of the pump chamber, and means for adjustably positioning the fuel admitting means relatively to the crankcase for varying the time and cycle of operation of the piston and crankshaft when the fuel admitting means will be rendered operative and inoperative.

4. In an internal combustion engine including a cylinder and a piston reciprocally disposed therein and having a two-cycle operation, a crankcase communicating with the inner end of said cylinder and containing a crank of the engine crankshaft to which the rod of said piston is connected, a pump chamber having a port communicating with the crankcase, a rotor eccentrically disposed in the pump chamber and driven by the crankshaft and provided with a vane or blade, a fuel intake port opening into the crankcase and through which fuel is drawn into the crankcase on the outward, compression stroke of the piston and forced into the pump chamber on the inward, power stroke of the piston, said rotor vane being arranged for compressing a charge of the fuel mixture in front thereof and on the power stroke of the piston and for creating an expanding chamber therebehind and during a portion of the power stroke and compression stroke of the piston for drawing the fuel into said expanding chamber from the crankcase and behind said blade, and an outlet passage leading from the pump chamber and opening into the cylinder and constructed and arranged to be uncovered at its outlet end when the piston approaches its lowermost position for injecting the compressed charge of the

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fuel mixture into said cylinder and above or outwardly of the piston.

5. A structure as in claim 4, one of the crank arms of said crankshaft being constructed and arranged to form a valve for admitting fuel to the crankcase during the outward or compression stroke of the piston and for closing the inlet to the crankcase during the power stroke of the piston.

6. A structure as in claim 4, one of the crank arms of said crankshaft being constructed and arranged to form a valve for admitting fuel to the crankcase during the outward or compression stroke of the piston and for closing the inlet to the crankcase during the power stroke of the piston, and means for variably positioning the fuel intake port relatively to the crankcase for varying the positions in the cycle of operation

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of the engine when the fuel intake port is opened or closed.

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