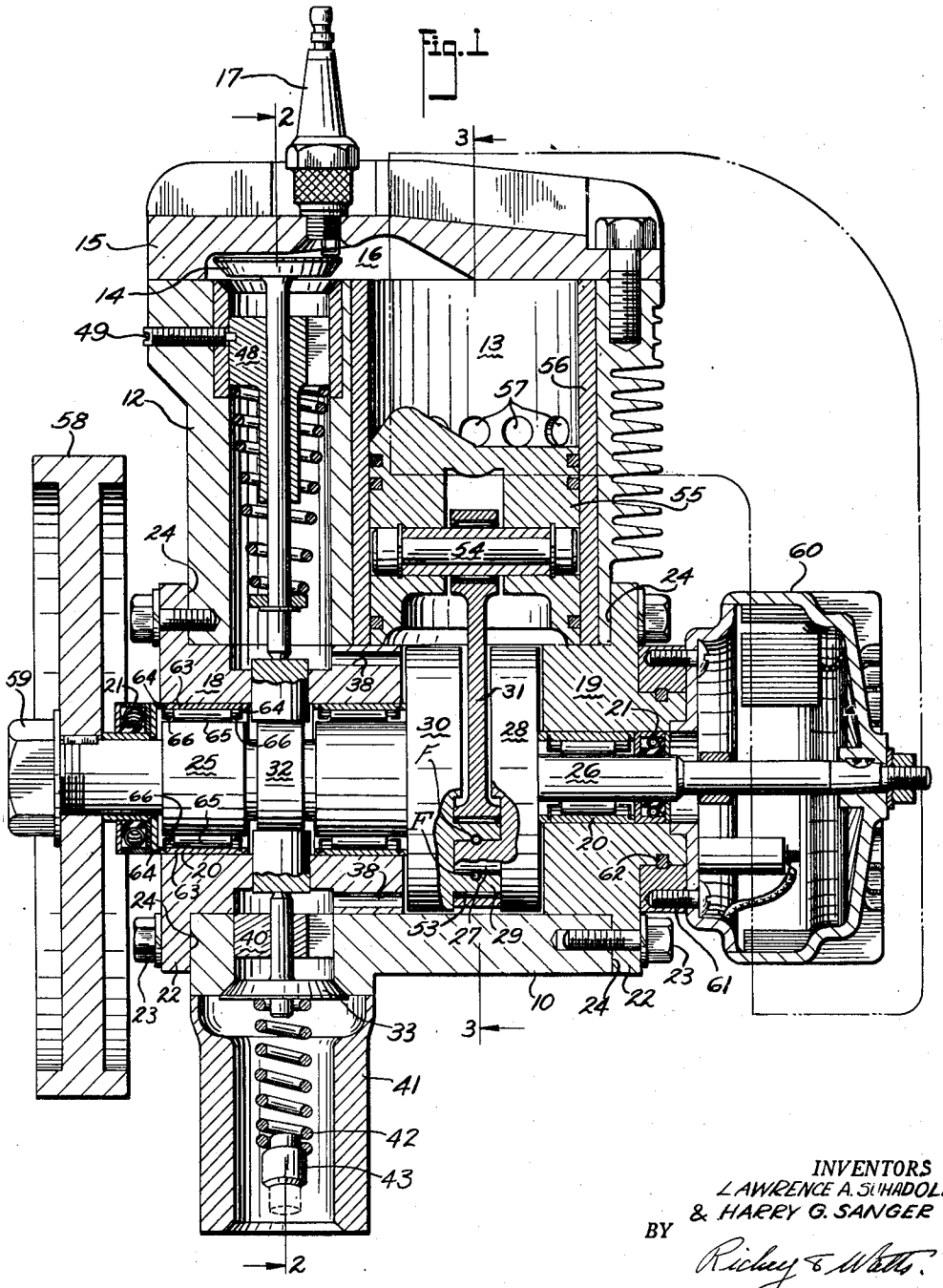
Aug. 19, 1952 L. A. SUHADOLNIK ET AL 2,607,329

TWO-CYCLE CRANKCASE COMPRESSION ENGINE

Filed Dec. 13, 1949 3 Sheets-Sheet 1

Fig. 1



INVENTORS
LAWRENCE A. SUHADOLNIK
& HARRY G. SANGER
BY
Richey & Watts.
ATTORNEYS

Aug. 19, 1952 L. A. SUHADOLNIK ET AL 2,607,329

TWO-CYCLE CRANKCASE COMPRESSION ENGINE

Filed Dec. 13, 1949 3 Sheets-Sheet 2

Fig. 2

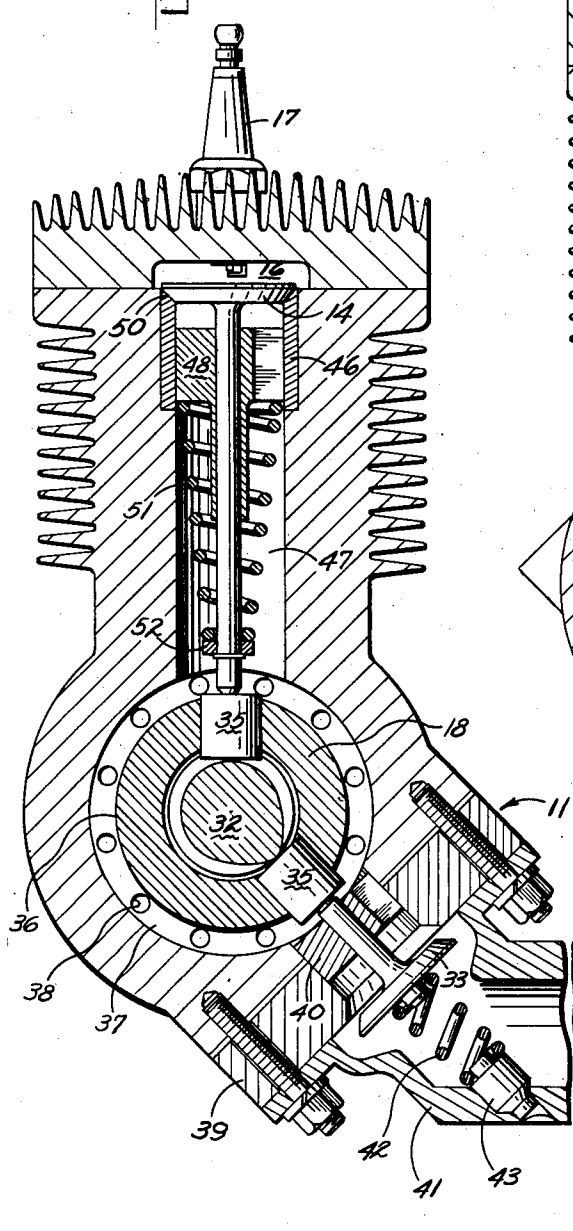
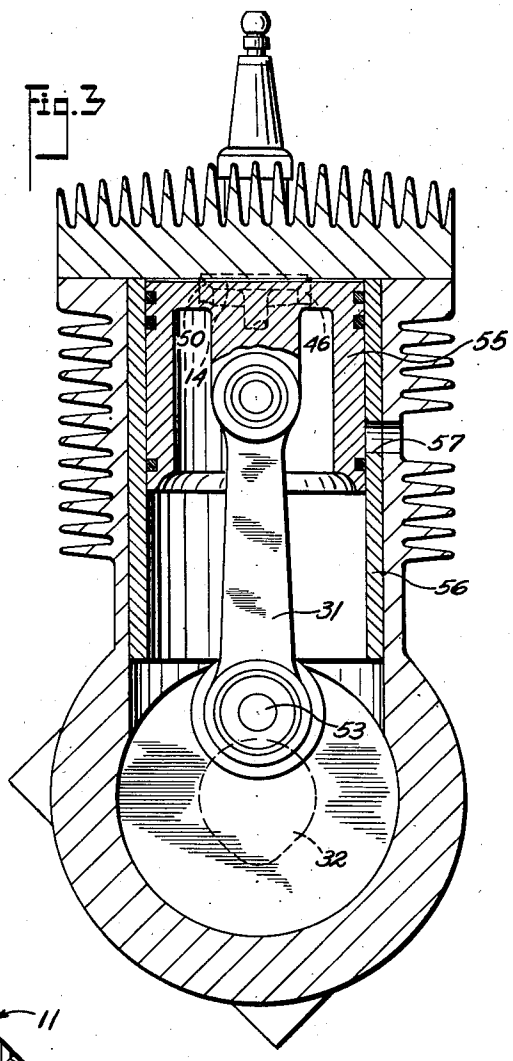


Fig. 3



INVENTORS
LAWRENCE A. SUHADOLNIK
& HARRY G. SANGER
BY
Richey & Watts
ATTORNEYS

Aug. 19, 1952 L. A. SUHADOLNIK ET AL 2,607,329

TWO-CYCLE CRANKCASE COMPRESSION ENGINE

Filed Dec. 13, 1949 3 Sheets-Sheet 3

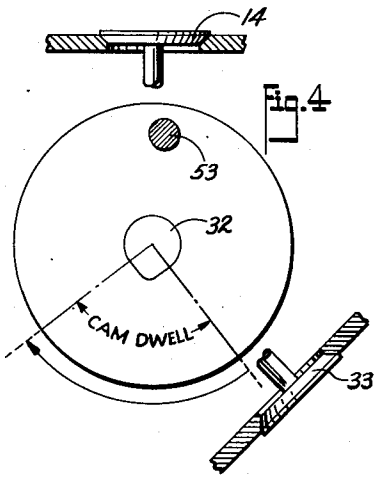


Fig. 4

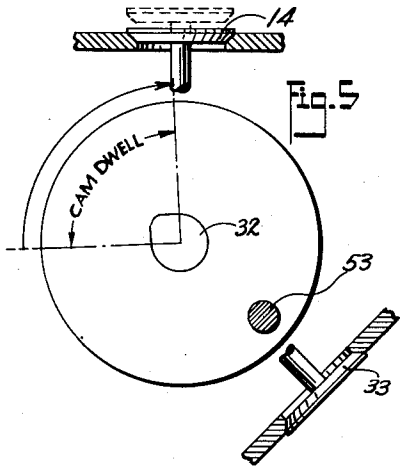


Fig. 5

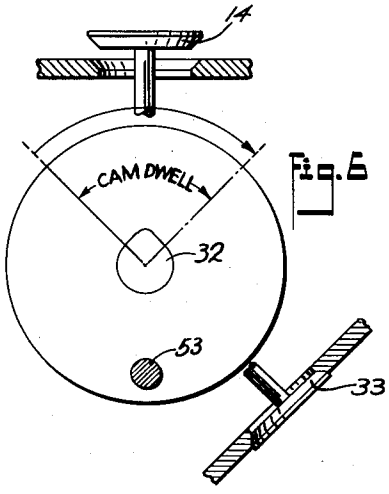


Fig. 6

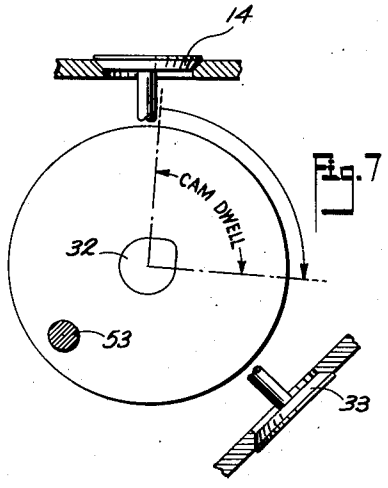


Fig. 7

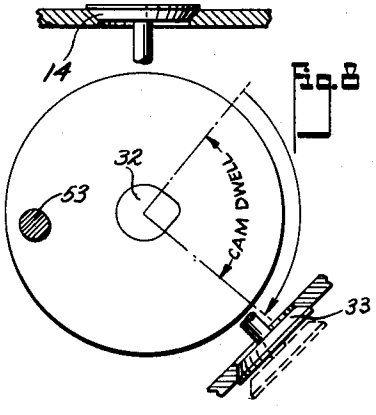


Fig. 8

INVENTORS
LAWRENCE A. SUHADOLNIK
& HARRY C. SANGER
BY
Richey & Watts.
ATTORNEYS

Patented Aug. 19, 1952 2,607,329

UNITED STATES PATENT OFFICE

2,607,329

TWO-CYCLE CRANKCASE COMPRESSION ENGINE

Lawrence A. Suhadolnik, Shaker Heights, and Harry G. Sanger, Euclid, Ohio

Application December 13, 1949, Serial No. 132,755

11 Claims. (Cl. 123—73)

1

This invention relates broadly to internal combustions and more specifically to improvements in the organization and structure of the valves, the operating mechanism therefor, and the construction of the crankshaft.

One of the objects of the invention resides in the provision of a pair of fuel inlet valves arranged for operation by a single cam.

Another object of the invention is to provide a composite crank and cam shaft and improved journal bearings therefor.

Another object of the invention is to provide a crankcase having a limited volumetric capacity and a carburetor inlet valve to meter the fuel charge.

Another object of the invention is to provide a crankshaft structure embodying a pair of aligned subassemblies which are designed for removal from either side of the engine.

Further objects of the invention reside in the provision of a relatively small engine which is light in weight, efficient of operation, and constructed to facilitate simple machining operations and ready assembly.

Other objects and advantages, more or less ancillary to the foregoing, and the manner in which all the various objects are realized, will appear in the following description, which, considered in connection with the accompanying drawings, sets forth the preferred embodiment of the invention.

In the drawings:

Fig. 1 is a vertical sectional view of the improved engine;

Fig. 2 is a vertical section of the engine taken on a plane indicated by the lines 2—2 in Fig. 1;

Fig. 3 is a vertical section of the engine taken on a plane indicated by the line 3—3 in Fig. 1, with the piston shown in its elevated position; and

Figs. 4 to 8 are diagrammatic views illustrating the operative cycle of the engine.

Referring first to Fig. 1, the engine comprises a combined cylinder block and crankcase 10 having a boss in the base thereof constituting a carburetor companion flange for the reception of a valve cage 11, a cylinder 12 having a piston 13 and inlet valve 14 therein, and a cylinder head 15 embodying the combustion chamber 16 and spark plug 17. The crankcase is bored for the reception of bearing blocks 18 and 19, which in turn are bored for the support of the crankshaft bearings 20, and crankcase packing glands 21. The bearing blocks are formed with flanged end portions 22 drilled for the reception of cap

2

screws 23 mounted on faced areas 24 in the opposed sides of the crankcase.

The crankshaft embodies two separable sections 25 and 26 disposed in coaxial alignment with each other and interconnected through the telescopic engagement of a pintle 27 on the crank arm 28 with a bore in the end of a boss 29 in the crank arm 30. The boss forms the journal bearing for the connecting rod 31 and the bore therein is slightly larger than the pintle and provided with a snap ring F constituting a fulcrum to permit oscillation of the crank section 26 in the event of misalignment of the crankshaft journal bearings. The crank arms are of annular form, disposed in close proximity with the end walls of the bearing blocks 18 and 19 and the central body of the connecting rod 31. The opposed faces of the crank arms are formed with recesses therein to accommodate the hub of the journal bearing the connecting rod. The crank section 25 is provided with a cam 32 formed integral therewith and disposed between a crankcase fuel valve 33 and the cylinder valve 14 in a plane common to the axes thereof.

The cam, as will be seen in Fig. 2, is engaged with shoes 35 guided in radial openings machined in the bearing block 18 intermediate the bearings 20. The block 18 is further machined with an annular groove 36 in the circumferential wall thereof, the flange 37 defined by the groove being provided with a plurality of openings forming transverse passageways 38 for the admission of the fuel mixture from the valve 33 to the crankcase.

The valve cage 11 includes a plate 39 bored for the reception of a spider 40 for guiding the stem of the valve 33 and chamfered to form a seat for the head thereof. The cage further includes an elbow 41 flanged for engagement with the plate 39 and cored to receive the valve head and a spring 42 for urging the valve against its seat and for maintaining the shoe 35 in contact with the cam. The elbow is provided with a post 43 disposed in axial alignment with the stem of the valve and formed with a boss thereon for the support of the spring 42. The outer end of the elbow is provided in the customary manner with a flange for the support of the carburetor 44. The valve 33 is disposed approximately 45° from the medial axis of the valve 14, which, as illustrated in Fig. 1, is parallel to the axis of the cylinder 13 and normal to the axis of the crankshaft section 25. The head of the valve 14 is seated in a sleeve 46 mounted in a counterbore in a chamber 47 communicating with the groove

36 in the crankshaft bearing block. The stem of the valve 14 is guided in a spider 48 retained in the sleeve 46 by a set screw 49, and the valve is urged against its seat 50 in the sleeve by a spring 51 interposed between the lower face of the spider and a collar 52 affixed upon the lower end of the valve stem. The combustion chamber 16 overlies the valve and the adjacent half of the cylinder 13, the spark plug 17 being disposed in the cylinder head in super-tangential relation with the valve in a plane common to the axes of the valve and cylinder.

The connecting rod 31 is mounted on needle bearings 53 on the boss 29, the upper end thereof being connected in a similar manner to a wrist pin 54 in the piston 55. The cylinder is preferably provided with a lever 56, which, together with the cylinder block, is cross-drilled in the central portion thereof to provide exhaust ports 57 tangential the upper face of the piston when disposed in its lower dead center position.

The outer end of the crankshaft 25 is provided with a flywheel 58 keyed thereon and locked against lateral movement by a nut 59. A packing gland 21 is disposed between the inner face of the flywheel and the end wall of the crankshaft bearing block 18. The outer end of the shaft 26 is diametrically reduced for the support of a magneto 60 of conventional form which is mounted on a plate 61 piloted on a shoulder in the bearing block 19 and retained thereon by a snap ring 62.

The crankshaft bearings 20 comprise rings 63 having annular grooves 64 therein adjacent the outer ends thereof. The bore in the ring is provided with rollers 65 formed with diametrically reduced end portions 66 which are engaged with a split ring 67 of right-angular transverse section. In assembly, the inner flanges of the rings are seated in the grooves 64 and the outer flanges thereof envelop spurs or pintles 66 in the ends of the rollers.

The lift or dwell of the cam is designed, relative to the bearing faces of the shoes 35, to effect the actuation of each of the valves 33 and 14 throughout approximately 90° of the operative cycle of the engine. The cam moreover, as will be seen in Fig. 3, is disposed with the peak thereof in diametric alignment with the crank pin 27 and in opposition to the throw thereof. Thus, as will be seen in Fig. 1, the valve 33 will be closed when the crank pin is in its bottom dead center position and the valve 14 will be closed, as shown in Fig. 3, when the crank pin is in its top dead center position.

The operative cycle of the engine is illustrated diagrammatically in Figs. 4 to 8.

Referring first to Fig. 4, as the cam 32 passes the shoe and closes the valve 33, during the initial descent of the piston, the fuel charge in the crankcase will be compressed and flow through the passageways 38 and into the chamber 47. Before the piston reaches bottom dead center (about ¾ of the descent thereof), the cam will open the valve 14 (Fig. 5) and the fuel charge will enter the combustion chamber 16. When the piston reaches bottom dead center (Fig. 6) the cam will be in its position of maximum lift, but continued movement thereof will effect the closure of the valve as the crankshaft passes a point about 45° beyond bottom dead center during the elevation of the piston (Fig. 7). Continued movement of the piston will compress the fuel charge entrapped within the combustion chamber until the crank arm reaches a point approximately 15° forward top dead center whereupon the ignition system will fire the compressed fuel charge and cause the expansion thereof. As the crank pin passes top dead center, the expanded gases will effect the descent of the piston until it reaches its lowermost position and liberates the burned products of combustion through the exhaust ports 57.

Before the piston reaches bottom dead center, the cam will open the valve 14 (Fig. 5) and permit a portion of the compressed fuel charge in the crankcase and chamber 47 to flow into the cylinder and thus scavage the contents thereof.

During the last quadrant of the ascent of the piston (Fig. 8) the cam will actuate the valve 33 and the depression in the crankcase will effect the admission of the fuel mixture from the carburetor into the crankcase. Continued rotation of the crank and cam will close the valve 33 coincident the passage of the crank arm beyond top dead center (Fig. 4).

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

We claim:

1. An internal combustion engine comprising a crankcase, a cylinder block thereon having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber in a plane common to that of said intake valve, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a cam on said crankshaft disposed between and rotatable about the point of intersection of the axes of said intake and carburetor valves, springs urging said valves into operative engagement with said cam, said crankcase having passageways therein communicating with the carburetor valve opening the crankcase and the fuel chamber.

2. An internal combustion engine comprising a crankcase, a cylinder block thereon having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a cam on said crankshaft disposed between and operatively engaged with said intake and carburetor valves, and a crankshaft bearing block in said crankcase having passageways therein connecting the carburetor valve opening with the crankcase and fuel chamber.

3. An internal combustion engine comprising a crankcase, a cylinder block thereon having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled

with said connecting rod, a cam on said crankshaft disposed with the peak thereof in axial alignment with the connecting rod bearing and remote therefrom, said cam being disposed between and operatively engaged with said intake and carburetor valves, a wall in said crankcase defining passageways between said fuel chamber and said crankcase, said carburetor valve being disposed in a vertical plane common to said intake valve and at an angle of 45° to the medial axes thereof whereby said cam will effect the sequential operation of said valves.

4. An internal combustion engine comprising a crankcase, a cylinder block thereon having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a crankshaft bearing block in said crankcase valve, lifter shoes mounted for sliding movement in said block and disposed in a common plane transverse the axes of the crankshaft, a cam on said crankshaft engaged with said shoes, said bearing block having recesses therein connecting the carburetor valve opening with said crankcase and said fuel chamber.

5. An internal combustion engine comprising a crankcase, a cylinder block thereon having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a crankshaft bearing block in said crankcase having a circumferential groove therein aligned with said fuel chamber, a transverse opening leading from the groove to the chamber defined by the crankcase, valve lifter shoes in said block below said groove engaged with said inlet and carburetor valves, a cam on said crankshaft engaged with said shoes, and springs urging said shoes into engagement with said cam.

6. An internal combustion engine comprising a crankcase, a cylinder block thereon having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a crankshaft bearing block in said crankcase having recesses therein connecting with the carburetor valve opening, the interior of the crankcase, and the fuel chamber, a crankshaft section in said bearing block, a cam on the crankshaft intermediate said intake and carburetor poppet valves and operatively engaged therein, a second crankshaft bearing block in said crankcase in axial alignment with the first-named bearing block, a second crankshaft section journaled thereon, shoulders on said crankshaft sections restraining axial movement thereof, a flange on the outer end of each of said bearing blocks demountably connected to the outer walls of said crankcase, whereby said bearing blocks and the crank sections thereon may be removed as units from the opposed sides of the crankcase.

7. An internal combustion engine comprising a crankcase, a cylinder block thereon having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a crankshaft bearing block in said crankcase having recesses therein connecting with the carburetor valve opening, the interior of the crankcase, and the fuel chamber, a crankshaft section in said bearing block, a cam on the crankshaft intermediate said intake and carburetor poppet valves and operatively engaged therein, a second crankshaft bearing block in said crankcase in axial alignment with the first-named bearing block, a second crankshaft section journaled thereon, shoulders on said crankshaft sections restraining axial movement thereof, a boss constituting a connecting rod crank pin on one of said crankshaft sections, said boss having an axial opening in the end thereof, a pintle on the other crankshaft section slidably engaged with the opening in said boss, and detachable means on said bearing blocks for the retention thereof.

8. An internal combustion engine comprising a crankcase, a cylinder block theeron having a fuel chamber therein, a cylinder head on said block having a combustion chamber therein, an intake poppet valve in said fuel chamber adjacent said combustion chamber, a carburetor on said crankcase, a carburetor poppet valve in said crankcase subjacent said fuel chamber, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a crankshaft bearing block in said crankcase having recesses therein connecting with the carburetor valve opening, the interior of the crankcase, and the fuel chamber, a crankshaft section in said bearing block, a cam on the crankshaft intermediate said intake and carburetor poppet valves and operatively engaged therein, a second crankshaft bearing block in said crankcase in axial alignment with the first-named bearing block, a second crankshaft section journaled thereon, shoulders on said crankshaft sections restraining axial movement thereof, and antifriction bearings in said bearing blocks comprising cylindrical races having internal grooves adjacent the outer ends thereof, rollers in said races, pins protruding from the opposed ends of said rollers, and snap rings of right angle cross section engaged in said grooves and with said pins.

9. An internal combustion engine comprising a crankcase having a carburetor passageway therein, a cylinder block thereon having a fuel passageway therein communicating with the first-named passageway, a cylinder head on said block having a combustion chamber therein, a crankshaft in said crankcase, a connecting rod thereon, a piston in said cylinder block coupled with said connecting rod, a single lift cam on said crankshaft, a poppet valve in the cylinder block passageway disposed in radial alignment with the axes of said cam and operatively engaged with the face thereof, and a poppet valve in the crankcase disposed in radial alignment with the axes of

said cam and operatively engaged with the face thereof.

10. An internal combustion engine comprising a crankcase, a cylinder block thereon, a cylinder head on said block, a crankshaft in said crankcase, a connecting rod thereon, a piston coupled therewith, a cam on said crankshaft, an inlet poppet valve in said cylinder block engaged with said cam above the axis of rotation thereof, and a carburetor poppet valve in said crankcase engaged with said cam below the axis of rotation thereof.

11. An internal combustion engine comprising a crankcase, a cylinder block thereon, a cylinder head on said block, a crankshaft in said crankcase, a connecting rod thereon, a piston coupled therewith, an inlet poppet valve in the top of said cylinder block, a carburetor poppet valve in the bottom of said crankcase, and a single lift cam

on the crankshaft disposed between said valves for the sequential operation thereof.

LAWRENCE A. SUHADOLNIK.
HARRY G. SANGER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
659,944	Weed	Oct. 16, 1900
1,719,388	Booth et al.	July 2, 1929
2,495,784	Starts	Jan. 31, 1950

FOREIGN PATENTS

Number	Country	Date
394,468	France	of 1909
259,331	Great Britain	of 1926