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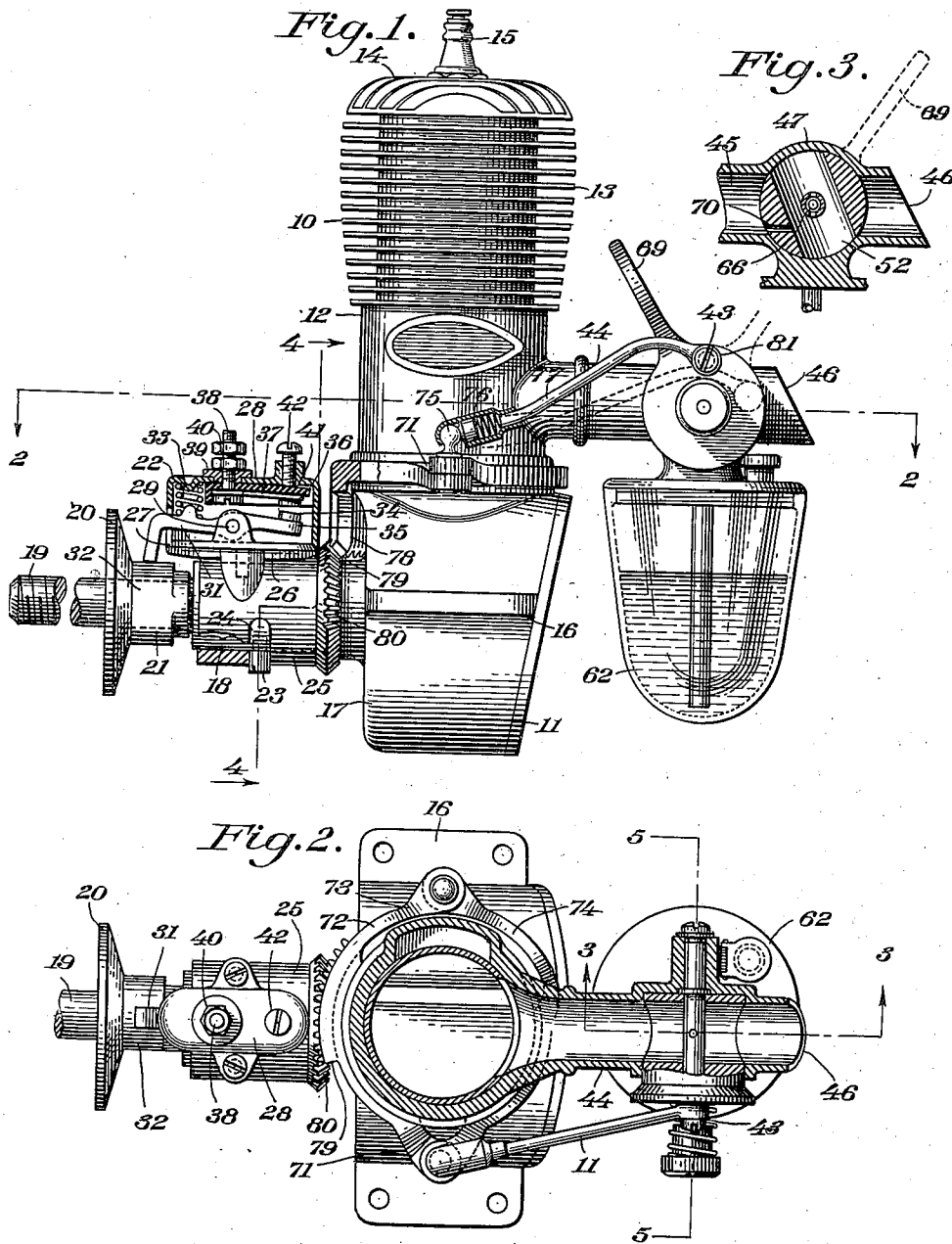
R. D. LLOYD ET AL

2,256,948

THROTTLE AND IGNITION CONTROL FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 14, 1940

2 Sheets-Sheet 1



Roy D Lloyd &
Robert L. Gardner:
INVENTORS

BY Victor J. Evans & Co.
ATTORNEYS

WITNESS.

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2 Sheets-Sheet 2

Fig. 4.

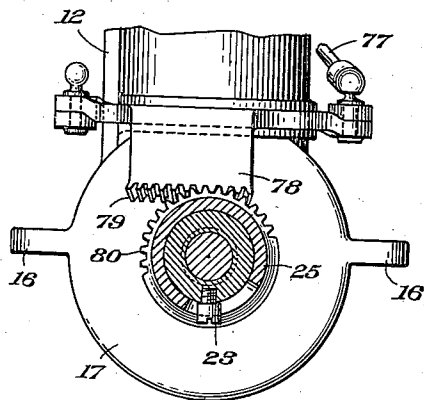


Fig. 5.

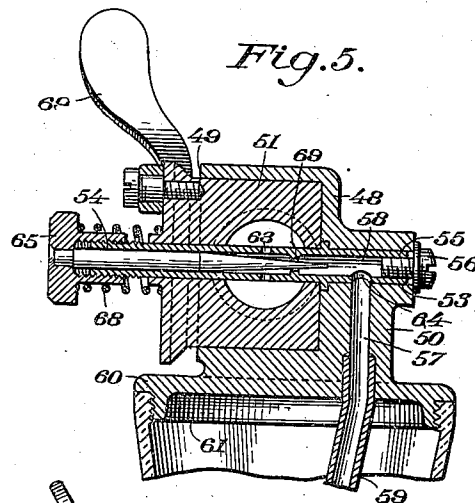


Fig. 6.

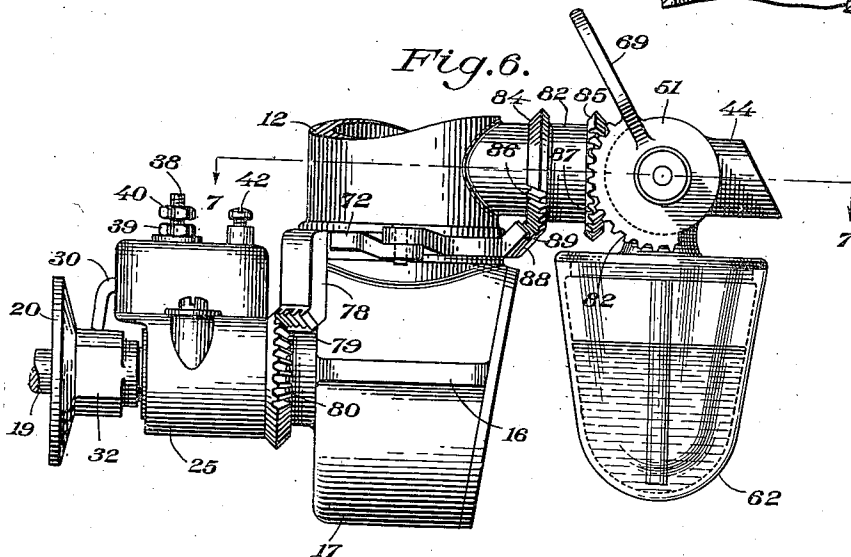
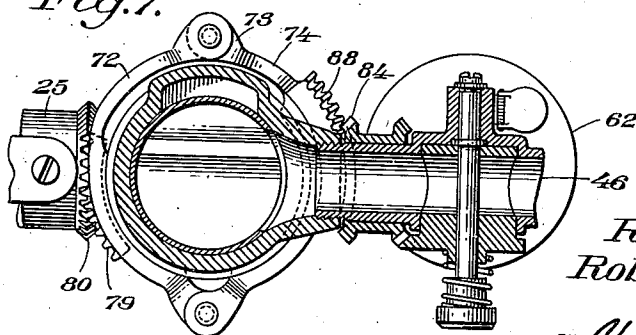


Fig. 7.



Roy D. Lloyd &
Robert L. Gardner:
INVENTORS

BY Victor J. Evans & Co.
ATTORNEYS

WITNESS

UNITED STATES PATENT OFFICE

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THROTTLE AND IGNITION CONTROL FOR
INTERNAL COMBUSTION ENGINES

Roy D. Lloyd and Robert L. Gardner, Pittsburgh,
Pa., assignors of one-half to Pittsburgh Brass
Manufacturing Company, Pittsburgh, Pa., a
corporation of Pennsylvania

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13 Claims. (Cl. 123—98)

Our invention relates to new and useful improvements in internal combustion engines.

An important object of our invention is to provide a control arrangement for internal combustion engines which will synchronize the choke, throttle and ignition of the engine.

Another object of our invention is the provision for means for manually operating the throttle and choke arrangement of the carburetor, which means will automatically and synchronously operate the spark timing device.

Still another object of our invention is the provision of an improved arrangement for regulating the fuel flow from the fuel supply to the engine.

Yet another object of our invention is to uniquely associate the parts of the engine so that the same may be easily adapted for either upright or inverted mounting.

Other objects and advantages of our invention, will be apparent during the course of the following description.

In the drawings, forming a part of this specification, and wherein like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevation showing parts in section and parts broken away of an internal combustion engine constructed in accordance with our invention,

Figure 2 is a longitudinal sectional view taken on the line 2—2 of Figure 1,

Figure 3 is a fragmentary vertical sectional view taken on the line 3—3 of Figure 2,

Figure 4 is a fragmentary vertical sectional view taken on the line 4—4 of Figure 1,

Figure 5 is a fragmentary vertical sectional view taken on the line 5—5 of Figure 2,

Figure 6 is a side elevation of a modification of our device, and

Figure 7 is a longitudinal sectional view taken on the line 7—7 of Figure 6.

In the accompanying drawings, wherein for the purpose of illustration, are shown preferred embodiments of our invention, the numeral 10 designates a conventional two-cycle internal combustion engine body of the type including a crankcase 11 having a cylinder 12 integrally formed thereon and arranged thereabove. The engine here illustrated is of the type particularly adapted for use in connection with model aeroplanes and the cylinder is, therefore, provided with a plurality of vertically spaced radial cooling fins 13. The upper end 14 of the cylinder is closed and the spark plug 15 carried thereby extends into the cylinder for igniting the fuel

vapors compressed therein by a piston (not shown) reciprocally mounted and actuated in the conventional manner.

The crankcase is provided at its opposite sides with outwardly extending flanges 16 by means of which the engine may be mounted on a suitable support. The side 17 of the crankcase is provided with a bearing extension 18 in which the crankshaft 19 is rotatably supported. The crankshaft extends substantially beyond the end of the bearing extension and the face plate 20 is fixedly connected to the extending portion thereof and with the boss portion 21 disposed in slight spaced relation with the end of the bearing extension.

The sleeve portion 25 of the spark timing device 22 is mounted for rotation about the bearing extension 18. It is desirable that the device be freely rotatable relative to the extension, however, it is equally important that its rotation be limited and that it be prevented from sliding longitudinally therealong. We have, therefore, provided a set screw 23 which extends through an elongated slot 24 in the sleeve portion in a manner whereby the sleeve is freely movable about the extension but its movement is limited and determined by the set screw. The upper periphery of the sleeve is formed with a platform 26 of substantially rectangular formation in plan having an outer peripheral groove 27 snugly receiving the open side of the cover member 28. The upper surface of the platform is formed at substantially its middle with a pair of laterally spaced lugs 29 between which is pivotally mounted the breaker arm 30. The arms 31 and 35 of the breaker extend at opposite sides of the pivot and are rockable about a horizontal axis. The arm 31 extends through a slot provided in the adjacent end of the cover member 28 and the portion extending exteriorly of the cover is bent downwardly to abuttingly engage the boss portion 21 of the face plate. The boss portion is essentially circular in cross section except for a flattened section 32 and the peripheral surface of the boss provides a cam for rocking the breaker arm about its pivot. A coil spring 33 interposed between the arm 31 and the top of the cover member 28 operates to hold the outer end of the breaker arm in pressed engagement with the cam surface of the boss whereby the rotation of the boss with the crankshaft will cause the contact 34 carried by the arm 35 to move into and out of engagement with the stationary contact 36.

As best illustrated in Figure 1, the stationary contact is provided with a laterally extending

spring arm 37 which is secured to the top of the cover member by means of the screw 38. The shank portion of the screw extends upwardly through the spring arm and through the housing and is enclosed by a rubber grommet 39 which insulates the same from the cover. The portion of the shank extending above the cover is provided with a pair of retaining nuts 40 for receiving and retaining the terminal of an electrical conductor therebetween. An insulating strip 41 extends from the grommet intermediate the spring arm 37 and the cover member whereby the adjusting screw 42 extending through the top of the cover above the contact 36 may be actuated to adjust the stationary contact 36 toward or away from the movable contact and to hold the same in a fixed position relative thereto at all times.

The throttle operating mechanism 43 is mounted on a tubular extension 44 which extends from the cylinder 12 in a direction opposed to the bearing extension 18 of the crankcase. The internal bore 45 of the extension constitutes a fuel passage which communicates at its inner end with the lower end of the cylinder and at its outer end with the atmosphere. The extension is enlarged, as at 47, intermediate its ends, the side 48 of the enlarged portion being laterally offset to provide an essentially thick wall 50 and the side 49 thereof being open to receive the plug 51.

The plug is essentially circular in cross-section and the longitudinal axis thereof extends transversely of the fuel passage. A relatively large bore 52 extends diametrically through the plug and the plug is rotatable to move the bore into and out of register with the passage. The bore is of substantially the same diameter as the fuel passage and rotation of the plug to the position illustrated in Figure 3 will close communication of the fuel passage with the atmosphere. On the other hand, if the plug is rotated to the position illustrated in Figure 2, the bore will be in full register with the fuel passage to open communication of the fuel passage with the atmosphere.

The essentially small tubular member 53 extends axially through the plug and transversely of the large bore 52. The opposite ends 54 and 55 of the tube extend beyond the ends of the plug and the end 55 thereof extends through the essentially thick wall 50, the last-mentioned end of the tube being closed by a filler plug 56. The vertical passage 57 in the wall 50 communicates at one end with the internal bore 58 of the tube through the port 64 and the other end thereof receives the fuel supply pipe 59. The cover 60 of the fuel tank depends from and is formed integral with the extension 44 at a point directly below the enlarged portion 47. An exteriorly screw-threaded annular lip 61 is formed on the bottom surface of the cover which lip detachably receives the fuel bowl 62. The fuel supply pipe extends into the bowl and below the normal surface of the fuel therein as clearly illustrated in Figure 1.

The tube 53 communicates with the large bore of the plug through essentially restricted ports 63 and the needle valve 65 is threadedly received by the extending end 54 of the tube, the pointed end 66 thereof being arranged and extending through an internal annular bead 67 formed in the tube intermediate the port 64 and the ports 63. A coil spring 68 is interposed between the outer face of the plug and the enlarged head portion of the valve, which valve may be thread-

ed axially along the tube 55 whereby the size of the opening between the tapered end thereof and the annular bead 67 may be selectively regulated.

In order to start the engine, the supply of air to the cylinder should be materially reduced or eliminated altogether and essentially raw fuel supplied thereto. The handle 69 extending radially from the outer end of the plug 51 may be manually grasped to effect rotation of the plug within the enlarged portion of the extension 44. If the plug is rotated so that the large bore 52 is not in register with the fuel passage 45, the portion of the passage communicating with the atmosphere will be closed. In order that the fuel may have access to the cylinder we have provided the essentially small bore 70 which operates as an automatic choke and which affords direct communication between the large bore and the fuel passage when the plug is in the above-mentioned position. The fuel may then be drawn from the fuel bowl by the suction created in the crankcase during the compression stroke of the piston, the fuel flowing through the fuel supply line 59 and into the passage 57 where it is discharged into the tube 53 through the port 64. The flow of the fuel along the tube 53 is controlled by the adjustment of the needle valve; however, the fuel has egress from the tube through the ports 63 and into the large bore 52 from which it has egress into the fuel supply passage 45 through the essentially small bore 70. The above positioning of the plug will thus prevent atmospheric air from being introduced into the cylinder but will assure an adequate supply of fuel.

It is well known that it is highly desirable that the spark timing device be disposed in a retarded position when the engine is being started or operated at a slow speed and that it is necessary that the same be moved to an advanced position as the speed of the engine is accelerated. In view of the fact that the positioning of the spark timing device is so closely correlated with the speed of the engine we have provided means for coordinating the movements of the spark timing device 22 and the throttle operating mechanism 43.

The engine body is formed intermediate the bearing extension 18 and the tubular extension 44 with a peripheral groove 71 and the ring 72 is mounted for rotation therein. The ring comprises semi-circular sections 73 and 74 the ends of which are arranged in overlapping relation and connected by the pivot pins 75. The ends of the pins extending above the ring are formed with enlarged spherically curved heads, one of which heads receives the universal connection 76. The connection is carried by one end of the link 77 the opposite end 81 of which link is pivoted to the projecting end of the plug 51 adjacent its peripheral edge. The plug 51 rotates about a horizontal axis and the ring 72 moves about a vertical axis, however, the link 77 uniquely connects the parts so that manual actuation of the plug will effect a corresponding rotation of the ring. The portion of the ring which extends in closest proximity to the spark timing device is provided with a depending apron 78 the bottom edge of which is provided with beveled gear teeth 79 which mesh with the beveled gear teeth 80 formed on the inner end of the sleeve 25. Rotation of the ring will, therefore, effect a corresponding rotation of the sleeve to adjust the position of the spark tim-

ing device relative to the actuating cam of the crankshaft.

When the plug is positioned to move the small bore 10 into register with the fuel passage, the link 77 will be disposed in the dotted line position illustrated in Figure 1 and the ring 12 will be rotated about the body of the engine to move the spark timing device to a retarded position. If the throttle lever is then advanced slightly so that a small quantity of atmospheric air may flow through the bore 52, the advancement of the spark timing device will be negligible and it is essential for the best operation of the engine that the spark timing device be advanced but slightly during the initial advancement of the throttle. The slight advancement of the spark timing device during this initial operation of the throttle lever is assured by the unique association of the link with the plug. By inspecting Figure 1 it will be seen that the initial rotation of the plug will move the end 81 of the link a relatively great distance in a vertical direction but that only slight lateral movement thereof will be effected. It is the lateral movement of the link which effects rotation of the ring and movement of the spark timing device. However, as the throttle is advanced toward the fully open position, the advancement of the spark timing device will be accelerated because of the fact that the end 81 of the link will be moving toward the top portion of its arc and relatively faster horizontally than vertically. It may thus be seen that we have coordinated and synchronized the actions of the choke, throttle and spark timing device so that each is automatically and properly positioned by the simple expedient of operating the throttle control lever.

By making the extension 44 separate from the body and joining the same thereto by a fluid-tight connection the same may be rotated 180° and the universal connection 16 engaged with the other of the pivot pins 15. If this construction is followed the engine may be operated with equal efficacy in either an upright or inverted position.

In the form of our invention illustrated in Figures 6 and 7, the projecting end of the plug 51 is formed at its periphery with a segmental section of gear teeth 82. A collar 83 is carried by the extension and its opposite edges 84 and 85 are formed with gear teeth 86 and 87, the teeth 87 having a driven engagement with the teeth 82 of the plug. The portion of the ring 72 disposed below the collar 83 is provided with an upturned flange portion 88 the edge of which is formed with gear teeth 89, which teeth mesh with the gear teeth 86 formed at the inner end of the collar. The opposite side of the collar is similarly formed with a depending apron having gear teeth 79 which mesh with the teeth 80 of the sleeve 25 for effecting rotation of the sleeve relative to the crankshaft.

The construction of the second form of the invention, other than as described above, is identical with the construction described for the first form of the invention.

In operation, manual rotation of the plug 51 will effect a rotation of the collar 83 about the extension 44 and the rotation of the collar will move the ring about the body. Movement of the ring in the above manner will advance and retard the spark timing device in the manner hereinbefore described.

It is to be understood that the forms of our invention, herewith shown and described, are to be taken as preferred examples of the same, and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of our invention, or scope of the appended claims.

Having thus described our invention, we claim:

1. In an internal combustion engine having a body portion, a spark timing device and a throttle arm, gear means carried by the spark timing device, gear means mounted for rotation about said body portion and meshing with the first gear means, and a connecting link pivoted to the throttle arm and to the second gear means whereby actuation of the throttle arm will act through the medium of the said gears to actuate the spark timing device.

2. In an internal combustion engine, a crankcase having a bearing extension for receiving the crankshaft of the engine, a spark timing device operated by the crankshaft and including a circular gear portion mounted for rotation about the said bearing extension, a ring mounted for rotation in a peripheral groove in the crankcase, said ring having a depending apron provided with gear teeth meshing with the gear portion of the spark timing device, and a throttle lever operatively associated with the said ring for synchronizing the movements of the spark timing device about the bearing extension with the movements of the throttle lever.

3. In an internal combustion engine, an upstanding crankcase having a horizontal bearing extension for receiving the crankshaft of the engine, a spark timing device operated by the crankshaft and including a circular gear portion mounted for rotation about the said bearing extension, a ring mounted for rotation in a peripheral groove in the crankcase, said ring having a depending apron provided with gear teeth meshing with the gear portion of the spark timing device, a throttle lever swingable about a horizontal axis for regulating the fuel flow to the engine, and a connecting link pivoted to the ring and to the throttle lever at one side of its pivot so that positioning of the throttle lever in the choke position will dispose the attached end of the link at the bottom of its swing whereby the initial advancement of the lever will effect a substantial upward swinging of the link but relatively slight lateral movement thereof to rotate the ring and whereby further advancement of the throttle lever will effect a more rapid lateral movement of the link to, in turn, effect accelerated actuation of the ring.

4. In an internal combustion engine, an upstanding crankcase having a horizontal bearing extension for receiving the crankshaft, a spark timing device operated by the crankshaft and including a circular gear portion mounted for rotation about the said bearing extension, a ring mounted for rotation in a peripheral groove in the crankcase, said ring having a depending apron provided with gear teeth meshing with the gear portion of the spark timing device, and a throttle lever operatively associated with the said ring in a manner whereby initial movement of the throttle arm to increase the flow of fuel to the engine will effect only slight movement of the spark timing device relative to the crankshaft but whereby further actuation of the throttle lever will effect a more rapid relative movement of the spark timing device.

5. In an engine, a spark timing device mov-

able about a horizontal axis, a ring movable about a vertical axis, gear means connecting the ring and spark timing device, a throttle lever swingable about a horizontal axis for regulating the fuel flow to the engine, and a connecting link pivoted to the ring and to the throttle lever at one side of its pivot so that positioning of the throttle lever in the choke position will dispose the attached end of the link at the bottom of its swing whereby the initial advancement of the lever will effect a substantial upward swinging of the link but relatively slight lateral movement thereof to rotate the ring and whereby further advancement of the throttle lever will effect a more rapid lateral movement of the link to, in turn, effect accelerated actuation of the spark timing device relative to the said crankshaft.

6. In an engine provided with a fuel intake passage having communication with the fuel chamber of the engine and with the atmosphere, means for regulating the flow of fuel through the passage comprising a plug extending transversely of the passage and having a relatively large bore movable into register with the passage to permit atmospheric air to have access to the fuel chamber and movable out of register with the said intake passage to prevent atmospheric air from having access to the fuel chamber, and a relatively small bore connecting the large bore with the side of the passage communicating with the fuel chamber when the large bore is in a non-registering position to close communication between the fuel chamber and the atmosphere.

7. In an engine including a fuel intake passage having communication with the fuel chamber of the engine and with the atmosphere, a plug arranged in obturating relation with the passage, said plug having a relatively large bore movable into and out of register with the fuel passage and a relatively small bore effecting communication between the large bore and the side of the passage communicating with the fuel chamber when the said large bore is out of register with the passage, and a fuel supply means having exclusive communication with the said large bore.

8. In an engine including a fuel intake passage having communication with the fuel chamber of the engine and with the atmosphere, a plug arranged in obturating relation with the passage, said plug having a relatively large bore movable into and out of register with the fuel passage and a relatively small bore effecting communication between the large bore and the side of the passage communicating with the fuel chamber when the said large bore is out of register with the passage, a fuel supply means having exclusive communication with the said large bore, and valve means for regulating the flow of fuel into the said large bore.

9. In an engine including a fuel intake passage having communication with the fuel chamber of the engine and with the atmosphere, a plug arranged in obturating relation with the passage, said plug having a relatively large bore movable into and out of register with the fuel passage and a relatively small bore effecting communication between the large bore and the side of the passage communicating with the fuel chamber when the said large bore is out of register with the passage, a relatively small tubular

member extending through the passage and communicating therewith through essentially restricted ports, and a fuel supply line opening into the tubular member for supplying fuel to the large bore through the said ports.

10. In an engine including a fuel intake passage having communication with the fuel chamber of the engine and with the atmosphere, a plug arranged in obturating relation with the passage, said plug having a relatively large bore movable into and out of register with the fuel passage and a relatively small bore effecting communication between the large bore and the side of the passage communicating with the fuel chamber when the said large bore is out of register with the passage, a relatively small tubular member extending through the passage and communicating therewith through essentially restricted ports, a fuel supply line opening into the tubular member for supplying fuel to the large bore through the said ports, and valve means for regulating the flow of fuel through the said ports.

11. An engine body having a crankcase provided with a lateral extension and a cylinder provided with a lateral extension, a sleeve rotatably mounted on the said last extension and having oppositely directed gear parts, a throttle arm provided with gear means meshing with one of the gear parts of the sleeve, a spark timing device rotatably mounted on the first extension and including a gear part, and a ring mounted for rotation about the body intermediate the said extensions, said ring including a first segmental gear means meshing with the other gear part of the sleeve and a second segmental gear means meshing with the gear part of the spark timing device.

12. An engine body having a crankcase provided with a lateral extension and a cylinder provided with a lateral extension, a spark timing device mounted for rotation on the said first lateral extension, a ring mounted for rotation about the body and having a driving connection with the spark timing device, a throttle lever, and a sleeve mounted for rotation on the second lateral extension having a driven connection with the throttle and a driving connection with the said ring.

13. In an engine having a fuel intake passage communicating with the fuel chamber of the engine and with the atmosphere, a crankshaft, and a spark timing device movable relative to the shaft, a manually rotatable plug arranged in obturating relation with the fuel passage, said plug having a relatively large bore movable into register with the fuel passage to open communication between the fuel chamber and the atmosphere and out of register therewith to close communication with the atmosphere and a relatively small bore leading from the large bore and opening into the fuel passage when the said large bore is in the said last-named position, and means coordinating the movements of the plug and the said spark timing device whereby the spark timing device will be in a retarded position when the small bore is in register with the fuel passage and in an advanced position when the large bore is positioned to open communication between the fuel passage and the atmosphere.

ROY D. LLOYD.
ROBERT L. GARDNER.