O. C. BLAIR.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JAN. 14, 1910.

1,018,093.

Patented Feb. 20, 1912.

4 SHEETS—SHEET 1.

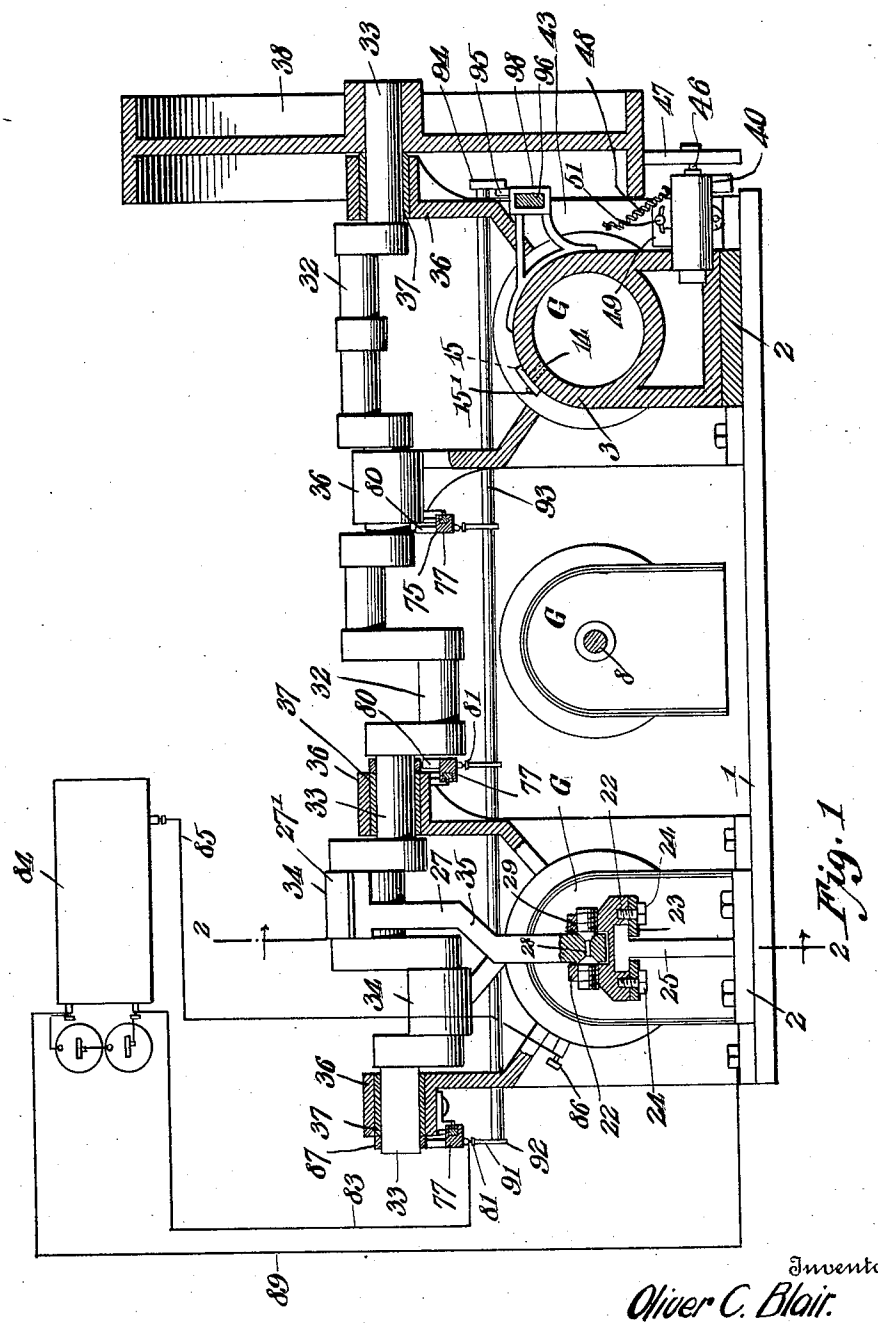

Fig. 1

Witnesses

L. B. Galt.

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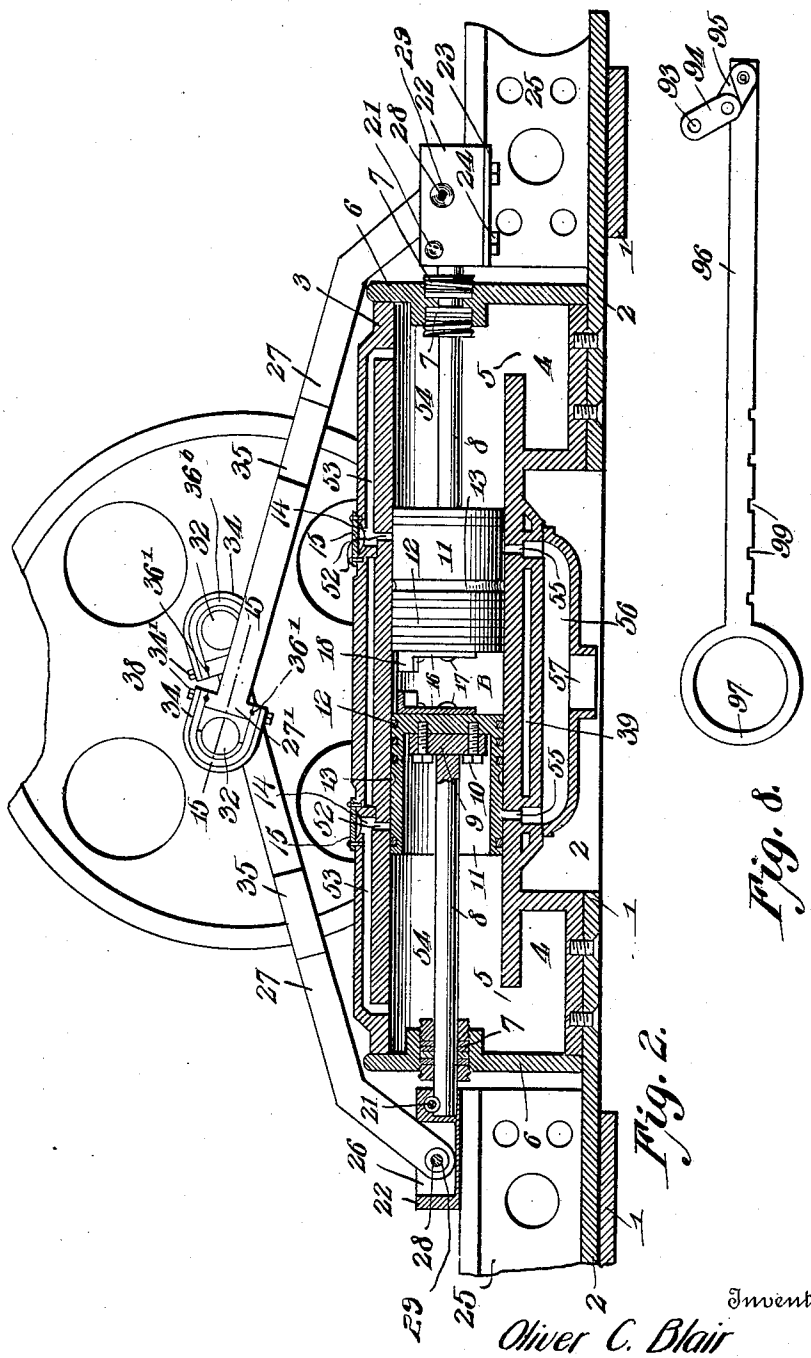

Fig. 2.

Fig. 3.

Witnesses

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4 SHEETS—SHEET 3.

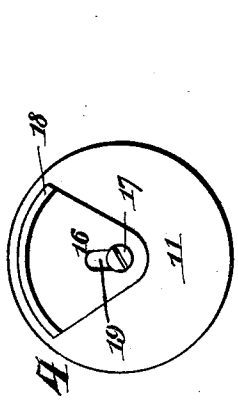

Fig. 4.

Fig. 3.

Fig. 7.

Witnesses

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4 SHEETS—SHEET 4.

Fig. 5.

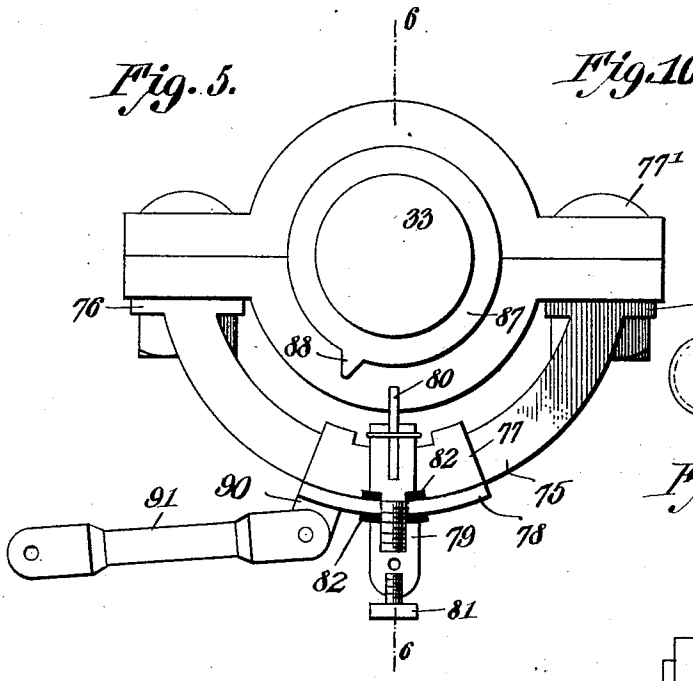
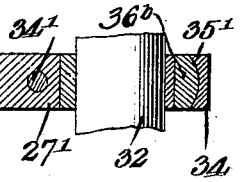


Fig. 10



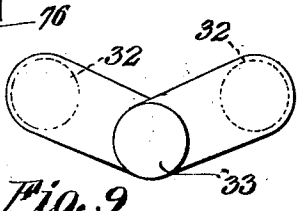
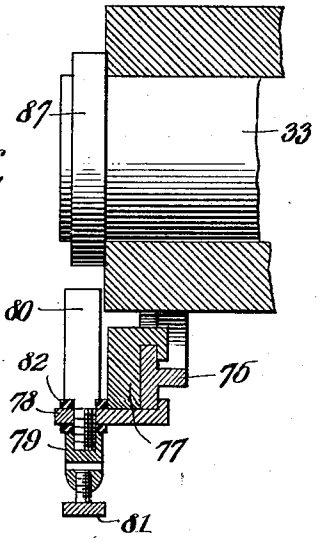


Fig. 9

Fig. 6.



Witnesses

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Wm. Bagger.

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UNITED STATES PATENT OFFICE.

OLIVER C. BLAIR, OF CLEVELAND, OHIO.

INTERNAL-COMBUSTION ENGINE.

1,018,093. Specification of Letters Patent. Patented Feb. 20, 1912.

Application filed January 14, 1910. Serial No. 538,097.

To all whom it may concern:

Be it known that I, OLIVER C. BLAIR, a citizen of the United States of America, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines, and it has among its objects to produce a simple, efficient and practically non-vibratory engine of this class.

Further objects of the invention are to produce an engine of the class referred to which shall possess superior advantages in point of simplicity, durability and general efficiency; which shall be light running and capable of developing great power relative to its dimensions.

With these and other ends in view which will readily appear as the nature of the invention is better understood, the same consists in the improved construction and novel arrangement and combination of parts which will be hereinafter fully described and particularly pointed out in the claims.

In the accompanying drawings has been illustrated a simple and preferred form of the invention, it being, however, understood that no limitation is necessarily made to the precise structural details therein exhibited, but that changes, alterations and modifications within the scope of the invention may be resorted to when desired.

In the drawings,—Figure 1 is an end elevation partly in section of an engine constructed in accordance with the invention, said engine comprising a battery of three units. Fig. 2 is a longitudinal vertical sectional view taken on the plane indicated by the line 2—2 in Fig. 1. Fig. 3 is a view in side elevation of one of the units of the improved engine, a portion of the frame being shown in section. Fig. 4 is an end view of one of the piston heads, showing the arrangement of the adjustable deflector. Fig. 5 is a view in side elevation and partly in section of a timing device used in connection with the invention. Fig. 6 is a sectional view taken on the line 6—6 in Fig. 5. Fig. 7 is a plan view of a timing device detached. Fig. 8 is a detail view of the operating rod for the timing device. Fig. 9 is an end view of the main shaft, showing the relative positions of the cranks associated with a single engine unit. Fig. 10 is a sectional detail view illustrating the pitman boxing used in connection with the cranks.

Corresponding parts in the several figures are denoted by like characters of reference.

In the construction of this improved engine a single unit or engine cylinder may be employed, but it is considered advantageous to use a battery composed of a plurality of units, and it is desired to be understood that in practice any desired number of units may be used. For the purpose of illustration, I have in Fig. 1 of the drawings shown a device comprising three units, the same combining to form an engine of suitable and convenient form. The engine units are all preferably of identical construction, and the description of one will apply to all.

A foundation 1 is provided of appropriate size and shape to support the desired number of units G, each of which is equipped with base plates 2, supporting the ends thereof and resting on the foundation which may consist of planks, castings, masonry or the like.

Each of the engine units includes a casing 3 having a longitudinal cylindrical bore and provided adjacent to each end with a flat bottomed chamber 4 resting on the base with which it may be connected by screws or bolts, and communicating with the cylindrical bore through a passage 5. The heads or end members 6 of the cylinder casings are provided with suitably constructed glands or packing boxes 7 for the passage of the piston rods 8, the inner ends of which are provided with heads 9 which are connected by screw bolts 10 with the cylindrical cup-shaped piston heads 11, which latter are provided with annular grooves in which packing rings 12 are seated and also with annular oil grooves 13 which may be supplied with lubricant through suitable openings in the cylinder casings, as shown at 14 in Fig. 1, which communicate with the inlet ports to be hereinafter described; and said openings being normally closed by plates 15, secured by screws 15′. Upon the inner end faces of the piston heads deflectors 16 are pivotally mounted for radial and arcuate adjustment by means of headed screws 17, said deflectors being provided with arcuate deflecting flanges 18 and with slots 19 for the passage of the fastening members 17, whereby the deflectors may be firmly secured at various adjustments.

The outer ends of the piston rods 8 are firmly connected by dowel pins 21, or other suitable means, with slides 22 having flanges 23 detachably connected therewith by screw bolts 24, said flange members serving to engage the T-shaped ways 25 which rise from the base members to support the slides. The latter are provided with recesses 26 in which the crank rods or connecting rods 27 are pivotally mounted by pins or bolts 28 and adjusting or tightening screws 29. The connecting rods 27 are of the angular shape clearly illustrated in Figs. 2 and 3 of the drawings to enable them to clear the ends of the cylinder casings and to provide the most effective thrust or throw between the slides at the ends of the piston rods and the cranks 32 upon the shaft 33 with which the inner ends of the rods 27 are connected by means of boxings 34 firmly secured upon the connecting rods and containing brasses or bearings of anti-friction metal directly engaging the cranks. The boxings 34 preferably consist of yokes having transversely concaved inner faces 35′, as best seen in Fig. 10 of the drawings to afford seats for the correspondingly shaped exteriorly convex half-bearings 36ᵇ which are thereby securely retained against lateral displacement when the parts are assembled, tending to secure an even, steady and non-vibratory motion. The connecting rods 27 are provided with heads 27′ upon which the yokes or boxings 34 are secured by means of bolts 34′; stress upon the bolts being relieved by pins or pegs, such as wires 36′ seated in suitable grooves in the proximate faces of the heads 27′ and the yokes 34. A very secure and efficient connection is thus formed, and one which admits of being readily assembled or disconnected when required, in order to make repairs or for other purposes. It will be observed that the connecting rods are formed with offsets 35 intermediate the ends thereof, the offsets of the two connecting rods extending from the piston rods at the opposite ends of each cylinder being in opposite directions in order that proper connection with the cranks may be effected. The crank shaft 33 extends transversely across the plurality of engine units and is supported for rotation in suitable boxes or bearings 36 which are equipped with linings 37 of anti-friction metal in order that smooth and easy running shall be insured. A single fly wheel 38 has been shown upon the shaft, but this may be dispensed with when a plurality of engine units are employed, and on the other hand a plurality of fly wheels may be used if considered necessary or desirable. It is also obvious that means for transmitting motion, such as an ordinary band pulley, may be mounted upon the shaft.

The opposite cranks 32 with which opposite connecting rods 27 of each engine unit are connected, instead of being diametrically opposite are angularly disposed with reference to each other, so that the axes of both cranks will be disposed in a plane spaced from a plane including the axis of the shaft and parallel to that in which the axes of the cranks are located. Thus, at the ends of the piston strokes, while the axes of both cranks will be slightly above or slightly below the axis of the shaft, as the case may be, the axis of each crank will be disposed in alinement with the axis of the shaft and also with that of the pin connecting the crank rod with the slide 22, so that the pulling strain of the slide will be properly exercised without the intervention of links or other connecting means.

The cylinder casing is jacketed, as shown at 39 in Fig. 2, for the circulation of water which is supplied from any suitable source by means of a suitable rotary feed pump 40 having a driving shaft 46 which is equipped with a friction wheel 47 engaging the fly wheel 38, thus supplying the motive power of the pump. A tension spring 48 is provided which connects the pump casing with the engine casing for the purpose of holding the friction wheel 47 in engagement with the fly wheel 38, and the pump casing is provided with a flange 49 having an arcuate slot 50 for the passage of a fastening member, such as a screw 51, whereby it may be secured at various adjustments, if desired.

The cylinder casing is provided with inlet ports 52, best seen in Fig. 2, for the admission of the charges of explosive mixture, said ports being in alinement with and communicating with the lubricating openings 14; and said ports are connected by ducts 53 with the mixing chambers or compression chambers 54 which are comprised by the ends of the casing including the chambers 4. The inlet ports 52 are situated just beyond the inner ends of the piston heads when the latter are in retracted position adjacent to the ends of the casing, and the parts are so proportioned that when the piston heads are retracted, the flanges 18 of the deflectors 16 will be situated directly below the said inlet ports, it being understood that the deflectors may be adjusted to suitable positions with relation to the said inlet ports to diffuse the explosive charge entering through the ports. The space between the inner ends of the piston heads, and which in Fig. 2 is designated B, constitutes the explosion chamber. The inlet ports are by preference arranged in the upper part of the cylinder casing, and the lower part of the latter is provided with exhaust ports 55 which have been shown as being so arranged as to permit the exhaust to begin slightly ahead of the admission of the fresh charge, whereby the spent gases

are displaced. Said exhaust ports are connected by a pipe or duct 56 with a common outlet 57.

The carbureters whereby the explosive charges are delivered to the cylinder casing may be of any suitable approved and well known construction, said carbureters being shown at 58. It will be understood that said carbureters are provided in the customary manner with valves to control the passage of the mixture to the casing.

In connection with each engine unit a timing device is provided for the purpose of properly timing the explosions, said timing device including an arcuate bar 75 provided at the ends thereof with apertured lugs or eyes 76, whereby the device may be mounted upon the bolts 77′ of one of the bearings of the crank shaft 33. The arcuate bar 75 is preferably flanged, as will be best seen in Fig. 6, to support a slide 77 which is suitably movable thereon. The slide 77 includes a flange 78 through which extends a holder 79 carrying a contact spring 80 and a binding screw 81, said holder being insulated from the slide by insulation 82. The binding screw 81 serves for the attachment of one end of a conductor 83 connected with a spark coil 84 which in turn is connected by a conductor 85 with a spark plug 86 suitably connected with the cylinder casing. A cam 87, which is keyed upon the engine shaft, is provided with a projection 88 adapted to contact with the spring 80 when the engine is in motion. The metallic frame of the engine is in electrical communication with the spark coil through a conductor 89.

As will be best seen in Fig. 1 of the drawings, one of the timing devices is disposed in proximity to each of the engine cylinders, and it will further be seen that the arcuate supporting bars 75 are concentric with the axis of the engine shaft. It is also obvious that the explosion of the charge in each cylinder may be timed by proper adjustment of the slides 77 upon the respective arcuate bars. For the purpose of effecting proper adjustment, each slide 77 is provided with a lug 90 which is connected by a link 91 with an arm 92 extending from a rock shaft 93 supported for oscillation upon the engine frame. Said rock shaft is provided with a crank arm 94 which is connected by a link 95 with one end of an operating rod 96, the opposite end of which is provided with a handle 97, whereby it may be conveniently manipulated. Said operating rod is guided through a suitable supporting sleeve 98, and it is provided with a plurality of notches 99 for the purpose of securing it in position at various adjustments.

In the operation of this device, when the pistons move inwardly in the respective cylinders, suction will be created in the compression chambers which will cause the charge to be drawn from the carbureters and to enter into the mixing chambers 54 at the ends of the cylinder casing. At this time the inner ends of the inlet, as well as the exhaust, ports will be obstructed by the pistons. By the movement in an outward direction of the respective pistons the charges will become compressed in the mixing chambers, which latter, as will be seen, are of large capacity, and by the pressure the carbureter valves will become seated. Before the limit of the outward movement of the respective pistons has been reached the inner ends of the inlet ports 52 will have become uncovered, and the compressed charge will pass through the duct 53 and through the inlet port to the explosion chamber which is the cylinder space comprised between the inner ends of the piston heads. The charge entering through the ports 52 will become deflected by the deflector flanges 18 and will thus become diffused throughout the explosion chamber. The exhaust ports having already been uncovered by the outward movement of the piston heads the explosion of the spent gases remaining from a former charge will be accelerated by the admission of the fresh charge, as stated. By the next inward movement of the piston heads, fresh charges are taken into the mixing chamber, as before, while the charge within the explosion chamber becomes compressed and is fired at the proper moment, which has been prearranged by proper adjustment of the timing device, the piston heads being thereby sent in an outward direction for a repetition of the operation. Movement is communicated from the slides connected with the piston rods through the connecting rods 27 to the crank shaft of the engine which is thus rotated.

In the event of back-firing occurring during the operation of the engine, serious consequences will be averted, and injury to more important parts avoided by the presence of the relatively light plates 15 obstructing the lubricating openings above the inlet ports, said plates constituting safety devices which are readily blown out under the impulse of an explosion caused by back-firing.

It is desired to be distinctly understood that while in the foregoing the preferred construction of the improved engine has been shown and described, I do not desire to limit myself in this respect, inasmuch as various modifications as to size, proportions and structural details of the device may be made without departing from the spirit of the invention or in any way sacrificing the advantages of the same.

Having thus described the invention, what is claimed as new, is:—

1. In an engine of the character described, a cylinder unit consisting of a cylindrical

casing provided at the ends thereof with enlargements constituting flat bottomed chambers resting upon a foundation and supporting the intermediate cylinder body above such foundation, said chambers communicating with the ends of the cylindrical bore and combining therewith to form mixing chambers, and heads mounted upon the ends of the unit; in combination with pistons operating in the cylindrical bore of the unit and having stems extending through the heads thereof.

2. In an engine of the character described, a cylinder unit consisting of a casing provided at the ends thereof with heads and with enlargements forming flat bottomed chambers communicating with the ends of the cylindrical bore and combining therewith to form mixing chambers, base plates supporting the casing and connected with the undersides of the flat bottomed portions, said base plates being provided with guideways rising therefrom, slides on the guideways, and piston rods and crank rods operatively connected with the slides.

3. In an engine of the character described, a cylinder unit having a cylindrical bore, said unit being provided with enlargements constituting supporting members and forming mixing chambers that communicate with the ends of the cylindrical bore, heads or closures upon the ends of the unit, pistons operating in the cylindrical bore and having stems extending through the heads, slides supported for reciprocation adjacent to the ends of the unit, said slides being connected with the piston stems, and crank rods pivotally associated with said slides.

4. In an engine of the character described, a cylinder unit having heads at the ends thereof, inlet ports spaced from the cylinder ends, lubricating apertures communicating with the inlet ports, covering plates secured over the apertures and constituting safety members, and pistons mounted for reciprocation in the cylinder and having annular lubricating grooves adapted to register with the inner ends of the inlet ports.

5. In an engine of the character described, a cylinder unit provided at the ends thereof with enlargements forming chambers communicating with the ends of the cylindrical bore and combining therewith to form mixing chambers, inlet ports spaced from the cylinder ends, lubricating apertures communicating with the inlet ports, covering plates secured over the apertures and constituting safety members, ducts connecting the inlet ports with the mixing chambers, and pistons mounted for reciprocation on the cylinder and intermittently obstructing the inner ends of the inlet ports, said pistons being provided with annular lubricating grooves adapted to register with the inlet ports to receive lubricant therethrough.

6. In an engine of the character described, a cylinder unit having diametrically and diagonally opposed inlet and exhaust ports, a piston mounted for reciprocation in the cylinder, and a deflector adjustably mounted upon the face of the piston, said deflector including an arcuate flange adapted to be disposed in the path of the charge entering through the inlet port.

7. In an engine of the character described, a cylinder unit, piston heads mounted for reciprocation therein and having stems extending through the cylinder ends, slides connected with the outer ends of the piston stems, said slides being provided with recesses in their upper sides and with flange members connected with their undersides, T-shaped ways supporting said slides for reciprocation, a crank shaft supported in bearings transversely of the cylinder unit, and rods connecting the cranks of the shaft with the slides, said rods being of angular shape to clear the cylinder ends and provided with lateral offsets for centering the same.

8. In an engine of the character described, a cylinder unit, pistons mounted for reciprocation in the same and having stems extending through the opposite cylinder ends, slides connected with the stems, a shaft extending transversely across the cylinder and having cranks disposed at an angle other than 180° with reference to each other, and rods connecting said cranks with the piston slides, said rods being of angular shape and provided with lateral offsets.

In testimony whereof I affix my signature in presence of two witnesses.

OLIVER C. BLAIR.

Witnesses:
WM. BAGGER,
H. DITTMAN.