

June 9, 1925

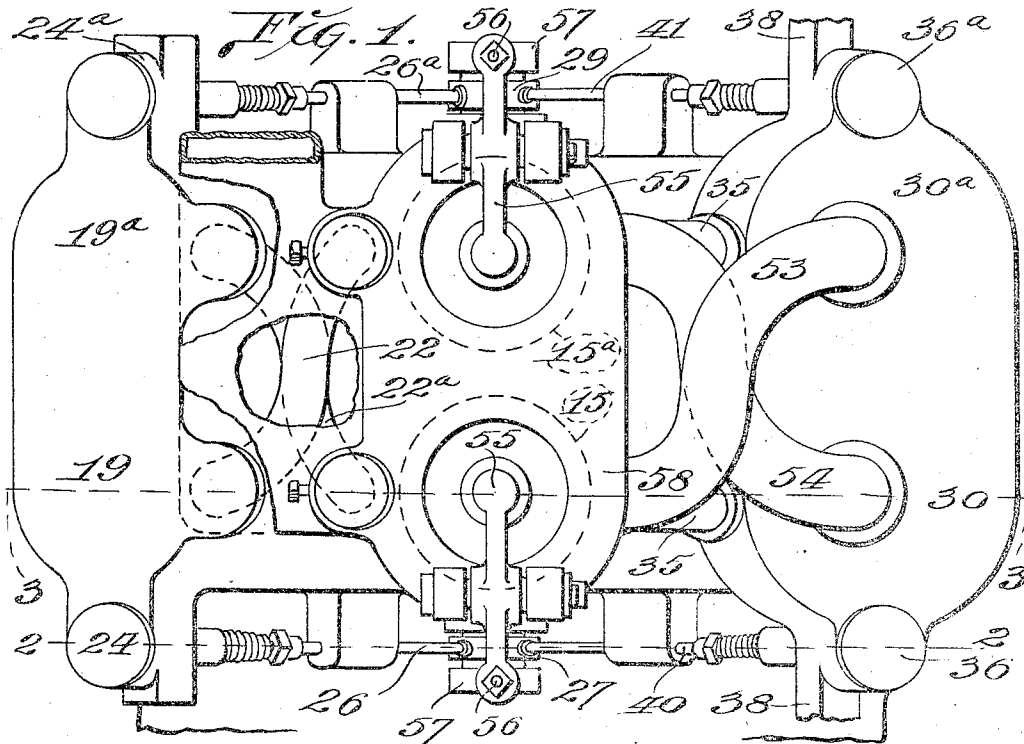
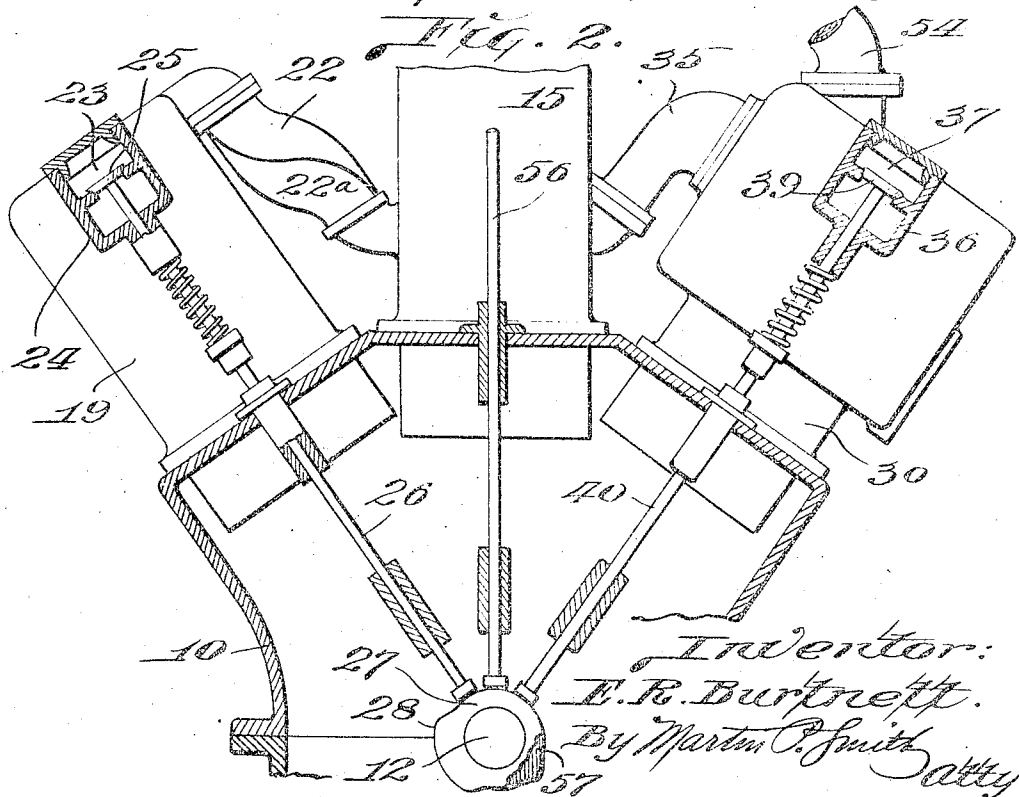
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E. R. BURTNETT

INTERNAL COMBUSTION ENGINE

Filed April 2, 1923

2 Sheets-Sheet 1



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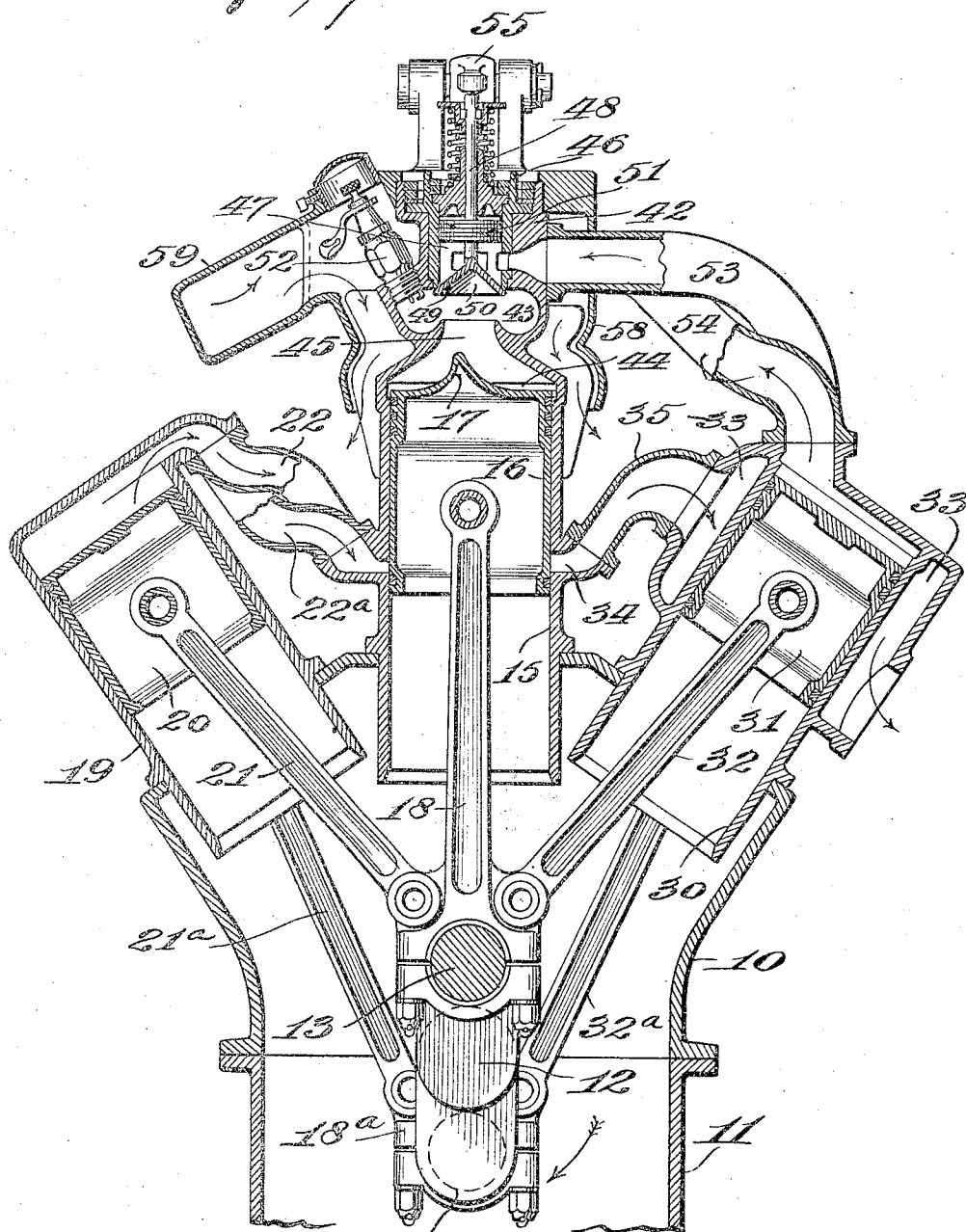
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2 Sheets-Sheet 2

Fig. 3.



*Inventor:—
Everett R. Burnett,
By Martin C. Smith, atty.*

UNITED STATES PATENT OFFICE.

EVERETT R. BURTNETT, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE AUTOMOTIVE VALVES CO., OF LOS ANGELES, CALIFORNIA, A VOLUNTARY TRUST.

INTERNAL-COMBUSTION ENGINE.

Application filed April 2, 1923. Serial No. 629,296.

To all whom it may concern:

Be it known that I, EVERETT R. BURTNETT, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to an internal combustion engine and has for its principal object, the provision of a six cylinder unit engine wherein the six cylinders are arranged in two series of three cylinders each, with each cylinder of each series performing a different function and the three cylinders of each series forming a cycle unit.

Further objects of my invention are to provide a two cycle, two unit internal combustion engine wherein the cylinders of one unit or series function in co-ordination with the functions of the three cylinders forming the other cycle unit, to provide an internal combustion engine having six cylinders arranged in two radial rows that are parallel with each other and with the plane of crank rotation, with the three pistons of the three cylinders in one radial row connected to one crank of the crank shaft by one main or master connecting rod and two auxiliary connecting rods, and with the three pistons of the three cylinders in the second or other radial row connected by like means to a second crank of the crank shaft, and further, to provide a six cylinder unit internal combustion engine having two cylinders adapted to function for internal combustion, two cylinders adapted for pumping a cool, inert volume as a scavenging function to the products of combustion within the combustion cylinders and two cylinders adapted for pumping a gaseous fuel mixture as a function of induction to the combustion cylinders.

Further objects of my invention are to provide a six cylinder unit internal combustion engine having a two throw crank shaft, the six cylinders arranged in two radial rows of three cylinders each, each radial row being in a line with the plane of the rotation of the crank to which the pistons of the three respective cylinders are connected, the first of the three cylinders of each row in the direction of crank rotation

being the inert scavenging volume pumping cylinder, the second, the internal combustion cylinder, the third, the gaseous fuel pumping cylinder and the first and third cylinders in direction of crank rotation of each row, developing the dual pumping functions to the second cylinder of the other, or opposite row.

A further object of my invention is to provide an internal combustion engine in which the residual products of combustion remaining within the combustion cylinder after the exhaust ports have opened, are displaced by a cool, inert volume induced under pressure greater than atmospheric, causing a cool volume to circulate through the hot cylinder, cooling the walls and scavenging the chamber, the residual outlet and inert volume inlet ports closing soon after the piston of the respective cylinder passes over the crank end dead center and the gaseous mixture inlet port, means being opened immediately thereafter and remaining open for a time corresponding to the piston travel for the first part of the compression stroke after the closing of the outlet and inert volume inlet ports, thereby allowing the induction of gaseous mixture as a throttle of variable quantity, in addition to a constant inert volume initial combustion cylinder content.

With the foregoing and other objects in view my invention consists in certain novel features of construction and arrangement of parts that will be hereinafter more fully described and claimed and illustrated in the accompanying drawings, in which:—

Fig. 1 is a top plan view of an internal combustion engine of my improved construction.

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

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1.

Referring by numerals to the accompanying drawings, 10 and 11 designate respectively the upper and lower parts of a crank case, the end walls thereof being provided with bearings for a crank shaft 12, having two cranks 13 and 14 that are arranged substantially 180 degrees apart.

Suitably supported in the upper portion of crank case part 10, and preferably di-

rectly above the crank shaft is a pair of combustion cylinders 15 and 15^a and arranged for operation within each cylinder is a piston such as 16.

6 Formed on top of each piston is a deflecting rib such as 17, the same being disposed substantially parallel with the axis of the crank shaft.

10 The piston within cylinder 15 is connected to crank 13 by a pitman or connecting rod 18 and, in like manner, the piston in cylinder 15^a is connected to crank 14 by a connecting rod 18^a.

15 Crank shaft 12 is arranged to rotate clockwise as designated by the arrow in Fig. 3.

Arranged in crank case member 10 and to the side of cylinders 15 and 15^a are inert volume pumping cylinders 19 and 19^a, the axes of which are radially disposed with respect to the axis of the crank shaft.

20 Arranged for operation within these cylinders are pistons such as 20, and the latter are connected, respectively, to the lower portions of the connecting rods 18 and 18^a by connecting rods 21 and 21^a.

25 The upper portion of the chamber within cylinder 19 is connected to the intermediate portion of the chamber within cylinder 15^a by a duct such as 22 and a similar duct 22^a connects the upper portion of the chamber within cylinder 19^a with the intermediate portion of the chamber within cylinder 15.

35 Cooling and scavenging volumes of inert air or cooled products of combustion are admitted into the upper ends of the chambers within the cylinders 19 and 19^a, through inlet ports such as 23, and which latter are enclosed by suitable valve housings 24 and 24^a, that are formed respectively, on the upper portions of cylinders 19 and 19^a.

40 The passage of the inert volumes through the valve housings and to the ports 23 is controlled by valves such as 25, that are arranged on the upper ends of suitable springheld push rods 26 and 26^a. Push rod 26 is arranged for operation in suitable bearings adjacent to cylinder 19 and its lower end bears on the periphery of a cam 27, that is carried by crank shaft 12 and said cam having a lobe 28 that is approximately 135 or 140 degrees in length.

45 Push rod 26^a is arranged for operation in suitable bearings adjacent to cylinder 19^a and its lower end bears on a cam 29 that is identical with cam 27 and which is carried by the crank shaft.

Obviously the cams 27 and 29 are set so that their lobes are directly opposite to each other.

50 Arranged on top of crank case member 10 and to the side of cylinders 15 and 15^a opposite from the side on which cylinders 19 and 19^a are located, are gaseous fuel compression cylinders 30 and 30^a.

55 Thus, cylinders 15, 19 and 30 are dis-

posed in one row and the cylinders 15^a, 19^a and 30^a form another row, said rows being parallel with each other and disposed transversely or at right angles to the axis of the crank shaft. The piston 31 within cylinder 30 is connected to the lower portion of rod 18 by a connecting rod 32, and a similar piston within cylinder 30^a is connected to the lower portion of rod 18^a by a connecting rod 32^a.

70 The upper portions of the walls of the cylinders 30 and 30^a are formed with chambers 33 and leading thereto from exhaust ports such as 34 that are formed in the intermediate portions of the chambers within cylinders 15 and 15^a are ducts such as 35.

75 Thus the heat of the products of combustion that discharge from the combustion chambers, is utilized for preheating the gaseous fuel that passes through the pumping cylinders 30 and 30^a.

80 The exhaust ports 34 occupy the same horizontal plane with the inlet ports at the inner ends of the inert volume ducts 22 and 22^a but said exhaust ports are slightly wider than said inlet ports so that they will open or be uncovered an instant earlier than the inlet ports, during the downward travel of the pistons 16.

85 Formed on the upper portions of the cylinders 30 and 30^a are, respectively, valve housings 36 and 36^a and leading from these housings into the upper portions of the chambers within said cylinders are gaseous fuel inlet ports such as 37.

90 These housings are connected by suitable ducts 38 to a suitable source of gaseous fuel supply and the passage of the gaseous fuel through said housings and to the ports 37 is controlled by valves such as 39.

95 The valve in housing 36 is carried by the upper end of a springheld push rod 40, that operates in suitable bearings, and the lower end of said rod bears on the periphery of cam 27.

100 The inlet valve within housing 36^a is carried by the upper end of a push rod 41 that is identical with rod 40 and the lower end of said rod 41 bearing on the periphery of cam 29.

105 The upper portion of each combustion cylinder is extended upwardly to form a head 42, and formed in each head is a concentrically arranged annular chamber 43 in which gaseous fuel is adapted to be compressed and ignited.

110 Each chamber is connected to the piston clearance chamber 44 of the corresponding combustion cylinder by a relatively short, concentrically arranged throat 45 that tapers gradually toward its upper end, thereby forming, in effect, a Venturi chamber or passageway from the center of the chamber 43 to the upper end of chamber 44.

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Removably seated in the top of each head 42 is a valve cage 46 having a centrally arranged cylindrical chamber 47, and arranged for operation in each cage is an axially disposed valve stem 48.

The lower end of each cage is provided with a suitable seat for a valve 49 that is carried by the corresponding valve being substantially conical in form and provided in its under face with a recess 50.

Carried by the valve stem, and located a short distance above the valve 49 is a short piston 51, carrying in its face a series of packing rings.

This piston reciprocates within the upper portion of chamber 47.

Seated in the head 42 above each chamber 43 is a spark plug 52, and the inner ends of the electrodes thereof, project into said chamber.

A compressed gaseous fuel duct 53 leads from the upper end of cylinder 30^a to the chamber 47 above combustion cylinder 15 and a similar duct 54 leads from the upper portion of cylinder 30 to the valve chamber 47 that is located above cylinder 15^a.

Suitable springs co-operate with the valve stems 48 to normally hold the valves 49 upon their seats and said valves are unseated by rocker arms 55 that are actuated by push rods 56, and the latter being arranged in suitable bearings to the sides of cylinders 15 and 15^a.

The lower ends of these push rods bear on cams 57 that are located on the crank shaft adjacent to the cams 27 and 28.

Formed on the upper portions of the walls of cylinders 15 and 15^a are heat disseminating webs or fins and surrounding said fins is a housing 58 that is mounted on the heads 42.

Leading from a suitably located fan to housing 58 is an air duct 59.

The construction just described provides means for disseminating the greater portion of the heat developed within the heads 42 and the upper portions of the combustion cylinders.

My improved engine operates on the two stroke cycle principle and each time the power pistons pass their high centers, the compressed gaseous fuel charges above said pistons will be ignited in the usual manner by the respective spark plugs, thereby driving said pistons downward on their power strokes.

For instance, as piston 16 passes high center, a spark produced between the terminals of plug 52, ignites the compressed fuel charge in chamber 43, thereby driving said piston downwardly and as the piston approaches its low center the corresponding exhaust port 34, will be uncovered, thereby permitting the internal pressure to instantly drop and the greater portion of the products

of combustion will discharge through said port, the corresponding duct 35 and chamber 33, which latter surrounds the gaseous fuel pumping cylinders 30 and 30^a.

Exhaust port 34 is uncovered an instant before the top of piston 16 passes below the inlet port at the lower end of duct 22^a and as said last mentioned inlet port is uncovered, a charge of air or cooled products of combustion that was compressed on the preceding upward stroke of the piston in cylinder 19^a, will discharge from the lower end of said duct 22^a into chamber 44 directly over the top of the piston 16.

This blast of air of cooled products of combustion will strike against the adjacent curved face of rib 17 and thereby be deflected upwardly through the corresponding side of chamber 44 and consequently driving the burnt products of combustion out through exhaust port 34.

As piston 16 starts to move upwardly and before any considerable degree of internal pressure has been developed in the clearance chamber above said piston, valve 50 is forced open by the action of corresponding cam 57, push rod 36 and rocker arm 55 and, said valve 50 is thus momentarily opened, a charge of gaseous fuel that has just been compressed in cylinder 30^a will pass through duct 53 and chamber 47 and discharge over the conical upper surface of valve 50, into the annular chamber 43.

After passing downward through the outer portion of this chamber 43, the compressed gaseous fuel will flow upwardly from the edge around the upper end of throat 45 and after striking against the recess in the under side of the valve, said gaseous fuel will flow axially downward through throat or venturi opening 45 into piston clearance 44 and in so doing said compressed fuel charge will force before it, the residual products of combustion left within said chamber after the closing of exhaust port 34.

Thus as the piston moves upward the charge of gaseous fuel admitted to the combustion cylinder will be compressed in a stratum within annular chamber 43 and the residual products of combustion diluted with the air admitted through duct 22^a will be compressed in a stratum in throat 45.

Thus on the subsequent ignition of the charge of compressed gaseous fuel, the resulting expansion will act through the stratum of residual products of combustion and air against the head of piston 16 to drive the same downward on its power stroke.

Pistons 20 and 31 move with piston 16 inasmuch as all of said pistons are connected to the same crank of shaft 12 and on the upward strokes, piston 20 forces compressed air through duct 22 to the piston clearance chamber in cylinder 15^a and piston 31 forces a compressed charge of gaseous fuel

through duct 50 into the annular chamber above the piston clearance chamber in said cylinder 15^a.

As will be understood, inlet valves 50 operate alternately in proper time relation with the movements of the corresponding sets of pistons and further that the valves 25 and 39 are opened at the proper time to admit air or cooled products of combustion to the cylinders 19 and 19^a and gaseous fuel to the cylinders 30 and 30^a.

Air pumped into duct 59 discharge downwardly over the fins or ribs on the upper portions of the cylinders 15 and 15^a thereby exerting a cooling effect upon the latter and also upon the walls surrounding the chamber 43.

Obviously the construction of the engine may be modified in minor details without departing from the spirit of my invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. An internal combustion engine having six cylinders arranged in two rows of three cylinders each and the individual cylinders of each row being radially disposed, a crank shaft having a fixed direction of rotation, the two first cylinders of each row in the direction of crank rotation being adapted to the function of pumping an inert scavenging and cooling volume, the two second cylinders of each row in the direction of crank rotation being adapted for internal combustion, the two third cylinders of each row in the direction of crank rotation being adapted to the function of gaseous fuel pumping, the first cylinder of each row in the direction of crank rotation functioning to provide the inert volume to the second cylinder of the other row, the third cylinder of each row in the direction of crank rotation functioning to pump the gaseous fuel to the second cylinder of the opposite row, means for supplying an inert volume to the inert volume pumping cylinders, means for supplying gaseous fuel to the gaseous fuel pumping cylinders, cross ducts from the inert volume pumping cylinders to ports that are located in the lower portions of the combustion cylinders, and ports which are uncovered and open only when the pistons in the combustion chambers are at the outer ends of their travel, cross ducts from the gaseous fuel pumping cylinders to the combustion cylinders and ignition means within said combustion cylinders.

2. An internal combustion engine having six radially arranged cylinders disposed in two rows, the two intermediate cylinders functioning as combustion cylinders, the two cylinders on one side of the intermediate cylinders functioning for the pumping

of inert scavenging volumes into the lower portions of the combustion cylinders when the pistons therein pass the low or outer centers thereof, the two cylinders of the other side of the intermediate cylinders functioning to pump gaseous fuel into said combustion cylinders, a crank shaft about which the cylinders are arranged, pistons within all of said cylinders, all three of the pistons in one row of cylinders being connected to one crank of the shaft, and all three of the pistons in the other row being connected to another crank of said shaft.

3. In an internal combustion engine, a pair of combustion cylinders, a pair of inert volume pumping cylinders arranged to one side of said combustion cylinders, inert scavenging volume ducts leading from the pumping cylinders to the lower portions of the chambers within the combustion cylinders, the discharge ends of said inert volume ducts being located so that they are uncovered and open only while the pistons in the combustion chambers are at their low centers, a pair of gaseous fuel pumping cylinders arranged on the other side of said combustion cylinders, a shaft having two cranks, pistons within all of said cylinders, the pistons in one of the combustion cylinders, one of the inert volume pumping cylinders and one of the gaseous fuel pumping cylinders being connected to one of the cranks and the pistons in the other combustion cylinder, inert volume pumping cylinder, and gaseous fuel pumping cylinder being connected to the other crank.

4. An internal combustion engine having six radially arranged cylinders disposed in two rows, the two intermediate cylinders of the two rows functioning as combustion cylinders, the two cylinders on one side of the intermediate cylinders functioning for the pumping of inert scavenging volumes into the lower portions of the combustion cylinders, and while the pistons therein are at their outer or low centers the two cylinders on the other side of the combustion cylinders functioning to pump gaseous fuel into said combustion cylinders, exhaust ducts leading from the lower portions of the combustion cylinders to heating chambers formed in the walls of the gaseous fuel pumping cylinders, pistons arranged for operation within all of the cylinders, a crank shaft about which all of the cylinders are arranged, all three of the pistons in one row of cylinders being connected to one crank of the shaft and all three of the pistons in the other row of cylinders being connected to another crank of said shaft.

In testimony whereof I have signed my name to this application.

EVERETT R. BURNETT.