April 12, 1927. E. R. BURTNETT 1,624,584

INTERNAL COMBUSTION ENGINE

Filed July 27, 1925

Fig. 1.

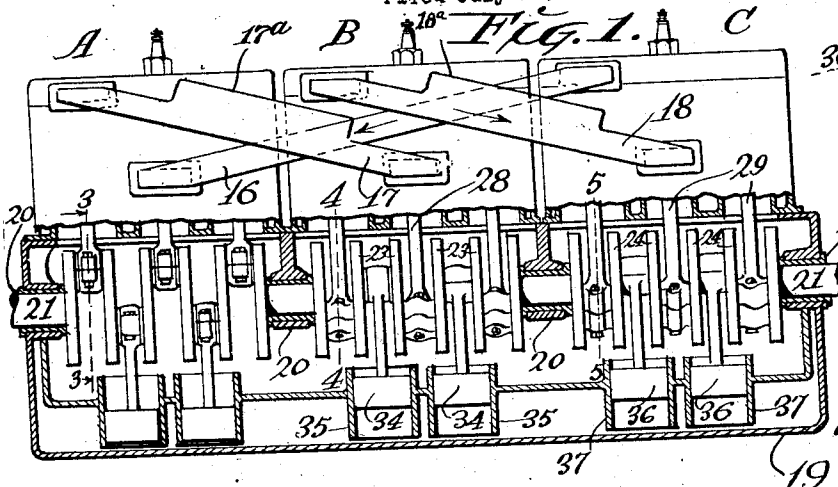


Fig. 3.

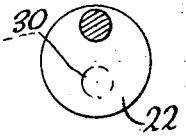


Fig. 4

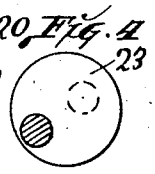


Fig. 5.

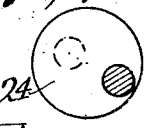
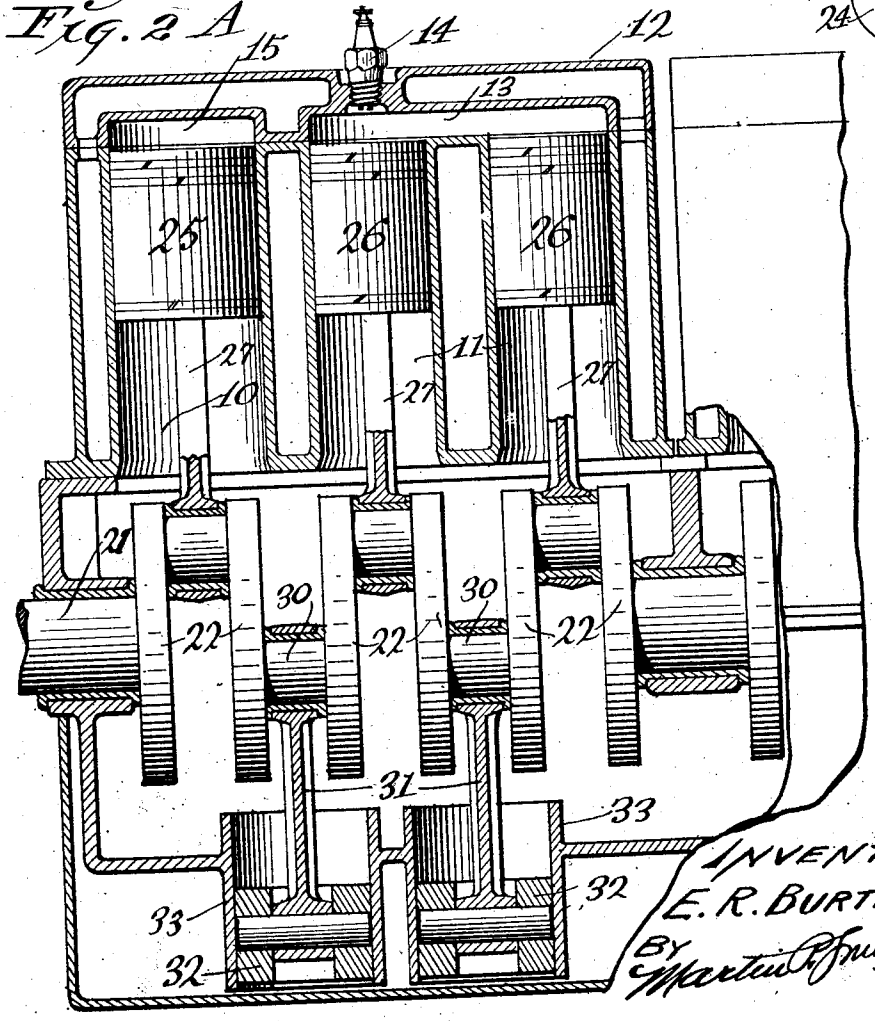


Fig. 2 A



INVENTOR,
E. R. BURTNETT.
BY Martin & Smith Atty.

Patented Apr. 12, 1927. 1,624,584

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 July 27, 1925. Serial No. 46,257.

My invention relates to a multiple cylinder two stroke cycle internal combustion engine, and has for its principal objects, the provision of a three unit engine structure, each unit comprising a pumping cylinder and a pair of combustion cylinders, the head ends of which are connected by a common compression and combustion clearance chamber, all the cylinders of the three units being arranged in a row with their axes parallel and in the same plane, to provide simple and efficient means for effecting a transfer of the gaseous fuel charges from each pumping cylinder in each unit to one of the two connected combustion cylinders in another one of the units, to provide in an engine of the character referred to, a crank shaft having three throws or cranks, the pins of which are disposed 120° apart; further, to connect the pistons of the three cylinders of each unit to the corresponding one of the three crank pins and, further, to arrange and associate with the three throw crank shaft, simple and efficient means, preferably, a plurality of reciprocatory members, for establishing perfect reciprocative and rotary balance of the cranks of the crank shaft and the pistons and piston rods that are connected to said cranks.

The structure herein described and claimed is an improvement on the invention forming the subject matter of my co-pending application filed July 27, 1925, Serial No. 46,256.

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 vertical section taken lengthwise through the center of an engine constructed in accordance with my invention and showing the upper portions of the cylinders thereof in elevation.

Fig. 2 is a vertical longitudinal section lengthwise through the center of one of the three engine units.

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

Fig. 4 is a cross section taken on the line 4—4 of Fig. 1.

Fig. 5 is a cross section taken on the line 5—5 of Fig. 1.

Referring by numerals to the accompanying drawings in detail A, B and C designated respectively the three units of my improved engine, each unit comprising three cylinders, one of which, such as 10, functions as a charge pumping cylinder and the other two designated by the numeral 11, function as combustion or power cylinders. Thus, the complete engine embodies nine cylinders that are arranged in a straight row with their axis parallel and in the same plane.

Secured on the head ends of the three cylinders of each unit is a head block such as 12 and formed in the underside thereof is a shallow recess such as 13 that connects and functions as a common compression and combustion clearance chamber for the combustion chambers 11.

Seated in the head 12, preferably at a point directly above the center of the combustion chamber in the cylinder 11 that is provided with gaseous fuel inlet ports, as hereinafter described is an ignition device such as a spark plug 14.

Formed in the underside of each head block 12 is a shallow recess such as 15 that provides a head clearance chamber for the corresponding pumping chamber 10.

Leading from the pumping cylinder clearance chamber 15 of the pumping cylinder in unit A to the lower portion of the combustion chamber 11 that is immediately adjacent to the pumping cylinder in unit B and a similar shorter gaseous fuel transfer duct 18 leads from the clearance chamber of the pumping cylinder in unit B to the lower portion of the combustion chamber 11 that is immediately adjacent to the pumping cylinder in unit C.

The transfer ducts 17 and 18, although shorter than duct 16, are provided respectively, with auxiliary chambers 17^a and 18^a, thus making said shorter ducts equal in volumetric capacity to the longer duct 16.

Associated with the units A, B and C is a crank case 19 having four main bearings 20 for a crank shaft 21 and the latter having three sets of crank throws to correspond with the three engine units A, B and C. are designated by numerals 22, 23 and 24.

The pins of the three cranks in each set are in longitudinal alignment with each other, and the three sets of pins are disposed circumferentially 120° apart.

Each pumping chamber is provided with a piston such as 25 and the combustion chambers are provided with pistons such as 26.

The pistons in unit A are connected respectively to the three pins of cranks 22 by connecting rods such as 27 and the three pistons in unit B are connected respectively to the three pins of cranks 23 by suitable connecting rods such as 28.

In like manner, the three pistons in unit C are connected respectively to the three pins of cranks 24 by connecting rods 29.

Arranged between the central one of cranks 22 and the end cranks of the same set and on the opposite side of the axis of the crank shaft 21 from the pins to which rods 27 are connected, are pins 30 to which are connected by means of rods or links 31, reciprocating counterweights 32.

The counterweights are arranged for reciprocatory movement within cylindrical bearings 33 that are secured in the lower portion of crankcase 19.

In like manner a second pair of counter balancing weights 34 operating in the bearings 35 are connected to the cranks 23 of unit B and a third pair of counterbalancing weights 36 operating within bearings 37 are similarly connected to the cranks 20 of unit C.

During the operation of my improved engine, it will be understood that the pumping cylinders in the three units function to pump gaseous fuel charges into the combustion chambers of said three units, which fuel charges pass through the ducts 16, 17 and 18 nd that the gaseous fuel charges are fired n the respective common clearance chambers 13, when compressed therein by the respective airs of pistons 26.

As the power impulses are transmitted to the crank shaft 21, the latter is rotated and, due to the connecting rods 31, the counterweights 32 will be reciprocated in their respective bearings 33.

Pistons 25 and 26 and the pistons ends of connecting rods 27 constitute the main reciprocating mass and the counterweights 32 and connecting rods 31 constitute and function as the counter reciprocating mass.

The reciprocatory mass crank pins 30 must necessarily be arranged 180 degrees from the pins of main cranks 22 in order to obtain movement of the counter reciprocating mass in opposite direction but in the same plane with the travel of the main reciprocating mass.

The weight of the reciprocatory mass must be an exact multiple of whatever the stroke of the counter-reciprocating mass member is less than the stroke of the main reciprocating mass in order that the inertia force developed in one plane, will be equal and uniform, so as to develop an equidisposed reciprocatory counter-reciprocating force balance without couple.

The crank shaft and the crank ends of the connecting rods that attach the pistons to their cranks as well as the crank end of the connecting rod that connects the counter-reciprocating members with their crank pin must be considered a unit of rotary mass in the same plane with the reciprocating mass of one complete unit and whatever the counter-reciprocating crank pin and connecting rod crank end lacks in counterbalancing the main reciprocating mass crank pin or pins counterbalance weight, will be formed on the crank shaft, so that the moments inches weight of the rotary mass concentrated above the axis of the two diametrically opposite crank pins will be equal, thus inherently producing perfect reciprocative rotary mass balance for single engine unit.

Obviously, the size, form and construction of the various parts of my improved engine may be varied and modified in certain details without departing from the spirit of the invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. In a two stroke cycle internal combustion engine, three units of three cylinders each, the nine cylinders of the three units being arranged in a row, with their axes parallel, each unit comprising a pumping cylinder and a pair of combustion cylinders, the head ends of the members of each pair of combustion chambers being connected by a common clearance chamber, a gaseous fuel transfer duct leading from the head end of each pumping chamber to one of the pair of combustion chambers in one of the other of the three units, a crank shaft having three sets of cranks to which the pistons in the three sets of cylinders are respectively connected, the pins of said crank being arranged 120° apart and a reciprocatory counterweight connected to each of the three sets of cranks.

2. In a two stroke cycle internal combustion engine, three units of the three cylinders each, the nine cylinders of the three units being arranged in a row, with their axes parallel, each unit comprising a pumping cylinder and a pair of combustion cylinders, the head ends of the members of each pair of combustion chambers being connected by a common clearance chamber, a gaseous fuel transfer duct leading from the head end of each pumping chamber to one of the pair of combustion chambers in one of the other of the three units, a crank shaft having three sets of cranks to which the pistons in the three sets of cylinders are respectively connected, the pins of said crank being arranged

120° apart, a reciprocatory counterweight connected to each of the three sets of cranks, and the point of connection between each reciprocatory counterweight and its respective crank being disposed on the opposite side of the axis of the crank shaft from the crank pin of the latter.

3. In a two stroke cycle internal combustion engine, three units of three cylinders each, the nine cylinders of the three units being arranged in a row, with their axes parallel, each unit comprising a pumping cylinder and a pair of combustion cylinders, the members of each pair of combustion cylinders being connected by a common clearance chamber, a gaseous fuel transfer duct leading from the head end of each pumping chamber to one of the pair of combustion chambers in one of the other of the three units, a crank shaft having three sets of cranks to which the pistons in the three sets of cylinders are respectively connected, the pins of said crank being arranged 120° apart, and means connected to the three sets of the crank shaft for establishing perfect reciprocative and rotary mass balance for the three engine units.

4. In a two stroke cycle internal combustion engine, three units of three cylinders each, the nine cylinders of the three units being arranged in a row with their axes parallel, each unit comprising a pumping cylinder and a pair of combustion cylinders, the head ends of the members of each pair of combustion chambers being connected by a common clearance chamber, a crank shaft having three sets of cranks, each set comprising three cranks, the corresponding and relative pins of the three sets of cranks being disposed 120° apart, pistons arranged for reciprocatory movement in all of the cylinders of the three sets, connections between said pistons and the respective pins of the three sets of cranks, three sets of reciprocatory counterweights connected respectively to said three cranks, the points of connection between the reciprocatory counterweights and the cranks being located diametrically opposite and on the opposite side of the axis of the crank shaft from the pins to which the connecting rods for the pistons are connected, and the row of cylinders and the counter-reciprocatory weights being disposed in the same plane and arranged for reciprocatory movement in opposite directions.

5. In a two stroke cycle internal combustion engine, three units of three cylinders each, the nine cylinders of the three units being arranged in a row with their axes parallel and in the same plane, each unit comprising a pumping cylinder and a pair of combustion cylinders, the latter being joined by a common combustion clearance chamber, a fifteen crank pin crank shaft, the fifteen crank pins being arranged in three sets of five crank pins each, the fifteen crank pins being centered on six axial lines, that parallel the axis of the crank shaft, the end five pins from either end constituting two sets of five and the center five crank pins constituting the third set of five crank pins, the first, third and fifth crank pins of either set from either end of each set of five crank pins having a common axis, the second and fourth crank pins of each set of five crank pins counting from either end of each set of five crank pins, having a common axis, the axis of the first, third and fifth crank pins of each set of five crank pins, being diametrically opposite the axis of the second and fourth crank pins of each set of five crank pins counting from either end of each set of five crank pins, the common axis of the three crank pins centered on one axial line of each set of the three sets of five crank pins, being spaced in relation 120° apart, and the common axis of the two crank pins centered on one axial line of each set of the three sets of five crank pins being spaced in relation 120° apart.

In testimony whereof I affix my signature.

EVERETT R. BURTNETT.