April 7, 1925. 1,533,004

M. HENRY

MULTIPLE CYLINDER COMBUSTION MOTOR

Filed Feb. 12, 1924 4 Sheets-Sheet 1

Fig. 1.

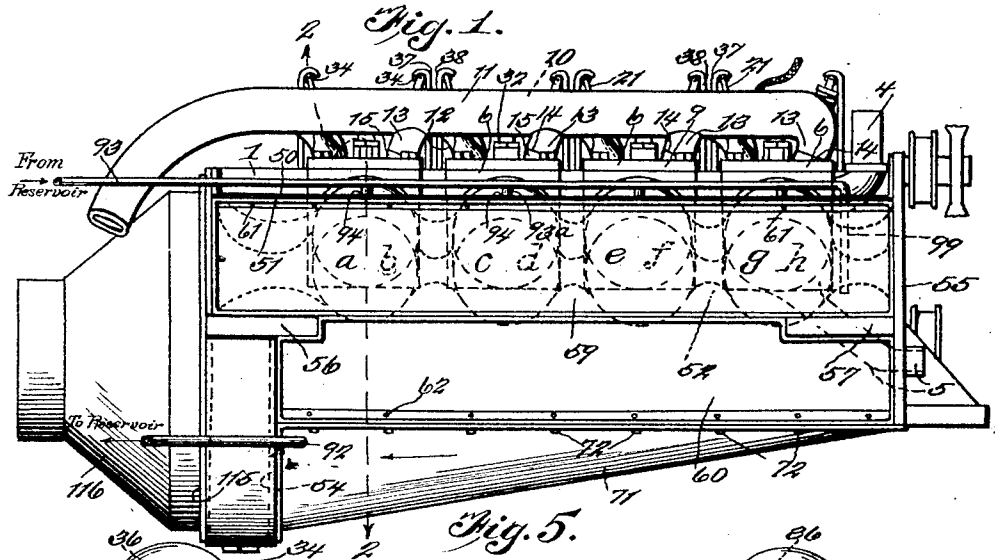
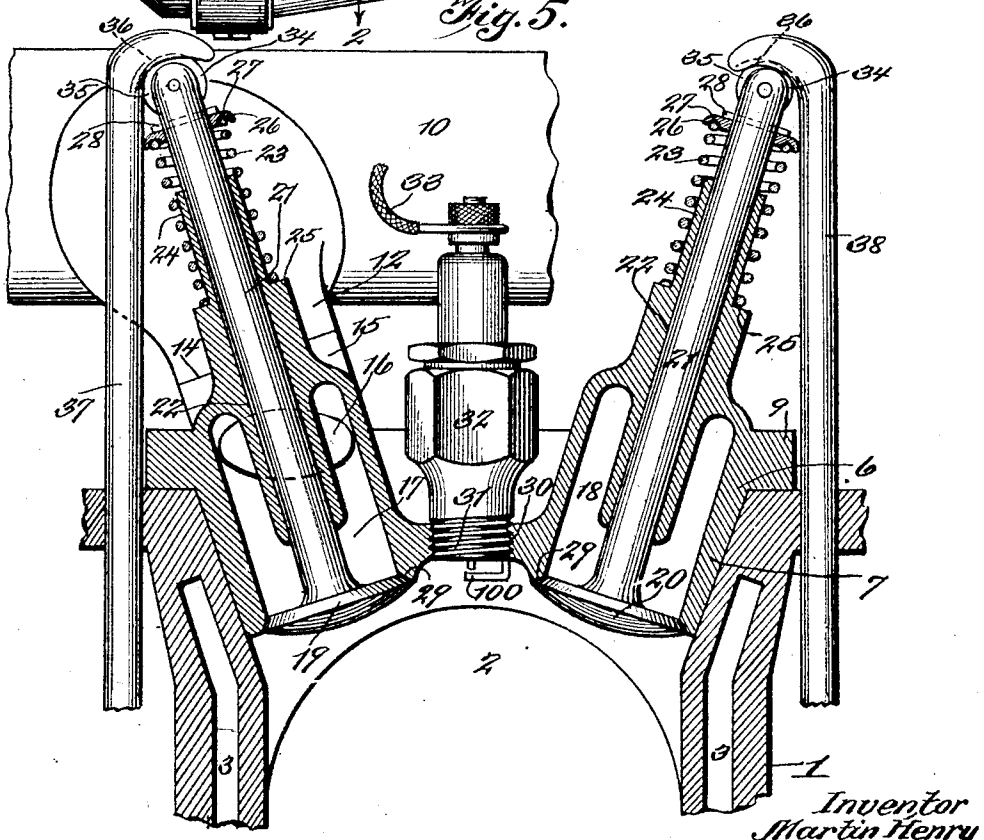


Fig. 5.



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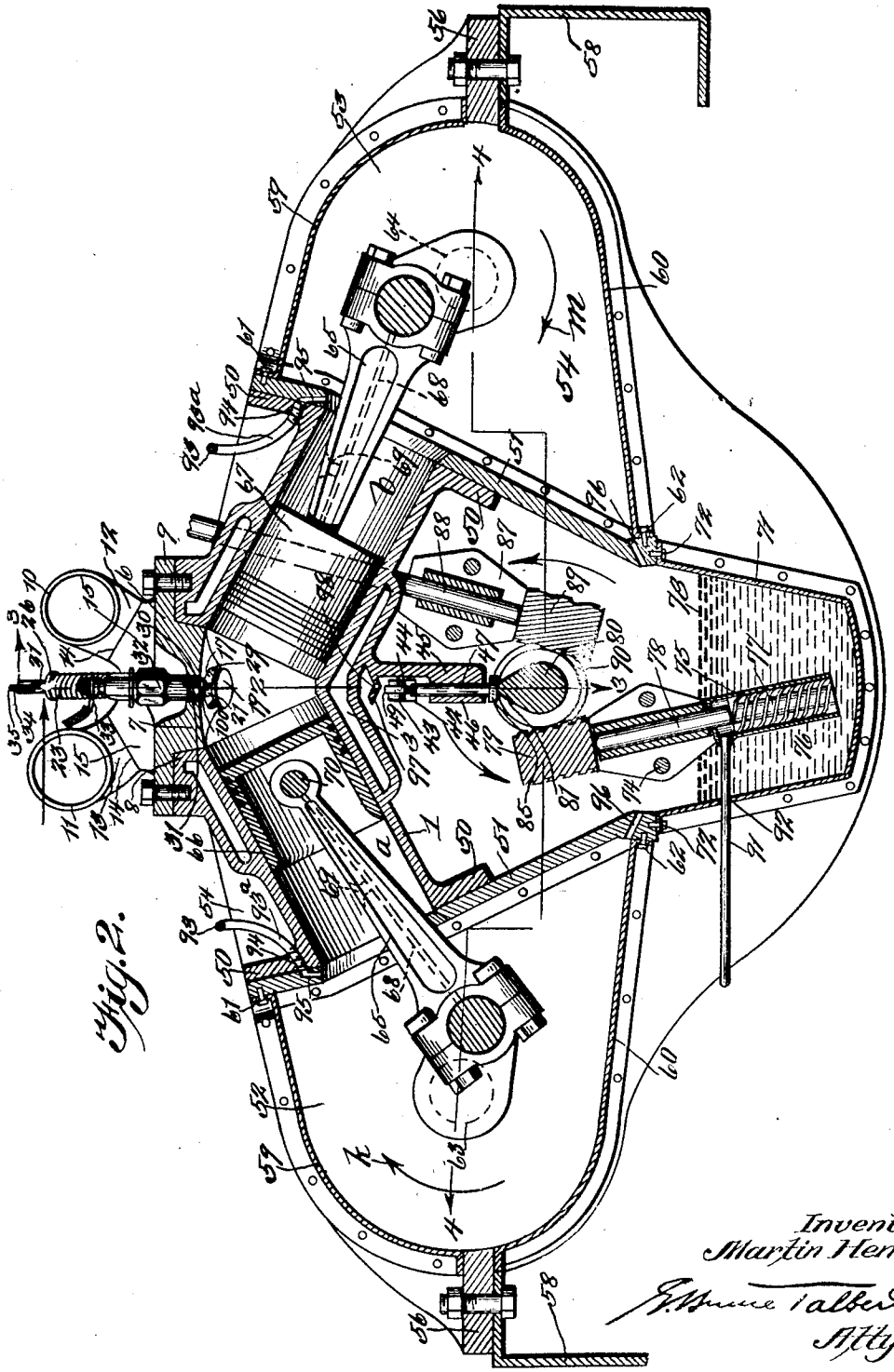


Fig. 2.

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Fig. 5.

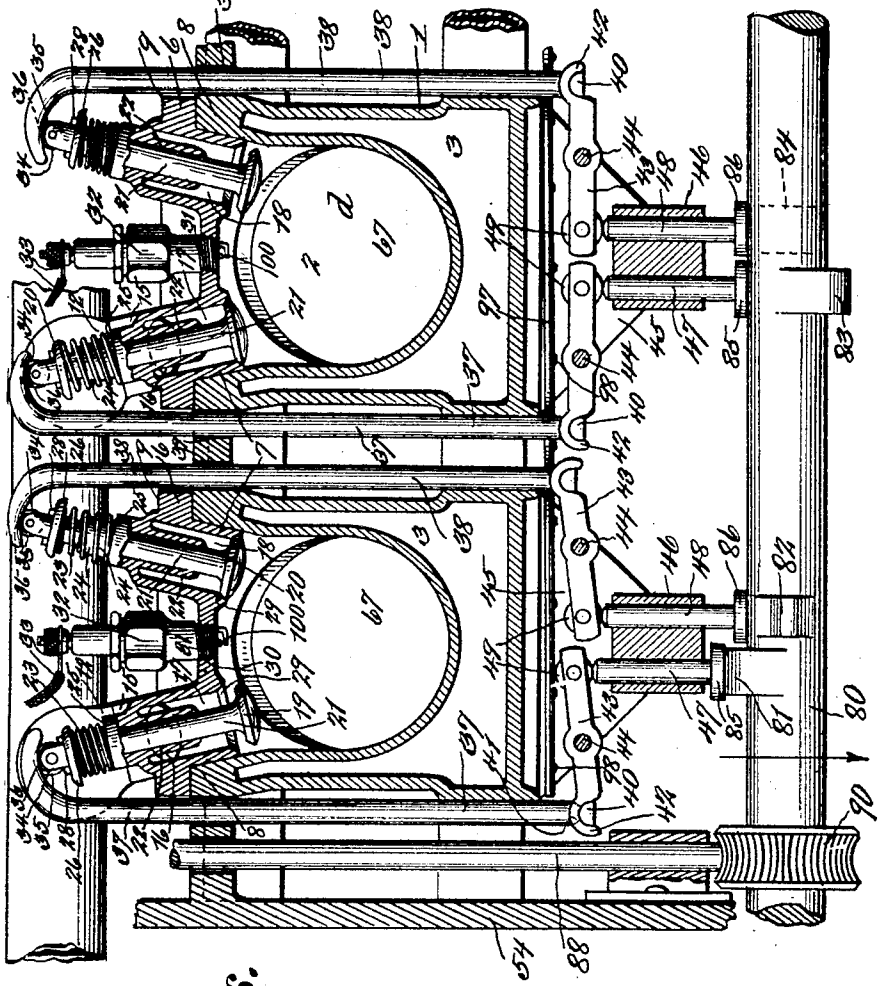


Fig. 6.



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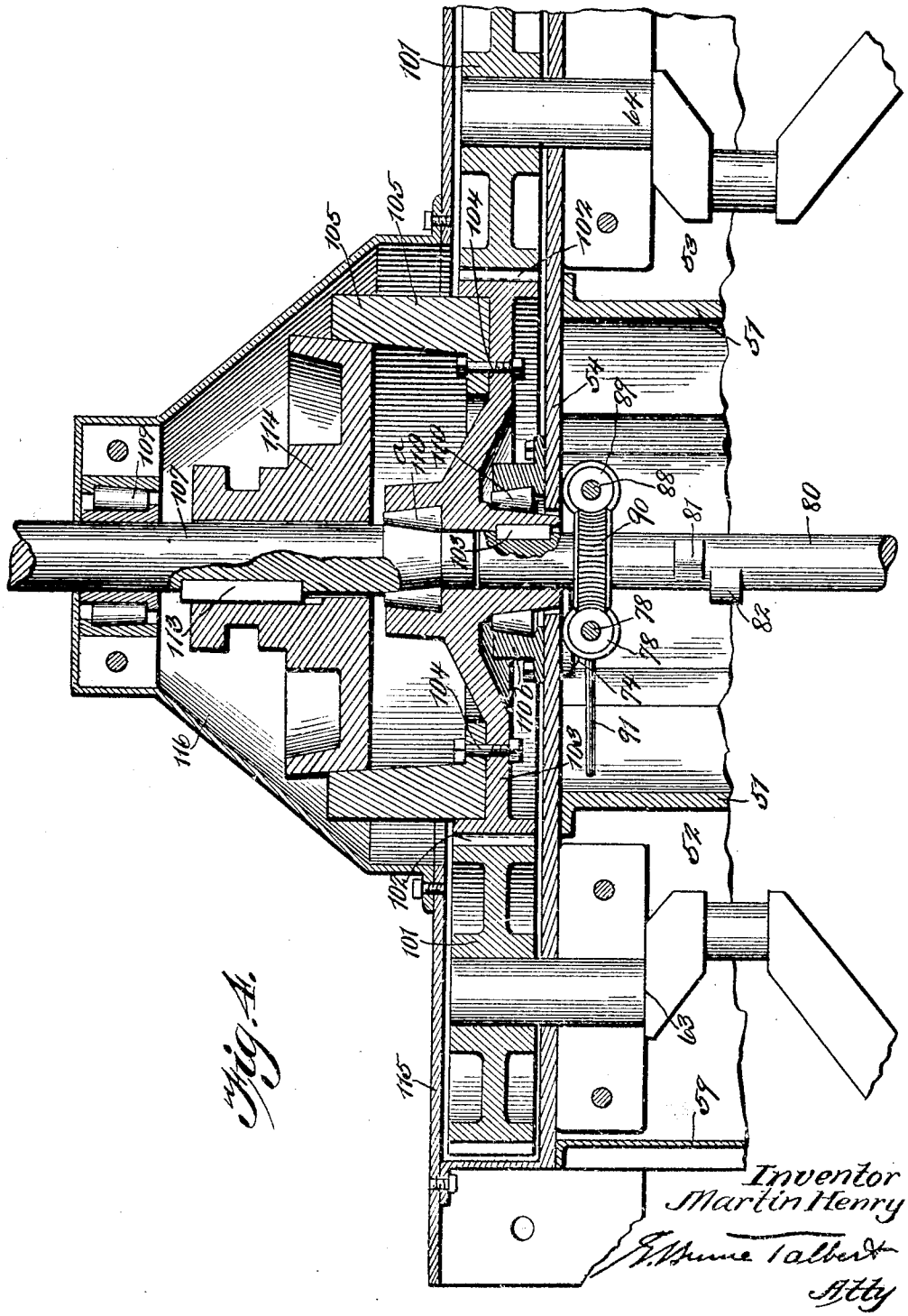


Fig. 4.

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UNITED STATES PATENT OFFICE.

MARTIN HENRY, OF VERDEN, OKLAHOMA.

MULTIPLE-CYLINDER COMBUSTION MOTOR.

Application filed February 12, 1924. Serial No. 692,343.

To all whom it may concern:

Be it known that I, MARTIN HENRY, a citizen of the United States of America, residing at Verden, in the county of Grady and State of Oklahoma, have invented new and useful Improvements in Multiple-Cylinder Combustion Motors, of which the following is a specification.

It is a purpose of the present invention to provide, in a multiple cylinder combustion motor of the compression type, a construction wherein the cylinders are in series or sets, the pistons of the cylinders of each series or set operating identically, with the cylinders diverging in V-shaped arrangement, including a single combustion chamber between the cylinders of each set, whereby the pistons may travel downward through the cylinders in diverging directions.

In the majority of combustion motors, it is very difficult and tedious to have access to the crank case and the cam shaft for repairs. With most motors it is necessary to crawl under the car to have access to the interior of the crank case or to remove the entire engine block. However, in connection with the present invention, it is another purpose to provide a motor wherein the interior of the crank cases are accessible at the sides, the crank case plates being removable which permits ready access to the crank shafts as well as the interiors of the cylinders, allowing the pistons to be easily removed without disturbing the positions of the intake and exhaust valves and the cylinder head which supports the valves.

Still another purpose is to provide an improved crank case construction wherein, after removing the outer crank case plates, the inner crank case plates may be removed to permit of access not only to the cam shaft and its attendant parts but also to the pump (which returns the oil to the reservoir) and to the means operated by the cam shaft for transmitting motion to the timing mechanism in the ignition system.

A further purpose is to provide, in this type of motor, a single combustion chamber between the adjacent ends of the diverging cylinders of each series or set so that, upon the ignition of a charge, the pistons (which are operable in the cylinders) will move in diverging directions and impart revoluble movement to the crank shafts which, in turn, are geared to the cam shaft which, in turn, cooperates with and actuates the intake and exhaust valves.

A still further purpose is to provide a motor of this type including an oil pan removably connected to the interior crank case plates so that the removal of this pan will permit of access to the cam shaft, to the oil pump and to the intake and exhaust valve operating means as well as the means for operating the timing devices of the ignition system, without the removal of the crank cases or any parts thereof. However, in gaining access to these parts by the removal of the oil pan or pot, it is necessary to crawl under the motor.

Also, it is the aim to provide a motor of this character which is very compact, relatively simple in construction and easily assembled and including improved means for mounting the motor more rigidly relative to the frame or chassis.

It is to be understood that the particulars herein given are in no way limitative and that, while still keeping within the scope of the invention, any desired modifications of detail and desired proportions may be made in the apparatus according to the circumstances.

The invention comprises further features and combinations of parts to be hereinafter set forth, shown in the drawings and claimed.

In the drawings:

Figure 1 is a view in side elevation of the improved motor constructed in accordance with the invention.

Figure 2 is a sectional view on line 2—2 of Figure 1, more adjacent the rear head of the engine block than the forward head, thereby showing the arrangement of the diverging cylinders, the crank cases, the oil pump and the means for actuating the intake and exhaust valves.

Figure 3 is a sectional view on line 3—3 of Figure 2, more clearly showing the intake and exhaust valves and the means for operating the same.

Figure 4 is a sectional view on line 4—4 of Figure 2, not only showing the cam shaft but also showing portions of the crank shafts and illustrating the operative gear connections between the crank shafts and the cam shaft.

Figure 5 is an enlarged detail sectional view of the intake and exhaust valves and also showing the spark plug mounting.

Figure 6 is an enlarged detail view in perspective of portions of the means for operating the intake and exhaust valves.

Referring to the drawings, 1 designates the motor block which, in the present instance, is cast in one piece and provided with eight cylinders *a* and *b*, *c* and *d*, *e* and *f* and *g* and *h*, although more or less may be employed. The cylinders *a* and *b* constitute one set or series, *c* and *d* another, *e* and *f* a third set or series and *g* and *h* a fourth set or series. The cylinders of each set or series are divergent, approximating the V-type of engine, there being a combustion chamber 2 between the adjacent ends of the cylinders of each set.

The adjacent portions of the cylinders are enlarged and have a water jacket 3, there being an extension 4 at the forward end of the motor for connection to the radiator (not shown) and a pipe or conduit 5 at the lower forward end of the motor for connection to the lower part of the radiator, so as to insure a circulation of cooling fluid, thereby acting to reduce the heat in the cylinder walls. The combustion chamber 2 is provided where the adjacent ends of the cylinders converge upwardly, as shown in Figure 2 of the drawings.

Cylinder heads 6 are provided for closing the respective combustion chambers 2, each cylinder head acting to close the adjacent ends of the cylinders of each set. The exteriors of the cylinders where they are enlarged are rectangular in cross section, as disclosed clearly in Figure 3. The cylinder heads 6 have integral enlarged extensions or bosses 7 which are tapered and fit between the extension walls 8 (on which the flange portions 9 of the cylinder heads rest) of the enlarged end portions of the cylinders. The cylinder heads are bolted in position.

10 and 11 are intake and exhaust manifolds, the lateral downward extensions 12 and 13 of which connect at 14 to the extensions 15 of the cylinder heads. The extensions of the intake and exhaust manifolds and the extensions 15 have passages, those designated by the character 16 of the extensions 15 communicating with the valve passages 17 and 18 of the cylinder heads. Intake and exhaust valves 19 and 20 are provided, the stems 21 of which are mounted in guides 22 of the cylinder heads.

The stems 21 diverge upwardly and are under tension of the coil springs 23 which surround the reduced extensions 24 of the bosses of the cylinder heads which have the guides 22. The springs 23 are interposed between the shoulders 25 and the collars 26 which have depressed annular seats 27 for the ends of the springs, there being suitable transverse pins 28 against which the collars abut. The springs bear against the collars and hold the valves 19 and 20 in engagement with their seats 29.

Each cylinder head between the bosses through which the valve stems 21 are guided is countersunk and has a threaded opening 30 for the threaded end 31 of a conventional form of spark plug 32 which, in turn, includes suitable connections, as at 33, with the timing mechanism (not shown) of the ignition system.

The upper terminals of the valve stems are forked for the reception of rollers 34 which have annular ribs or flanges 35 which engage with the grooves 36 of the lateral ends of the valve actuators 37 and 38. These actuators are mounted in guides 39 between the rectangular portions of the cylinders, as shown clearly in Figure 3 of the drawings, and the lower terminals of the actuators 37 and 38 have semispherical members 40.

These members 40 where they connect with the lower ends of the actuators merge into conical necks 41 to permit the forks 42 of the rocking levers 43 to engage with the members 40. The levers 43 are fulcrumed at 44 on the extension webs 45 of the cylinders. The extension webs have lateral bosses 46 in which the pins 47 and 48 are guided. The levers 43 are arranged in pairs, one pair for each cylinder, and the adjacent ends of the levers of each pair are forked for the reception and mounting of the rollers 49 which ride upon the upper ends of the pins 47 and 48.

It will be noted that when the pin 47 is moved upwardly through its guide, the lever is rocked, thereby causing a downward movement of the actuator 37, and due to the lateral terminal of the upper end of the actuator bearing upon the stem of the intake valve 19, the valve 19 opens and permits the intake of a charge to the combustion chamber 2. The exhaust valve operates in a similar manner, that is, when the pin 48 is moved upwardly through its guide, operating the actuator 38 through the medium of the lever which is connected to its lower end.

The divergent terminals of the motor block, that is, where the cylinders are formed, are provided with flanges 50 to which the inner crank case plates 51 are bolted. In cross sectional area of the motor, it will be noted that these plates 51 converge downwardly and constitute the inner walls of the crank case 52 and 53. Connected to the ends of the motor block are the motor block heads 54 and 55, the lateral terminals of which have lugs 56 and 57. These lugs extend toward each other and are secured to the channel bars 58 of the chassis, as shown in Figure 2. Crank case

plates 59 and 60 are not only bolted to the motor block heads 54 and 55 but are also bolted at 61 and 62 to the inner crank case plates 51. These plates also engage with the lugs 56 and 57, that is, where the plates meet at points adjacent the opposite ends of the motor, as shown in Figure 1 of the drawings.

Obviously, either one or both of these plates 59 and 60 may be removed to permit of access to the crank shafts 63 and 64 which are mounted in suitable bearings of the motor block heads. The crank shafts rotate in the direction of the arrows *k* and *m* and the respective cranks of the shafts 63 and 64 are connected by the connecting rods 65 with the pistons 66 and 67 which are operable in the cylinders. As shown in Figgure 2, the cylinders *a* and *b* have pistons 66 and 67. The connecting rods 65 have ducts or channels 68 for lubricating purposes, there being openings 69 to permit oil or lubricant to reach the ducts or channels 68. Obviously, the backward and forward movements of the connecting rods will act to agitate the oil or lubricant and feed it toward the crank shaft and toward the wrist pins 70 of the pistons to insure lubricating these parts.

An oil pan or casing 71 is bolted at 72 to the lower edges of the inner crank case plates 51 and is adapted to receive oil to a level as indicated at 73, and secured, as at 74, to the inner face of the motor block head 54 is an oil pump 75 consisting of a casing 76 and a feed screw 77, the latter being mounted in the former and having a shaft 78 on the upper end of which a worm 79 is mounted.

Mounted in bearings of the motor block heads 54 and 55 is a cam shaft 80 which is provided with cams 81 and 82, 83 and 84. There are two cams for each set of cylinders, the cam 81 cooperating with the pin 47 to cause an intake of a charge into the combustion chamber while the cam 82 cooperates with and raises the pin 48 to cause an exhaust of the utilized or burnt gases; in fact, the cams cooperate with disks 85 and 86 at the lower ends of the pins 47 and 48. On each revolution of the cam shaft, the cams 81 actuate the pins 47.

Mounted in a bearing of a plate 87 which is secured to the motor block head 54 is a shaft 88, the upper end of which is adapted to operatively connect with the timer (not shown) of the ignition system (not shown) whereas the lower end of the shaft carries a worm 89. The worm 89 is opposed to the worm 79 and carried by the cam shaft at one end thereof is a worm wheel 90 which is interposed between the worms 79 and 89 and mesh therewith for the purpose of imparting motion to the shafts 78 and 88. The revoluble movement of the shaft 78 causes movement of the feed screw of the pump for the purpose of lifting the oil from the oil pan or pot 71 and feeding it through the pipe 91.

The pipe 91 passes through the wall of the oil pan 71, as at 92, and connects with a reservoir (not shown). This reservoir, however, has pipes 93 provided with branches 93ª which are connected to the flanges 50 of the motor block, as shown at 94. In fact, the branches 93ª thread through the flanges 50 and communicate with the ducts 95 formed through the inner crank case plates 51. The ducts 95 are so located as to convey oil on the connecting rods 65 and, due to the provision of the openings 69, the oil enters the ducts 68 and is conveyed to the bearings of the connecting rods with the crank shafts and also to the pins 70 of the pistons. The oil which may drop from the connecting rods is received in the crank cases and is conveyed back to the oil pan or pot by way of the ducts 96 (Figure 2) which are formed through the lower portions of the inner crank case plates 51.

Formed integral with the depending webs 45 is a lateral trough 97 which extends from the forward portion of the motor block to the rear portion and is inclined slightly downward toward the rear. The bottom of the trough is V-shaped and has a plurality of openings or apertures 98 and, due to the extreme bottom of the trough being aligned over the cam shaft, the openings convey oil to the cam shaft, there being a pipe 99 (Figure 1) merging from one of the pipes 93 and disposed to convey oil to the trough, flowing from the forward end of the motor to the rear end, and during its passage seeping through the several apertures in order to reach the cam shaft. The lubricant not only feeds to the cam shaft but also drips upon the levers 43 and upon the pins 47 and 48 and then upon the cam shaft due to the trough being above the levers 43.

Revoluble movement of the shaft 88 imparts movement to the timer (not shown) of the ignition system (not shown) for the purpose of creating a spark at the spark plug terminals 100, as shown in Figure 5.

Referring to Figure 4 of the drawings, it will be noted that the motor block head 54 has bearings for the rear ends of the crank shafts, which rear ends of the shafts project beyond the motor block head 54 and carry gears 101 which mesh at 102 with a spur gear 103 which is bolted at 104 to a female clutch member 105. The spur gear 103 has its hub keyed at 103ª on the rear end of the cam shaft, so that the spur gear will rotate therewith. The hub on one side of the gear 103 is mounted in roller bearings 110 of conventional construction. The hub on the other side of the gear has roller bearings 110ª of well known construction in which the end of a drive shaft 107 is

mounted. These roller bearings permit of easy rotation of the cam shaft and the drive shaft. The casing 110[b] for the roller bearings 110 is fixed to the motor block head 54. The drive shaft 107 and the cam shaft are axially aligned and the former is driven by the spur gear when in clutch. The drive shaft is mounted in additional roller bearings 109 and due to the crank shafts 63 and 64 being geared to the spur gears 103, the drive shaft 107 receives motion. This drive shaft 107 extends rearwardly and connects in the usual manner, such as a conventional form of differential (not shown), with the rear axle of the automobile, and keyed to the forward portion of the drive shaft 107 at 113 is a male clutch member 114. This male clutch member is designed to be operated by any suitable well known means (not shown) for shifting it into and out of engagement with the female clutch member 105, so as to connect and disconnect the shaft 107 to and from the female clutch member 105 which receives motion from the crank shafts through the medium of the gears 101 and 103.

A cover plate 115 is bolted to the motor block head 54 for the purpose of covering the gears 101 and secured to the plate 115 is a suitable housing or casing 116 for enclosing the male and female clutch members as well as the gear 103. However, this housing or casing 116 may have a suitable opening (not shown) whereby conventional connections may be made with the male clutch member for operating the same.

In the operation, and assuming the pistons 66 of cylinders *a* and *b* have about started on their downward strokes for an intake, with the cam shaft in a position whereby the cams 81 are disposed for raising the pins 47 and opening the intake valve 19, the charge enters the combustion chamber 2. After the pistons have completed their suction strokes, the combustion chamber having been filled with the charge, the cam 81 has moved from under the pin 47, that is, the pin for operating the intake valve 19 of cylinders *a* and *b*, and the pistons return on their compression stroke, compressing the charge in the combustion chamber. Immediately following the compression stroke of the pistons of cylinders *a* and *b*, the charge is fired, again moving the pistons away from each other in diverging directions and thereby imparting motion to the crank shafts 63 and 64. Upon the return strokes of the pistons, that is, after completing their firing strokes, they act to scavenge the cylinders and thereby cause an exhaust of the utilized or burnt gases. About the time the pistons proceed toward each other on their scavenger strokes, the cam 82 engages with and operates the pin 48 which causes a pulling movement on the actuator through the medium of an oscillatory lever, thereby depressing the stem of the exhaust valve 20 and permitting the escape of the utilized or burnt gases. Following the scavenger strokes of the pistons of cylinders *a* and *b*, the cam 81 is again in position to actuate the pin 47, thereby tilting the lever 43 and imparting a pulling action upon the actuator 37, again opening the intake valve 19 which results in the intake of a fresh charge.

As previously stated, the cylinders are designated *a* and *b*, *c* and *d*, *e* and *f* and *g* and *h*. The cylinders *a* and *b* are a set of two, so are the other cylinders. Therefore, the table of operations of the several cylinders is as follows:

Cylinders *a* and *b*—intake, compression, firing, exhaust.

Cylinders *c* and *d*—exhaust, intake, compression, firing.

Cylinders *e* and *f*—intake, compression, firing, exhaust.

Cylinders *g* and *h*—exhaust, intake, compression, firing.

It will be noted that the gearing between the crank shafts and the cam shaft is such that on every two complete revolutions of the crank shafts, the cam shaft rotates one revolution, in which case the cam 81 operates the pin 47 for opening the intake valve 19 at the completion of every fourth half revolution of the crank shafts to permit of an intake into the combustion chamber between the pistons of the cylinders *a* and *b*.

It is obvious that by removing either one of the crank case plates 59 or 60, access may be had to the crank shafts, and by removing the oil pan 71 ready access may be had to the pump and to the cam shaft as well as to the various pins 47 and 48 and the actuators. It is possible to remove the crank case plates 59 and 60 and then detach the inner crank case plates 51 which will permit of access to the cylinders of the motor block and to the timing worm 89, the actuators and the pins 47, the cam shaft and the pump, without detaching the oil pan or pot. Repairs may be made in this way to these various parts and without detaching the motor block heads, the motor block remaining intact and in position, and without removing the cylinder heads. The cylinder heads may be detached without disturbing the crank cases to permit access to the valves. Any one of the cylinder heads may be detached without affecting the others and vice versa.

The invention having been set forth, what is claimed is:

1. A multiple cylinder combustion motor including a motor block in one piece with a plurality of sets of cylinders, the cylinders of each set diverging laterally and downwardly with a combustion chamber between

the adjacent ends of the cylinders of each set, crank cases at the laterally divergent ends of the cylinders, crank shafts in said cases, pistons operable in the cylinders and operatively connected with the crank shafts, intake and exhaust valves for the combustion chambers, and intake and exhaust valve operating means between the crank cases and operatively connecting with the crank shafts for opening and closing the intake and exhaust valves at every two revolutions of the crank shafts, the crank cases consisting of upper and lower removable crank case plates, the removal of which permits access to the crank shafts and the connecting rods, permitting the pistons to be removed without disturbing the motor block and the valve operating means.

2. A multiple cylinder combustion motor including a motor block provided with a plurality of sets of cylinders, the cylinders of each set diverging laterally and downwardly with a combustion chamber between the adjacent ends of the cylinders of each set, intake and exhaust valves for said combustion chambers, means below the motor block and operatively connecting with the intake and exhaust valves for operating the same, a housing below and connected to the motor block for housing said means, crank cases carried by the opposite sides of the housing and having crank shafts therein operatively connecting with the intake and exhaust valve operating means for operating said valves at every two revolutions of the crank shafts, and pistons in the cylinders and operatively connecting with the crank shafts, the crank cases consisting of upper and lower removable crank case plates, the removal of which permits access to the crank shafts and the connecting rods, permitting the pistons to be removed without disturbing the motor block and the valve operating means.

3. A multiple cylinder combustion motor including a motor block provided with a plurality of sets of cylinders, the cylinders of each set diverging laterally and downwardly with a combustion chamber between the adjacent ends of the cylinders of each set, intake and exhaust valves for said combustion chambers, means below the motor block and operatively connecting with the intake and exhaust valves for operating the same, a housing below and connected to the motor block for housing said means, crank cases carried by the opposite sides of the housing and having crank shafts therein operatively connecting with the intake and exhaust valve operating means for operating said valves at every two revolutions of the crank shafts, and pistons in the cylinders and operatively connecting with the crank shafts, the crank cases consisting of upper and lower removable crank case plates, the removal of which permits access to the crank shafts and the connecting rods, permitting the pistons to be removed without disturbing the motor block and the valve operating means, the housing for the intake and exhaust valve operating means including an oil pan at the bottom, the removal of which permits of access to the valve operating means.

4. In a multiple cylinder combustion motor, a motor block including divergent cylinders in sets with combustion chambers between the adjacent ends of the cylinders, pistons operable in the cylinders, remote lateral crank cases with crank shafts therein operatively connected with the pistons, a housing below the motor block and in between the crank cases, intake and exhaust valves for the combustion chambers, a cam shaft in said housing and operatively connected with the crank shafts, and means operatively connecting the intake and exhaust valves and the cam shaft for operating the former.

5. A multiple cylinder combustion motor including a motor block provided with a plurality of sets of cylinders, the cylinders of each set diverging laterally and downwardly with a combustion chamber between the adjacent ends of the cylinders of each set, intake and exhaust valves for said combustion chambers, means below the motor block and operatively connecting with the intake and exhaust valves for operating the same, a housing below and connected to the motor block for housing said means, crank cases carried by the opposite sides of the housing and having crank shafts therein operatively connecting with the intake and exhaust valve operating means for operating said valves at every two revolutions of the crank shafts, pistons in the cylinders and operatively connecting with the crank shafts, the crank cases consisting of upper and lower removable crank case plates, the removal of which permits access to the crank shafts and the connecting rods, permitting the pistons to be removed without disturbing the motor block and the valve operating means, the housing for the intake and exhaust valve operating means including an oil pan at the bottom, the removal of which permits of access to the valve operating means, a web depending from the motor block and located within the housing and carrying the operative connections of the means for actuating the intake and exhaust valves, and a trough or channel carried by the web and adapted to receive lubricant and being located above the cam shaft and the elements of the valve operating means and provided with outlets for feeding lubricant to said elements and the cam shaft.

In testimony whereof he affixes his signature.

MARTIN HENRY.