Sept. 4, 1934. M. S. PETERSEN 1,972,409

TWO-CYCLE INTERNAL COMBUSTION ENGINE

Filed April 7, 1932 5 Sheets-Sheet 1

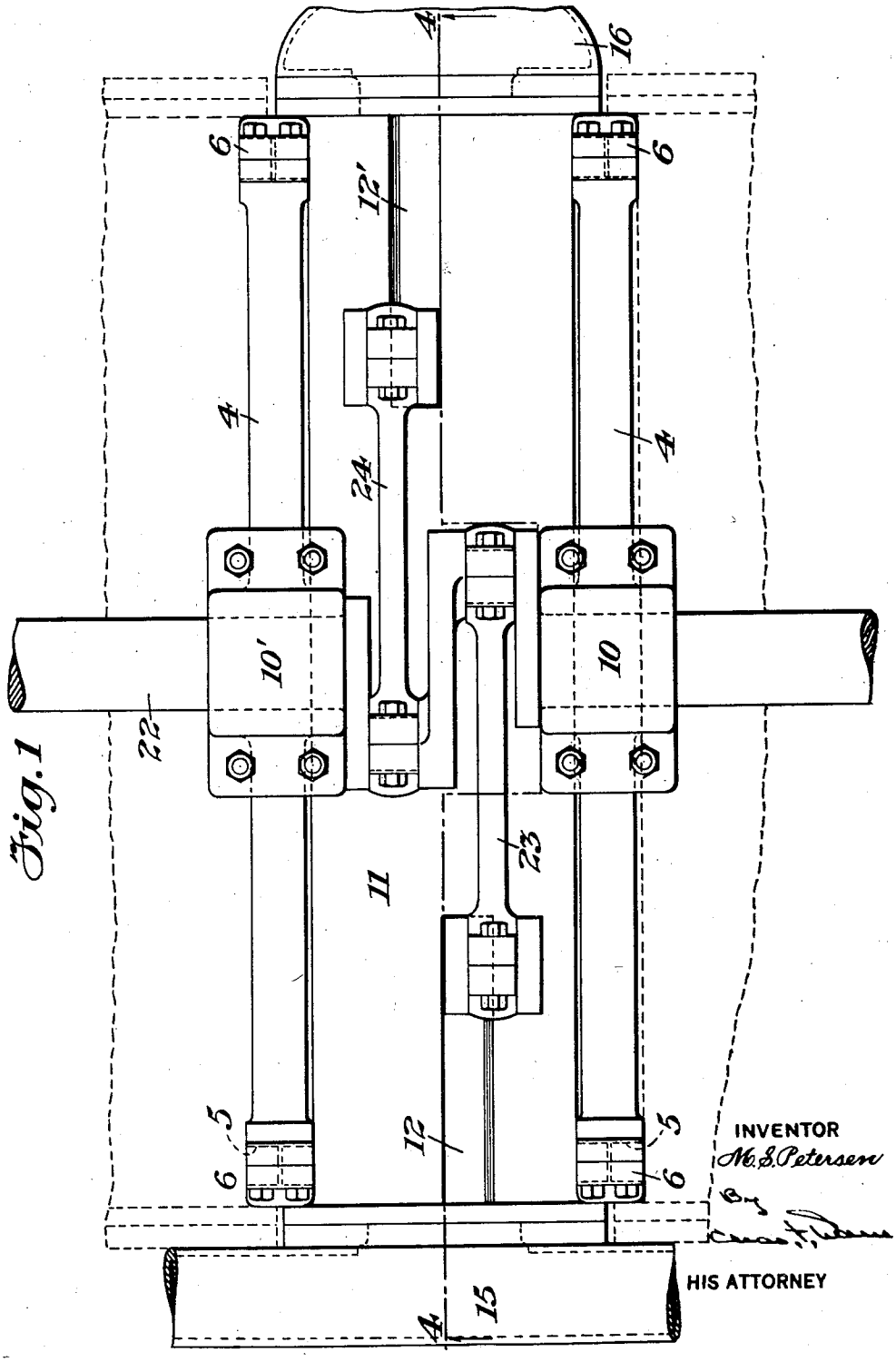


Fig. 1

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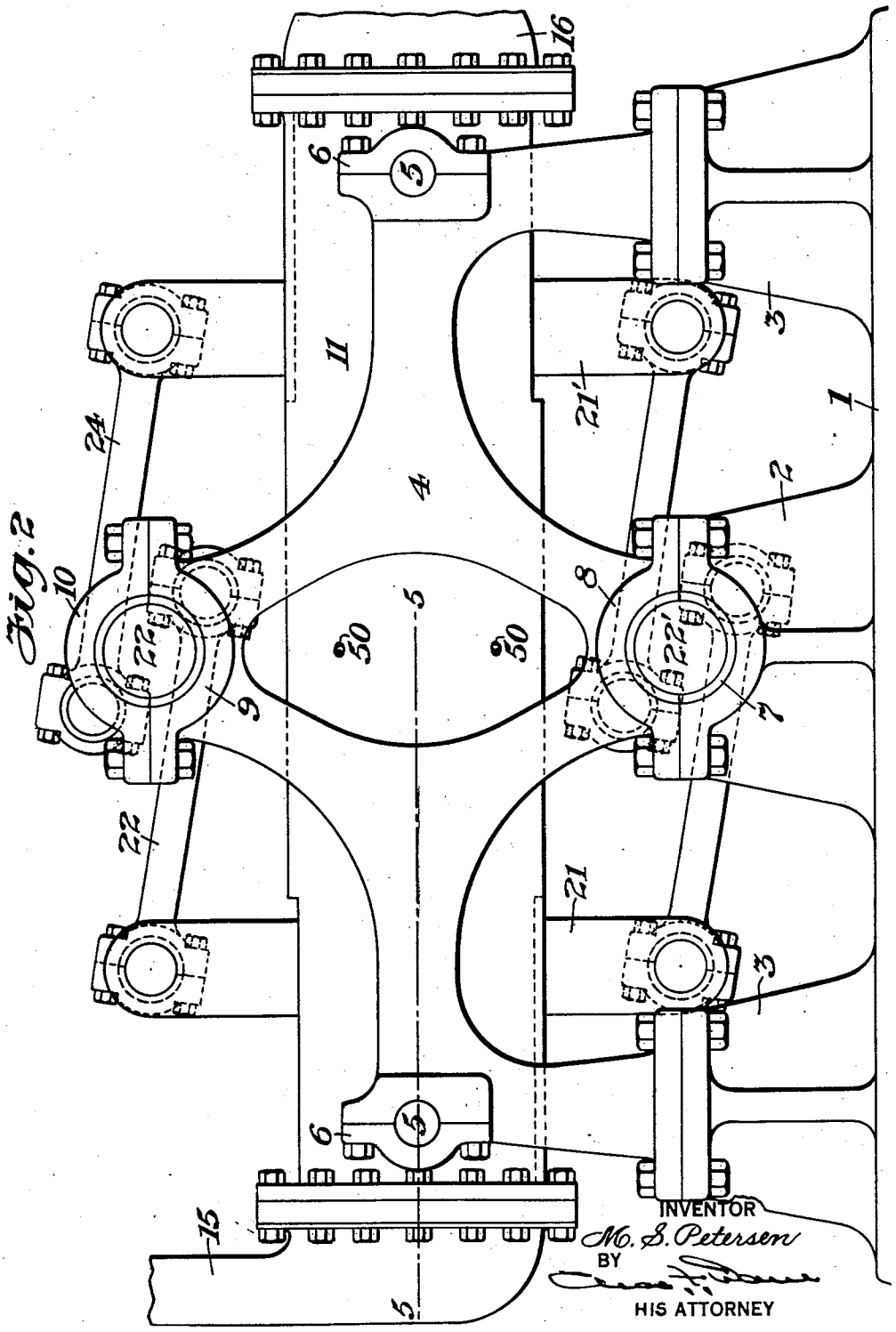


Fig. 2

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TWO-CYCLE INTERNAL COMBUSTION ENGINE

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Fig. 3

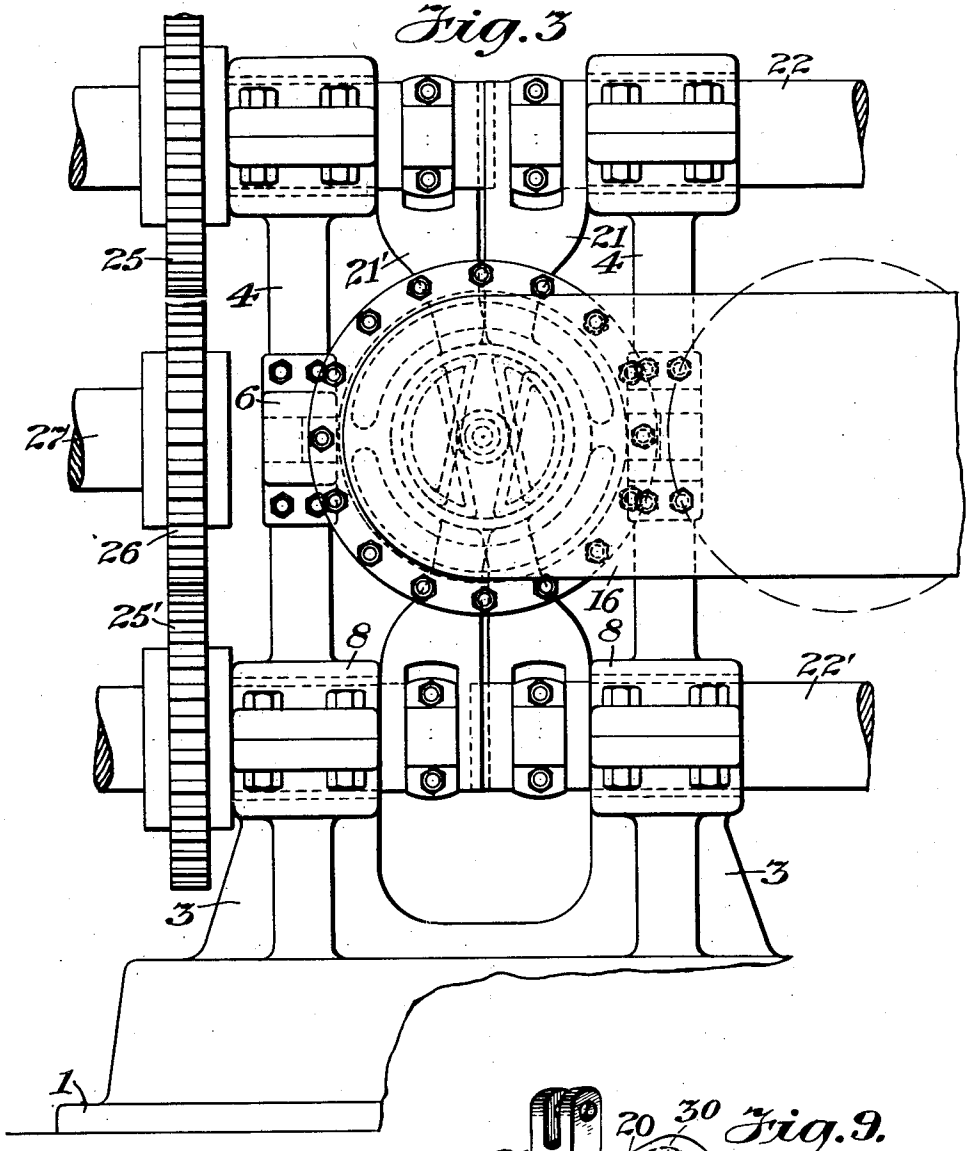


Fig. 9.

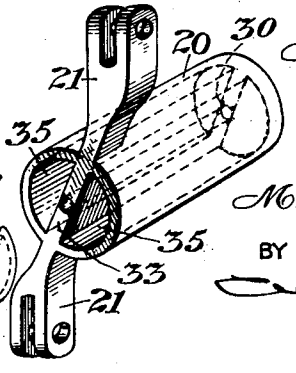
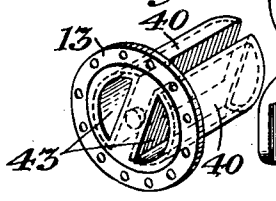


Fig. 10.



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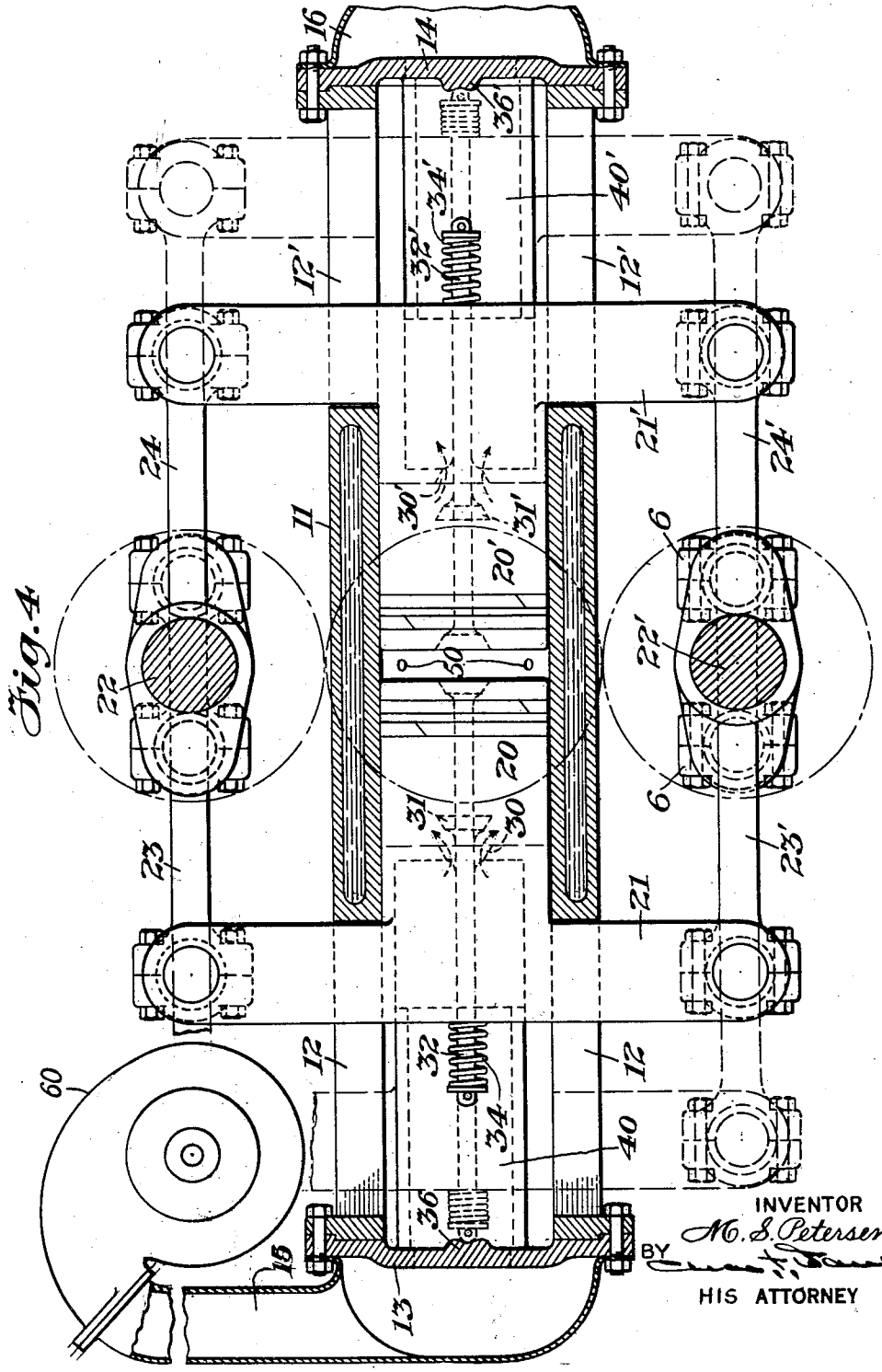


Fig. 4

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TWO-CYCLE INTERNAL COMBUSTION ENGINE

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Fig. 5

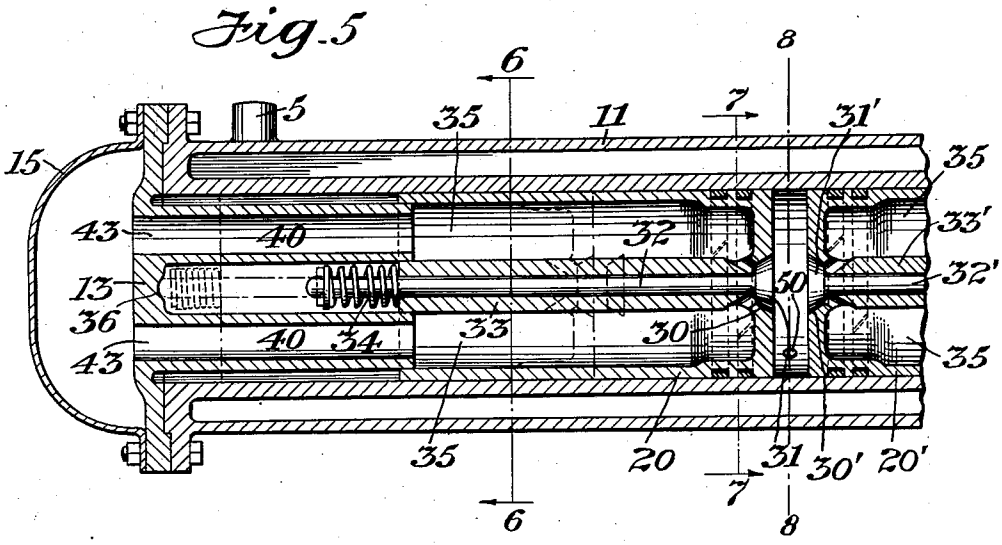


Fig. 6

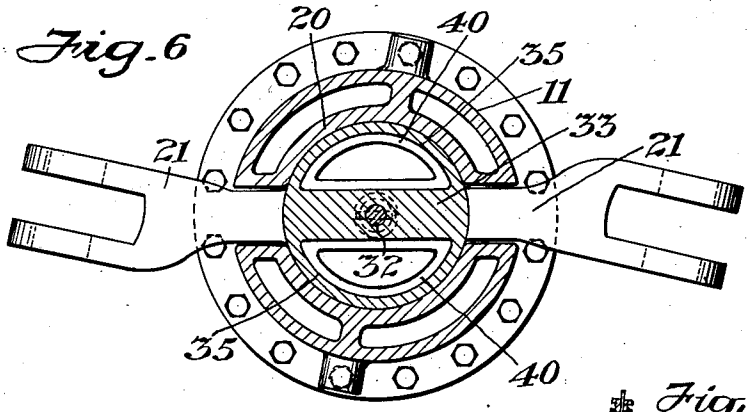


Fig. 8.

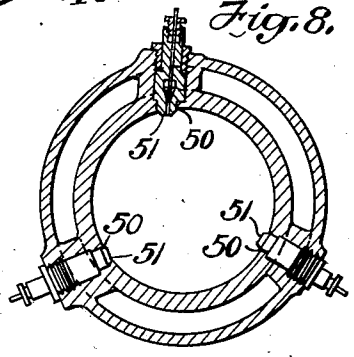
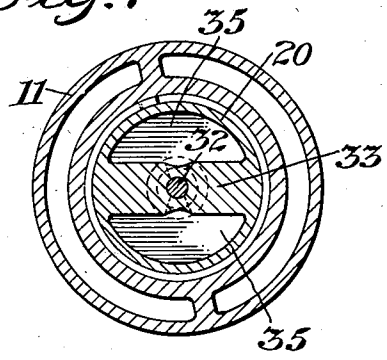


Fig. 7



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Patented Sept. 4, 1934 1,972,409

UNITED STATES PATENT OFFICE

1,972,409

TWO-CYCLE INTERNAL COMBUSTION ENGINE

Max S. Petersen, New York, N. Y.

Application April 7, 1932, Serial No. 603,706

4 Claims. (Cl. 123—51)

The invention relates to certain improvements in two cycle internal combustion motors having opposed pistons operating in a common cylinder, the pistons having valves in their heads to control the supply and exhaust to and from the explosion chamber between the pistons, conduit members connected to the respective heads of the cylinder and telescoping with the pistons to provide the inlet and exhaust of the engine, each piston being provided with a cross head extending through slots on opposite sides of the cylinder, the respective cross heads being connected to crank shafts mounted on opposite sides of the cylinder and connected by gearing to a common driven shaft.

The invention is illustrated in the accompanying drawings, in which:—

Fig. 1 is a plan view of an engine unit involving a single cylinder, the dotted lines indicating additional units.

Fig. 2 is a side elevation.

Fig. 3 is an end elevation.

Fig. 4 is a sectional elevation on line 4—4 of Fig. 1.

Fig. 5 is a section on line 5—5 of Fig. 2.

Fig. 6 is a section on line 6—6 of Fig. 5.

Fig. 7 is a section on line 7—7 of Fig. 5.

Fig. 8 is a section on line 8—8 of Fig. 5.

Fig. 9 is a perspective view of one of the pistons, and

Fig. 10 is a perspective view of one of the cylinder heads with its extensions adapted for telescoping connection with the piston.

Referring to the drawings, 1 indicates the bed plate of the engine provided with pedestals 3, 3 upon which are supported side frames 4, 4 between which the engine cylinder 11 is mounted, the mounting being conveniently effected by means of pins 5, 5 extending from the outer walls of the cylinder, which pins are secured to the side frames 4, 4 by means of caps 6, 6.

Intermediate pedestals 2, 2 serve as supports for the central portions of the side frames 4, 4 and are provided with bearings 7 having removable caps 8, in which bearings one of the engine shafts is journaled. The upper middle portions of the side frames are furnished with journal bearings 9 having caps 10, in which bearings a second engine shaft is journaled.

The cylinder 11 is suitably water jacketed and is provided near its ends with slots 12, 12 and 12', 12' on its upper and lower sides, as particularly illustrated in Figs. 1, 4 and 6. The ends of the cylinder are provided with heads 13 and 14, the former having associated therewith a manifold 15, which communicates with the supply of air or of explosive mixture, which is supplied under pressure to the manifold, by a blower 60 or the like, as indicated generally in Fig. 4. If the engine is of the type in which the air and the fuel are admixed before delivery to the cylinder, the mixture is delivered to the manifold, and, if the engine is of the Diesel or similar type, air under pressure is delivered to the manifold and admixed with the fuel in the explosion chamber. The cylinder head 14 is equipped with a hood or manifold 16, which communicates with the ultimate exhaust of the engine.

Slidably mounted in the cylinder 11 are opposed pistons 20 and 20', the heads of which face each other toward the middle of the cylinder and which heads, together with the mid section of the cylinder, constitute the combustion chamber, the explosion causing the pistons to move outwardly in opposite directions in the cylinder. The pistons 20 and 20' are provided at their outer ends with cross heads 21 and 21', respectively, which extend transversely of the cylinder through the slots 12, 12 and 12', 12', respectively, in which slots said cross heads may be guided. Each cross head is formed of radial arms which terminate in laterally deflected or inclined yokes, adapted for connection with a corresponding crank shaft. The radial arms serve to guide the pistons in straight line movements and avoid any twisting or torsional strains on the pistons during the reciprocations of the latter. As indicated, cross head 21 is connected to crank shaft 22 by pitman 23 and to crank shaft 22' by pitman 23' and, similarly, cross head 21' is connected to crank shaft 22 by pitman 24 and to crank shaft 22' by pitman 24'. The respective crank shafts 22 and 22' are mounted in transverse alignment with the mid section of the cylinder and are connected to a common driven shaft 27 by gearing 25, 25' and 26, as indicated in Fig. 3.

The supply of the air or the combustible mixture to and the exhaust of the burned gases from the combustion chamber is effected through valve controlled ports in the piston heads. As indicated, piston 20 is formed as a hollow casting having an axially transverse septum or partition 33 provided at its junction with the cylinder head with ducts leading to a central port 30 in the piston head, with which port cooperates a valve 31, of the poppet type, having an elongated stem 32 mounted in an axial bore in the partition 33, the end of the stem being provided with a helical spring 34, which normally seats the valve. The end of the valve stem 32 is adapted to engage an

abutment 36 disposed in the center of the cylinder head 13, which unseats the valve 31 just before the end of the power stroke of the piston 20 for the purpose of admitting the air or the explosive mixture to the explosion chamber. The piston 20' is similarly equipped with valve port 30' in its head with which cooperates valve 31' having a stem 32' operating in the bore of the cross partition 33' and equipped with retractile spring 34' normally seating the valve, the end of the stem being adapted to engage an abutment 36' on cylinder head 14 to unseat the valve 31' to effect the exhaust of the burned gases at the end of the power stoke. Each of the cylinder heads is suitably ported to permit the admission and exhaust of the fuel and the products of combustion, respectively.

As indicated, the cross partition in each piston divides the same into two ducts or semi-cylindrical passages, which communicate with the inlet port in one cylinder and the exhaust port in the other. As shown in Figs. 5, 6 and 7, these passages 35, 35 in the piston 20 are adapted to receive with a telescoping tight fit two hollow semi-cylindrical extensions 40 of the cylinder head 13, which are separated from each other by a space in which the cross partition 33 of the piston telescopes. These extensions 40 constitute ducts communicating with the interior of the hollow piston and serving to connect the latter with the supply of air or explosive mixture by way of inlet ports 43 in the cylinder head.

The piston 20' is provided with a similar arrangement of telescoping sleeve members 40' formed integrally with the cylinder head 14 and communicating with the exhaust through ports in said cylinder head.

The engine, as described, may be operated by premixed explosive charges which are admitted to the explosion chamber, compressed during the inward strokes of the pistons and fired at the proper time by a spark plug or equivalent ignition means; but the engine is especially adapted for operation on the Diesel principle, in which case the fuel is sprayed into the combustion chamber by suitable nozzles 51 secured in openings 50 in the cylinder wall, preferably in the arrangement shown in the patent to Junkers No. 1,127,772. If, however, the engine is to be operated by premixed explosive charges admitted to the combustion chamber as referred to, spark plugs of usual construction for effecting the firing of the charges may be substituted for the nozzles 51 in the said openings 50.

The operation of the engine, as described, is on the two cycle principle. As indicated in Fig. 4, the engine is shown with the parts in the relation they assume at the end of the suction stroke, with the two pistons at their nearest point of approach to the mid section of the cylinder and compressing the air or the explosive mixture between them. When the compressed charge is fired by any appropriate ignition means, not shown, both of the pistons are forced outwardly in opposite directions in the cylinder, thereby moving the respective cross heads 21' and 21 and translating movements thereof to the crank shafts 22 and 22' and ultimately to the driven shaft 27. Just before piston 20' reaches the end of its power stroke, the end of valve stem 32' engages abutment 36' and unseats exhaust valve 31' and permits the burned gases to escape through the exhaust ports in cylinder head 14 by way of ducts 40'. Shortly thereafter, and while the exhaust valve 31' is still maintained in its open or unseated position, the stem 32 of the inlet valve 31 engages abutment 36 on the cylinder head 13, thereby unseating the valve and permitting the air or the explosive mixture, as the case may be, to enter the passages 35 in the piston by way of the telescoping ducts 40 of the inlet conduit connected with the cylinder head 13 and pass into the combustion chamber through the open port 30 in the head of piston 20, and this entering air or mixture being under pressure will effectively scavenge the cylinder of burnt gases through the open exhaust port in cylinder head 14 by way of ducts 40'. Shortly after the pistons have begun the opposite or compression stroke, the inlet and exhaust valves 31 and 31' are closed by their springs and the explosive charge contained in the cylinder between the heads of the pistons is compressed, ready to be fired, when the pistons reach the end of their inward or compression strokes.

It will be noted that any suitable ignition means for the explosive mixture may be employed associated with any proper timing mechanism and, as these devices are matters of common practice and knowledge, they have not been illustrated.

Some of the special features of mechanical advantage and operative efficiency in the engine, as described, are as follows: The arrangement of the cross heads on the outer ends of the pistons and their connections with the crank shafts journaled opposite the mid section of the cylinder admits of a shorter cylinder and a more compact structure than has been possible in opposed piston engines as heretofore constructed, and effects a better balance of the moving parts resulting in reduced vibration and a more uniform torque applied to the crank shafts. The location of the inlet and exhaust valves in the piston heads and the simple means employed for operating the valves obviates the involved cam mechanism heretofore employed and also avoids the necessity of providing the side walls of the cylinder with operating valve ports, the only opening or openings in said side walls of the cylinder proper being to receive the spark plug, when the engine is used with the usual timed electric ignition system, or to receive the fuel spray nozzles when the engine is operated on the Diesel principle. The arrangement of the inlet and exhaust ducts formed in the two part sleeves telescoping with coordinate chambers formed in the pistons provides gas-tight inlet and exhaust connections that are not subject to undue wear or impairment. The motor is particularly adapted to assembly in multiple units arranged in parallel order, as diagrammatically indicated by dotted lines in Figs. 1 and 3, and each unit, consisting of relatively few and simple parts may be constructed and assembled, adjusted and repaired at a minimum cost of labor and materials.

What I claim is:

1. A two cycle internal combustion engine, comprising a cylinder, opposed pistons therein having valves in their heads, means located within the cylinder for actuating the valves to control the supply and exhaust respectively, said means being effective to open the exhaust valve in advance of the supply valve, means connected with the respective cylinder heads and with the pistons for supplying fuel and discharging the burned gases, and means connected with the outer ends of the pistons for converting the reciprocatory motions of both pistons into a unitary rotary motion.

2. A two cycle internal combustion engine, comprising a cylinder, opposed hollow pistons therein, an inlet port in the head of one piston and an ex-

haust port in the head of the other piston, inlet and exhaust sleeves carried by the respective cylinder heads and telescoping with the pistons, valves cooperating with the inlet and exhaust ports having stems extending axially of the pistons, abutments on the cylinder heads cooperating with the valve stems to open the valves, springs for closing the valves, cross heads carried by the outer ends of the pistons and projecting through pairs of slots in the cylinder, crank shafts on opposite sides of the cylinder, and pitmen connecting the ends of each cross head with a crank shaft.

3. An internal combustion engine as described in claim 2, in which each piston is provided with an axially transverse partition bored to guide the stem of its valve and the sleeves telescoping with the pistons are bifurcated to receive the corresponding partition.

4. An internal combustion engine as described in claim 2, in which the abutments are effective to open the exhaust valve in advance of the inlet valve.

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