S. J. MACFARREN.

MULTICYLINDER GAS ENGINE.

APPLICATION FILED JUNE 13, 1904.

1,031,131.

Patented July 2, 1912.

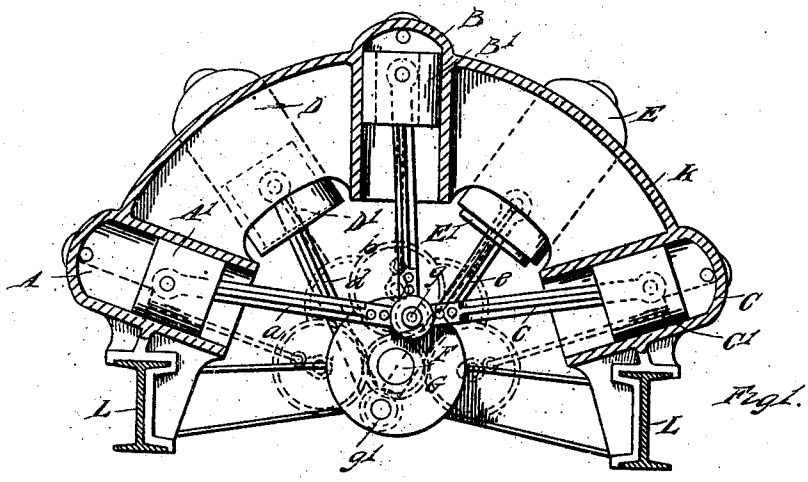

Fig 1.

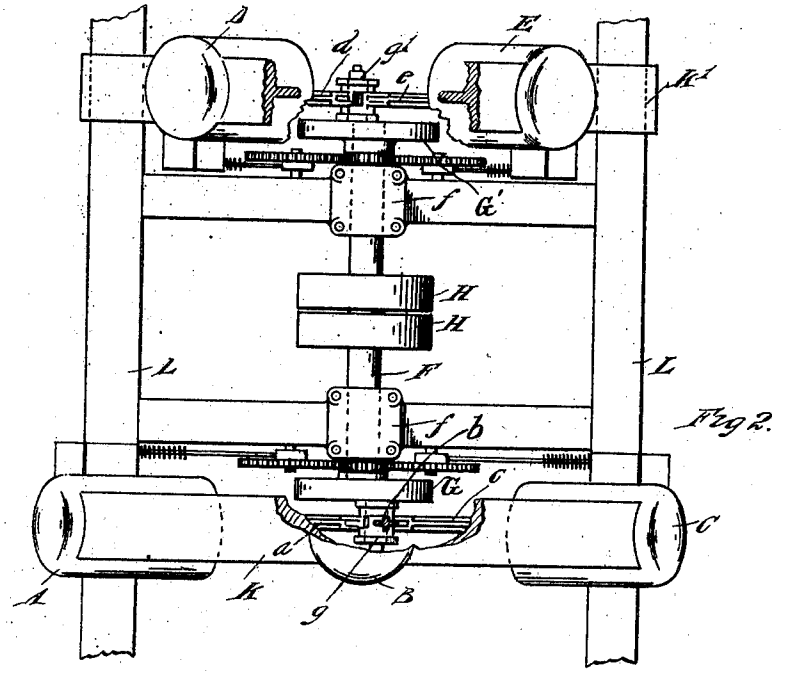

Fig 2.

WITNESSES

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[illegible]

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UNITED STATES PATENT OFFICE.

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MULTICYLINDER GAS-ENGINE.

1,031,131. Specification of Letters Patent. Patented July 2, 1912.

Application filed June 13, 1904. Serial No. 212,241.

To all whom it may concern:

Be it known that I, SAMUEL JAMES MACFARREN, a citizen of the United States, residing at Pittsburgh, county of Allegheny, State of Pennsylvania, have invented a certain new and useful Improvement in Multicylinder Gas-Engines, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to a multiple cylinder gas engine of the radial type, and the object of my improvements is to provide an improved engine to reduce the vertical space or the space in one plane hitherto necessarily occupied by this type of engine, while retaining the uniformity of torque or turning effort and to secure greater stability. I secure this object in the device illustrated in the accompanying drawings, in which,

Figure 1, is a side elevation, partly in section, of an engine embodying my invention. Fig. 2, is a plan view of the same, some of the parts being partly broken away.

L, L, is the foundation; K, K¹, are frames formed in the arc of circles and supported on the foundation L, L. There are two frames K and K¹, in different vertical planes.

F, is the main shaft pivoted in bearings *f*, *f*. H, H, are pulleys upon the shaft F.

G, G¹, are disks upon the ends of the shaft F.

g, *g*¹, are crank pins in the disks G, G¹.

In the engine illustrated, the four cycle mode of operation is used and five cylinders are shown arranged in vertical planes. Upon the frame K are cylinders A, B, C, located 72° apart. In these cylinders are pistons A¹, B¹, C¹, connected by connecting rods *a*, *b*, *c*, with the crank pin *g*. Upon the frame K¹ are located similar cylinders D, E, also at 72° apart. In the cylinders D, E, are pistons D¹, E¹, connected with the crank pin *g*¹, by connecting rods *d*, *e*. The crank pin *g*¹ is located at a point 180° from the crank pin *g*, and the cylinders D, E, are located opposite to the position which cylinders would occupy if upon the same frame as the cylinders A, B, C, and spaced at the same angular distances as said cylinders. This brings the cylinder E angularly between the cylinders B and C and the cylinder D between the cylinders A and B and at equal angular distances from said cylinders. As in the four cycle mode of operation, the sequence of events occurs in an angle of 720°. To secure uniformity of torque, the successive explosions must occur in cylinders 144° from each other, that is, one-fifth of 720. Thus in the arrangement shown, the sequence of explosions would be as follows:—cylinder A, cylinder C, cylinder E, cylinder B, and cylinder D.

It will be observed that in the above form of engine, all the cylinders are located above a horizontal plane through the axis of the crank shaft or upon one side of the shaft, so that the total height of the vertical type of radial engine is much reduced and the cylinders are made accessible and the engine is more compact and stable; so that this type of engine is, by my invention, made especially adaptable to vehicle or marine propulsion.

While I have shown my invention as applied to a vertical gas engine of the four cycle type, its adaptation to other engines will be obvious to those skilled in the art.

What I claim is:—

1. In a four-cycle gas engine, a horizontally arranged shaft provided with two cranks arranged at an angle of 180°, three gas engine cylinders positioned at one side of the horizontal plane of the shaft and in a vertical plane at right angles to the longitudinal axis of said shaft, two similar gas engine cylinders positioned on the same side of the shaft and in another vertical plane at right angles to the longitudinal axis of the shaft, pistons in all of said cylinders, pitmen connecting the pistons in the cylinders of one group with one of the cranks of the shaft, pitmen connecting the pistons in the other group of cylinders with the other crank of the shaft, all of said cylinders being arranged so as to produce impulses at equal angular intervals.

2. In a gas engine of the four cycle type, a horizontally disposed shaft provided with two separated cranks adjacent the ends thereof and arranged at an angle of 180°, a group of radially arranged gas engine cylinders positioned in a plane at right angles to the plane of the longitudinal axis of said shaft and above the horizontal plane of the shaft, a second group comprising a

different number of radially arranged gas engine cylinders positioned in a plane at right angles to the plane of the horizontal axis of said shaft and above the horizontal plane of the shaft, and separated from said first mentioned group to leave an unobstructed space therebetween, pistons in all of said cylinders, connections between the pistons of one group of cylinders and one of the cranks and connections between the pistons of the other group of cylinders and the other of said cranks, all of said cylinders being arranged so as to produce impulses at equal angular intervals.

3. An internal combustion engine having an uneven number of cylinders in two parallel groups, the cylinders of each group being arranged to make equal angles with each other, and a shaft having oppositely set cranks, each of said two groups of cylinders being above a horizontal plane passed through the axis of said shaft, and the pistons of all of the cylinders of one group being connected with one crank of said shaft, while those of the cylinders of the other group are connected with the other crank of said shaft.

4. An internal combustion engine having five cylinders in two parallel groups, the cylinders of each group being arranged to make equal angles with each other, and a shaft having oppositely set cranks, each of said two groups of cylinders being above a horizontal plane passed through the axis of said shaft, and the pistons of all of the cylinders of one group being connected with one crank of said shaft, while those of the cylinders of the other group are connected with the other crank of said shaft.

5. An internal combustion engine having an uneven number of cylinders in two parallel groups, a shaft having oppositely set cranks, each of said two groups of cylinders being above a horizontal plane passed through the axis of said shaft, pistons in said cylinders, the pistons of all of the cylinders of one group being connected with one crank of said shaft, while those of the cylinders of the other group are connected with the other crank of said shaft, the cylinders of said groups being arranged to produce impulses at equal angular intervals throughout the revolution of the engine shaft.

6. An internal combustion engine having five cylinders in two parallel groups, a shaft having oppositely set cranks, each of said two groups of cylinders being above a horizontal plane passed through the axis of said shaft, pistons in said cylinders, the pistons of all of the cylinders of one group being connected with one crank of said shaft, while those of the cylinders of the other group are connected with the other crank of said shaft, all of said cylinders being arranged to produce impulses at equal angular intervals throughout the revolution of the engine shaft.

In testimony whereof, I sign this specification in the presence of two witnesses.

SAMUEL JAMES MACFARREN.

Witnesses:

IRENE PATTERSON,

JOHN W. MOORE.