No. 819,557. PATENTED MAY 1, 1906.

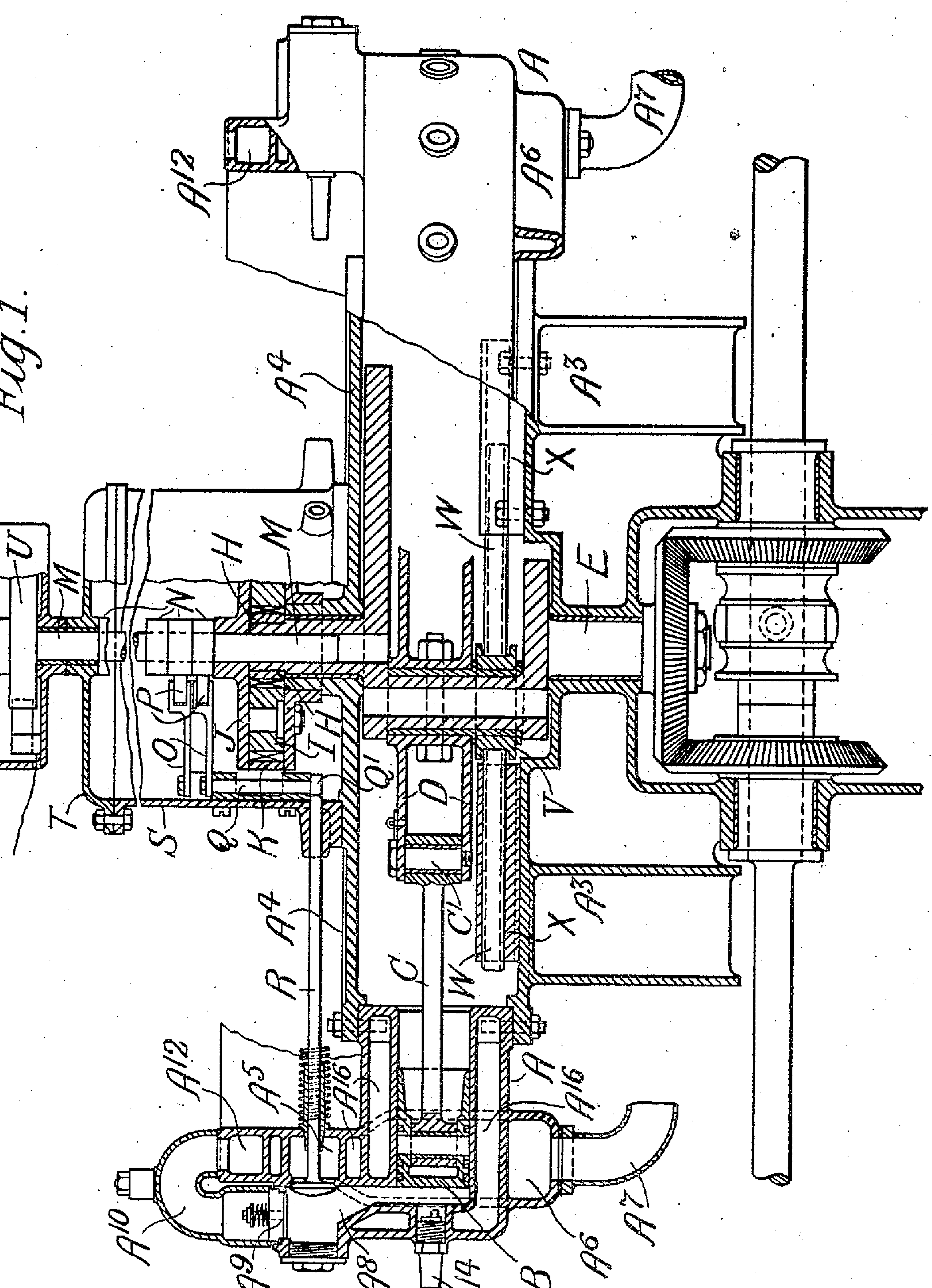
J. B. KING.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 26, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:-
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3 SHEETS—SHEET 2.

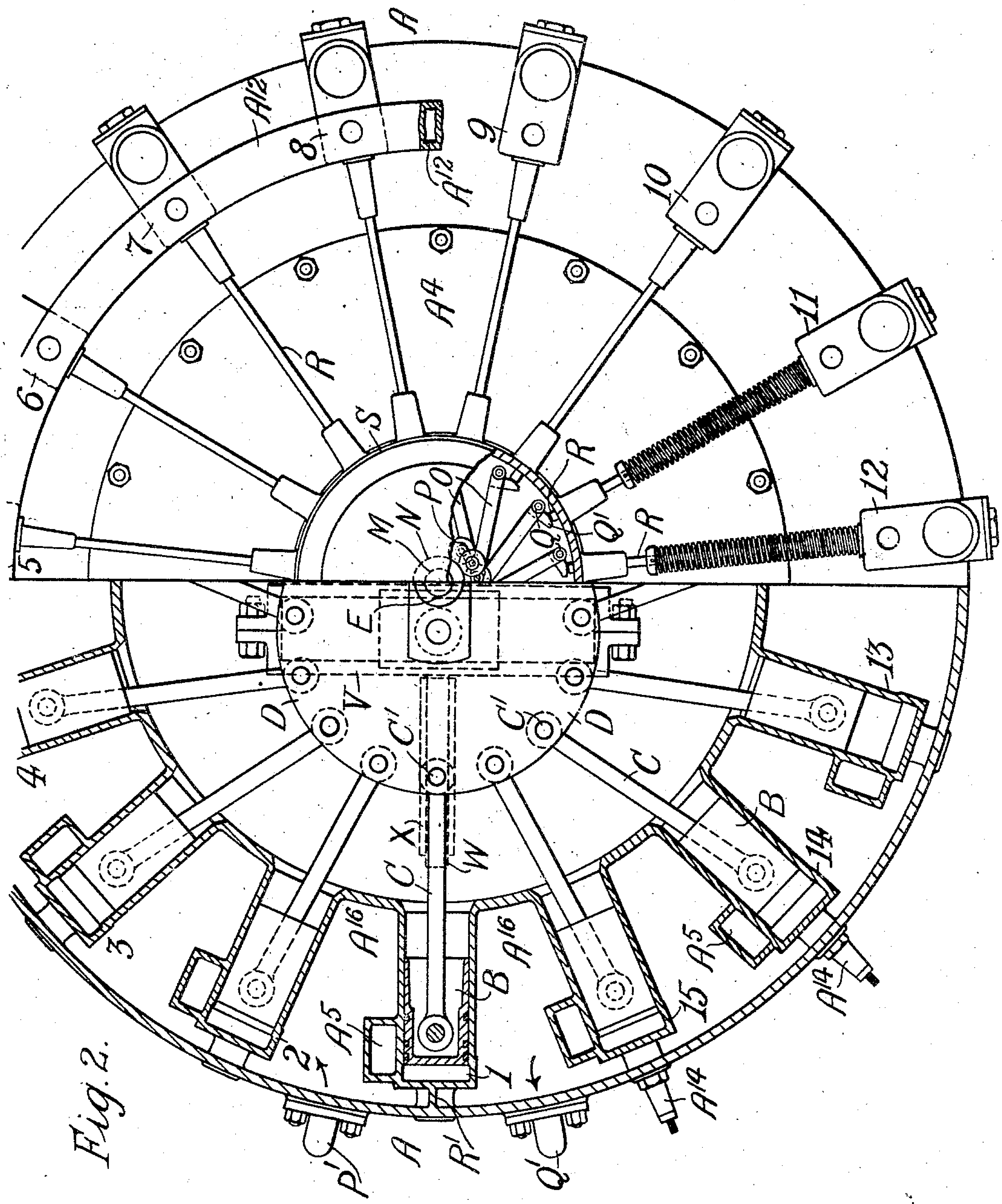

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 4.

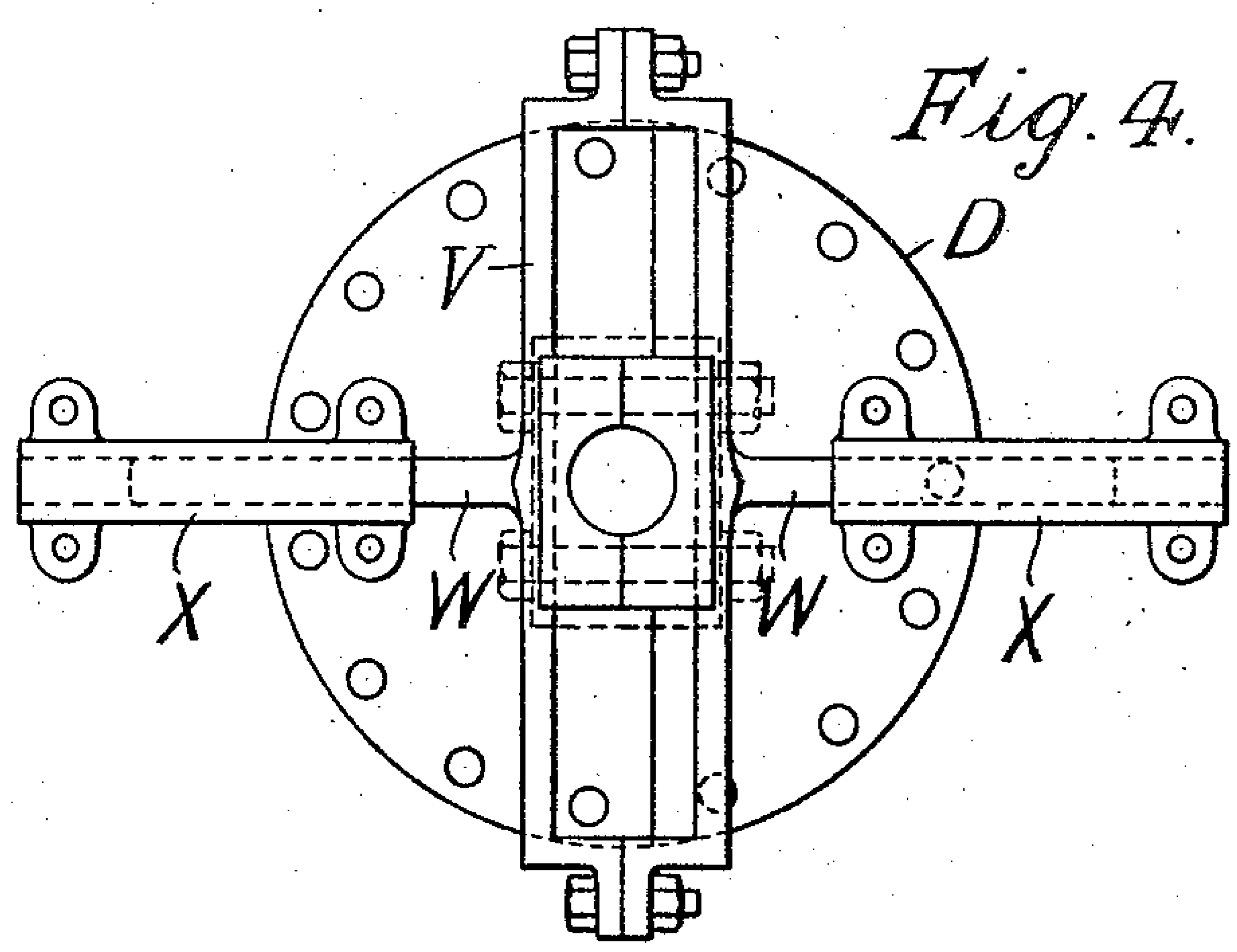
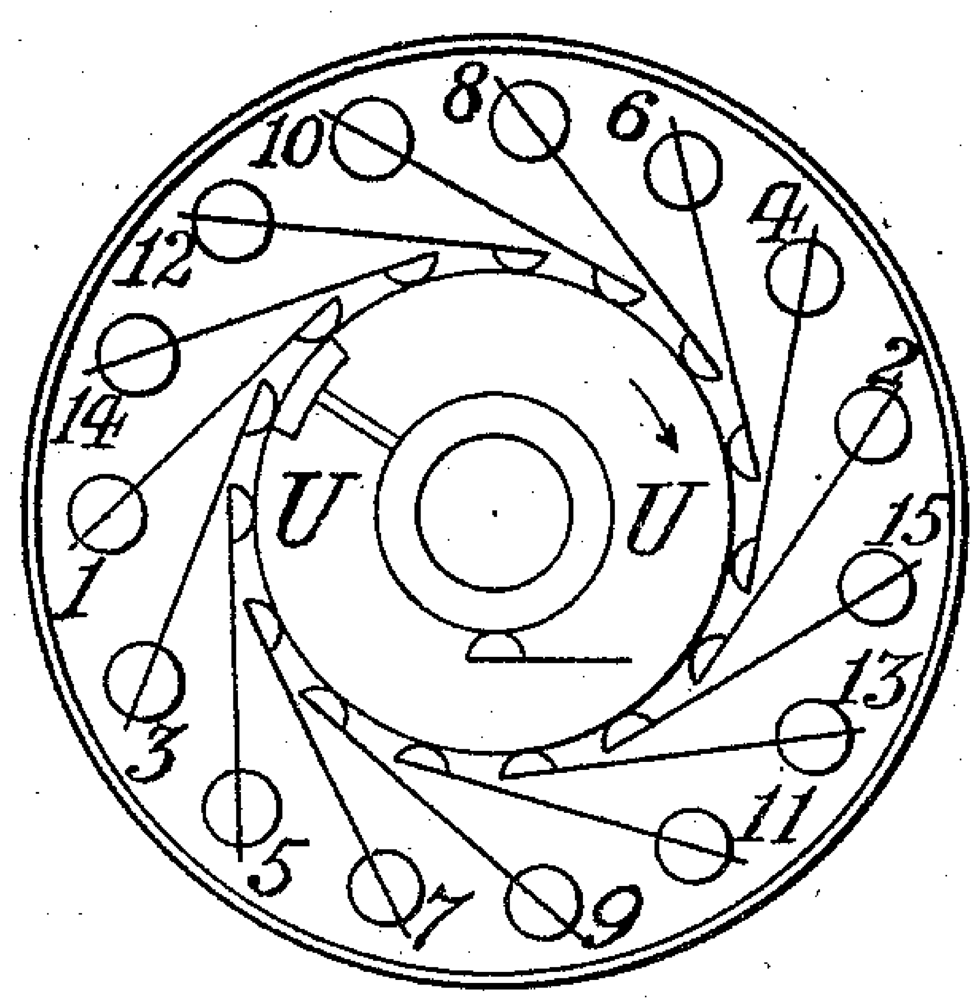


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN BARAGWANATH KING, OF PLYMOUTH, ENGLAND.

INTERNAL-COMBUSTION ENGINE.

No. 819,557. Specification of Letters Patent. Patented May 1, 1906.

Application filed April 26, 1905. Serial No. 257,457.

To all whom it may concern:

Be it known that I, JOHN BARAGWANATH KING, a subject of the King of the United Kingdom of Great Britain and Ireland, residing at Plymouth, county of Devon, England, have invented certain new and useful Improvements in an Internal-Combustion Engine, of which the following is a specification.

This invention relates to improvements in and relating to internal-combustion engines.

An engine constructed according to my invention comprises an annular casting formed with radially-disposed cylindrical recesses which form the power-cylinders of the engine. There is an odd number of cylinders in which the explosions take place alternately, the valve-gear and commutator being specially designed to suit this arrangement.

In the accompanying drawings, which illustrate the invention, Figure 1 is a longitudinal section of the improved engine. Fig. 2 is a part-sectional plan thereof. Fig. 3 is a diagram showing an arrangement of brushes or contact-pieces for the commutator, and Fig. 4 an inverted plan showing the disk to which the ends of the connecting-rods of the engine are pivoted.

As shown in said drawings, the engine comprises a cored casting or castings A of annular form and provided with an odd number of radially-disposed cylindrical recesses. In the present case there are fifteen cylinders arranged equidistant from one another. The said recesses are open-ended on the inside of said annular casting and form the explosion or power cylinders of the engine and are each provided with pistons B. Pivotally connected with said pistons B are the connecting-rods or pitmen C, the inner ends of which are pivoted to pins C′, secured to a disk D.

The explosive mixture passes from the carbureter through the annular gas-receptacle A^{12}, through the branches A^{10} and inlet-valves A^{9} (shown as automatic valves, though mechanically-operated valves might be used) to the combustion-chamber A^{8} of each cylinder, where it is fired by the sparking plug or other igniting device A^{14}. The exhaust passes through the exhaust-ports A^{5} and annular receptacle A^{6} through the exhaust-outlets A^{7}. A space A^{16} is cored between the walls of said cylinders, combustion-chambers and ports, and the retaining-walls of the annular casting for cooling purposes. As shown in Fig. 2, water is admitted through P′ and issues at Q′, a partition or diaphragm R′ being provided within and on one side of the cored water-space, whereby an efficient water circulation throughout the entire casting may be effected.

The crank-shaft E is provided with a one-throw balanced crank and occupies the axial center of the annular casting and the crank-pin the axial center of the disk. The bearings of the said crank-shaft are supported in the castings A^{3} and A^{4}, which are bolted to the casting A and form covers thereof. When the engine is arranged in horizontal position, the lower cover forming the base is provided with brackets for the purpose of securing the engine. The lower cover may also be provided with an oil-retaining box joined in halves containing bevel-wheel gear, the said gear being employed in transmitting the motion and power of the vertical shaft to horizontal shafting, as required. The upper cover A^{4} also supports a vertical shaft M, revolving independently of the crank-shaft E at one-half the speed of the said crank-shaft. This may be effected by transmitting motion from the crank-shaft by means of the pinion H, keyed thereto, through free pinions I on the carrier J to an internally-toothed wheel K, keyed to the shaft M, after the manner in common use for obtaining a reduction of speed to one-half that of the crank-shaft. Fast on the half-speed shaft M are a number of cam-bosses N, corresponding to the number of cylinders adopted. The said cam-bosses operate the exhaust-valves of the engine through the intervention of levers O, provided with rollers P, engaging said bosses and through connecting-shafts Q and cocking-levers Q′ on the spring-actuated valve-stems R. The said gearing is inclosed in a casing S, secured on the cover A^{4} and itself having a cover T in a box on which is carried the commutator U on the half-speed shaft M. The commutator is provided with brushes or contact-pieces corresponding in number to the number of cylinders employed. The numbers marked on the commutator-contacts correspond to the numbers on the various cylinders, and electrical connections are provided to the various sparking plugs. The said commutator is preferably so designed that more than one contact-piece is in electric circuit at the same time, and the contact-pieces may be partially rotated for retarding or advancing the time of firing, as may be required. The disk D is formed in halves and is prevented from rotating on its own center during the revolution of the crank-shaft by means of a reciprocating cross-head V, which is provided with cross-bars W, sliding on brackets X, secured to the base A^3, the said disk being meanwhile free to move in a circular path or orbit during the rotation of the crank. The said cylinders are fired alternately—that is, in the order 1 3 5 7 9 11 13 15 2 4 6 8 10 12 14 1 or in the reverse order. As the crank-shaft thus makes two revolutions for every explosion in the same cylinder, the piston performing four strokes for each explosion, the operations are practically those of the Otto cycle.

It is to be understood that though I have described the invention in the simplest form in which a single engine is provided with a vertical shaft, in actual practice it may be preferable to arrange two or more engines on the same shaft, so as to obtain a more accurate balance, and obviously the said engine or engines may be constructed with a horizontal shaft. Alternatively the engine may be arranged with two or more tiers of cylinders and provided with a crank for each tier.

Instead of employing clutch-gearing to obtain reversal of motion the engine may itself be reversed, and in this case the half-speed shaft instead of being rigidly connected with its gearing may have a limited free movement, so as to enable the engine to be turned past the dead-center while the various cylinders are fired.

Having now described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. The improved internal-combustion engine, comprising in combination an annular casting, an odd number of cylinders having their axes in one plane and radially disposed in said casting with spaces for water circulation between the same, a crank-shaft, a disk formed in two parallel halves and connected to said crank-shaft, pistons in said cylinders, connecting-rods for said pistons, pins on said disk to which said connecting-rods are pivoted, means for guiding said disk to prevent its rotation on its own center, a centrally-disposed half-time shaft, gearing connecting said half-time shaft with the crank-shaft, a commutator on said half-time shaft, commutator-segments disposed so as to effect ignition successively in alternate cylinders, and valves for said cylinders actuated from said half-time shaft.

2. The improved internal-combustion engine, comprising in combination an annular casting, a crank-shaft, a plurality of cylinders formed in said casting with their axes in one plane, and disposed radially of said crank-shaft, a diaphragm and water inlets and outlets for circulating water through said annular casting, pistons adapted to reciprocate in said cylinders, connecting-rods for said pistons, a disk formed in parallel halves and supported on the crank-pin of said crank-shaft, pins pivotally connecting said piston-rods with said disk, a cross-head adapted to slide in brackets secured to the engine-frame and preventing rotation of the disk on its own center, valve mechanism, a half-time shaft arranged in alinement with said crank-shaft and centrally of the valve mechanism, gearing operating said half-time shaft from said crank-shaft, cams operating said valve mechanism, and a commutator on said half-time shaft with devices for producing ignition in the cylinders, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN BARAGWANATH KING.

Witnesses:
WALLACE FAIRWEATHER,
JNO. ARMSTRONG, Junr.