Jan. 6, 1931. C. WARD ET AL 1,788,259

CAM DRIVEN GEAR FOR RECIPROCATING PISTON ENGINES

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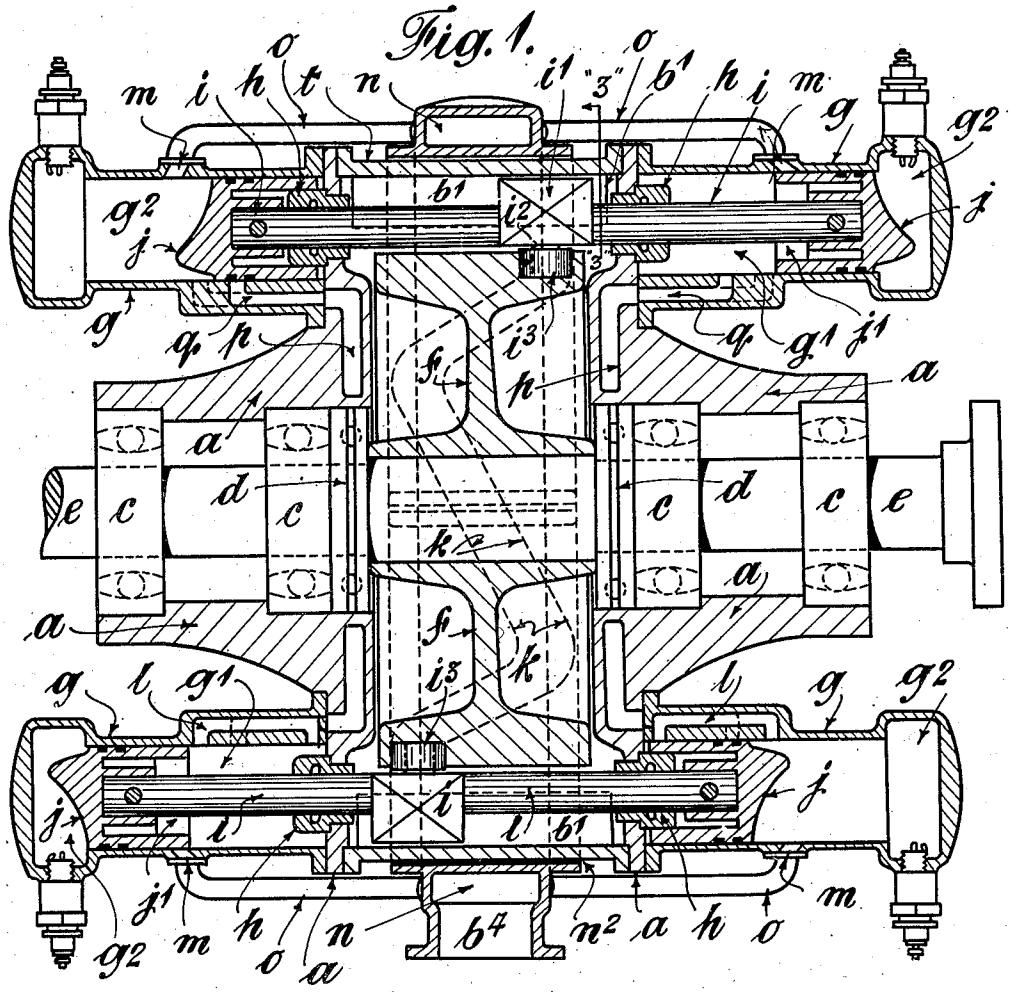
Fig. 1.



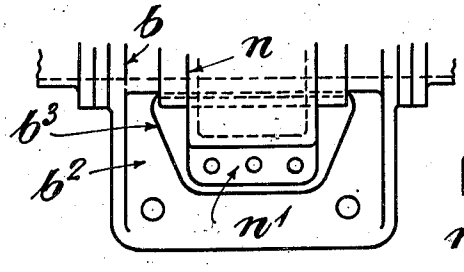


Fig. 5.

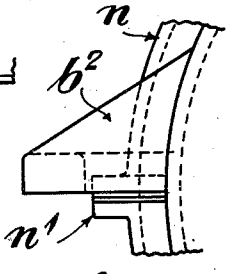


Fig. 4.

INVENTORS:
Charles Ward
Thomas G. Hascall
BY ATTORNEY:—Richard E. Babcock

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Fig. 2.

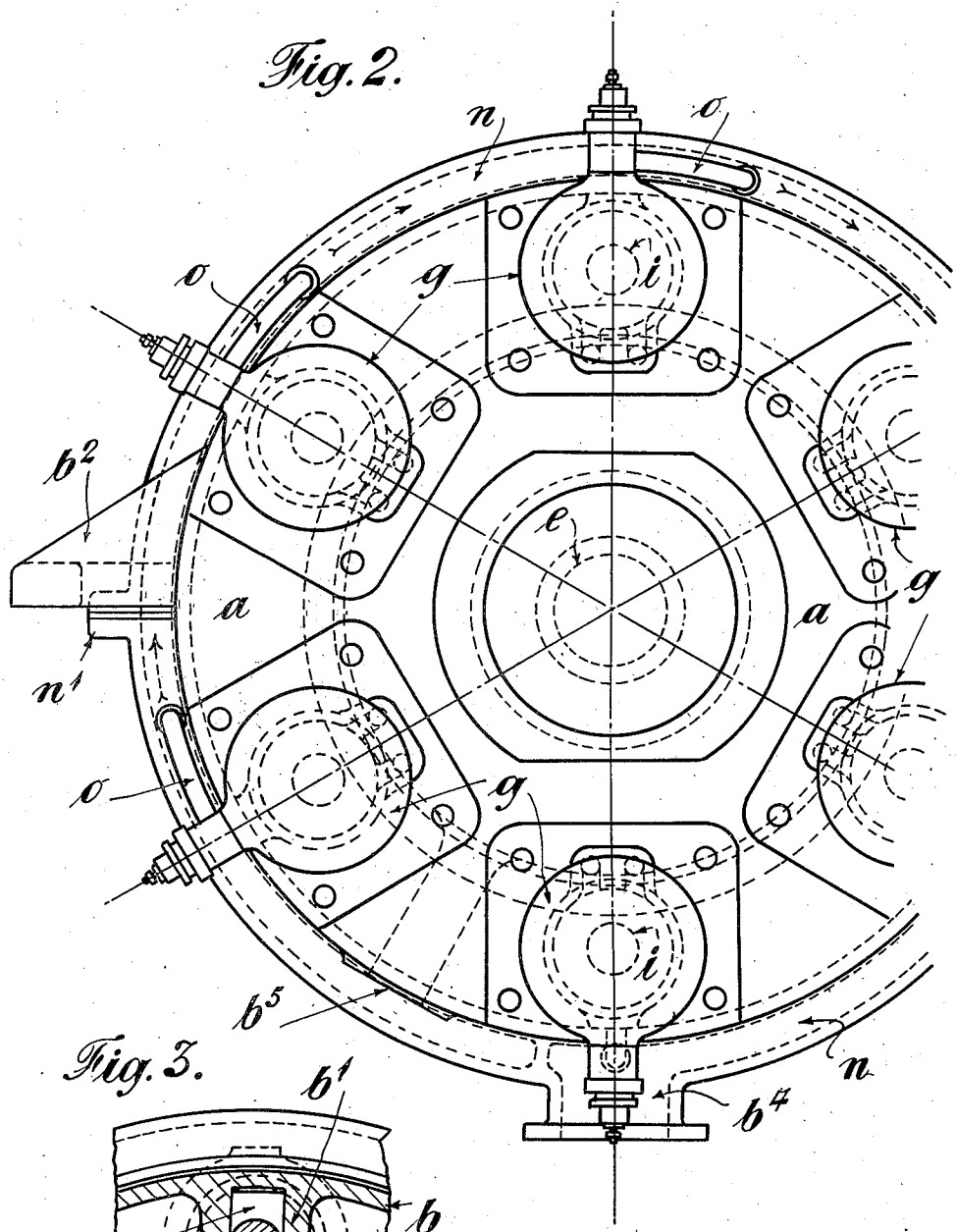
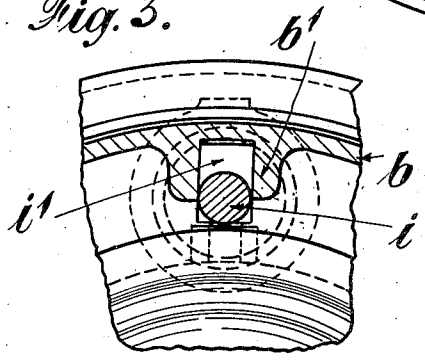


Fig. 3.



INVENTORS:
Charles Ward
Thomas J. Hassall
BY ATTORNEY :- Richard E. Babcock

Patented Jan. 6, 1931

1,788,259

UNITED STATES PATENT OFFICE.

CHARLES WARD, OF STRETFORD, AND THOMAS GORDON HASSALL, OF STOCKPORT, ENGLAND; SAID WARD ASSIGNOR TO SAID HASSALL

CAM-DRIVEN GEAR FOR RECIPROCATING PISTON ENGINES

Application filed May 18, 1929, Serial No. 364,161, and in Great Britain November 19, 1928.

This invention relates to reciprocating piston engines having cam driving gear and whilst primarily directed to internal combustion engines is applicable for use with steam or other motive power, and has for its object to produce a multi-cylindered engine of great simplicity and power relatively to its weight.

According to the present invention a plurality of cylinders are located on a pitch circle, preferably two sets being used in opposed relationship and with a rotary member journalled between the same. Pistons are located in each cylinder, each piston being connected to a piston rod, one piston rod being used for each pair of opposed pistons. The pistons are each provided with slippers or cross heads sliding in guides preferably formed in an all around casing constituting the distance piece for the two sets of cylinders.

Located in said casing is the rotary member journalled in suitable bearings carried thereby, and to which the driving shaft is connected. Said rotary member is formed with a peripheral cam groove or projection to engage projections or recesses on the slippers, said cam being shaped to allow for the reciprocation of the slippers one or more times in both directions for each revolution thereof, the working strokes of each cylinder being timed to commence at the nearest apex of the cam and terminate at the end thereof at which point the working stroke of the opposed cylinder is timed to commence, any number of cylinders being used equally spaced around the rotor and timed so that the impulses transmitted to the rotary member are in correct relationship to the cam to produce the progressive rotary motion, which is transmitted to the member to be driven in any desired manner.

The invention will be more particularly described by the aid of the accompanying drawings in which:—

Figure 1 is a sectional elevation of an engine constructed according to the invention,

Figure 2 is an end view.

Figure 3 is a detail sectional view on the line 3—3 of Fig. 1 showing more particularly one of the slippers and guides therefor.

Figure 4 is a side view, and

Figure 5 is a plan view of one of the supporting brackets for the engine casing.

In carrying the invention into effect according to one convenient manner as illustrated, and as applied to an internal combustion engine, two end pieces a, a are provided separated by a tubular distance piece b having flanged ends to which said end pieces a are bolted. The latter are each provided with a central boss, bored to receive the anti-friction bearings c, c and anti-friction thrust bearings d to receive a shaft e formed in one with or rigidly connected to a cam rotor f located between said end pieces a, a. Equally spaced around a pitch circle of slightly larger diameter than the rotor f, on each end piece a, are any desired number of cylinders g, a convenient number being six on each, the cylinders on the respective end pieces being in axial alignment. Said cylinders are preferably bolted to the end pieces which are provided with glands h through which the piston rods i pass, said glands being fitted in position on the end pieces and extending within the cylinders, the piston j being recessed at j^1 to accommodate the same. The pistons j in each pair of opposed cylinders g are connected to opposite ends of the same rod i which is formed with, or has secured theron, at its mid portion a slipper i^1 sliding in a grooved guide b^1 formed in the tubular distance piece b. Each slipper i^1 is provided with a stub axle i^2 the axis of which, produced, forms a radii of the tubular distance piece, each axle i^2 having an anti-friction roller i^3 thereon to enter a cam groove k, formed in the periphery of the rotor f. Said groove is continuous and the contour of the cam is such as to allow of the full stroke of each piston inwardly and outwardly, preferably three times as shown, during each revolution of the rotor, but if desired it may be of a contour to allow of only a single inward and outward stroke or such as to permit any desired number of inward and outward strokes of the pistons for each revolution.

Preferably the cylinders work on the two stroke principle, the forward end g^1 of each

cylinder constituting a charging unit and the rear end g^2 the explosion end, ports l connecting the two ends being controlled by the piston j in known manner, ports m leading from the rear end g^2 of each cylinder to a common exhaust manifold n via the inclined pipes o. Said exhaust manifold conveniently comprises a tubular ring formed in two parts, each provided with flanges n^1 by means of which they are bolted together around the distance piece b, a layer of asbestos n^2 or other heat insulating material being interposed as shown in Figure 1, the carrying brackets b^2 cast in one with said distance piece being formed with openings b^3 to accommodate the same, see Figs. 4 and 5. The inclination of the pipes o causes the exhaust gases to enter the exhaust manifold n at an angle so as to maintain a uniform flow of the combined exhaust gases to the common outlet b^4. An all around inlet manifold p is formed in each end piece a having a series of outlets communicating with the respective inlet ports q of each cylinder leading to the forward end g^1 of the same. A carburetor is attached at b^5 to each end piece, a passage being formed therein leading to the inlet manifold, and if desired provision may be made to admit the hydrocarbon fluid at two or more points around the inlet manifold.

Timing gear, not shown, is provided by means of which the charge is exploded in each cylinder as the anti-friction roller i^3 on the respective slipper or cross head i^1 rides over the adjacent apex of the cam k so that as the slipper is reciprocated it reacts on the cam and produces a turning movement of the rotor, the cylinders being arranged and timed so that a very even torque is produced.

By these means very efficient motors of simple construction are produced which are comparatively light and have few working parts and which can be adapted for use with light or heavy fuel oils or steam for both stationary and movable engines, and in particular for road vehicles, aeroplanes and submarines.

What we claim is:—

1. In an internal combustion engine a tubular distance piece formed with guides to accommodate cross heads on piston rods, two end pieces secured to the distance piece and each formed with an all around inlet manifold communicating with the inlet ports of cylinders, cylinders bolted to the outside of each end piece the cylinders on one end piece being in axial alignment with the cylinders on the other end piece, pistons in said cylinders, piston rods connecting each pair of opposed pistons and formed with cross heads to enter the guides, anti-friction bearings in the end piece, a rotor formed with a cam groove located in the distance piece and having a shaft journalled in the anti-friction bearings, stub axles on the cross heads engaging the cam groove, an exhaust manifold communicating with exhaust ports in the cylinders the inlet and exhaust ports in each cylinder being controlled by the respective piston, substantially as described.

2. In an internal combustion engine a tubular distance piece formed with guides to accommodate cross heads on piston rods, two end pieces secured to the distance piece and each formed with an all around inlet manifold communicating with the inlet ports or cylinders, cylinders bolted to the outside of each end piece the cylinders on one end piece being in axial alignment with the cylinders on the other end piece, pistons in said cylinders, piston rods connecting each pair of opposed pistons and formed with cross heads to enter the guides, anti-friction bearings in the end piece, a rotor formed with a cam groove located in the distance piece and having a shaft journalled in the anti-friction bearings, stub axles on the cross heads engaging the cam groove, a common exhaust manifold and conduits leading from the exhaust ports in the cylinder to the exhaust manifold, said conduits being arranged at an angle to maintain a uniform flow of the exhaust gases to a common outlet, substantially as described.

3. In an internal combustion engine a tubular distance piece formed with guides to accommodate cross heads on piston rods, two end pieces bolted to the distance pieces and each formed with an all around inlet manifold, cylinders bolted to the outside of each end piece, the cylinders on one end piece being in axial alignment with the cylinders on the other end piece, pistons in said cylinders, piston rods connecting each pair of opposed pistons and formed with cross heads to engage the guides, inlet conduits leading from the common inlet manifold to the under side of the pistons, ports leading from below the inner to the outward end of the cylinder and exhaust ports in said cylinders communicating by means of inclined conduits with a common exhaust manifold, anti-friction bearings in the end pieces to receive the shaft of a rotor, a rotor formed with a cam groove located in the distance piece and having a shaft journalled in said anti-friction bearings and stub axles on the cross heads engaging the cam groove in the rotor, substantially as described.

In testimony whereof, we have signed our names to this specification at Manchester in the county of Lancaster this 2nd day of May, 1929.

CHARLES WARD.
THOMAS GORDON HASSALL.