(No Model.) 3 Sheets—Sheet 1.

F. WYNNE.

MULTI-CYLINDER ENGINE.

No. 341,984. Patented May 18, 1886.

FIG. 1.

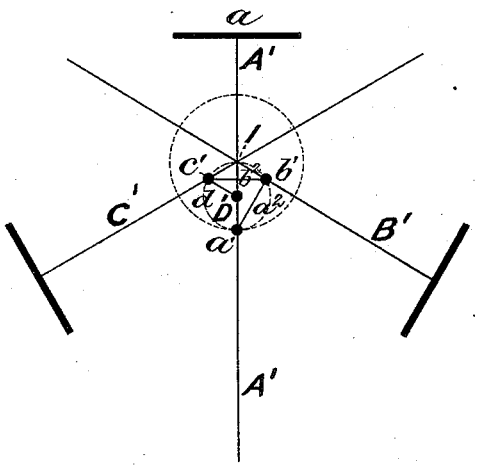
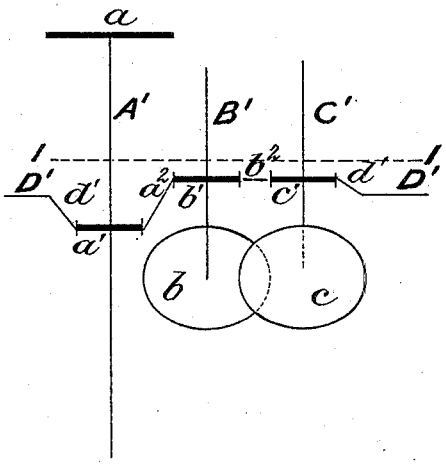


FIG. 2.



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(No Model.) 3 Sheets—Sheet 2.

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MULTI-CYLINDER ENGINE.

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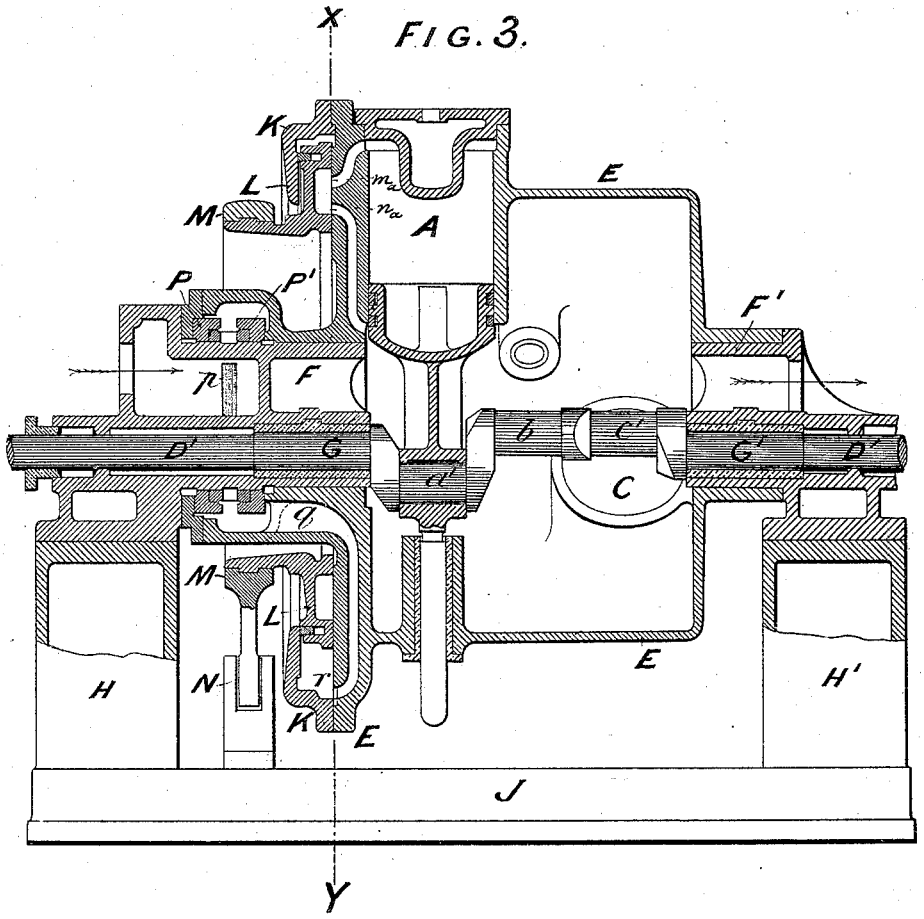
FIG. 3.



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3 Sheets—Sheet 3.

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MULTI-CYLINDER ENGINE.

No. 341,984. Patented May 18, 1886.

FIG. 5.

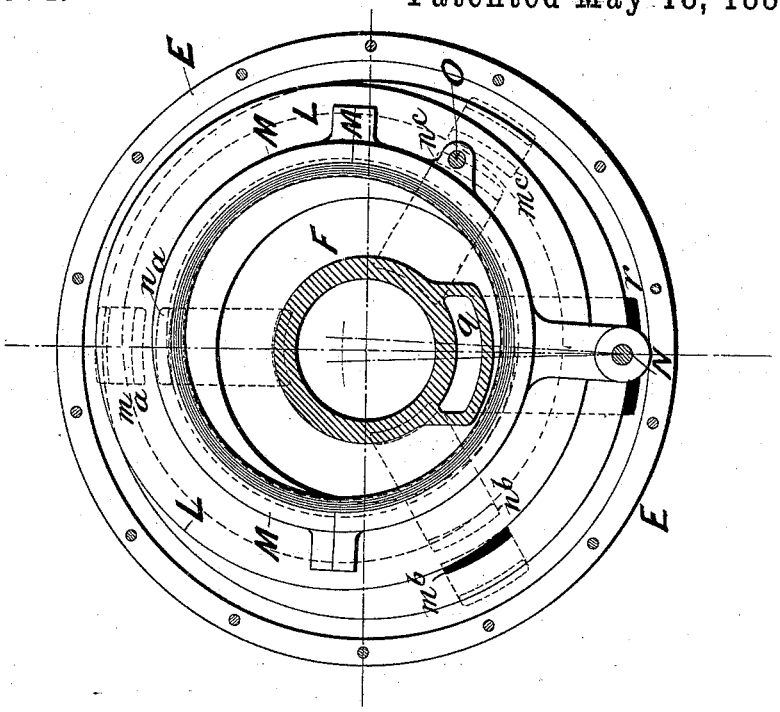
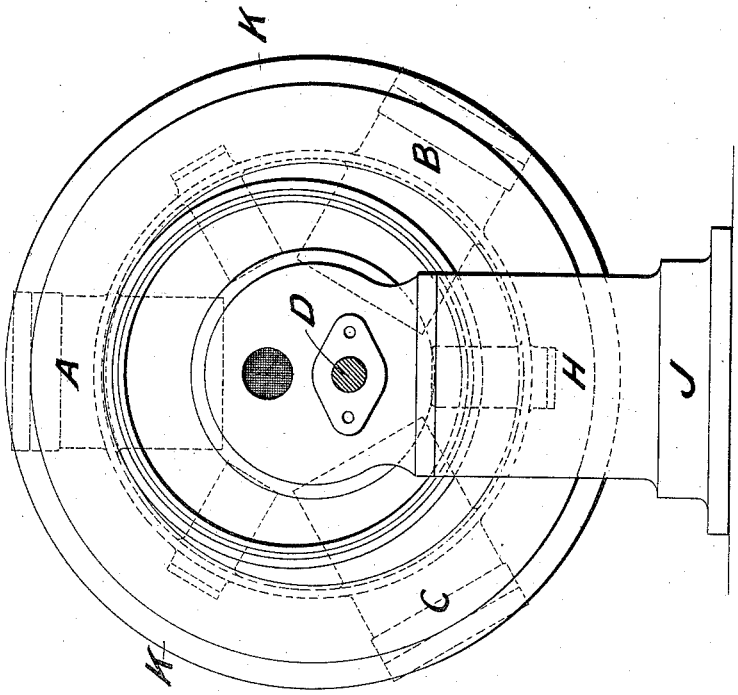


FIG. 4.



Witnesses,
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UNITED STATES PATENT OFFICE.

FRANK WYNNE, OF LONDON, ENGLAND.

MULTI-CYLINDER ENGINE.

SPECIFICATION forming part of Letters Patent No. 341,984, dated May 18, 1886.

Application filed April 20, 1885. Serial No. 162,750. (No model.) Patented in England June 18, 1884, No. 9,142; in France March 17, 1885, No. 167,696, and in Belgium April 10, 1885, No. 32,855.

To all whom it may concern:

Be it known that I, FRANK WYNNE, of London, England, have invented a new and useful Improvement in Multi-Cylinder Engines, of which the following is a specification.

This invention relates to motive-power engines having three or more cylinders with reciprocating pistons driven by means of steam, gas, air, water, or other fluid pressure, and whereby the reciprocating motion of the piston in the engine may be made to produce direct rotary motion. I set the cylinders radially round or on a frame, supported on trunnions or journals at each end, and the cylinders are so set and equilibriated that the whole forms a balance system. When I employ three cylinders, I set them preferably at an angle of one hundred and twenty degrees to one another; when employing five, I set them at an angle of seventy-two degrees, or thereabout, to one another; when employing six, I mount them in pairs opposite to each other, and by preference distribute the pairs symmetrically, so that the center lines of the cylinders form about sixty degrees to one another. Each cylinder is provided with a piston and a piston-rod, and each piston and piston-rod is, by suitable means, constrained to move in a straight line. In order to clearly explain this construction, I refer to the diagrams Figs. 1 and 2 of the accompanying drawings, and premise that as many parallel planes as there are piston-rods A′ B′ C′ can be drawn, each plane passing through the axis of one of the piston-rods and a straight line, I, drawn perpendicularly to all the planes and intersecting all the axes of the piston-rods, and continued to any distance beyond any of the planes, I call the "line of intersection." A pin, a' b' c', hereinafter called the "crank-pin," is passed through each piston-rod at a point which, at mid-stroke, coincides with the line of intersection. On that part of each pin which projects beyond the piston-rod into the space between the said rod and the next piston-rod (but not so far as to come into collision with the latter) is mounted one end of a link, a^2 b^2, attached with its other end to the pin projecting similarly from the contiguous piston-rod at a corresponding point of its length. These links and crank-pins are by preference made in one piece, or otherwise rigidly connected together, and will then be found to form a multiple-throw crank, the throw of which is equal to half the stroke of the piston-rods. The balanced casting formed by the cylinders, or on which they are mounted, is pivoted on fixed hollow trunnions, which contain the bearings for the crank-shaft D′. These bearings are situated eccentrically to the circumference of the trunnions, or out of line with their center, which is on the line of intersection I, to the extent of a quarter of the piston-stroke, the throw of the cranks which connect the piston-rods being equal to half the stroke of the pistons. The connection of the driving-shaft, D′, passing through these bearings, with either end of the multiple-throw crank, is made by an arm, d' d', hereinafter called a "driving-arm," the said arm being of a length (measured from center to center of pins—that is, from center of driving-shaft D′ to the center of the adjacent crank-pin a' or c')—equal to one-quarter of the stroke of the piston-rods, and at such an angle that in the extreme position of any of the rods the prolonged axis of the driving-shaft passes through the axis of the rod which is in this extreme position (or through the prolonged axis of such rod) at a distance from the line of intersection equal to one-quarter of the piston-stroke, and between the line of intersection and the crank-pin of that rod. The driving-shaft extends in one or both directions through the trunnions to the outside.

It will be found that on applying pressure to the pistons each piston-rod is allowed to move in a straight line, and inasmuch as it is so guided or constrained that it can only move in this one straight line in its plane and toward or from the line of intersection it at the same time forces the frame carrying the cylinders to revolve, and for each complete revolution of this frame the crank-shaft D′ is caused to make two revolutions.

In further describing my invention reference will be made to the accompanying drawings, in which—

Fig. 3 is a longitudinal vertical section, and Fig. 4 an end elevation, of a three-cylinder engine embodying my invention. Fig. 5 is a section along line X Y of Fig. 3.

A, B, and C are the three cylinders.

a, *b*, and *c* are the corresponding crank-pins of the multiple-throw crank, which forms one piece with the driving-shaft D.

E is the balanced casting which supports the cylinders or forms one piece with the same.

F F′ are the hollow trunnions, serving as pivots for the casting E and containing the eccentric bearings G G′ for the crank and driving-shaft D.

The projecting trunnions F F′, upon which the frame revolves, may be attached to the sides of a casing which incloses the frame and allows sufficient space for the rotary motion of the same; but in the engine illustrated by the drawings each trunnion forms one piece with the corresponding bearing, G, of the driving-shaft, and rests on a pedestal, H or H′, formed on the bed-plate J. The said casing may be made approximately cylindrical, and form in its lower part a receptacle for holding oil or other lubricant, or such water of condensation as may come from the exhaust, which may be allowed to escape within the casing; but the exhaust may also be arranged to escape into the center of the frame E—namely, the space in which the cranks work, and thence through one of the trunnions to the outside. The drawings show the latter arrangement, the inlet of steam and the outlet of exhaust being indicated by arrows. A passage for the admission of steam or other working-fluid is formed in the trunnion F, which communicates through a properly packed joint with a steam-chest near the cylinders.

Any convenient form of valve or valves may be used for distributing the steam to the cylinders—for instance, by admitting the steam first into one cylinder, where it is partially expanded, and then admitting it through a convenient form of valve to another cylinder larger than the first, and in which the steam is further expanded.

The steam-chest K is preferably placed in front of the cylinders and provided with an adjustable circular valve, L, fitted between the valve-face of the cylinders and the back of the valve-chest, as shown by Figs. 3 and 5. This valve is eccentric to the trunnions F F′ and held stationary, so as to periodically open and close the steam-ports m^a, m^b, and m^c and the exhaust-ports n^a n^b n^c of the cylinders during the revolution of the latter. This circular mushroom-valve L is held in position by a ring or strap, M, secured to the bed-plate J by a hinge-joint, N, or other suitable means. A regulating-screw attached to a bolt, O, passing through a slot is made to hold the strap M, Fig. 5, and to vary the position of the valve relatively to the ports when required.

For altering the cut-off in the cylinders, it is only necessary to loosen the bolt O, then shift the strap M more or less to the right or left, and fix it in this position by tightening the bolt or screw O.

The steam-passage q communicates with the hollow trunnion F through an opening, p, and with the steam-chest K through the port r.

P P′ are packing-rings between the trunnion F and the casting or frame E.

In the case of five or six cylinder engines the circular valve may serve for all cylinders, as will be easily understood. In six-cylinder engines the piston-rods of diametrically-opposite pistons may either be rigidly connected with each other, so as to form one piston-rod, or they may be independent of each other, so as to allow a relative sliding motion in the direction of their axes—for instance, by converting one piston-rod into a fork continued beyond the crank-pin, and guiding between its two sides or prongs the rod of the opposite piston; but any other suitable shape of piston-rods may be adopted, as long as they are guided in the direction of their axes.

I am aware that similar engines have been constructed with four cylinders at right angles to each other, and I do not therefore claim this special case; but the principle of construction for three or more cylinders placed at other than right angles has never been shown.

What I claim is—

1. A multiple-cylinder engine having a system of three or more cylinders distributed round a common axis of rotation, so that the axes of the cylinders form radii to the same, and adapted to impart to a shaft parallel with the said axis of rotation two revolutions for every revolution made by the system of cylinders, substantially as described.

2. In multiple-cylinder engines, the combination of three or more rigidly-connected cylinders having their axes in parallel planes and adapted to turn on an axis perpendicular to the axes of the cylinders with pistons and piston-rods, a multiple-crank shaft forming crank-pins for the piston-rods and placed eccentrically to the axis of rotation of the cylinder in the manner described, bearings for the crank-shaft and for the cylinders, and means for admitting, distributing, and discharging the working-fluid as required, substantially as described.

3. In multiple-cylinder engines, the combination of a system of three or more movable cylinders constructed and connected substantially as described, with pistons and piston-rods, a multiple-crank shaft placed eccentrically to the axis of rotation of the cylinders and forming crank-pins for the piston-rods in the manner described, a pair of hollow trunnions or journals adapted to support the cylinders and forming bearings for the crank-shaft as well as passages for the fresh and the spent working-fluid, a circular valve-chest, and a circular slide-valve placed eccentrically to the trunnions and adapted to distribute the working-fluid to the cylinders, substantially as described.

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

FRANK WYNNE.

Witnesses:
CHAS. ROCHE,
F. SHARGE.