(No Model.) 3 Sheets—Sheet 1.

C. A. & R. C. PARSONS & J. H. KITSON.

FOUR CYLINDER ROTARY ENGINE.

No. 304,553. Patented Sept. 2, 1884.

FIG. 6

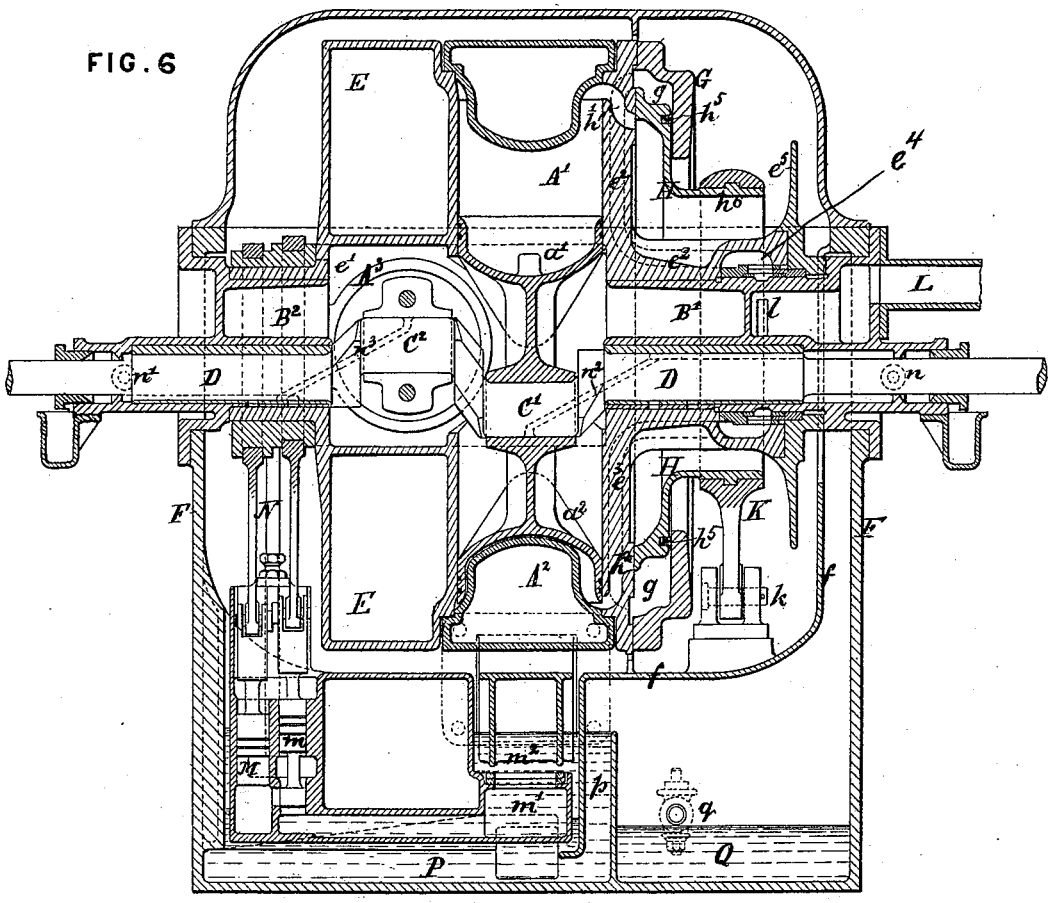

FIG. 1

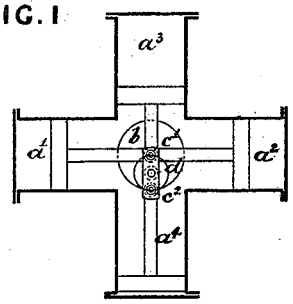

FIG. 2

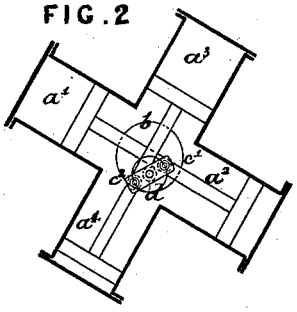

FIG. 9

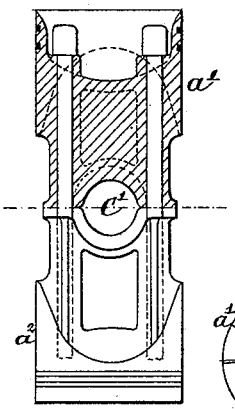

FIG. 5

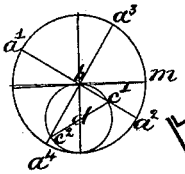

FIG. 4

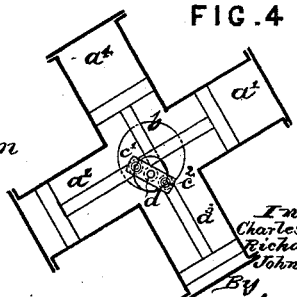

FIG. 3

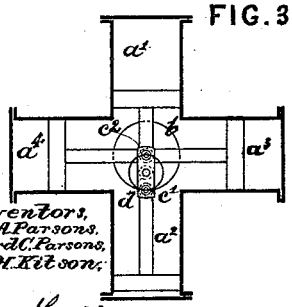

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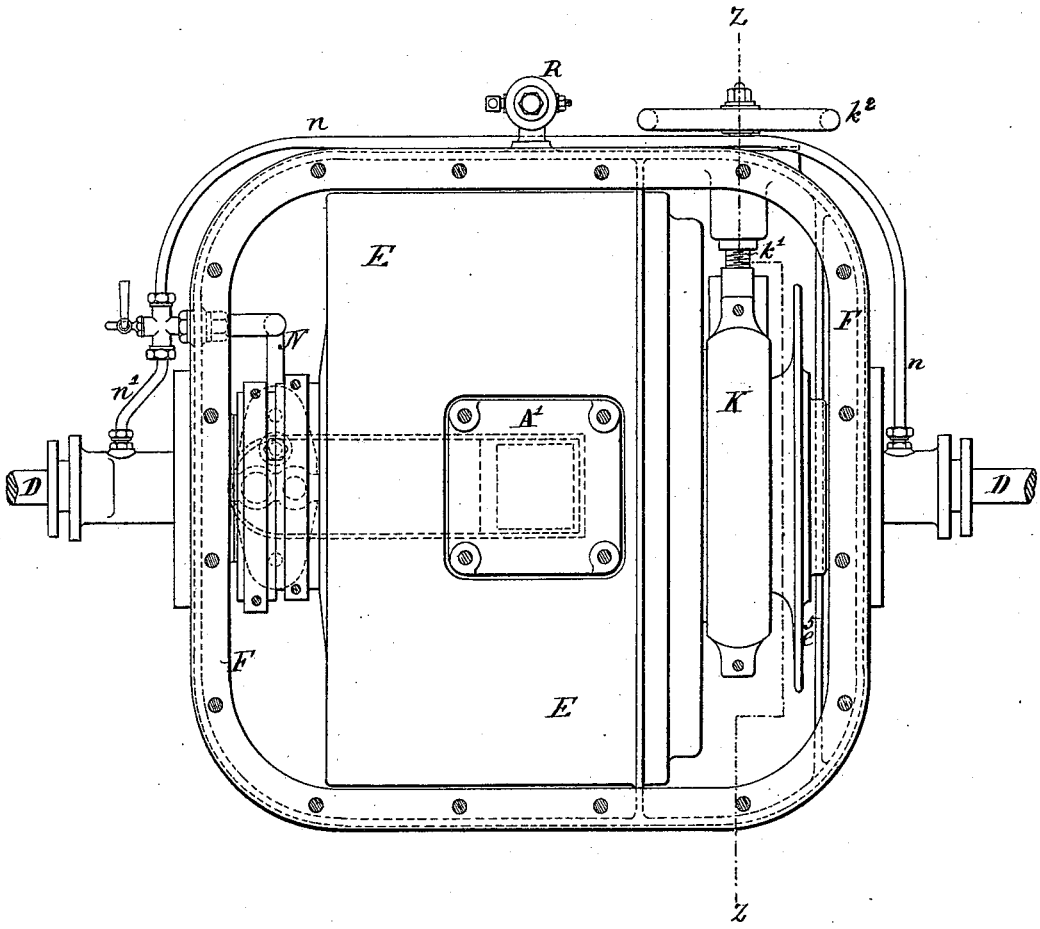
FIG. 7



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(No Model.) 3 Sheets—Sheet 3.

C. A. & R. C. PARSONS & J. H. KITSON.

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FIG. 8

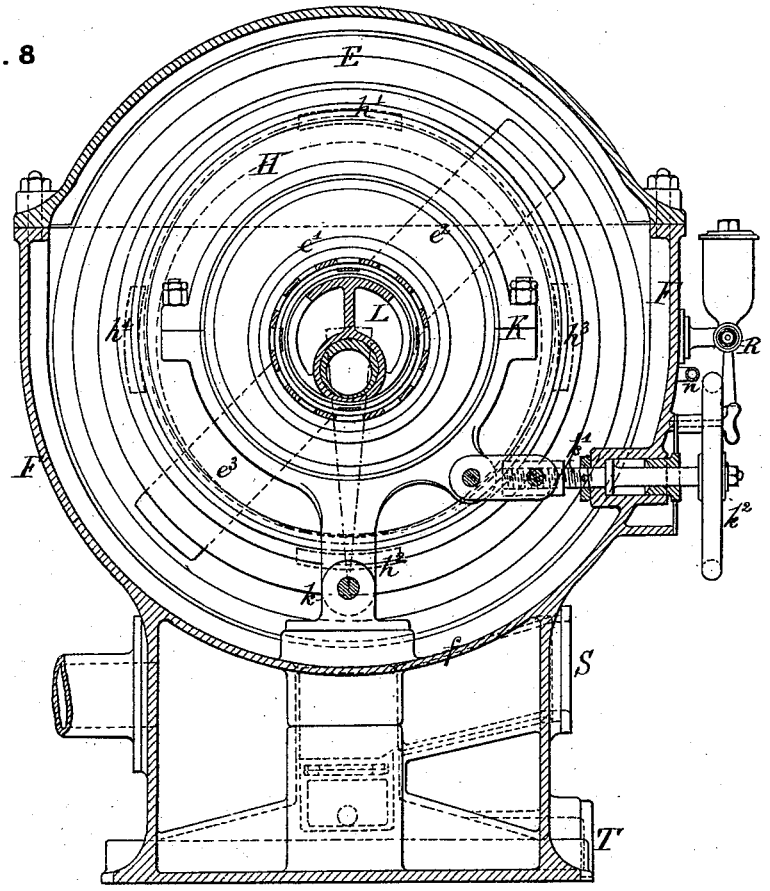


FIG. 10

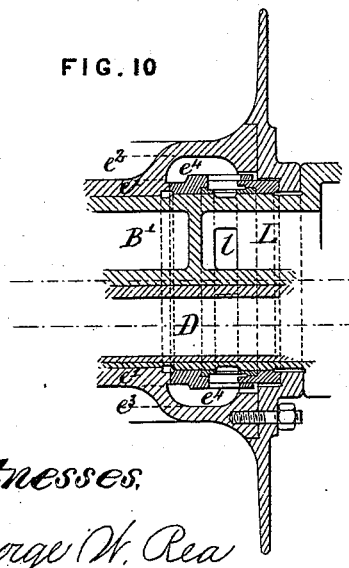
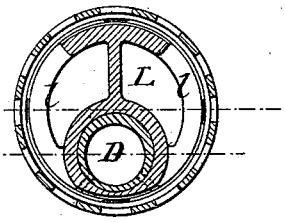


FIG. 11



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John H. Kitson,
By James L. Norris.
Atty.

UNITED STATES PATENT OFFICE.

CHARLES ALGERNON PARSONS, RICHARD CLERE PARSONS, AND JOHN HAWTHORN KITSON, OF LEEDS, COUNTY OF YORK, ENGLAND.

FOUR-CYLINDER ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 304,553, dated September 2, 1884.

Application filed June 18, 1884. (No model.) Patented in England October 9, 1882, No. 4,797.

To all whom it may concern:

Be it known that we, CHARLES ALGERNON PARSONS, RICHARD CLERE PARSONS, and JOHN HAWTHORN KITSON, citizens of England, all residing at Leeds, in the county of York, England, have invented an Improved Construction of Four-Cylinder Rotary Engine suitable for high speed, (for which we have obtained a patent in Great Britain, No. 4,797, dated October 9, 1882,) of which the following is a specification.

This invention consists in an improved construction of that kind of four-cylinder rotary engine which works in the manner illustrated by the diagrams, Figures 1, 2, 3, 4, and 5, of the accompanying drawings. There are four single-acting cylinders, a pair, $a' a^2$, opposite to and in line with one another, and a pair, $a^3 a^4$, also opposite to and in line with one another, but situated at right angles to the pair $a' a^2$ and at one side of them, so that the two sets of piston-rods and parts connected therewith are clear of one another. These four cylinders are all fixed on a framing free to revolve on trunnions *b*. The pistons of $a' a^2$ are rigidly connected together, their connection having at its middle an eye taking on to a crank, c', and in like manner the pistons of $a^3 a^4$ are connected to a crank, c^2. These cranks are opposite to one another on a shaft, *d*, free to revolve in bearings eccentric to the trunnions *b*, the eccentricity being equal to the crank-throw. The pistons being caused to reciprocate by steam or other fluid pressure acting at the outer ends of the cylinders in succession, the framing carrying the four cylinders is caused to revolve round the axis of the trunnions *b*, and the cranks are caused to revolve with twice the angular speed of the cylinders.

Figs. 1, 2, 3, and 4 show diagrammatically four successive positions of the parts as they revolve, and Fig. 5 shows diagrammatically one of these phases corresponding with Fig. 2, from which it will be seen that the angular departure of one of the cylinders—such as a^2—from a fixed point, *m*—that is to say, the angle $m\ b\ a^2$ is half the angle $b\ d\ c'$, which is the corresponding angular departure of the crank c' from the point *b*. It is to be understood that in what has preceded it is intended merely to explain the kind of engine to which this invention applies. As this is a type of engine already known, no general claim is made to it, but only to the particular features in its construction, which will now be described. Referring to the other figures of the drawings, Fig. 6 is a longitudinal section. Fig. 7 is a plan with the cover of the casing removed to show the parts of the engine below. Fig. 8 is a transverse section on *z z*, Fig. 7. Fig. 9 is a part elevation and part section of a connected pair of pistons. Fig. 10 is a longitudinal, and Fig. 11 a transverse, section to an enlarged scale of part of the right-hand trunnion, showing details of the steam-passage joint.

$A' A^2$, Fig. 6, are a pair of the cylinders, and A^3 is the mouth of one of the other pair. All the cylinders are cast in one piece with the barrel or framing E, which has projecting at each end a hollow boss, e', fitted to revolve on the trunnions $B' B^2$, which project inwardly from the casing F, having flanges bolted thereto. The two pistons $a' a^2$, Fig. 9, have frames projecting from them, which meet in the middle between them, forming an eye, c', to embrace one of the cranks $C' C^2$ on the shaft D, the two pistons being secured together by a pair of bolts passing lengthwise through the frames, one on each side of the eye c'. The right-hand end of the barrel E has cast in it two passages, $e^2 e^3$, which extend radially from an annular cavity, e^4, Fig. 10, at the trunnion, and have mouths opening outward, near the periphery of the barrel, into the cavity *g*, within a slide-case, G, that is bolted onto the end of the barrel. From the cavity *g* four ports and passages, $h' h^2 h^3 h^4$, lead, one to the end of each of the four cylinders. On the face of the barrel in which the ports and passages are formed, and between that face and the slide-case G, is the circular slide H, which has a spring packing-ring, h^5, near its periphery, bearing against the interior surface of G. The slide H has a hollow projecting neck, h^6, which is embraced by an eccentric strap, K, linked to a stationary pin, *k*, carried in a bracket projecting inward from an internal partition, *f*, of the casing F. To the eccentric strap K is linked a screw-spindle, k', which passes through a stuffing-box in the side of the casing F, and can be turned by an external wheel or handle, k^2. By means of this screw the slide H, while it is free to revolve within the strap K, can be made to take a central position, or

can be moved to the one hand or the other, according as the engine is to be driven in the one direction or the other, with more or less cut-off. The steam or fluid under pressure for working the engine, supplied by the passage L to a cavity in the trunnion B′, passes thence by slits *l* and through packing-rings, as shown in Figs. 10 and 11, to the annular cavity e^4 in the barrel. From e^4 it passes by the conduits e^2 e^3 to the space *g*, surrounding the slide H, and as the four ports h' h^2 h^3 h^4 become successively uncovered by the exterior periphery of the slide H it passes to the four cylinders in succession. The exhaust from the cylinders issues by the same four ports as they are successively uncovered by the interior periphery of the slide, and passes through the hollow of the slide-boss h^6 into the interior of the casing. On issuing from h^6 the exhaust is deflected outward by a disk, e^5, attached to and revolving with the barrel E, this disk arresting particles of water and oil and throwing them outward into the cavity of the casing F. The packing-rings shown in Figs. 10 and 11, through which the working-fluid passes from L to e^4, overlap each other and are pressed to right and left by the pressure of the fluid in the middle, so that the outer edges of the rings, where they bear against the shoulders of *e′*, do not permit leakage of fluid past them.

For the purpose of lubricating the working parts, there is an oil-pump, M, and an adjoining piston-slide, *m*, which acts as the supply and discharge valves of the pump, both M and *m* being worked by eccentrics on the trunnion B^2 of the revolving barrel E. The pump draws oil from the oil-well *m′* from under a filter-screen, m^2, and it forces the oil by the pipes N and branches *n* *n′* to the two bearings of the shaft D, supplying cavities surrounding the shaft just within the stuffing-boxes through which the shaft passes. Along the shaft chases are cut, and oblique holes n^2 n^3 are drilled, by which the oil passes to the cranks C′ C^2, as shown in Fig. 6. There are also passages from the shaft-bearings to the trunnion-bearings. The oil issuing from the bearings and water of condensation collect on the partition *f* of the casing and flow down into the oil-well, whence the oil-pump takes its supply. The water, owing to its greater specific gravity, becomes to a great extent separated from the oil flowing down to the compartment P below the oil-well. From P it is caused, by excess of column in the oil-well, to ascend the passage *p*, and it overflows into the compartment Q, whence it can be drawn off from time to time by opening a cock, *q*. As the ascending passage *p* opens from the bottom of P, only the heaviest part of the liquid escapes by it.

When fresh lubricant is required, it is supplied by a grease-cock, R. There are lateral holes provided with removable covers S and T, for giving access for cleaning to the filter m^2 and to the bottom of P.

Having thus described the nature of our invention and the best means we know of carrying it into practical operation, we claim—

1. In four-cylinder engines of the kind described, the barrel E, having cast in one piece with it the four cylinders, having at its ends trunnions B′ B^2, one of the trunnions made with an annular cavity, e^4, and having in its one end passages e^2 e^3 from the annular cavity e^4, and ports h' h^2 h^3 h^4 to the four cylinders, having also bolted on its said end the circular slide-case G, open in the middle, as described.

2. In four-cylinder engines of the kind described, in combination with the end of the barrel E, having passages e^2 e^3 and ports h' h^2 h^3 h^4, and having the slide-case G bolted thereon, the circular slide H, having a hollow boss fitted to revolve within the eccentric strap K, and the fulcrum-pin *k* and screw-spindle *k′*, whereby the position of the strap is held and adjusted, as and for the purpose set forth.

3. In four-cylinder engines of the kind described, in combination with the end of the barrel E and its passages e^2 and e^3, and trunnion B′ and annular cavity e^4, the cavity L and slits *l* in the stationary trunnion B′, and the packing-rings with passages through them, as described.

4. In four-cylinder engines of the kind described, the combination of a pair of the pistons, as a' a^2, and their projecting frames bolted together and forming at their joining the eye *c′* for the crank, as described.

5. In four-cylinder engines of the kind described, the combination of the trunnion B^2, the eccentrics thereon, the oil-pump M, its piston-valves *m*, the oil-well *m′* and filter m^2, and the oil-pipes N, *n*, and *n′*.

6. In four-cylinder engines of the kind described, the combination of the oil-well *m′*, the compartments P and Q at the bottom of the casing F, and the overflow-passage *p*.

In testimony whereof we have signed our names to this specification, in the presence of the subscribing witnesses, the 15th and 29th days of May, A. D. 1884.

CHARLES ALGERNON PARSONS.
RICHARD CLERE PARSONS.
JOHN HAWTHORN KITSON.

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FRED. W. DENELY,
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HENRY OWEN,
Clerk, Airedale Foundry, Leeds.