(No Model.) 2 Sheets—Sheet 1.

R. M. FRYER.

ENGINE.

No. 283,704. Patented Aug. 21, 1883.

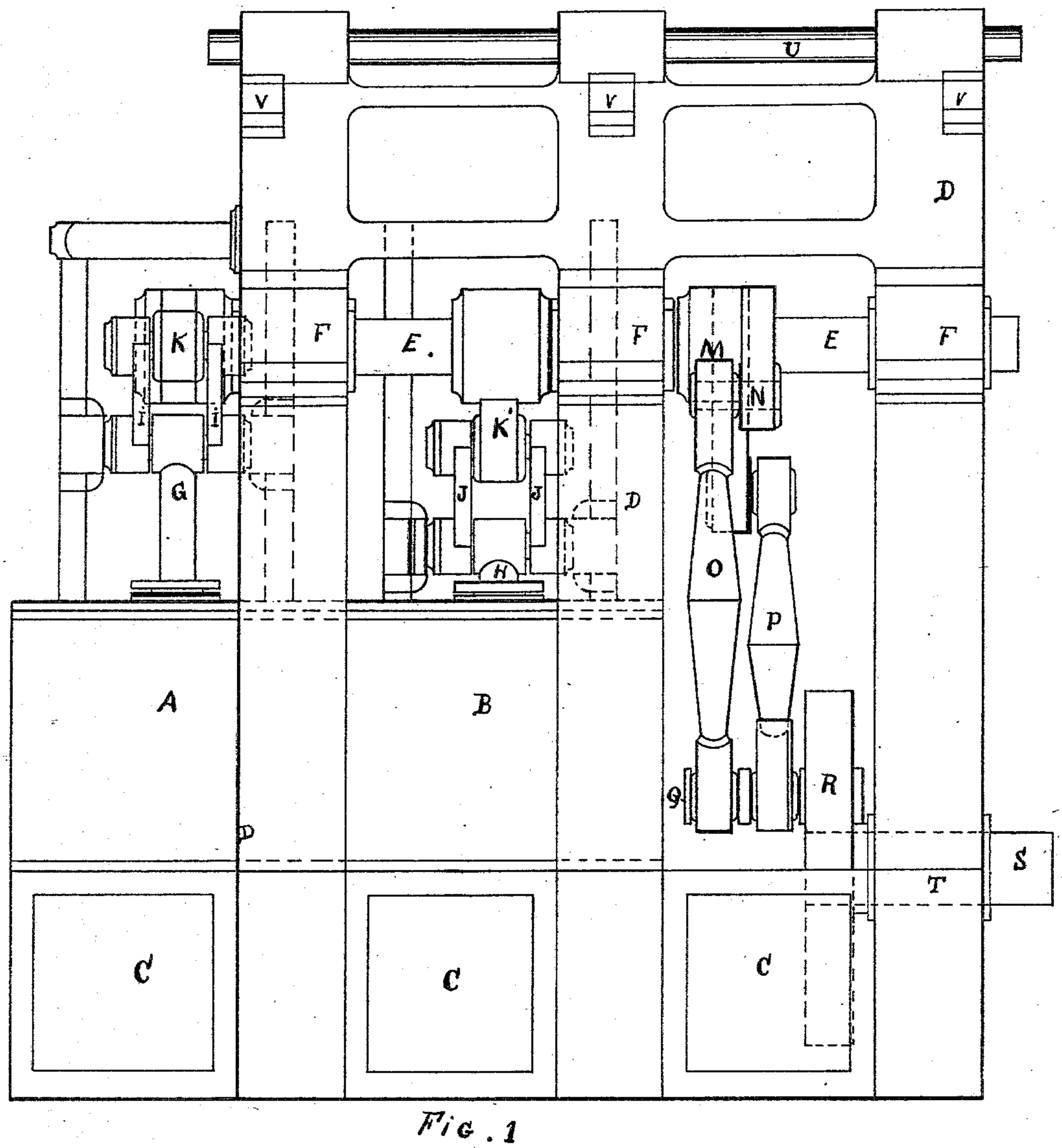

Fig. 1

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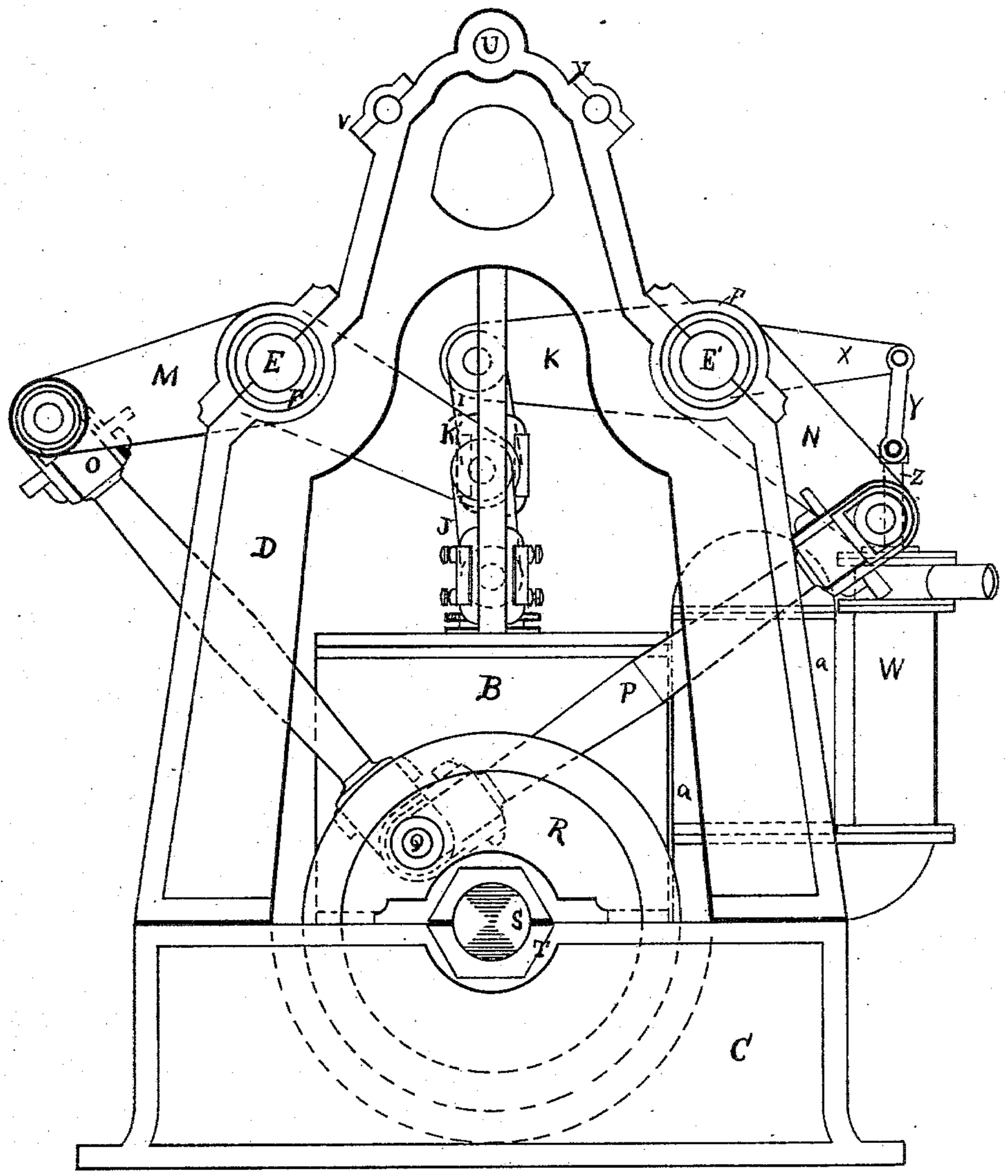

Fig. 2.

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UNITED STATES PATENT OFFICE.

ROBERT M. FRYER, OF NEW YORK, N. Y.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 283,704, dated August 21, 1883.

Application filed December 9, 1882. (No model.)

To all whom it may concern:

Be it known that I, ROBERT M. FRYER, of the city, county, and State of New York, have invented certain new and useful Improvements in Engines, of which the following is a specification.

This invention relates to that class of engines known as the "double-cylinder" or "compound engine," and is designed to connect the power derived from both cylinders with one crank, avoiding the use of the double crank now extensively employed in screw-steamers; and it consists in arranging a pair of steam-cylinders on a bed-plate in fore-and-aft position in line with the center of the crank-shaft, and connecting the piston-rods of the same with the vibrating ends of two half-working beams or levers by suitable links. The other end of each of the levers are fixed to one of the two rock-shafts, which are supported by a frame parallel with the cylinders a proper height above the top of cylinders to secure proper length of links, (say one-half the stroke,) and also set far enough apart to secure the proper length of lever (say a length equal to that of the piston-stroke.) These rock-shafts are sufficiently long to convey the power from pistons connected, as above described, to a point at the rear of the cylinders, where another lever is fixed to each of the said rock-shafts equal in dimensions to the above half-beams, and from the vibrating ends of which a connecting-rod is attached, leading to the crank-pin of a crank or disk located on a shaft supported in a pillow-block by the bed-plate to which the cylinders are attached, so that the power of the pistons is applied to the crank at or nearly at right angles to its center, while the pistons move accordingly. The above rock-shafts also extend far enough to the front or rear of the cylinders to work the valve-gear, as described in my application now pending therefor before the Patent Office. The said rock-shaft is also employed for working the air and other pumps, as hereinafter more fully described.

The object of my invention is to produce an engine for marine purposes, of the compound type, having the cylinders located fore and aft in a vessel as much as possible below the water-line, whereby very large cylinders may be employed without danger of rendering a vessel "top heavy," as where such cylinders are located a long way above the water-line, as in the ordinary propeller-engine; second, to avoid the use of the double right-angled crank now employed to overcome the "dead-center," as in the case of the ordinary vertical compound engine, which cranks are so often broken, and lead to terrific marine disasters or damaging delays; third, to secure the requisite pump motion by positive and simple means; and, finally, to produce an engine, for both marine and land purposes, constructed within small space, embodying vertical cylinders and the proper length of connections between the same and the crank, and arranged to apply the power to the crank at or nearly at right angles to its center, to avoid the use of double cranks; and, furthermore, to embody the qualities—solidity, strength, convenience of handling, and cleanliness—the latter quality being gained from the fact that the piston-rods work from the top of the cylinders, whereby the steam, water, and oil cannot find their way to the other parts, like in the case of engines now employed, where the piston-rods work from the bottom of the cylinders; where, also, the connections to fix the engine as low as possible are generally too short, whereby a great amount of lubricating material is used to overcome the consequent increased friction.

In the drawings, Figure 1 represents a side elevation of my engine, in which A and B are the cylinders, the position of which may be reversed, so as to bring the larger or smaller cylinder fore or aft. These cylinders are secured to the bed-plate C by bolts or other suitable means. D represents a frame-work, which supports rock-shafts E E′. (See Fig. 2.) These rock-shafts are provided in the frame with suitable boxes or bearing-blocks, F, in which the said shafts oscillate. G and H are the piston-rods, which connect, by means of links I and J, with the levers K K′. These levers are firmly fixed to the rock-shafts E E′, so that when the pistons are reciprocated the said rock-shafts are compelled to oscillate accordingly, which motion is conveyed by E E′ to the levers M and N, which are also fixed to the shafts, and from the vibrating ends of the said levers rods O and P are connected, leading to the crank-pin Q, located in disk R on wheel-shaft S. Thus the connection is com-

pleted between the cylinders and crank, by which the rectilinear motion of the two pistons is converted into one continuous rotary motion at the crank, avoiding the thump and jar occasioned when the power of each piston is applied directly across the center of the shaft, like in the case of the ordinary double-cylinder vertical propeller-engine. The top of the frame D of this engine is adapted to connect with an arch belonging to a longitudinal brace or extended keelson, described in another application for a patent which I am about to file, by which means the weight of the engine is distributed over a great surface, while the shaft is firmly supported throughout its entire length. The connection between the top of the frame D and the arch referred to may be made by any suitable adjustable link or loop in union with the said arch and the rod U at various points. This admits of removal of the frame at any time, and is a convenient fastening, when required as such, but can of course be substituted by other fastening devices. The boxes V are employed to support a rock-shaft for the valve-gear, which is operated by eccentrics upon shaft S, or by an improved device for which I have filed a separate application for a patent. Therefore its description here is unnecessary.

Fig. 2 is an end view of the engine, and shows the position of the two rock-shafts E E′ and their connecting-rods O and P and levers M and N; also, their connection with the piston-rods G and H by the levers K K′ and links I and J. In this view W represents one of the pumps, which is worked by rock-shaft E′, in connection with lever X and rod Z Z′. *a* is a condenser, which connects with the engine and pumps in the ordinary manner. It should here be stated that by separating the cylinders A and B and locating the crank between them, the power can be transmitted thereto from the rock-shafts E E′ by connecting-rods O and P as readily as where they are now located. In this plan, however, one of the cylinders, at least, will have to be correspondingly raised, and the steam-connection between the two cylinders would have to be somewhat changed. Otherwise this modification is unobjectionable, and in some cases may be preferable.

Operation: Referring to Fig. 2 of the drawings, it will be seen that the piston of cylinder A is at half-stroke, and that the piston of cylinder B is designed to be at the lower end of its stroke. Now, by applying sufficient pressure to the former piston at either side the power is conveyed by links I to the lever K, to the rock-shaft E, to the lever M, to the connecting-rod O, to the crank-pin Q, which is thus moved in either direction, carrying the connections of B (the companion cylinder) along to a point where the power of the latter may be applied to the crank, in a manner to help rotate the same, until the piston of A reaches the end of its stroke, when the office of the piston of cylinder B and connections becomes the same as those of A were at the beginning, and so the offices of each are at times reversed, or working in conjunction, to move the crank in a continuous rotary plane, whereby the dead-point in this single crank is thoroughly overcome, and a positive rotary motion is given to the wheel-shaft S, to which eccentrics may be attached for working the valves for regulating the flow of steam to the cylinders; but as such valves may be worked by a system for which I have already made application for a patent, I will omit the description of the valve operation here. It will be seen in this, Fig. 2, where the air-pump and condenser are shown, that either rock-shaft E or E′ may be employed for working the pumps, and that the condenser may be located on either side of the engine, or at any other convenient point.

I am aware that oscillating pump-shafts have been used in connection with engines, and that the said shafts have been specially located and operated for the purpose of working pumps similar to the one I have shown; but I am not aware that such shafts were ever used to convey the power of the piston or pistons of an engine to a point fore or aft of the cylinders, to connect therewith a crank, as I have shown and described; and it may be here stated that the cylinders may be located above the center of these rock-shafts, and work downward, uniting with the crank in a similar manner, avoiding the use of the double crank, as now employed in compound or double engines. Therefore—

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. In an engine having two cylinders arranged in line with the center of the crank-shaft, the combination, with one crank, of two rock-shafts located parallel with the center of the cylinders, and connected with the pistons thereof by suitable links or rods leading to vibrating levers located on said rock-shafts, and with the crank, by suitable connecting-rods, leading to the other levers located on said rock-shafts, substantially as shown and described.

2. In an engine having two cylinders arranged in line with the center of the crank-shaft, the combination, with one crank, of two rock-shafts located parallel with the center of the cylinders and connected with the pistons thereof, and connections for operating the pumps, substantially as and for the purposes set forth.

ROBT. M. FRYER.

Witnesses:
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IDA J. FRYER.