R. McC. FRYER.

Valve-Gears for Engines.

No. 135,796. Patented Feb. 11, 1873.

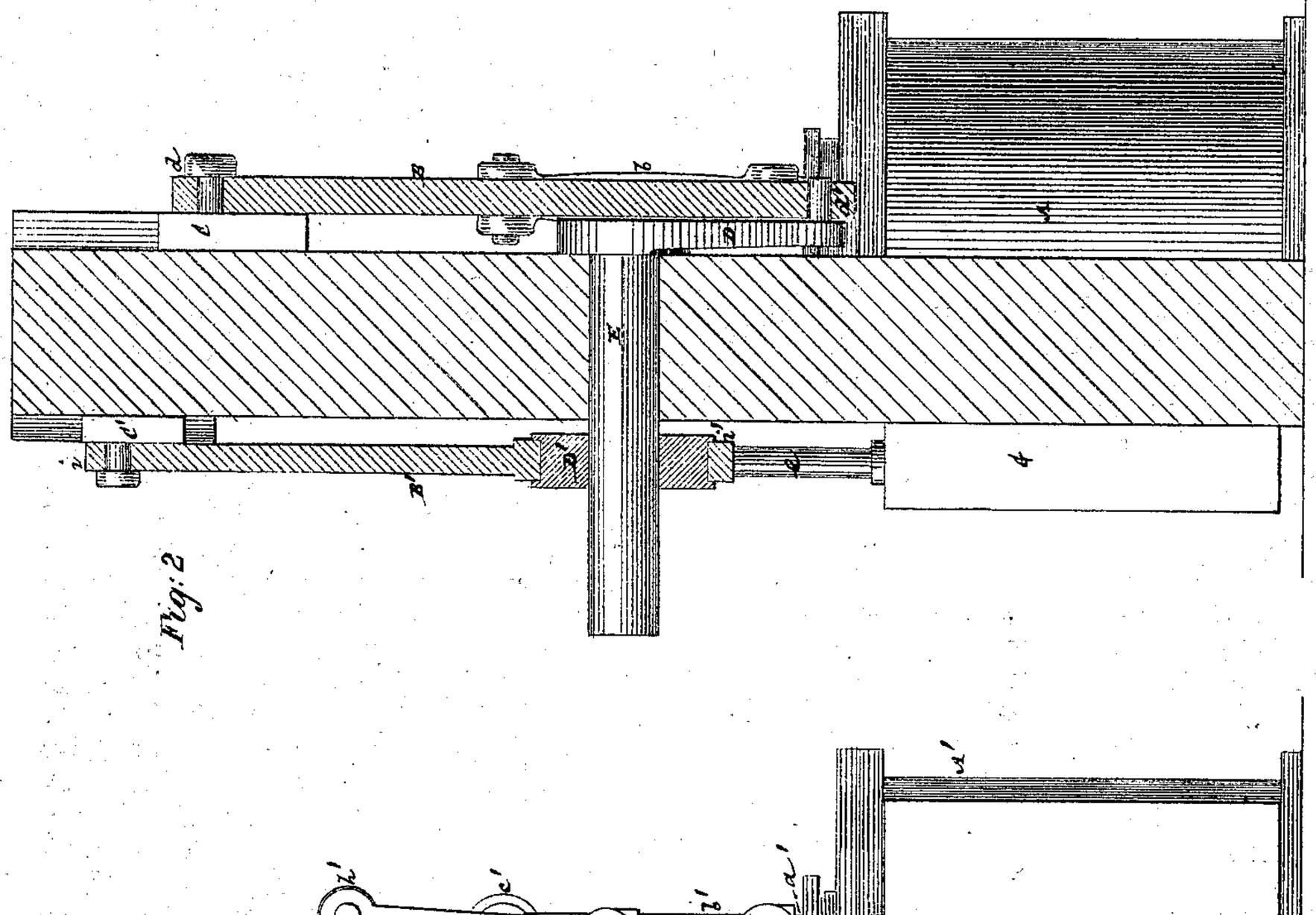

Fig. 2

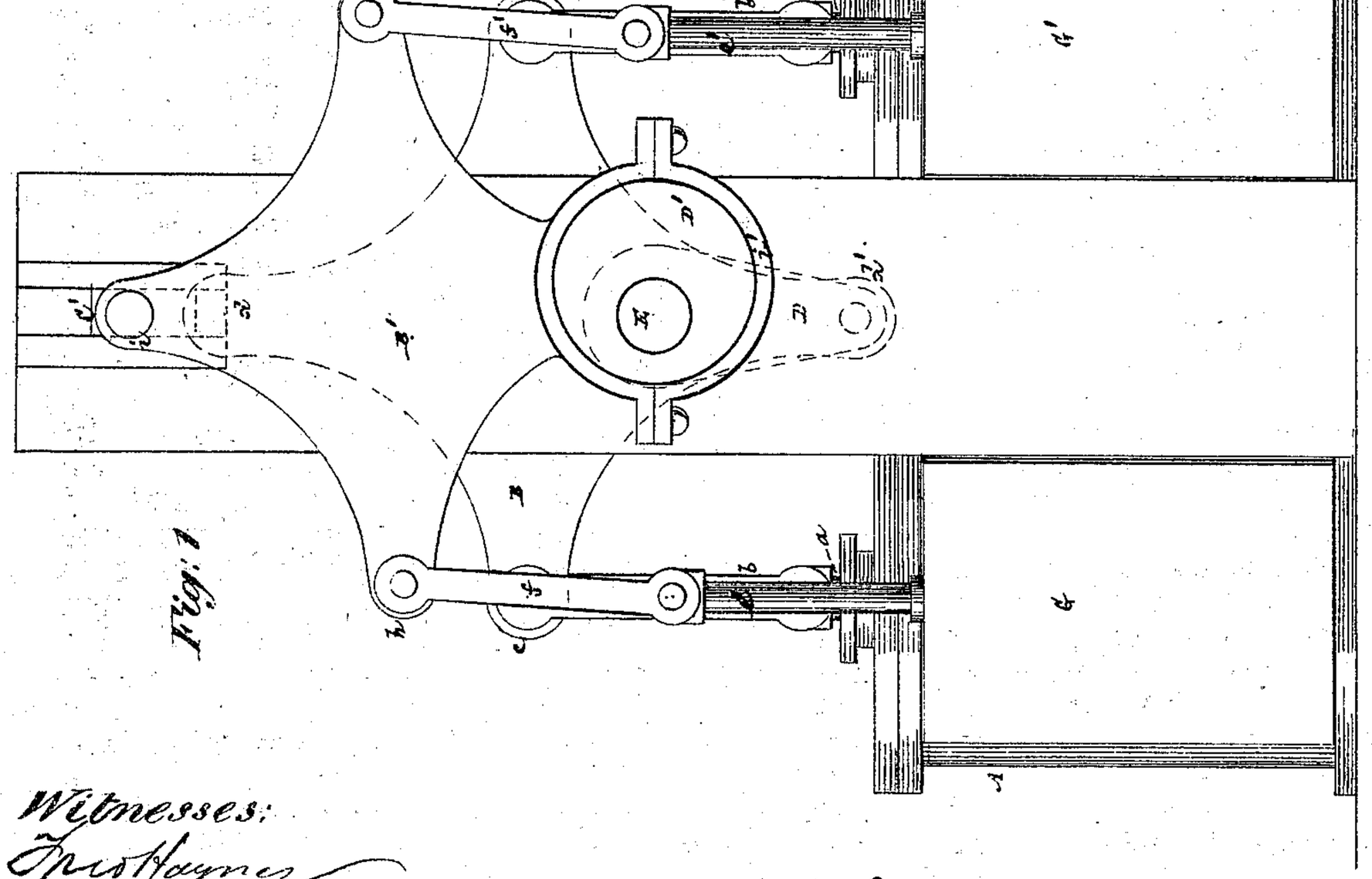

Fig. 1

Witnesses:
Jno. Haynes
Benj. F. Sharp.

Robert McC. Fryer

UNITED STATES PATENT OFFICE.

ROBERT McC. FRYER, OF NASHVILLE, TENNESSEE, ASSIGNOR OF ONE-HALF HIS RIGHT TO GEORGE W. SAULPAW.

IMPROVEMENT IN VALVE-GEARS FOR ENGINES.

Specification forming part of Letters Patent No. **135,796**, dated February 11, 1873.

To all whom it may concern:

Be it known that I, ROBERT McC. FRYER, of Nashville, in the county of Davidson and State of Tennessee, have invented a new and useful Improvement in Valve-Gear for Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing forming part of this specification, and in which—

Figure 1 represents a rear elevation of a double-cylinder engine with my improved valve-gear applied, and Fig. 2 a partly sectional side elevation of the same.

Similar letters of reference indicate corresponding parts in both figures.

This invention relates to steam and other engines, constructed substantially as described in Letters Patent No. 124,805, issued to me March 19, 1872, and in which a rocking beam or device having no fixed center, and constituting a cross or its equivalent, was used for converting reciprocating motion into rotary motion, said cross having its one end or arm connected with the crank to which it is required to give rotary motion, its opposite end or arm with a reciprocating cross head or slide, and its two remaining arms with the reciprocating pistons, respectively, of a double-cylinder engine, whereby a variable motion was produced which avoided dead-centers as regards the action of the crank. My invention consists in a certain gear for operating the valves which control the admission and escape of the steam or other propelling medium to and from the pistons of such engines, said gear comprising a similar rocking-beam or "cross"-connection having its one arm pivoted to a cross head or slide, its opposite arm worked by an eccentric on the engine-shaft, and its remaining arms connected, respectively, with the valve-rods of the two cylinders, whereby the valves are operated in exact unison with the engine-pistons to obtain a proper action for the latter when connected with the main or crank shaft, as described.

In the accompanying drawing, A A′ are the cylinders of a double-cylinder steam-engine, the pistons of which are connected, respectively, by their rods *a a′* and links *b b′*, with the opposite ends or arms *c c′* of a rocking beam or cross, B, having no fixed center. The two other remaining arms *d d′* of the cross are connected, respectively, as hereinbefore referred to, with a cross head or slide, C, and with a crank, D, of the main or engine shaft E.

In an engine-connection of this description, when force is applied separately to either of the pistons, the arm *c* or *c′* of the cross B in connection therewith has a tendency to revolve the whole cross; but as this is prevented by the slide C, which acts as a fulcrum, the opposite arm *c* or *c′* is forced to the right or to the left, as the case may be, and at the same time is forced in an opposite direction to the force applied to the piston. When equal force is applied in the same direction to both pistons the whole cross B acts as an ordinary connecting-rod, in combination with a crank and reciprocating motion, and has no direct vibratory force. The crank D being arranged as represented in relation with the cross and pistons or their rods, steam is admitted at different intervals to the pistons to rotate the engine-shaft, being first admitted to act upon a single piston, and then upon both pistons, and toward the conclusion of the stroke upon a single piston again, the two pistons moving at different velocities relatively with each other during certain portions of the stroke, all as described in my Letters Patent hereinbefore referred to.

In such an engine-connection, however the admission and exhaustion of the steam to and from the engine-cylinders may be adjusted, it is important that the action of the valves which control the engine-pistons should be in accordance with the motion as derived from the cross B. To this end I employ a valve-gear similar to the engine-beam or cross-connection, but deriving its motion from the rotary movement of the main shaft E by means of an eccentric, D′, and whereby rotary motion is converted into reciprocating motion to operate the valves of the two cylinders. G G′ are the valve-boxes of the cylinders A A′, and *e e′* the valve-rods, connected by links *f f′* with the two opposite ends or arms *h h′*, respectively, of a second rocking and reciprocating beam or cross, B′, having no fixed center, and the two remaining arms *i i′* of said cross being connected, respectively, with a

slide, C′, and with the eccentric D′ on the engine-shaft E. By means of this valve-gear the valves are operated in timely relation with the engine-pistons, as controlled by the cross B of the engine.

Under this arrangement a single eccentric, D′, serves to operate two separate valves—that is, one for either cylinder.

What is here claimed, and desired to be secured by Letters Patent, is—

The combination, with the revolving shaft E of the engine and its operating-cross B or its equivalent, of the secondary cross B′ or its equivalent, the eccentric D′, the slide C′, and the valve-rods *e e′*, the whole being arranged in relation with each other for operation substantially as specified.

ROBERT McC. FRYER.

Witnesses:
FRED. HAYNES,
BENJ. P. SHARP.