

R. McC. FRYER.
Valve Gears and Connections for Steam and other
Engines.

No. 135,795.

Patented Feb. 11, 1873.

Fig. 2

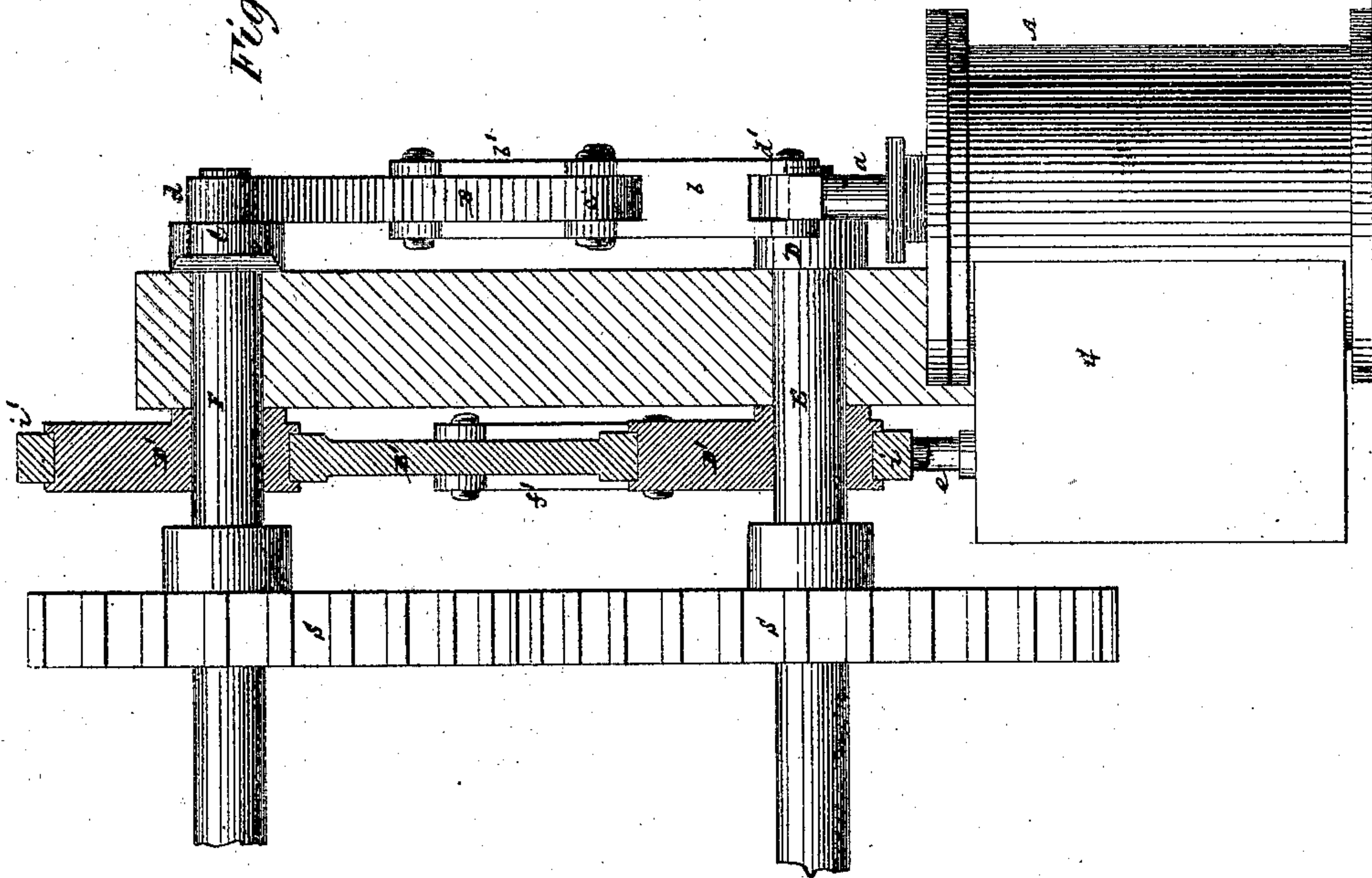
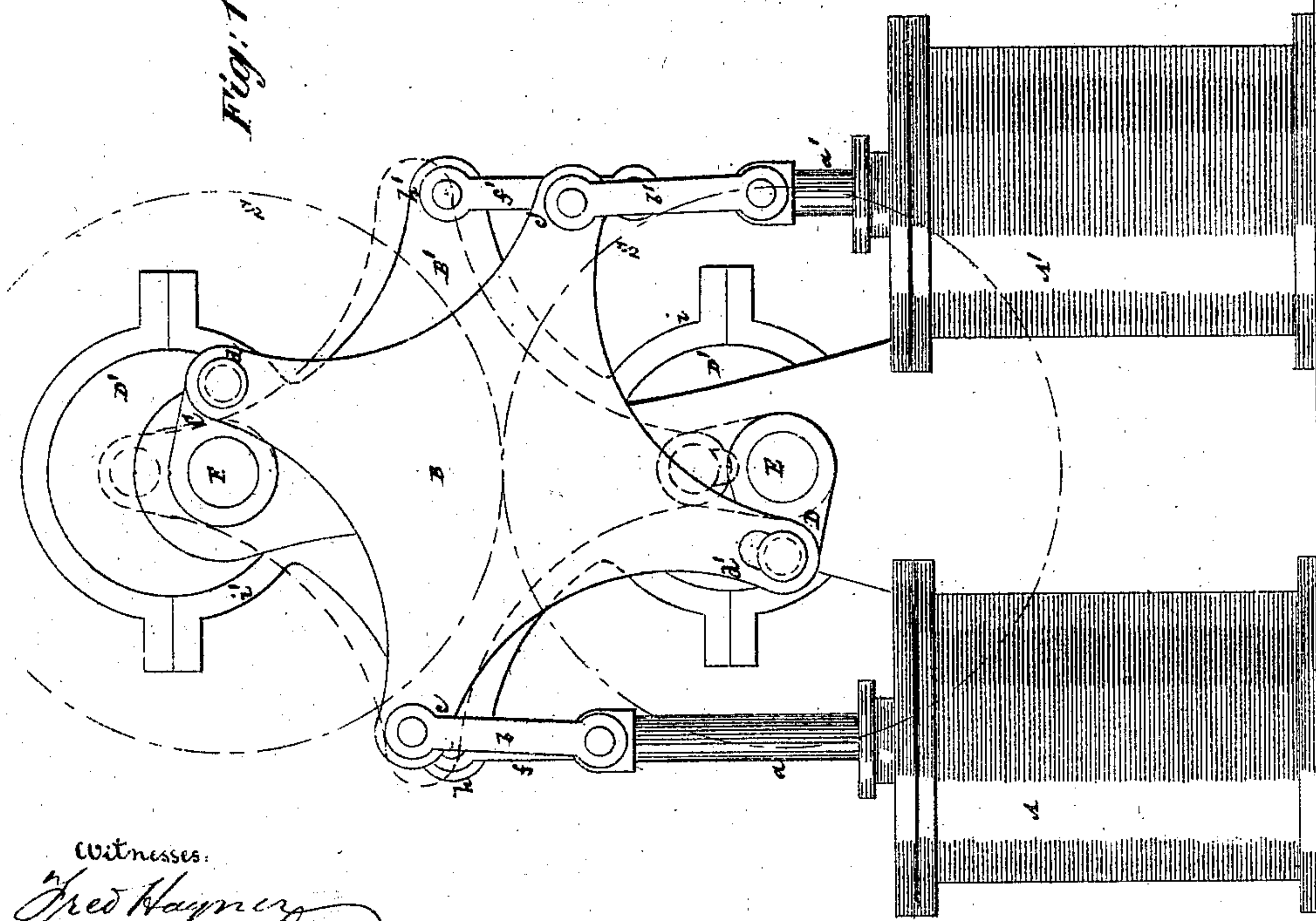


Fig. 1



Witnesses:
Fred Haymer
Burj. S. Sharp.

Robert M. C. Fryer.

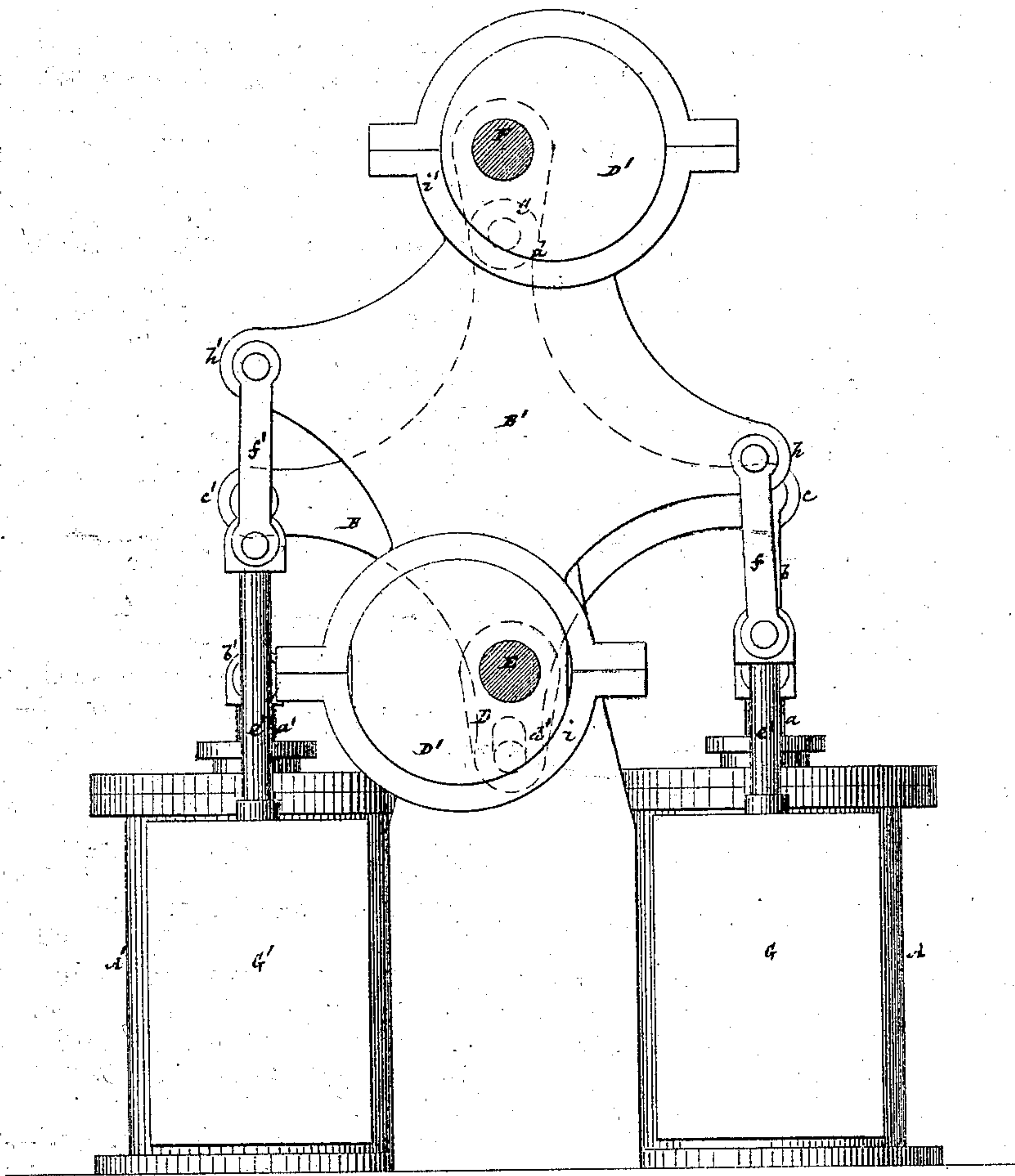
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Fig. 3



Witnesses.

Frederick H. Harnes
Benj. S. Sharp.

Robert M. C. 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 AND CONNECTIONS FOR STEAM AND OTHER ENGINES.

Specification forming part of Letters Patent No. 135,795, 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 certain new and useful Improvements in Connections for Steam and other Engines and Valve-Gear for Operating the Same, said devices constituting means for converting reciprocating into rotary motion, and vice versa; 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 front elevation of a double-cylinder engine with my invention applied; Fig. 2, a partly sectional side elevation of the same; and Fig. 3, a rear elevation thereof.

Similar letters of reference indicate corresponding parts.

This invention more particularly relates to steam and other engines constructed, as regards the connection between the crank-shaft and two cylinders of the engine, mainly as described in Letters Patent No. 124,805, issued to me March 19, 1872; such connection consisting of a rocking beam or device having no fixed center, and constituting a cross or its equivalent, two opposite arms of which were connected with the two piston-rods of the engine, while the other two arms were connected, respectively, with the crank of the main shaft and with a guide or moving fulcrum, whereby a variable motion was produced which avoided dead-centers as regards the action of the crank. My invention consists in a cranked construction of the moving fulcrum of said beam or cross and slotted connection of the opposite arm of the cross with the crank of the engine-shaft, whereby a very efficient and easy-working connection of the description hereinbefore referred to is obtained. The invention also 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 carried at opposite points or arms by eccentrics fast on the shaft of the cranked fulcrum of the beam and on the main crank-shaft of the engine,

said shafts being geared to rotate in unison, and the remaining two opposite arms of the cross being connected 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 engine 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'* are connected, respectively, as hereinbefore referred to, with a movable fulcrum, 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 movable fulcrum C, 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 simply as a connecting-rod, in combination with a revolving crank and reciprocating movement, and has no direct vibratory force.

Instead of, as in the engine described in my patent hereinbefore referred to, the movable fulcrum C being a straight reciprocating slide, it is formed of a crank fast to a revolving shaft, F, which is connected by gearing S S with the engine-shaft E to rotate at the same velocity as the latter, and the arm *d'* of the cross is in slotted connection with the crank D of the engine. This produces a very efficient and easy-working cross-like engine-connection.

The crank D of the engine being arranged as represented in relation with the cross and pistons or their rods, steam is admitted at 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 sin-

gle 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 movements of the shafts E F by means of eccentrics D' 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' 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 by the eccentrics D' D', respectively, with the shafts E F for operation by said eccentrics, whereby the valves are operated in timely relation as required with the engine-pistons as controlled by the cross B of the engine.

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

1. The combination of the crank C with the cross B or its equivalent, the crank D of the engine-shaft E, and the piston-rods a a' of the cylinders A A', the whole being combined and arranged for operation as described.

2. The combination, with the elements recited in the preceding clause of claim, of the secondary shaft F, the wheels S S, the cross B' or its equivalent, the eccentrics D' D', and the valve-rods e e', substantially as and for the purposes herein set forth.

ROBERT McC. FRYER.

Witnesses:

FRED. HAYNES,
BENJ. P. SHARP.