No. 668,058.

Patented Feb. 12, 1901.

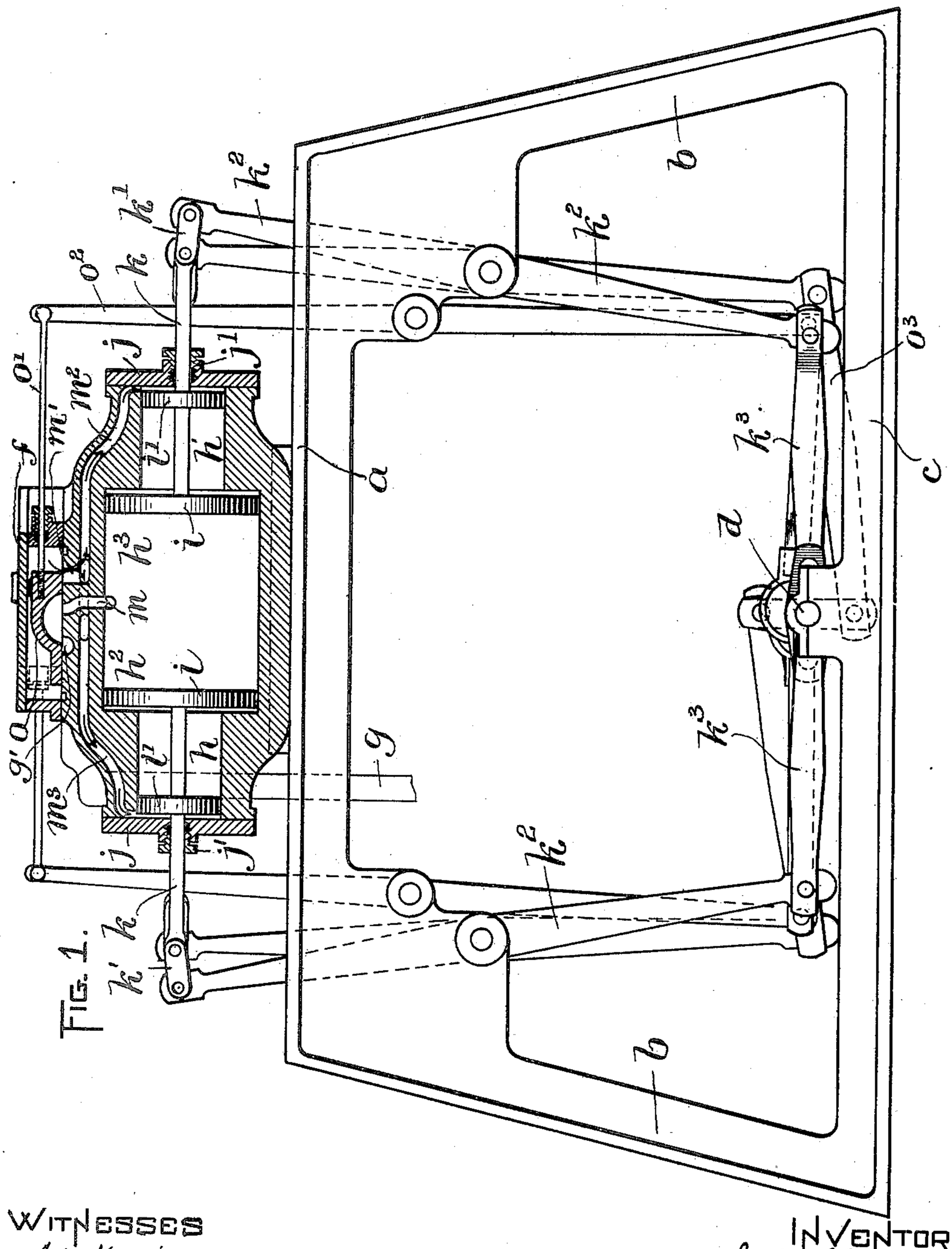
H. F. SHAW.

MOTOR.

(Application filed Apr. 19, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses
A. D. Harrison
D. W. Leggett.

Inventor:
H. F. Shaw
by Wright Brown Quinby & Co
his attys

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(No Model.) 2 Sheets—Sheet 2.

FIG. 3.

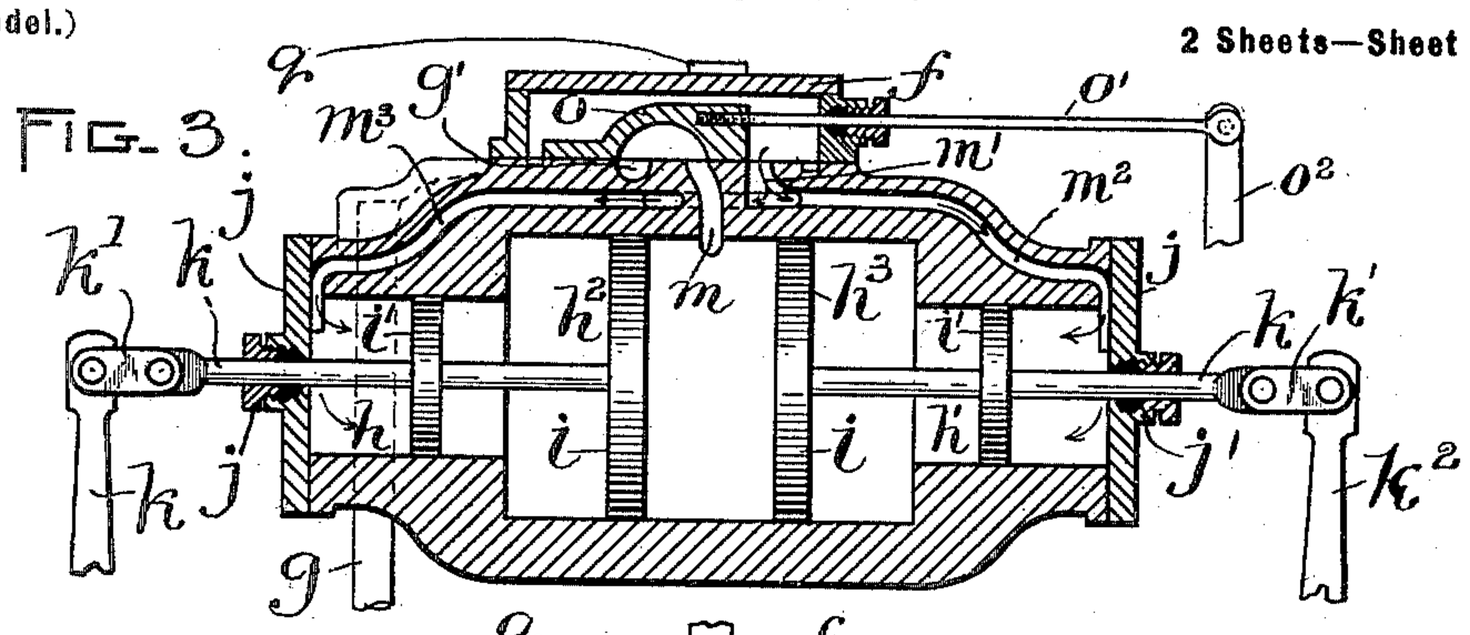

FIG. 4.

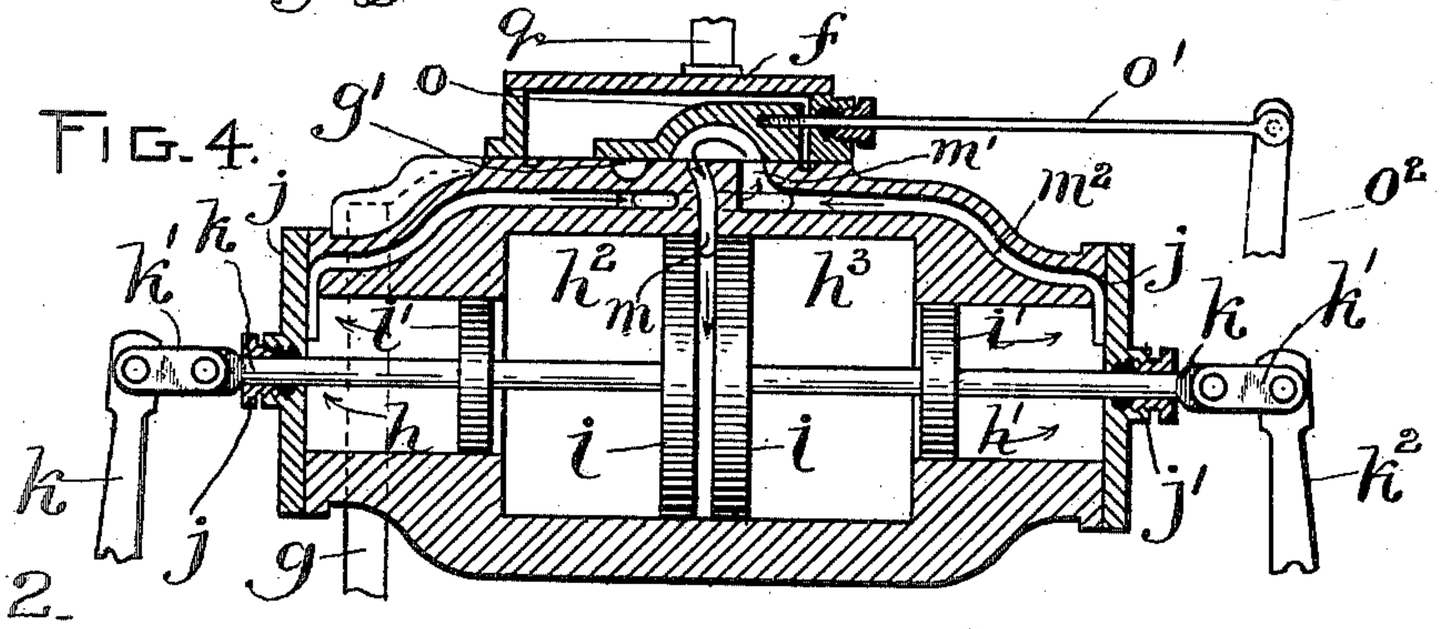

FIG. 2.

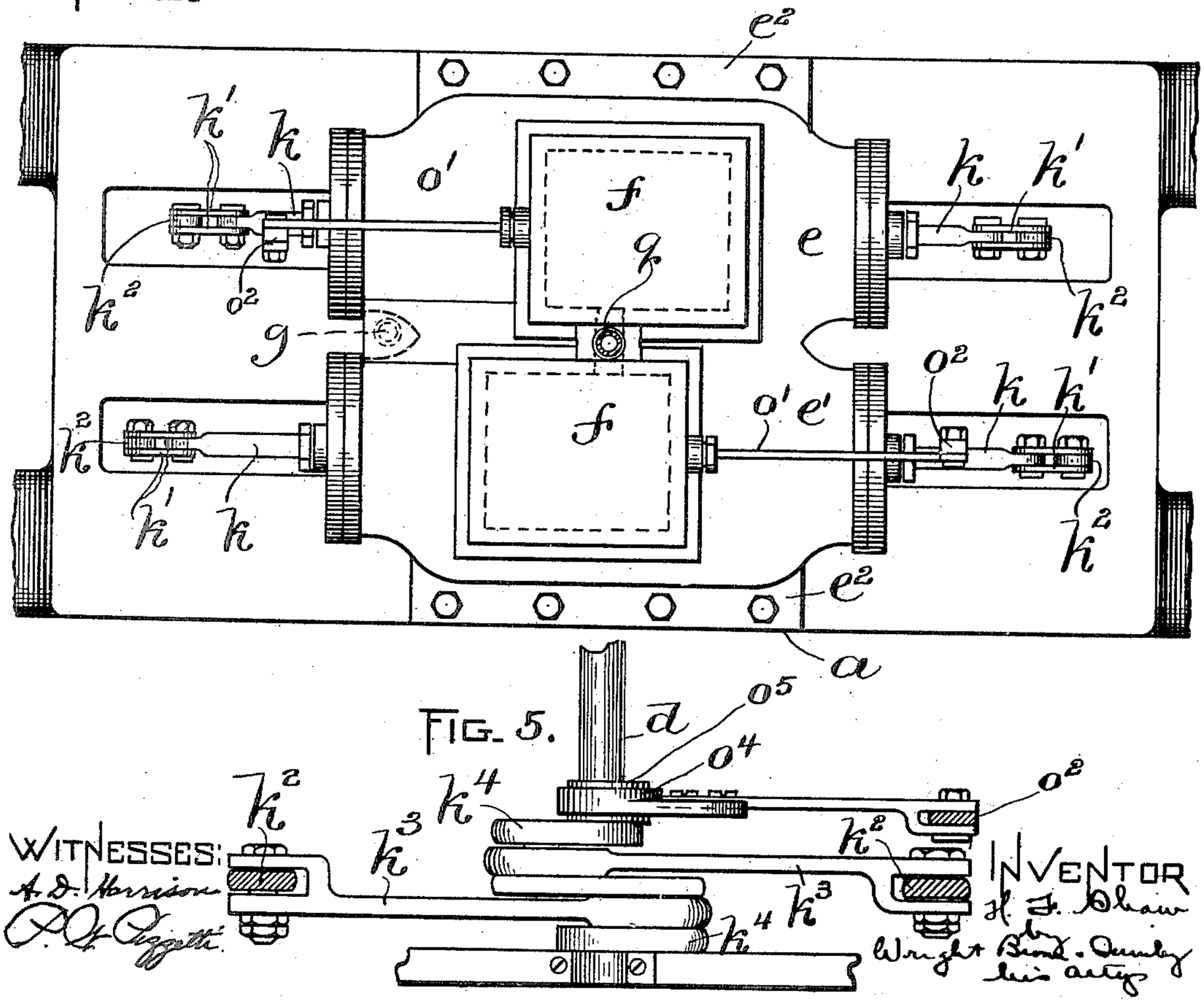

FIG. 5.

WITNESSES:
A. D. Harrison
P. L. Siggett

INVENTOR
H. F. Shaw
by Wright Brown, Quinby & Coulter
his attys

UNITED STATES PATENT OFFICE.

HENRY F. SHAW, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE SHAW MOTOR VEHICLE COMPANY, OF SAME PLACE.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 668,058, dated February 12, 1901.

Application filed April 19, 1900. Serial No. 13,462. (No model.)

To all whom it may concern:

Be it known that I, HENRY F. SHAW, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Motors, of which the following is a specification.

This invention has relation to steam-motors, and while it is more particularly designed for employment in motor-carriages and other locomotives in which it is desirable to prevent, so far as possible, vibration by reason of the delicate mechanism employed thereon, it may be employed otherwise and mounted stationarily.

The principal object of the invention is to provide an engine in which the parts may be all moved and actuated so as to counterbalance each other and prevent vibration, said parts, in addition, being mechanically balanced, whereby one will not tend to overbalance the other.

To these ends the invention consists of a balanced motor having certain features of construction and relative arrangement of parts, as illustrated upon the accompanying drawings, described in the following specification, and pointed out in the claims.

Referring to said drawings, Figure 1 represents a steam-motor embodying my invention. Fig. 2 represents a plan view of the same. Figs. 3 and 4 represent sections through the compound cylinders and show different positions assumed by the pistons and the valve. Fig. 5 represents the crank-shaft and connecting-rods which connect the pistons with the cranks.

On said drawings, which illustrate one embodiment of the invention, to which it will be understood I am not limited, a frame is shown having a table a, end standards b b, and a base-plate c. The crank-shaft d is journaled in bearings on the base c, while the motor is placed directly above it on the table a, the crank-shaft being directly under the middle of the motor. The motor comprises twin cylinders e e', which are each provided with a valve-box f, connected to the steam-exhaust g. Each of the cylinders is compound and is provided with four pistons—that is to say, each cylinder is divided into two high-pressure cylinders and two low-pressure cylinders, the two high-pressure cylinders being indicated at h h and the two low-pressure cylinders at h^2 h^3. These four cylinders I comprehend in the term "compound" cylinders, for lack of a better expression, and they are all placed end to end, with the two low-pressure cylinders in the middle. The pistons for the low-pressure cylinders are indicated at i i, while those of the high-pressure cylinders are at i' i'.

Each compound cylinder has on both ends cylinder-heads j j and stuffing-boxes j' j', through which the piston-rods k k pass. Each piston-rod k is rigidly secured to a piston i' and a piston i and at its outer end is connected by a link k' with a centrally-fulcrumed lever k^2, whose lower end is connected by a connecting-rod k^3 with a crank k^4 on the crank-shaft d. The cranks k^4 k^4 of each pair are at an angle of one hundred and eighty degrees to each other, so that at each rotation of the crank-shaft the pistons move in opposite directions to exactly the same extent, whereby they counterbalance each other.

A duct m leads from the valve-chest to a point exactly midway between the outer ends of the low-pressure cylinders h^2 h^3, while another duct m' leads from the valve-chest to branch ducts m^2 m^3, extending to the extreme outer ends of the high-pressure cylinders h h'. The branch duct m^3 passes around the duct m, as indicated in the drawings. The exhaust-outlet, which connects with the exhaust g, is indicated at g'. Steam is admitted through a single inlet q.

The slide-valve is indicated at o, and it is connected by a valve-rod o' with a centrally-fulcrumed lever o^2, pivoted at its lower end to a connecting-rod o^3, the latter being in turn connected to an eccentric-strap o^4 on an eccentric o^5, carried by the crank-shaft d. Upon examination of Figs. 2, 3, and 4 it will be seen that the steam is first admitted to the high-pressure cylinders to force the pistons inward, the exhaust-steam passing from the low-pressure cylinder through the duct m into the outlet g' and the exhaust g. The steam is cut off when the pistons in the high-pressure cylinders have moved about two-thirds of their stroke and thereafter acts expansively. When the pistons have completed

their stroke, the valve is shifted to permit the steam to flow to the low-pressure cylinders, and since the balance is equal on both sides of the high-pressure cylinders the low-pressure cylinders are forced outward, thus completing one rotation of the crank-shaft.

I have provided, as previously explained, two compound cylinders, and each is a duplicate of the other, except that the valve mechanism is reversed, whereby there is a lever o' at each end of the motor. The cranks for the second compound cylinder are at an angle of one hundred and eighty degrees to the first, as said, and the eccentric on the crank-shaft for one valve is at an angle of ninety degrees to that for the valve mechanism of the other. The levers k^2 and o^2 are all fulcrumed so that they are balanced, and the levers and connecting-rods at one end of the lever are exactly equal in weight to those at the other end, so that they are mechanically balanced. From this construction it will be observed that when the motor is in operation there is no vibration at all perceptible.

The twin cylinders e e' are all formed of one casting, the latter having side flanges e^2, which may be bolted to the table a. By means of this construction provision is made for the rapid rotation of a crank-shaft without vibration and with the most economical consumption of steam.

The location of the low-pressure cylinders at the middle of the casing between the high-pressure cylinders is provided for a particular purpose. Where a single emission of steam is used for a complete rotation of the crank-shaft, it is liable to condense in the low-pressure cylinders, and hence in my engine I place the low-pressure cylinders in the middle of the casing, where they are heated by the high-pressure cylinders and are maintained at a high temperature, so that the steam in reaching them does not condense readily.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without having attempted to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. A motor comprising two high-pressure cylinders and two low-pressure cylinders, placed end to end with the low-pressure cylinders communicating, a piston in each cylinder, the pistons of a high and a low pressure cylinder being connected and moving together, and means for admitting fluid first to the said high-pressure cylinders on opposite sides of the two pistons therein, and then to the low-pressure cylinders, whereby the pistons balance each other in their movements.

2. A motor comprising two high-pressure cylinders and two low-pressure cylinders, all communicating and placed end to end, with the low-pressure cylinders between the high-pressure cylinders, a piston for each cylinder, two oppositely-movable piston-rods, each connected to the pistons of a high-pressure and a low-pressure cylinder, a crank-shaft having diametrically opposite cranks connected to the pistons, and means for simultaneously admitting steam to both said high-pressure cylinders, and then to both said low-pressure cylinders.

3. A motor comprising two low-pressure cylinders and two high-pressure cylinders, all communicating and placed end to end with the low-pressure cylinders between the high-pressure cylinders, a piston in each cylinder, two oppositely-movable piston-rods each connected to the pistons of a high-pressure and a low-pressure cylinder, means for simultaneously admitting steam to both the high-pressure cylinders and then to both the low-pressure cylinders, a crank-shaft having cranks which are diametrically opposite and connections between said cranks and said piston-rods.

4. A motor comprising two high-pressure cylinders and two low-pressure cylinders placed end to end, with the low-pressure cylinders communicating and arranged between the high-pressure cylinders, a piston in each cylinder, the pistons of a high-pressure and a low-pressure cylinder being connected and moving together, and means for admitting fluid, first to the high-pressure cylinders simultaneously and then to the low-pressure cylinders simultaneously, substantially as described.

5. In a motor comprising compound cylinders placed end to end, with the low-pressure cylinders communicating and arranged in the middle, pistons in said cylinders, the piston of a low-pressure cylinder being connected to the piston of an adjacent high-pressure cylinder, a steam-chest, a duct leading from said steam-chest to a point substantially at the junction of the low-pressure cylinders, and ducts leading from said steam-chest to the outer ends of the high-pressure cylinders, and a suitable valve in said chest adapted to admit steam first to the ducts for the high-pressure cylinders, and then to the duct for the low-pressure cylinders.

6. A motor comprising twin engines arranged side by side in parallelism, each engine having two compound cylinders with the low-pressure cylinders end to end and communicating, a valve mechanism for each engine, and means for admitting steam to said valve mechanism.

In testimony whereof I have affixed my signature in presence of two witnesses.

HENRY F. SHAW.

Witnesses:
M. B. MAY,
C. C. STECHER.