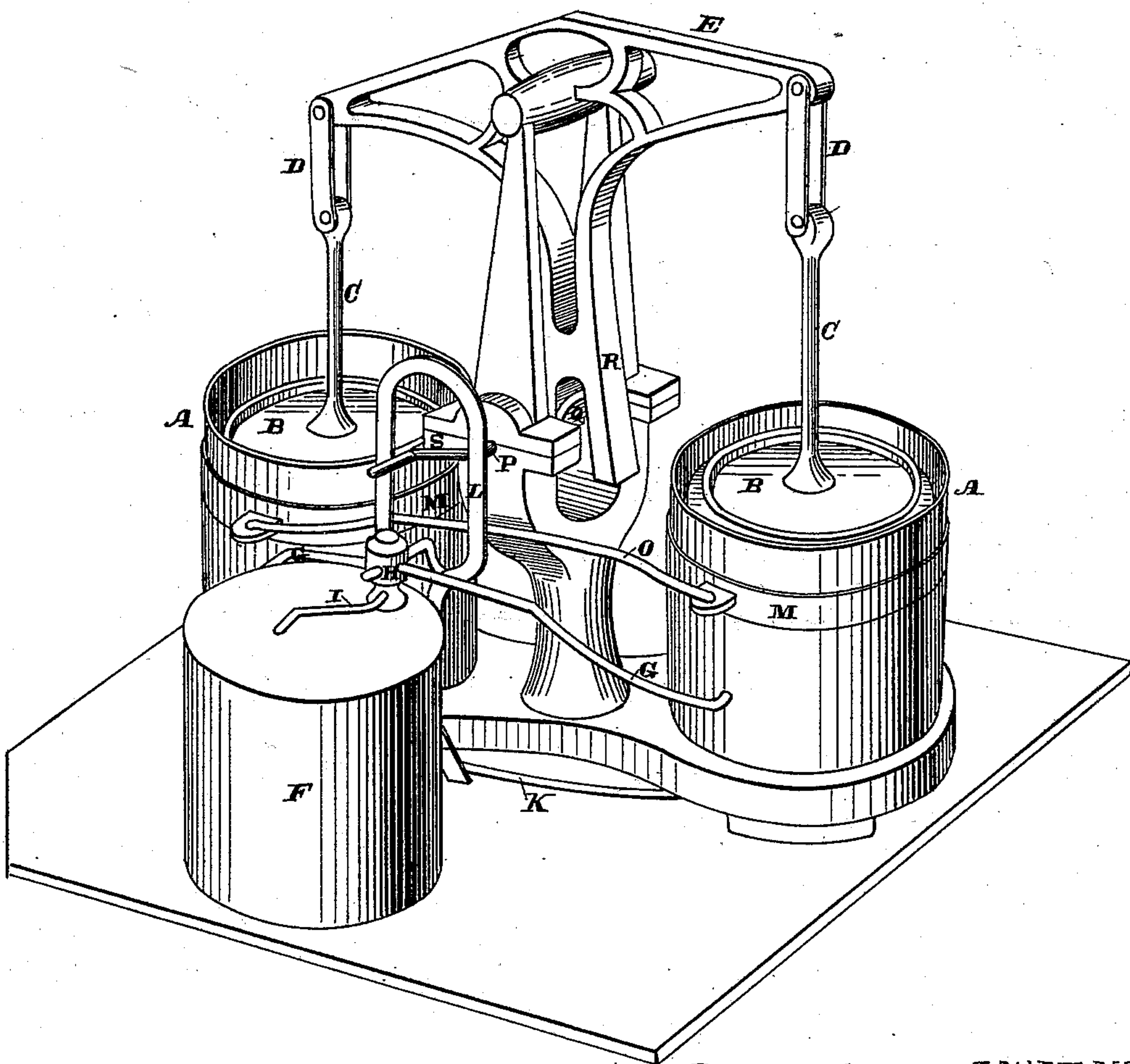


B. GOLDMANN.  
Vacuum Engine.

No. 221,961.

Patented Nov. 25, 1879.

FIG. 1.



WITNESSES.

Frank A. Brooks  
J. H. House

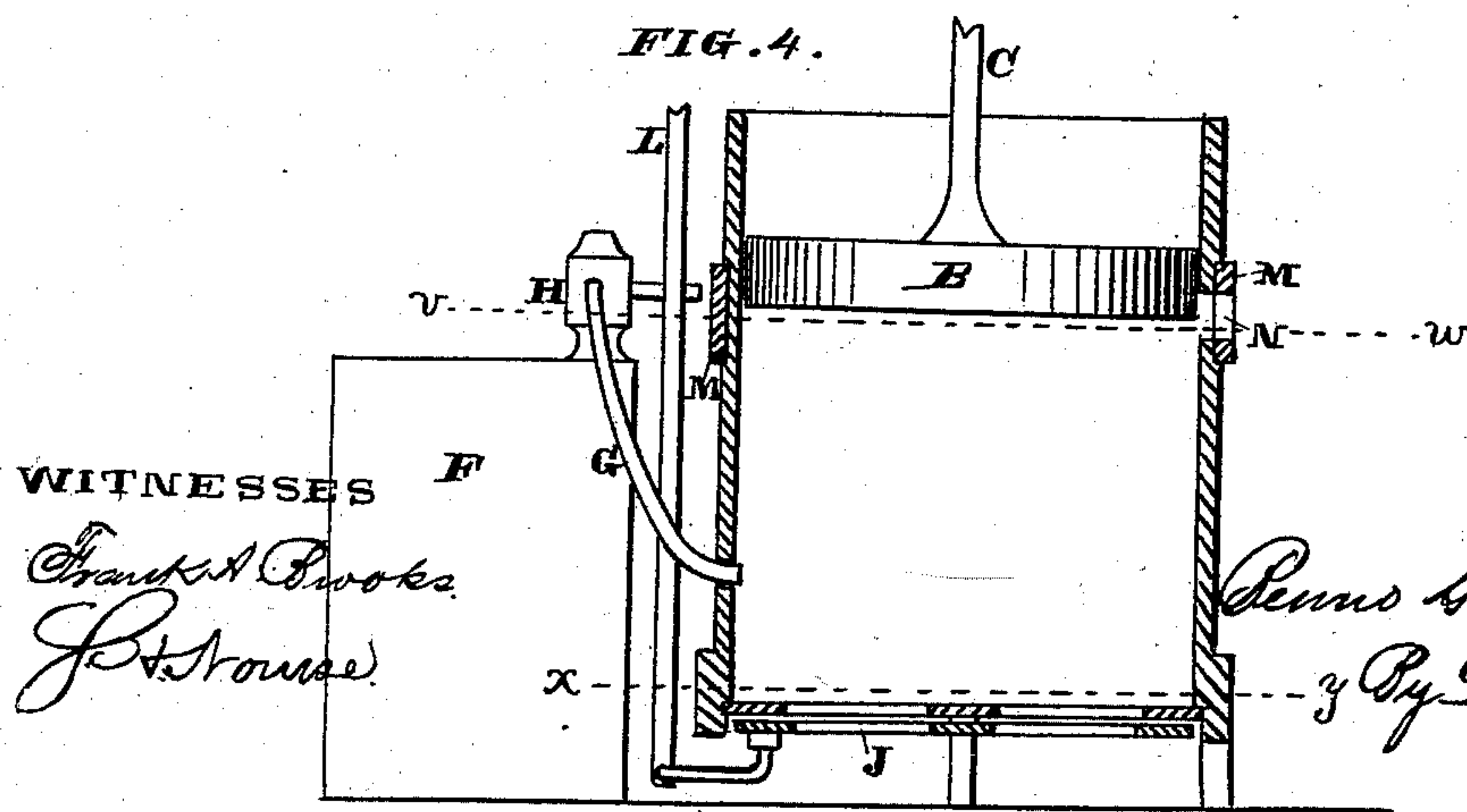
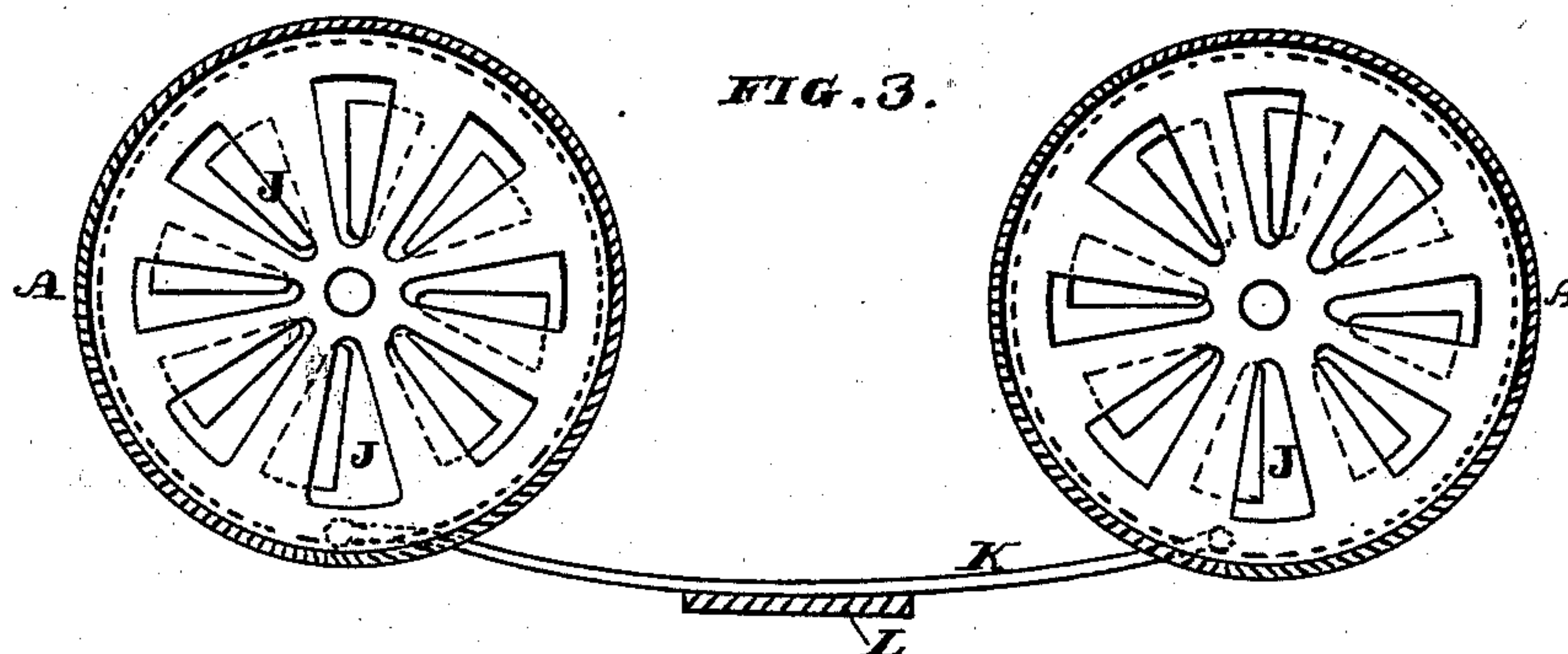
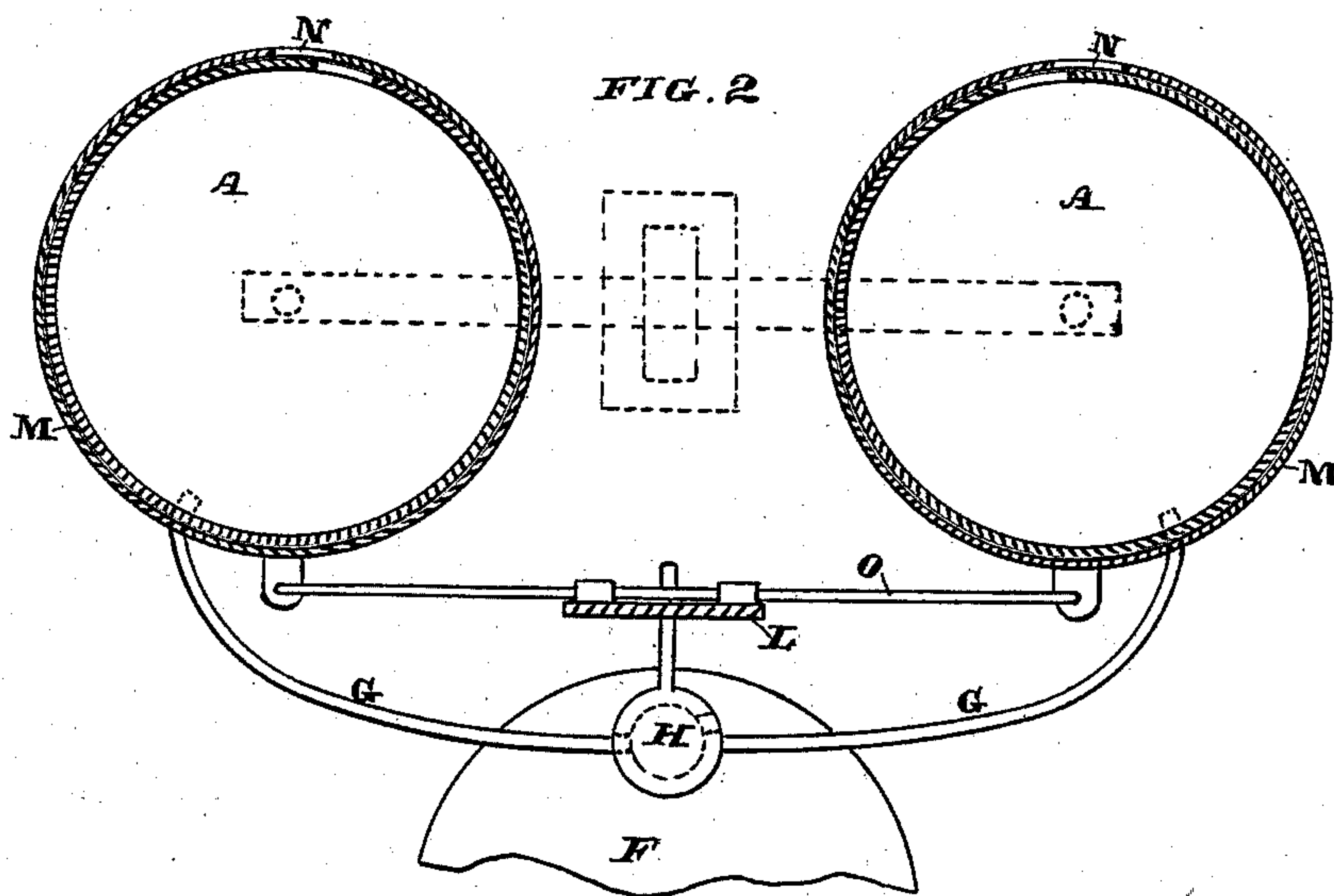
INVENTOR

Beno Goldmann  
By Duvey & Co.  
attys

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# UNITED STATES PATENT OFFICE.

BENNO GOLDMANN, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO CHARLES WACHER, HENRY SCHÜNEMANN, AND HENRY LEWIS, ONE-FOURTH TO EACH.

## IMPROVEMENT IN VACUUM-ENGINES.

Specification forming part of Letters Patent No. **221,961**, dated November 25, 1879; application filed September 6, 1879.

*To all whom it may concern:*

Be it known that I, BENNO GOLDMANN, of the city and county of San Francisco, and State of California, have invented a Vacuum-Engine; and I hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a novel construction for a vacuum-engine; and it consists in the employment of one or more cylinders having suitable ingress-valves, by which an explosive or inflammable gas or vapor may be admitted and ignited. The surface of the piston or pistons is open to the action of atmospheric pressure, and when the vacuum is formed beneath the piston it will be depressed.

Suitable operating-levers and connections serve to move the different parts, as will be more fully described by reference to the accompanying drawings, in which—

Figure 1 is a view of my apparatus. Fig. 2 is a section taken through the line *vw*. Fig. 3 is a section through the line *xy*. Fig. 4 is a vertical section of one of the cylinders.

In the present case I have shown my apparatus as composed of two working-cylinders, A A, having tight-fitting pistons B, piston-rods C, and links or connections D, uniting them to the beam E, so that they will operate alternately.

F is a tank, reservoir, or generator, within which the gas or vapor to be employed may be stored or produced. This generator is connected with the cylinders by means of pipes G, and a valve, H, is operated by an oscillating frame, L, so as to direct the gas alternately into one cylinder and the other. I is a valve, by which the whole supply may be cut off when desired; or a part may be cut off, and the action thus regulated.

At the bottom of each cylinder is a valve, J, which rotates upon a central pivot, and these valves are operated by connecting-rods K, which extend to the frame L, before mentioned. A ring, M, surrounds each cylinder at a point near the bottom of the stroke of the piston, and this ring is perforated with openings N, which correspond with similar openings in the side of the cylinder. These rings are also connected by rods O with the frame L, so as to

be operated simultaneously with their corresponding valves J. These valves serve to admit air, which mingles with the gas as it is introduced, and serves to assist its combustion or explosion.

A shaft, P, extends across the supporting-frame of the machine, and has a crank or eccentric, Q, to which an arm, R, from the beam connects, so that the oscillation of the beam will communicate motion to the shaft P.

A crank, S, at the end of this shaft has its crank-pin fitted to move within a wide slot or loop in the frame L, acting upon this frame like a cam.

The operation will then be as follows: The generator F may supply hydrogen gas; or, if desired, ordinary coal or other gas or a combustible vapor may be employed. Just as the piston in one of the cylinders reaches its lowest point the action of the crank S will have moved the cam-frame L to one side, so as to strike the arm and open the valve H to admit a charge of gas to the cylinder. At the same time the valve J at the bottom and the ring-valve M around the cylinder are opened by the action of the frame L, so as to admit a charge of air to mix with the gas.

As the piston completes its ascent these valves are closed and the charge ignited by any suitable means. When hydrogen is employed platinum sponge will serve to ignite it; or the charge may be ignited by an electric spark, or otherwise. This produces a vacuum within the cylinder, and the pressure of air upon the exterior of the piston will force it down again. The operation of the opposite cylinder is similar, and the two will produce a continuous rotary motion of an axle or shaft by the intervention of any well-known form of machinery for that purpose.

When a single cylinder is used, as for pumping or other direct-acting work, the operation will be the same; but some variation may be made in the operating mechanism for moving the valves. This apparatus forms a very economical and efficient engine.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—



1. The cylinders A, pistons B, rods C, links D, and the beam E, with its bifurcated arm R connected thereto, in combination with the shaft P and crank Q, whereby the shaft is rotated, substantially as and for the purpose herein described.

2. The cylinders A, with their pistons so connected as to drive the shaft P, in combination with the cam-frame L, connecting-rods K O, and the valves J M, substantially as and for the purpose herein described.

3. The cylinders A, provided with the valves J and M, with their connecting-rods K and O, and the frame L, operated from the shaft P, as shown, in combination with the gas or vapor supplying tank F, with its pipes leading to the cylinders, and the valve H, substantially as herein described.

4. The apparatus consisting of the cylinders A, with their pistons B, and air-valves J and M, in combination with the gas-supply tank or reservoir F, with its valve H, and the cam-frame L, operated from the main shaft P, whereby combustible gas or vapor is supplied and ignited, so as to be burned beneath each piston alternately and a vacuum produced, substantially as and for the purpose herein described.

In witness whereof I have hereunto set my hand.

BENNO GOLDMANN.

Witnesses:

S. H. NOURSE,  
FRANK A. BROOKS.