

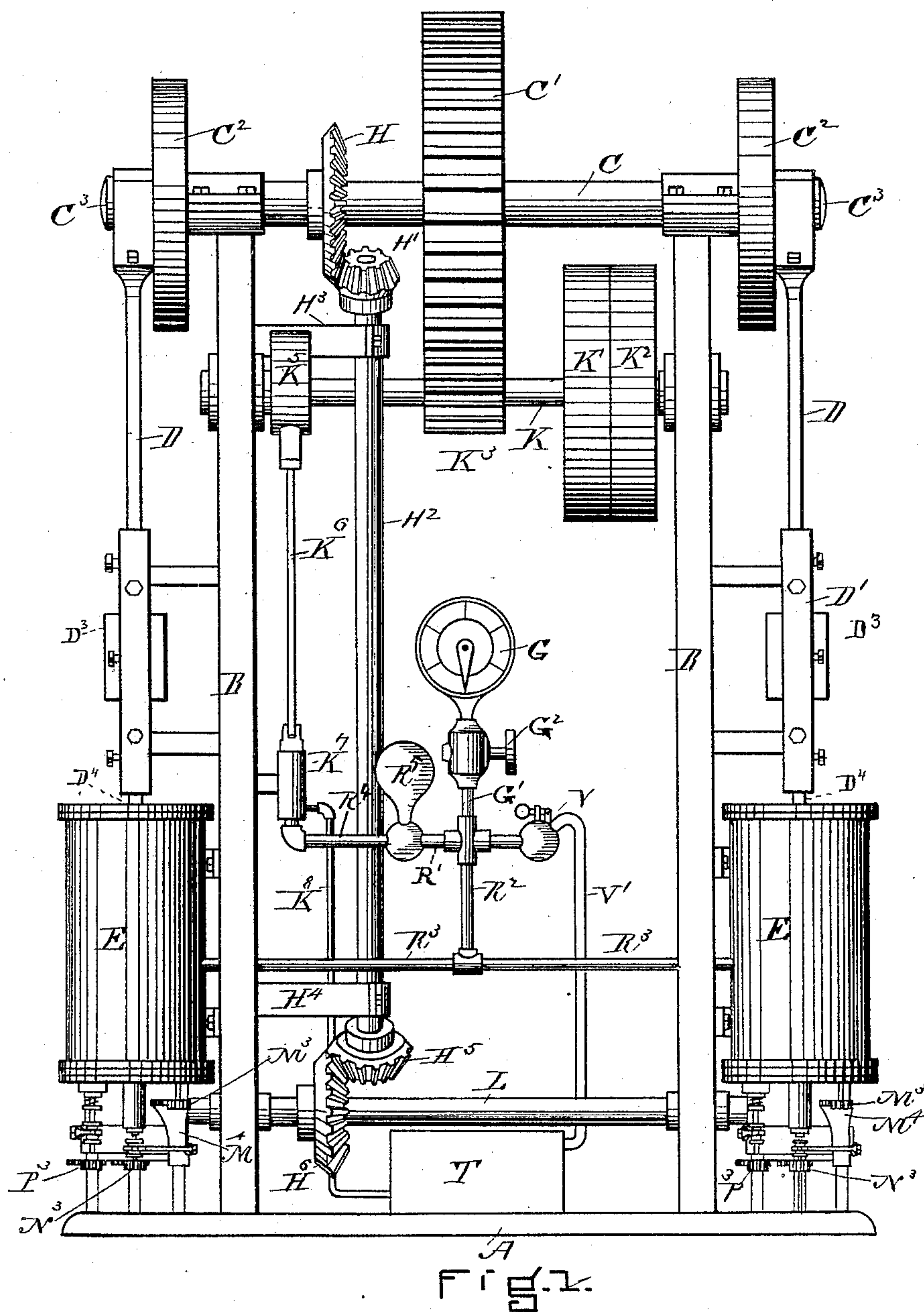
(No Model.)

3 Sheets—Sheet 1.

A. BERRENBURG.
VACUUM PUMP.

No. 421,346.

Patented Feb. 11, 1890.



WITNESSES.

Matthew M. Blunt.
William Edson.

INVENTOR.

Adolph Berrenberg

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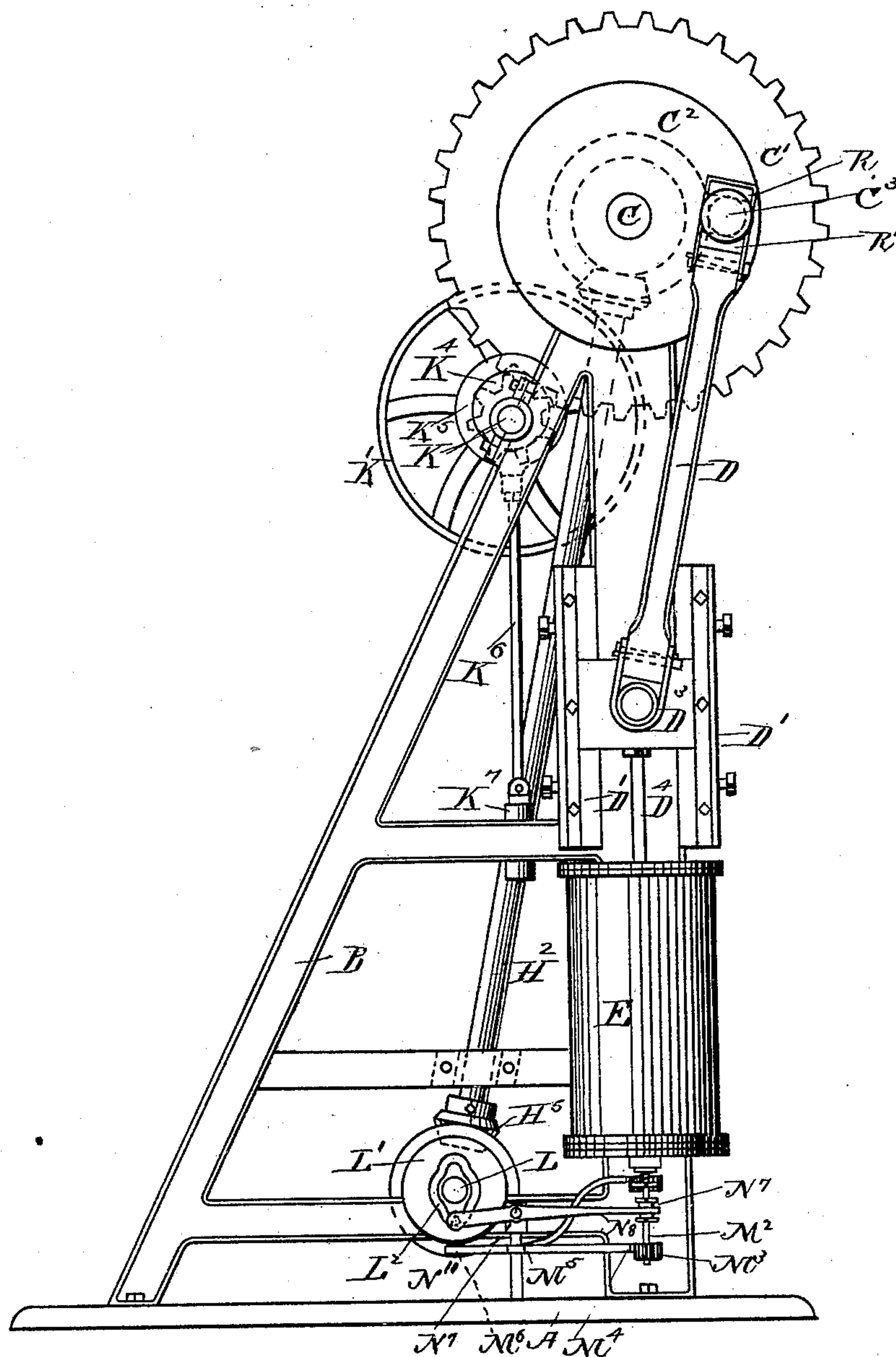


Fig. 2.

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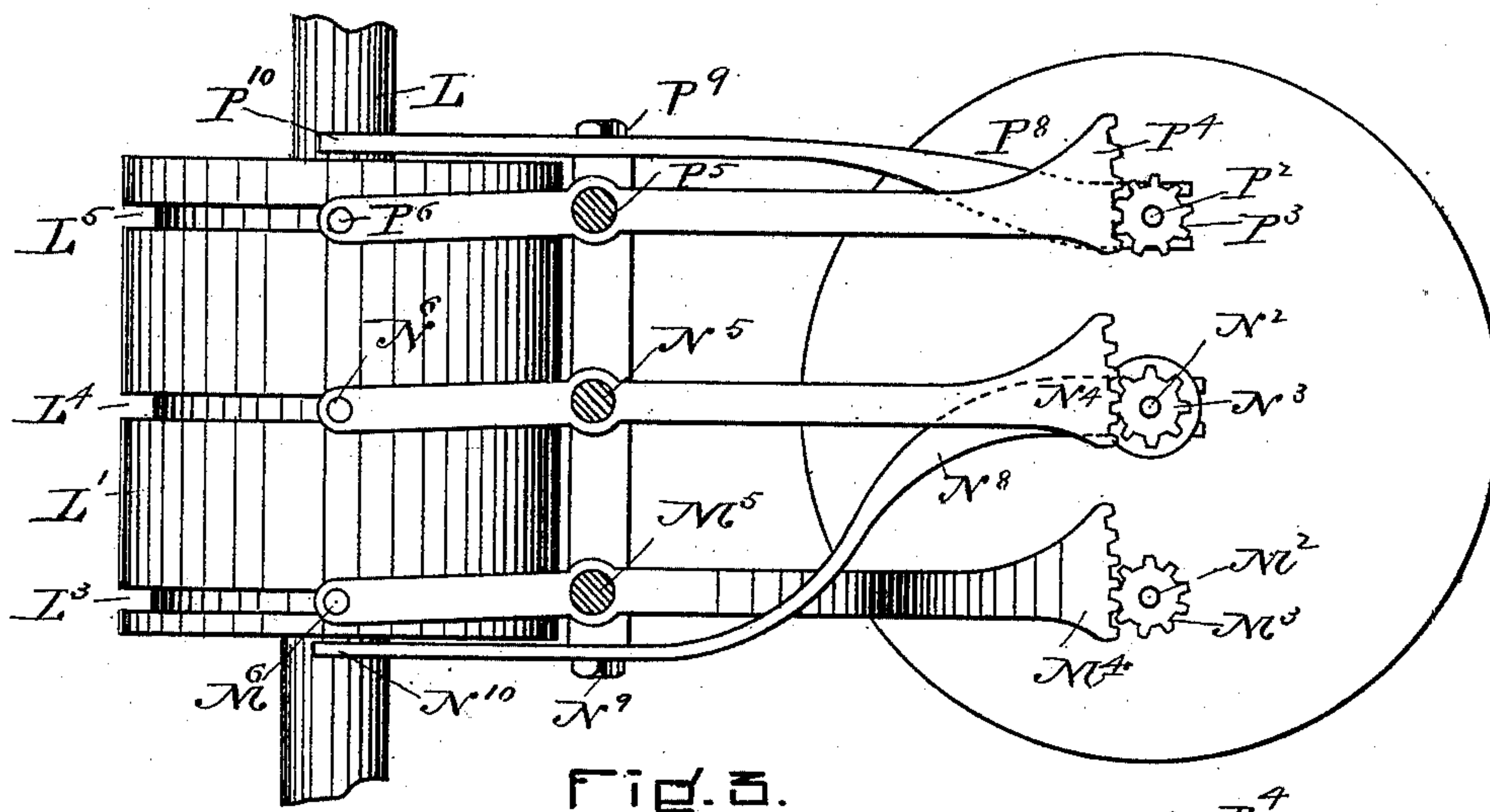


Fig. 3.

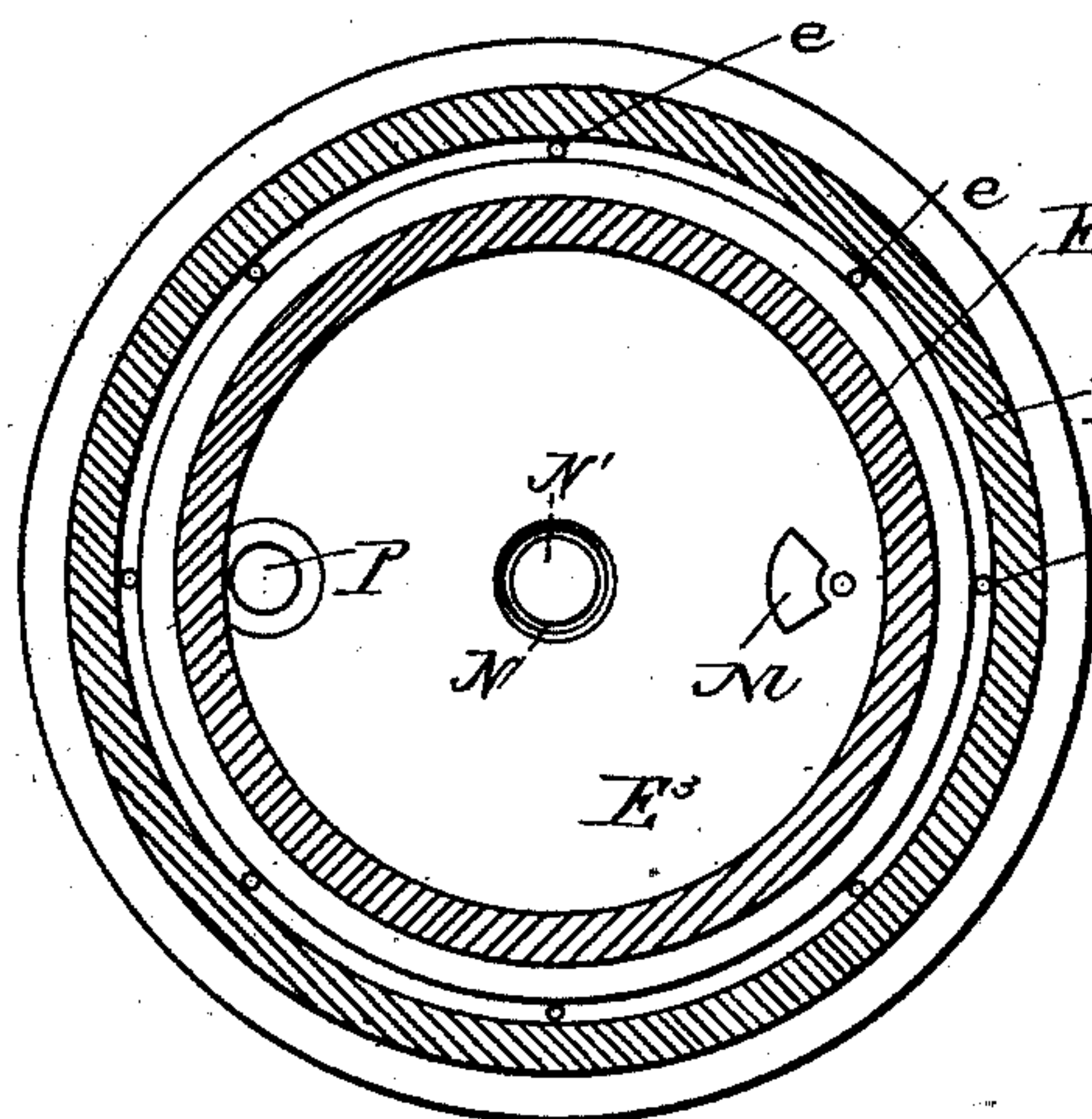


Fig. 5.

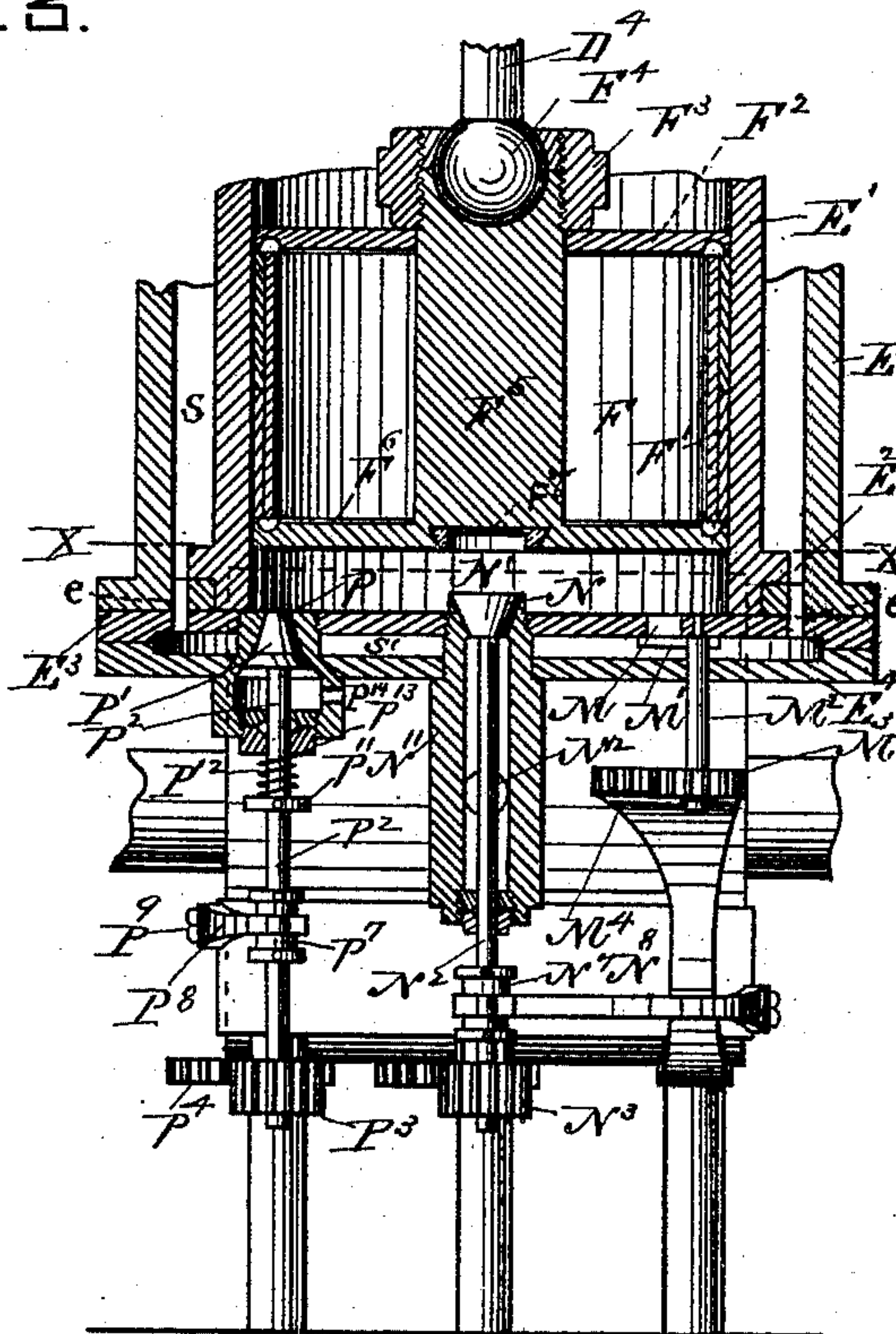


Fig. 4.

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UNITED STATES PATENT OFFICE.

ADOLPH BERRENBURG, OF SOMERVILLE, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO JACOB HEILBORN, TRUSTEE, OF BOSTON, AND ANNA M. BERRENBURG, OF SOMERVILLE, MASSACHUSETTS.

VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 421,346, dated February 11, 1890.

Application filed May 2, 1888. Serial No. 272,582. (No model.)

To all whom it may concern:

Be it known that I, ADOLPH BERRENBURG, of Somerville, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Vacuum-Pumps, of which the following, taken in connection with the accompanying drawings, is a specification.

The object of my invention is to so construct and treat the parts of an air-pump that no air shall enter the cylinder by infiltration, leakage, or openings of valves. This object I attain by the mechanism shown in the accompanying drawings, in which—

Figure 1 is a front elevation. Fig. 2 is a side elevation. Fig. 3 is a plan looking from underneath, showing the mechanism for operating the valves. Fig. 4 is a cross vertical section through the lower part of the cylinder and piston, showing in elevation a part of the mechanism for operating the valves; and Fig. 5 is a horizontal section taken on line *x x* of Fig. 4.

In the drawings, Figs. 1 and 2, A represents the base of the machine, and B B the standards or frame-work to which the operating parts are attached.

The main shaft C is mounted at the top of the frame-work, as shown in Figs. 1 and 2. To this main shaft C, I attach at each end a crank-disk C², and in the center a large gear-wheel C'. I also have on this shaft a beveled gear H. Each of the crank-disks C² C² has a crank-pin C³, which gives motion to the pitman D. These pitmen D, acting through the cross-heads D³, in turn give motion to the piston-rods D⁴, and thence to the pistons, one of said pistons being shown in section enlarged in Fig. 4.

E and E' are cylinders made exactly alike. Therefore I will describe but one of them. I may also add that the valves and their connected parts and the valve-actuating gears are the same for both cylinders.

Referring to Fig. 4, I will describe one of the cylinders. E represents an outside casing made of some strong metal, like iron. This casing E has an inwardly-projecting flange E² at the bottom. (See Fig. 4.) The upper and in-

ner edge of this flange E² is turned perfectly true and smooth and receives the lower end of the inner cylinder E', which makes with it an air-tight joint. Both cylinders E and E' fit air-tight onto the valve-plate E³. The valve-plate E³ has a series of perforations *e e e e*, which coincide with corresponding perforations in the inner flange E² of the outer cylinder E. These perforations *e e e e* connect the space S between the cylinders E and E' with the space S' between the valve-plate E³ and the lower plate E⁴. The lower plate E⁴ is made to fit air-tight onto the under side of the valve-plate E³, but leaving a space S' between. The space S' between the valve-plate E³ and the lower plate E⁴, being connected with the space S between the inner and outer cylinders, is always full of fluid under pressure, which will prevent air from leaking into the cylinder through the pores of the valve-plates. The fluid also in passing in small quantities through the valve M occupies all of the space that may exist between the bottom of the piston when down and the valve-plate E³, and thus exclude any air that might otherwise exist between the piston and the valve-plate.

As these pumps are single-acting, the upper ends are left open; but the space S, forming the chamber between the inner and outer cylinders, is made air-tight at the top, so that a fluid under pressure may be confined in the space S S'. The piston F is made as shown in Fig. 4, F⁵ being a central portion, to which the lower disk F⁶ is attached or made a part of. F² is a disk that serves to form the top of the piston and is held in place by a screw-nut F³. F⁴ is a ball-and-socket joint which serves to connect the piston-rod D⁴ to the piston, and is made in this manner to allow the piston to adapt itself to work in exact collimation with the cylinder E'. F', Fig. 4, represents packing-rings made double and arranged to break joints.

The above-described piston is fully described in the specification of Patent No. 369,093, granted to me August 30, 1887, entitled "piston-packing."

For the purpose of allowing the piston to

rest for a short time on the bottom of the cylinder—i. e., on the valve-disk—I make the pitman D longer than is required to take the piston down to the full end of its stroke, and
 5 to compensate for this extra length I have rubber packing-boxes R and R', Fig. 2, so that although the piston has actually come to the bottom of the cylinder before the crank-pin C³ has reached its lowest point the crank-
 10 disk may continue to revolve, simply compressing the rubber packing R', and as the crank-pin C³ passes its center then the piston will not begin to ascend, as the expansion of the rubber R' will still keep it down onto the
 15 valve-disk E³. By this arrangement I am enabled to have the valve-working mechanism in operation while the piston is still down on the valve-disk.

The fluid-valve M M' (see Figs. 4 and 5) is
 20 operated as follows: It is hung on a semi-rotating stem M², upon which I have a gear M³, which is operated by a segment-gear on the end of the lever M⁴. (See Fig. 3.) This lever M⁴ is pivoted at M⁵ and has a pin M⁶, which
 25 is worked by the cam-groove L³. The above valve M moves in one plane only—that is, horizontally about its axis—and serves to allow a small portion of the fluid in the space S' to pass up into the cylinder, so as to exclude
 30 any air that might otherwise occupy the space and impair the vacuum.

The valve M opens when the piston is down and lets the fluid from the space S pass in and occupy any space between the piston and
 35 valve-plate, and thus exclude air that might otherwise enter.

The valve-opening at P, Figs. 4 and 5, serves as an outlet, and its valve P has two motions—viz., an up-and-down or close-and-open motion and a rotary motion on its seat. This
 40 rotary motion is given to it for the purpose of keeping it always in good order. In fact, it is ground onto its seat at each motion. The spring P¹², Fig. 4, is connected to the disk P¹¹ and to a part of the box P¹³, and, being a tension-spring, serves to keep the valve
 45 P' up to its seat. The exhaust through the valve-opening at P passes into the box P¹³, Fig. 4, and out through an opening P¹⁴. A rotary motion is given to the valve P' by
 50 means of a gear P³ on its stem P², said gear being turned by the segment-gear on the end of the lever P⁴, said lever P⁴ (see Fig. 3) being pivoted at P⁵ and operated by a pin P⁶,
 55 working in the cam-groove L⁵. The up-and-down motion is given to the valve P by means of a forked lever P⁸, which works in a collar P⁷, Fig. 4, on the stem P², and is pivoted at P⁹ (see Fig. 3) and worked by pin P¹⁰, which
 60 is operated by a face cam-groove L², Fig. 2.

The principal valve-opening N, Figs. 4 and 5, acts as an inlet for the pump, and is connected with the lamp or other article to be
 65 exhausted. Its valve N' has also a twofold motion—one up and down to open and close, and another about its center to cause a grinding action on its seat to keep it always in

order. The rotating motion is secured by the following means: N³, Figs. 3 and 4, is a gear attached to the stem N² of the valve N', and
 70 is made to rotate by means of the segment-gear on the lever N⁴, Fig. 3, said lever N⁴ being pivoted at N⁵ and operated by a pin N⁶, working in the cam-groove L⁴. The up-and-down motion is given to the valve N' by
 75 means of a forked lever N⁸, which works in the collar N⁷ on the stem N², and, being pivoted at N⁹, Fig. 3, is operated by pin at N¹⁰, working in a face cam-groove (not shown) made in the end of the cam-wheel L'. The
 80 valve N N' opens from the chamber N¹², which is directly connected to the lamp-bulb or other vessel which is to be freed from air or exhausted.

Motion is given to the cams L' by means of
 85 the beveled gear H on the shaft C. This gear H, acting through the gear H', shaft H², and gears H⁵ and H⁶, drives the shaft L, upon which the cam-drum L' is mounted. The shaft H² is mounted in housings at H⁴ H³, Fig. 1.
 90

The shaft K has upon it fast and loose pulleys K' K² and a pinion K³, which engages with the large gear-wheel C' on the shaft C. Motion is communicated to the machine by
 95 a belt, which, acting through the pulley K' and shaft K, turns the pinion K³, and through it the large gear-wheel C'.

My auxiliary or fluid pump is shown at K⁷, Fig. 1. This pump is operated by a pitman K⁶, which is attached to an eccentric-strap K⁵,
 100 and is driven by the eccentric K⁴ on the shaft K. The pump K⁷ draws its supply from the tank T through the pipe K⁸ and distributes it through the pipe R⁴, R', R², and R³ to the
 105 chambers S S' in the casing of the cylinders E E. R⁵ is an air-chamber attached to the pipe R⁴ to ease the flow of the fluid. G is a gage for indicating the pressure of the fluid as it passes from the pump. This is attached to the pipe R' by the pipe G'. G² is a hand-
 110 valve for connecting or disconnecting the gage G to the pipes.

V is a safety-valve connected to the pipe R', and serves to prevent a too great pressure from accumulating in the pipes or chambers
 115 S S'. Any overflow from the safety-valve V can pass through the pipe V' back to the tank T.

When my pump is in use, the tank T, Fig. 1, has a supply of some liquid—for instance,
 120 oil, glycerine, or even water. This liquid is pumped by the pump K⁷, so as to fill all of the pipes, and also the spaces S and S', and is maintained under pressure, so as to fill any
 125 pores in the metal casing, as well as to fill all of the joints in or through which air might leak. In filling the pores of the metal and maintaining a pressure about the cylinder in the chambers S S', I effectually prevent any
 130 infiltration of air, and thus am enabled to obtain and maintain almost a perfect vacuum. The piston F is also to be filled with a liquid, as has been fully disclosed in the specification of the patent above referred to.

F⁷, Fig. 4, is a disk made of some yielding material, like rubber, and inserted in the under side of the piston F, it being made with a recess, as shown, so that as the piston comes
 5 down onto the valve-disk E³ it—the rubber—will closely fit the projection in which the valve-seat N is formed.

I claim—

1. In an air-pump, the combination of the
 10 valve-disk E³, outlet-valve P⁷, stem P², spring P¹², collar P⁷, lever P⁸, cam-wheel L⁷, and pinion P³, with the segment-gear lever P⁴ and cam-wheel L⁷, all operating together substantially as described, and for the purpose set
 15 forth.

2. In an air-pump, the combination of the valve-disk E³, inlet-valve N⁷, stem N², collar P⁷, lever P⁸, cam-wheel L⁷, pinion N³ with the segment-gear lever N⁴ and the cam-wheel
 20 L⁴, all operating together substantially as described, and for the purpose set forth.

3. In an air-pump, the combination of the piston F, cylinders E and E⁷, valve-disk E³, and lower disk E⁴, forming chambers S S⁷,
 25 adapted to receive a liquid under pressure,

the said valve-disk E³ having a valve N⁷ and raised valve-seat N, with the valve N⁷, valve-seat N, and valve M, adapted to admit at each stroke of the piston a quantity of fluid from the chamber S⁷, substantially as and for the
 30 purpose set forth.

4. In an air-pump having cylinders E and E⁷ and disks E³ and E⁴, said cylinders and disks forming chambers S and S⁷, adapted to receive a liquid under pressure, the combina-
 35 tion of the inlet-valve N⁷ and its seat N in the disk E³ with the outlet-valve P, having an opening through both disks E³ and E⁴ and the valve M, all operating together substantially as described, and for the purpose set
 40 forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 26th day of April, A. D. 1888.

ADOLPH BERRENBURG.

Witnesses:

WILLIAM EDSON,
 MATTHEW M. BLUNT.