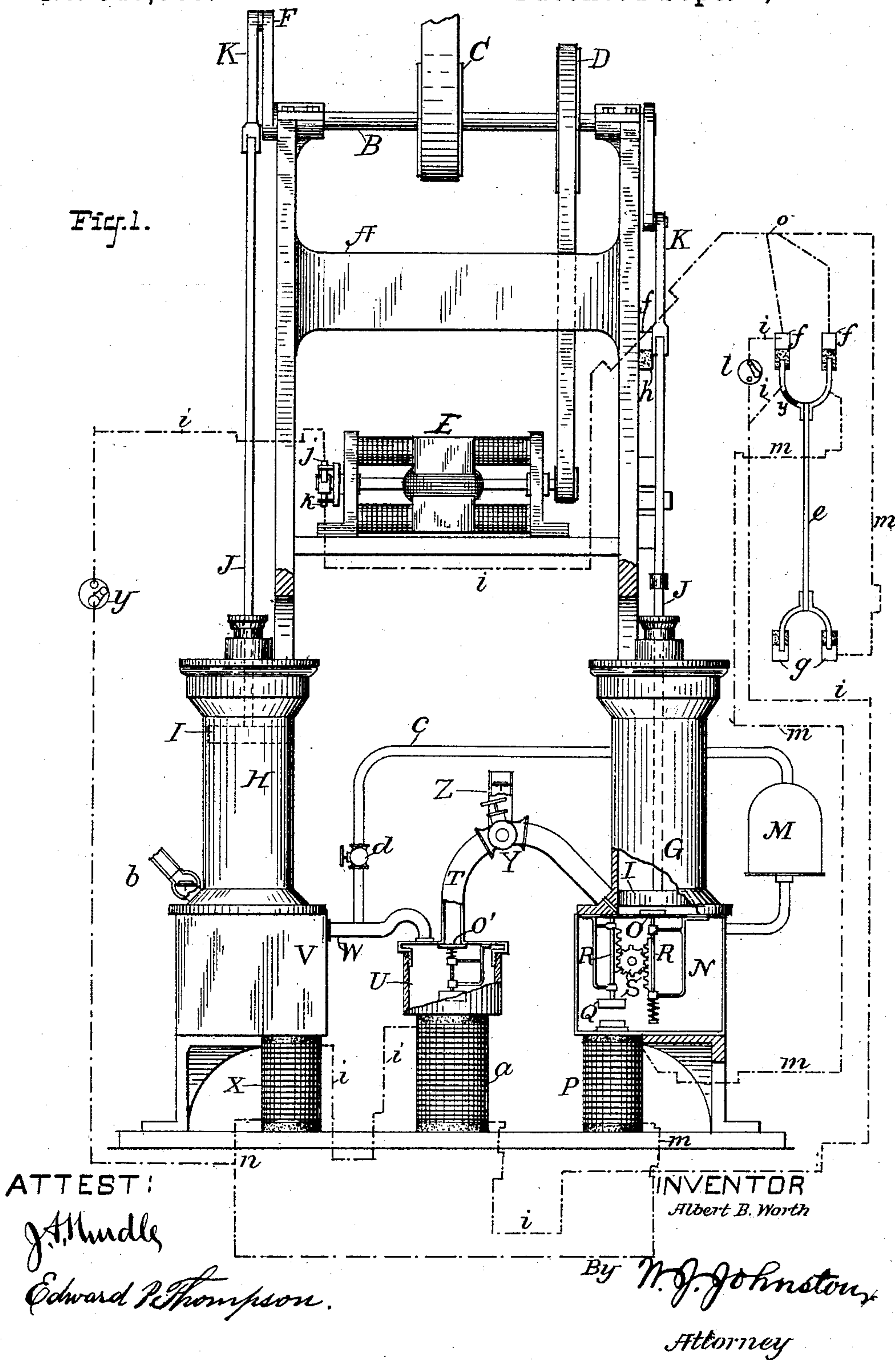


2 Sheets—Sheet 1.

ELECTRIC AIR PUMP SYSTEM.

Patented Sept. 7, 1886.



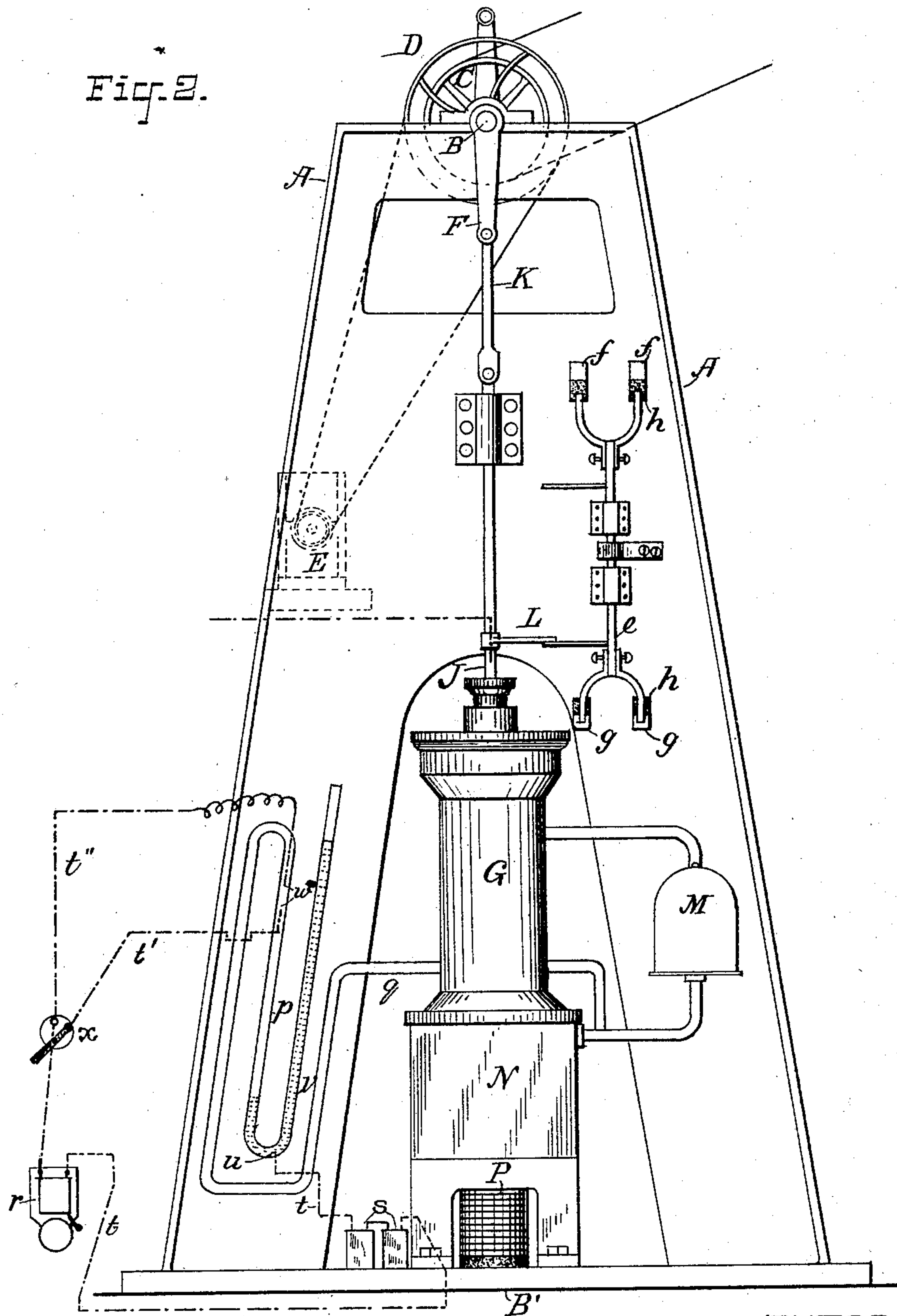
(No Model.)

2 Sheets—Sheet 2.

A. B. WORTH.
ELECTRIC AIR PUMP SYSTEM.

No. 348,606.

Patented Sept. 7, 1886.



ATTEST:

J. H. Mudd

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INVENTOR:

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UNITED STATES PATENT OFFICE.

ALBERT B. WORTH, OF GREENPORT, NEW YORK.

ELECTRIC AIR-PUMP SYSTEM.

SPECIFICATION forming part of Letters Patent No. 348,606, dated September 7, 1886.

Application filed April 14, 1886. Serial No. 198,792. (No model.)

To all whom it may concern:

Be it known that I, ALBERT B. WORTH, a citizen of the United States, and a resident of Greenport, in the county of Suffolk and State

of New York, have invented certain new and useful Improvements in Electric Air-Pump Systems, described, claimed, and shown in the following specification, claims, and drawings. My invention relates to an electric air-

pump system involving the application of electricity to the operation of the valves and improvements upon the devices and apparatus described and claimed in my United States Patents Nos. 337,803 and 337,804, both of

March 9, 1886. The improvements relate, principally, to the circuit-controlling device, the same being operated directly by the piston-rod; to a number of pumps in combination with an intermediate vacuum-chamber; to a vacuum-alarm; to the particular disposition of the circuits, and to the combination of details in so far as such combination is patentable.

The object of the invention is to provide means for operating two or more air-pumps in series; to operate all valves by the aid of electricity in a superior manner, and to provide in general a complete system for automatically operating vacuum air-pumps.

The object of placing two pumps in series with but one receiver is to accomplish rapidity of exhaustion, each pump being itself as large as it is practicable to build them. In order to illustrate the practical manner of carrying out the invention, and to enable others skilled in the art to which the invention appertains to make and use the same, drawings are hereunto annexed and described, in which similar letters represent corresponding elements, and in which each part referred to is designated by a single character.

Figure 1 is a general end view of the whole system in which two pumps are shown, certain parts being shown in section and a side view of one of the details being represented as separated at the right of the figure; and Fig. 2 is a general side view showing in particular the vacuum-alarm and the circuit-controlling device.

The invention embraces the combination of a frame or support, A; a main shaft, B, at the

top thereof; a driving-pulley, C, and a second pulley, D, belted to a dynamo, E, said pulleys being fixed to said shaft; a crank, F, at each end of the shaft; cylinders G and H, respectively, at the bottom of said frame, and pistons I working therein; connecting-rods K, joining said cranks with piston-rods of said pistons; a projection, L, upon one of said piston-rods; a receiver or other vessel, M, intended to be exhausted of air; an air-chamber, N, located under the cylinder G and connecting with the receiver; a valve, O, between said chamber and cylinder G; an electro-magnet, P, having an operating-armature, Q, geared to said valve by means of the racks R and pinion S; a second air-chamber, U, having a pipe-connection, T, with the bottom of cylinder G; a valve, O', in said pipe; a third air-chamber, V, located underneath the cylinder H, and having a pipe-connection with said second air-chamber, and being in all respects as to its interior, and as to its connection with the cylinder V and magnet X, similar to the air-chamber N; a three-way cock, Y, in the pipe T, and serving to afford an opening to the atmosphere through the pipe Z, which has a valve; an electro-magnet, a, having an operating-armature connected to the valve O'; a pipe, b, which connects with the bottom of the cylinder H, and the atmosphere; a pipe, c, having a hand-valve, d, and connecting the receiver M directly with the air-chamber V; a switch having operating connection with the piston of the cylinder G through the projection L, and consisting of the metallic slide e, adapted to move first upon the electric terminals f and then upon the electric terminals g, the parts h being of an insulating substance; a circuit, i, passing from the dynamo-brush j through the magnet X and a, branching to the metallic slide e and to the little switch l, and both branches passing to the opposite brush, k; an electric circuit, m, passing from the circuit i, at the point n, through the magnet P to the slide e, and from the terminals g to the brush k, connecting with the circuit i at the point o; a vacuum-alarm consisting of the barometer p, having continual connection with the receiver through the pipe q; an electric bell, r, and battery s, and an electric-circuit, t, passing through said

bell and said battery, and having one terminal, *u*, at the lower part of the mercury *v*, and two other terminals, *w*, of the same polarity as to each other and of opposite polarity to the first-named terminal located above the mercury, and a switch, *x*, located in said circuit.

The internal construction of the three-way cock *y* is similar to that of other three-way cocks. Its construction is therefore not shown in detail, especially as it is not a part of my invention.

By the phrase "same polarity" I mean connected to the same pole of the electrical generator.

When the shaft rotates, the pistons *I* of the cylinders *G* and *H* operate, the one being up while the other is down. When the bell rings—*i. e.*, when the vacuum is comparatively high, and the pressure of the air inside the chambers *N* and *V* is insufficient to operate the valves *O'*, and those connecting with the interior of the cylinders—the switch *y* is turned so as to close the circuit. The circuit *i*, as well as *m*, is connected to the slide *e*; but the two said circuits are insulated from each other, and the former from the lower part of the slide *e* by the insulating-piece *g*. As the projection *L* moves upward and downward, it operates the slide *e* in such a manner as to pass a current through the magnet *P* when in its lower position, and through the magnets *X* and *a* when in its upper position, so that the air passes from the receiver *M* to the chamber *N*, thence to the cylinder *G*, then to the chamber *U*, then to the chamber *V*, and, finally, to the cylinder *H* and atmosphere. If the switch *x* is in the position shown in the drawings—*i. e.*, closed as to the branch *t'*—then the signal upon the bell will be sooner than when through the branch *t''* alone. One of the pumps—for instance, *G*—may be operated alone by opening the three-way cock *Y* to the atmosphere. The pump *H* may be operated alone by opening the cock *d*, the other pump in each case being disconnected from the shaft *B*, and the cock *Y* being so turned that the pipe *T* is completely closed at said cock.

The switch *l* is for operating the circuit through the magnet *X* by hand, in case the pump *G*, and therefore the projection *L*, is not in operation.

The invention is not limited to the precise construction hereinbefore described, as it is evident that many modifications may be made therein without departing from the spirit of the invention.

It is evident that any electric generator may

be substituted for the battery *s*—as, for instance, the dynamo, *E*. In the actual construction I prefer to make all air-chambers and pipes as small as possible, so as to leave the minimum amount of space to be exhausted.

Having now stated the object of the said invention, having described its practical realization by reference to the accompanying drawings, having particularly ascertained the manner in which the same operates to accomplish the said object, what I consider to be novel and original, and therefore claim as my invention, is—

1. In an electric air-pump system, the combination of air-pumps and electro-magnetic valves for each pump, an intermediate chamber communicating through an electro-magnetic valve with each pump, and an automatic operating electric connection between all of said valves and any one of the pistons of said pumps, substantially as and for the purpose set forth.

2. In an electric air-pump system, the combination of air-pumps having an air-chamber under each, an external air-chamber communicating with the cylinder of one pump and with the air-chamber located under the cylinder of the other pump, and suitable automatic operating electric valves in circuit with a circuit-controlling device having an operating connection with one of the movable parts of said pump.

3. In an electric air-pump system, the combination of air-pumps having an air-chamber under each, an external air-chamber communicating with the cylinder of one pump and with the air-chamber located under the cylinder of the other pump, suitable valves between the various chambers and cylinders, and mechanism for operating said valves.

4. In an electric air-pump system, the combination of a main shaft, a dynamo having a belt-connection therewith, two pistons having crank-connections with said shaft, a switch having operating connections with one of said pistons and in circuit with electro-magnetic valves located within said pump system and with said dynamo, an electric alarm dependent for its action upon the density of the air within that space being exhausted, and suitable air passages and valves between the pumps of said system, substantially as set forth.

Witness my signature and seal this 8th day of April, 1886.

ALBERT B. WORTH. [L. S.]

Witnesses:

EDWARD P. THOMPSON,
M. H. TOPPING.