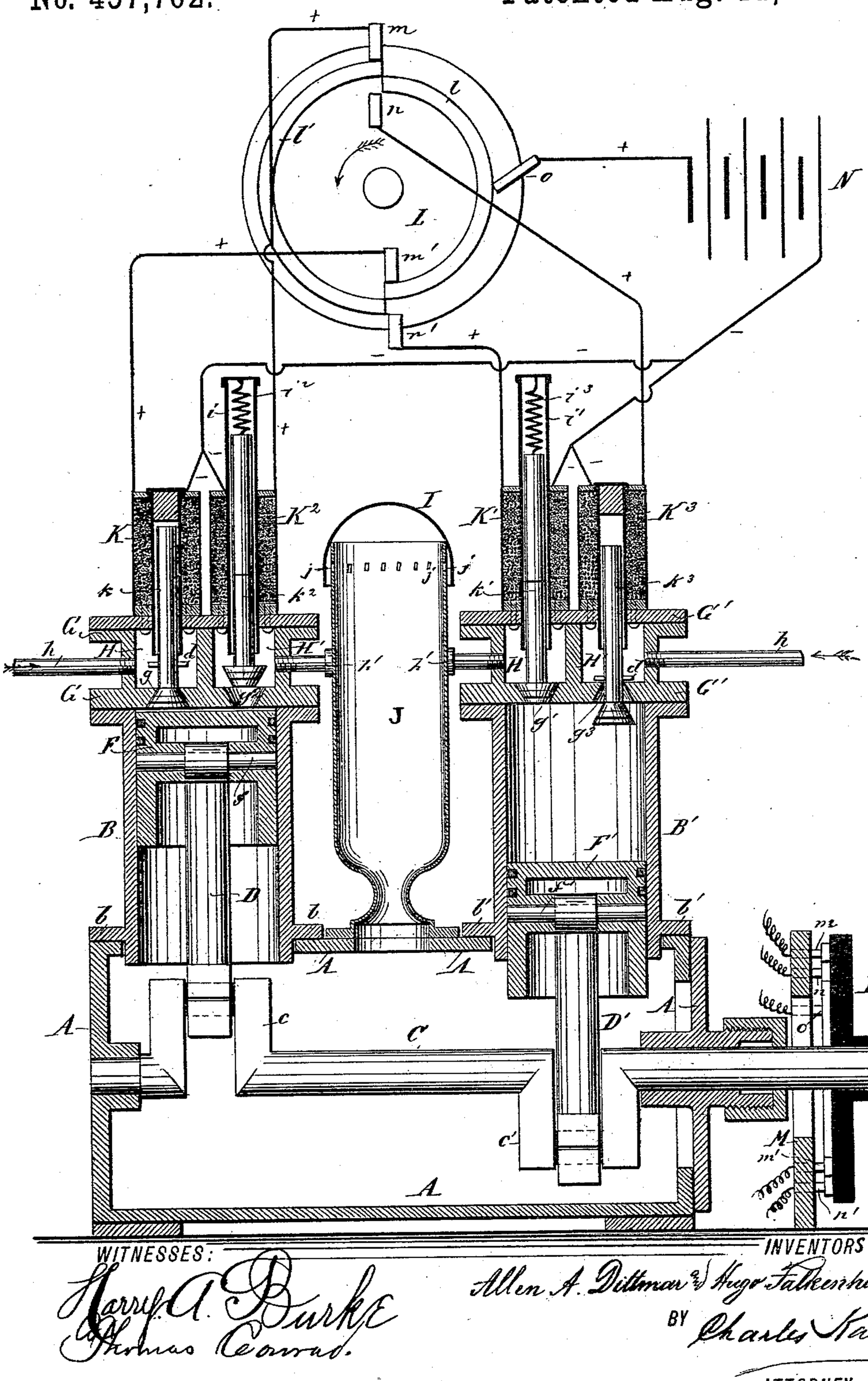
(No Model.)

A. A. DITTMAR & H. FALKENHAUSEN.

ELECTRIC AIR PUMP.

No. 457,762. Patented Aug. 11, 1891.



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ELECTRIC AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 457,762, dated August 11, 1891.

Application filed January 23, 1891. Serial No. 378,782. (No model.)

To all whom it may concern:

Be it known that we, ALLEN A. DITTMAR and HUGO FALKENHAUSEN, citizens of the United States, and residents of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electric Air-Pumps, of which the following is a specification.

Our invention has reference to improvements in air-pumps; and the invention consists of an electric air-pump in which the suction and discharge valves are worked by electricity. This object is attained by the mechanism shown in the accompanying drawing, which is a vertical section of an air-pump in accordance with our invention, with a plan showing the connection of the air-pump with an electric generator.

Similar letters of reference indicate corresponding parts.

A in the drawing is a chamber or casing, and B B′ are the pump-cylinders, which are perpendicularly mounted upon the chamber by means of flanges *b b′*, screwed or otherwise secured on the upper part of the said chamber. The upper part or top plate of the said chamber A has openings which communicate with the lower openings of the cylinders.

Through the chamber A passes a crank-shaft C, one end of which is fitted to the inner side of one wall of the chamber by means of a bearing, while the other end passes out through the opposite wall of the same with bearing and stuffing-box. The crank-shaft has two cranks *c c′*, opposite each other, and each crank arranged directly below the center of one of the pump-cylinders B B′. The pistons F F′, within the said pump-cylinders, are operated by means of the connecting-rods D D′, which are connected with the cranks of the crank-shaft, and the pins *f f′* of the pistons. The upper ends of the pump-cylinders are closed by the casings G and G′, the outwardly-extending flanges of the bottom plates of which are screwed or riveted to the outwardly-extending flanges at the upper ends of the cylinders. The bottom plates of the casings G G′ are provided with valve-openings *g*, *g′*, *g²*, and *g³*, conical in shape, the openings *g* and *g³* tapering upward and the openings *g′* and *g²* tapering in a downward direction.

The casing G, as well as the casing G′, is divided into two compartments H H′. The suction-pipes *h h*, to which the vessels to be evacuated are connected, enter the compartments H, and the discharge-pipes *h′ h′* lead from the compartments H′ to the trap-cylinder J. The latter is mounted on the top plate of the base-chamber A and communicates with the interior of the same. The upper part of the trap-cylinder is provided with air-holes *j* and covered by a dome I.

K, K′, K², and K³ are solenoids placed upon the top plate of the chambers G and G′, the bores of the same communicating with the interior of the compartments H H and H′ H′. The movable cores *k k′ k² k³* within the solenoids serve as valve-stems, and are provided at their lower ends with conically-shaped valve-pistons, which fit into the respective valve-openings *g g′ g² g³* in the bottom plates of the chambers G G′.

To the top portions of the solenoids K² and K′ longitudinal guide-casings *i i′* are secured, in which the cores *k²* and *k′* are suspended by means of spiral springs *i²* and *i³*.

The pistons of the valve-stems or cores are provided with suitable packing-rings, so as to form an air-tight closing of the valve-openings. The cores are made of soft iron, but the lower portions of the same consist of brass, so that these portions may not be magnetized by the electric current and not affect the iron parts of the pump.

L is an electric commutator, made of hard rubber or any other non-conducting material, in the shape of a disk, which is mounted on the crank-shaft and receives by the same its rotary motion. Semi-annular conducting-rings *l* and *l′* are secured to the commmutator-disk, the ring *l* being somewhat smaller than the ring *l′*, so that each semi-annular ring lies in a different periphery, as shown in the plan view, Fig. 2. A standard M is provided with a spring-acting conducting-brush

o, which presses alternately upon the ring-sections *l* and *l'* when the commutator-disk is in rotary motion. The ring-sections *l* and *l'* are so arranged that both sections receive the electric current simultaneously by the brush *o*. The standard M is, furthermore, provided with one pair of stationary conducting-brushes *m* and *m'* and with one pair of like brushes *n* and *n'*, the brushes *m'* and *n* coming alternately in contact with the ring-section *l* and the brushes *m* and *n'* in contact with the ring-section *l'* when the pump is in motion. The electric current is conducted from an electric generator N through the spring-acting brush *o* to the commutator and through the ring-sections *l* and *l'* and the conducting-brushes *m m'* and *n n'*, respectively, to the solenoids, the electric current being closed by wires leading from the solenoids back to the electric generator, as clearly shown in the plan attached to the drawing.

The chamber A, the cylinders B B', and the trap-cylinder J are filled with oil, as usual in air-pumps. The crank-shaft may be rotated by hand or power, as desired.

In the illustration shown in Fig. 1 the piston F is in a position about to close the valve g^2 of the compartment H' of the casing G, the air being forced through the said valve and the discharge-pipe *h'* into the trap-cylinder J, from where the air escapes through the air-openings *j*. The valve-stem or core *k* is about to drop from the suction-valve *g* in the compartment H of the casing G with the downstroke of the piston F, whereby the suction-compartment H of the casing G is opened. The stop-pin *d* prevents the core *k* from dropping too far down. Of course the valve g^2 will be closed before the valve *g* is opened. The piston F' is in a position about to complete its stroke, and the valves g' g^3 are in a position reversed to the valves *g* g^2.

The opening and closing of the valves is performed by electricity, and the electricity operates when the pump is in motion in the following manner: The brush *o* presses against the ring-section *l* and transfers the positive current from the electric generator N to the ring-sections, and from there by means of the conducting-brushes *m m'* to the solenoids K K^2. The current is closed by the wires leading from the said solenoids to the negative pole of the electric generator. The cores *k* k^2 of the solenoids K K^2 are thus magnetized and automatically drawn up, whereby the valve *g* is closed and the valve g^2 opened by the valve-pistons of the said cores, as clearly shown in Fig. 1. When a further motion is made by the crank-shaft, the conducting-brush *n'* will come in contact with the ring-section *l'* and the brush *n* in contact with the ring-section *l*, and the current will be conducted through the brushes *n n'* and the respective wires to the solenoids K' K^3. The cores *k'* k^3 will then be magnetized and drawn up, whereby the valve g' is opened and the valve g^3 closed, while the valve *g* will be opened and the valve g^2 closed, as by the broken current in the solenoids K K^2 the cores *k* k^2 become demagnetized and drop—*i. e.*, they assume the position of the cores *k'* k^3 shown in the drawing. In this manner the opening or closing of the respective valves is performed simultaneously with the alternating up and down strokes of the pistons in the pump-cylinders.

The process of the evacuation of vessels, &c., is the same as in other mechanical air-pumps, and therefore not illustrated in the drawing.

Our improved air-pump is very simple, and has the advantage that any complicated mechanism for opening or closing the suction and discharge valves is entirely dispensed with by the same.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. In an electric air-pump, suction and discharge compartments communicating with the pump-cylinders by valve-openings, in combination with solenoids placed over openings in the top plates of the compartments and having movable cores which pass through the openings in the said top plates and act as valve-stems, so as to open and close the respective valve-openings by electric currents conducted alternately through the respective solenoids, substantially as set forth.

2. In an electric air-pump, the combination of the top plates of the suction and discharge compartments, which have openings for the valve-stems with the movable solenoids, cores passing through said openings of the top plates and acting as valve-stems for the valve-openings, by which the said compartments communicate with the pump-cylinders, substantially as set forth.

3. In an electric air-pump, suction and discharge compartments communicating with the pump-cylinders by valve-openings, in combination with solenoids placed over openings in the top plates of the compartments and having movable cores which pass through the openings in the said top plates, and an electric commutator connected with the solenoids, by which commutator electric currents are conducted alternately through the respective solenoids and the cores magnetized, so as to open and close the respective valve-openings in the pump-cylinders, substantially as set forth.

4. In an electric air-pump, suction and discharge compartments communicating with the pump-cylinders by valve-openings, in combination with solenoids placed over openings in the top plates of the compartments and having movable cores, and the piston crank-shaft bearing an electric commutator which is electrically connected with the solenoids,

so that by the rotation of the crank-shaft electric currents are conducted through the respective solenoids, and the cores are magnetized and open and close the respective valve-openings simultaneously with the stroke of the pump-pistons, substantially as shown and described.

Signed at New York, in the county of New York and State of New York, this 17th day of January, A. D. 1891.

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Witnesses:
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