(No Model.)

J. P. BOETTIGER.

VACUUM PUMP.

No. 472,802. Patented Apr. 12, 1892.

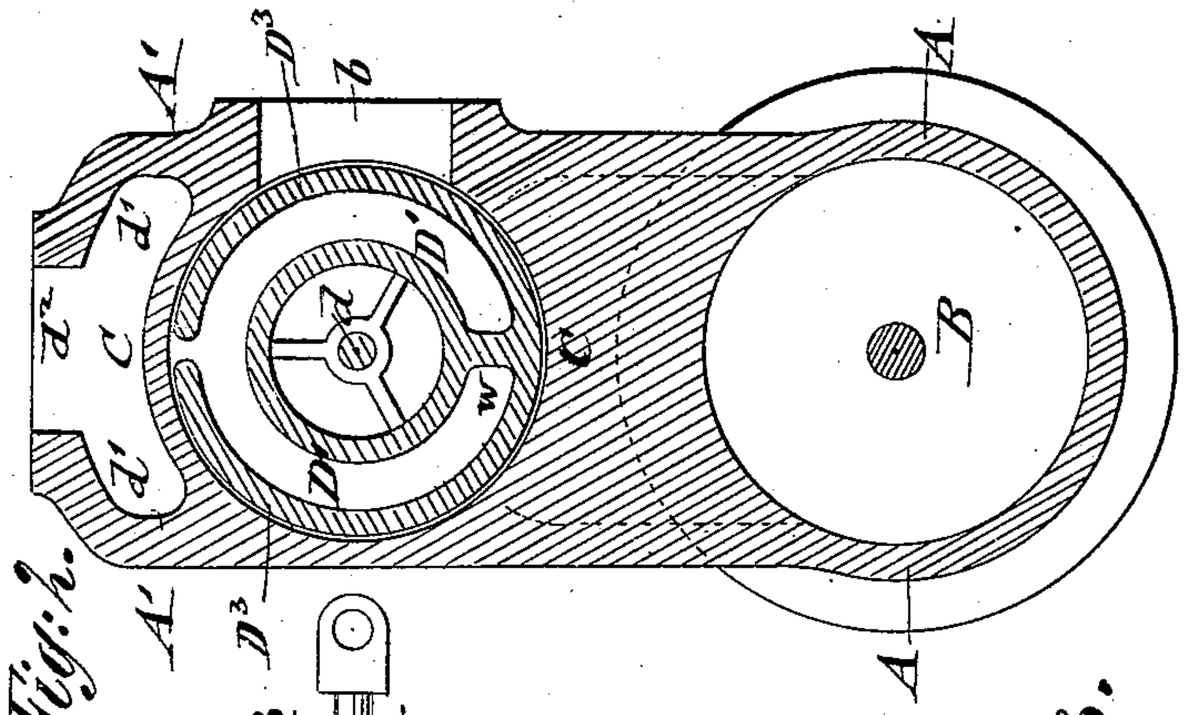

Fig. 2.

Fig. 1.

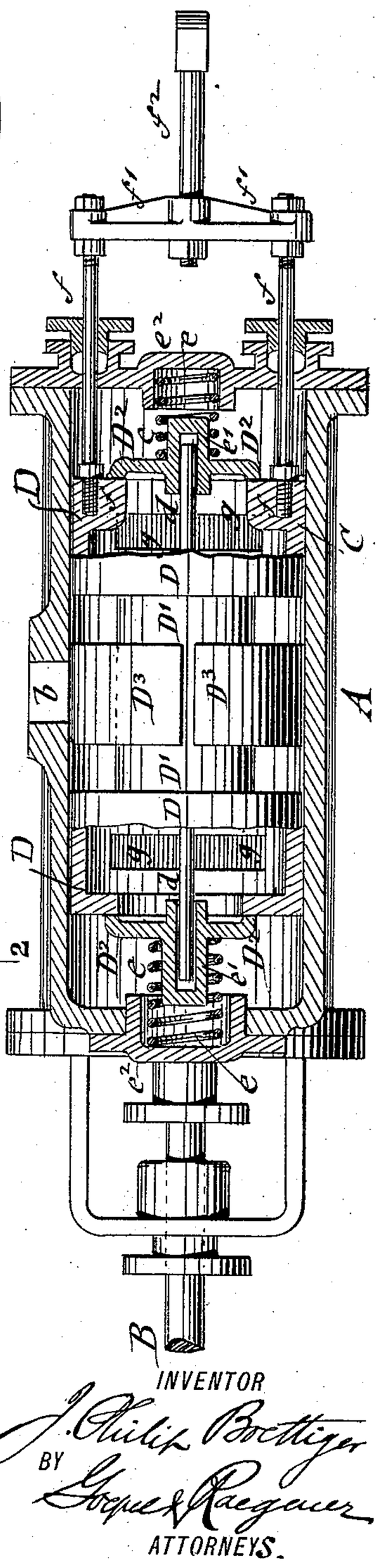

Fig. 3.

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VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 472,802, dated April 12, 1892.

Application filed October 7, 1891. Serial No. 407,973. (No model.)

To all whom it may concern:

Be it known that I, JOHN PHILIP BOETTIGER, a citizen of the German Empire, residing at Cold Spring, in the county of Putnam and State of New York, have invented certain new and useful Improvements in Vacuum Pumps, of which the following is a specification.

This invention relates to pumps for the exhaustion or compression of gases and other elastic fluids; and the object of the invention is to compensate the pressure in the spaces of the pump-cylinder, so as to obviate the so-called "dead-space" in such pumps, which is formed at the time when the piston arrives in the dead-point positions of its stroke.

The invention consists of a pump for moving gaseous bodies, the slide-valve of which is guided in a cylinder located in the valve-chest, said cylinder being open at the ends and provided with spring-cushioned valves, which are operated at the proper time. The slide-valve is made of cylindrical shape and provided with a central contraction, which is provided with a split ring or band that fits tightly to the inner surface of the guide-cylinder and that is connected by a web with the contracted portion of the slide-valve, said ring or band opening or closing the suction-port as the slide-valve moves in one or the opposite direction. The contracted portion of the slide-valve is made of such length that it connects the ports of the pump-cylinder when the piston arrives at its dead-point position, so that the pressure of the gases in the dead-spaces of the pump-cylinder is compensated by means of the induction and eduction channels and the annular space at the center of the slide-valve, while at the same time the suction-port is closed by the split ring or band, as will be more fully described hereinafter, and finally pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section of my improved valve for pumps for moving gaseous bodies. Fig. 2 is a vertical transverse section of the same on line 2 2, Fig. 1; and Fig. 3 is a horizontal section on line 3 3, Fig. 1.

Similar letters of reference indicate corresponding parts in all the figures.

Referring to the drawings, A represents a pump-cylinder, which is provided with the usual induction and eduction channels *a a'*. B is the piston-rod, which extends through a stuffing-box in the head of the cylinder, which stuffing-box is preferably provided with a suitable oil packing, so as to prevent the ingress of atmospheric air to or the egress of the gases from the pump-cylinder.

The pump-cylinder A is provided with a valve-chest A' and a longitudinal guide-cylinder C in said valve-chest, which cylinder is open at both ends and preferably cast integral with the body of the pump-cylinder A. The guide-cylinder C is provided at one side with a suction-port *b*, while the spaces between the heads of the valve-chest and the ends of the guide-cylinder are connected by a longitudinal connecting-channel *d'* with a delivery-port d^2.

In the guide-cylinder C is arranged a cylindrical slide-valve D, which is open at the ends and is provided with a central contracted portion D', said ends being closed by spring-cushioned delivery-valves D^2, that are alternately operated by a longitudinal spindle *d*, which is supported in fixed center bearings of the slide-valve D and held in position thereon by means of suitable screw-nuts $d^\times$. The spindle *d* of the slide-valve D extends into central sockets *e'* of said valves, which sockets extend into sockets e^2, located in the heads of the valve-chest, as shown clearly in Fig. 1.

The slide-valve D is operated by means of two rods *f*, which are attached at two diametrically-opposite points to the slide-valve D and guided in stuffing-boxes applied to the head of the valve-chest, said rods being connected at their outer ends by a cross-head *f'*, which is again attached to a valve-rod f^2, by which the connection with the operating element of the pump-actuating motor is made. The central contracted portion D' of the slide-valve D is made of such a length that it extends over the ports of the induction and eduction channels, but without entirely closing the same when the piston arrives at one of its "dead-point" positions, so that the pressure in the dead-space formed at one end of the same can be compensated by connection with the dead-space at the opposite side of the same. In this position of the slide-valve D it is necessary to close the suction-port *b*, which is produced by providing the contracted portion D' with a split ring or band D^3, that is connected

by a web *w* with the contracted portion, as shown clearly in Figs. 1 and 2. The split ring or band D^3 fits tightly to the inner surface of the guide-cylinder C and produces the closing of the suction-port *b*, when the compensating action between the dead-space of the pump-cylinder takes place. As soon as the slide-valve D is moved in one direction the suction-port *b* is opened, so that the air or the gases can be drawn by the piston into the cylinder, while the air or the gas that is at the time in the cylinder is forced through the eduction-channel into the cylinder-valve D and through the delivery-valve D^2 at the corresponding end of the slide-valve into the delivery-channel *d'* and to the delivery-port d^2. The slide-valve D is provided at its bottom with ports *g g*, by which the connection with the induction and eduction channels *a a'* is made. When the piston arrives at its dead-point position at the opposite end of the pump-cylinder, the compensating action takes place for a short time through the channel *a'* and the contracted portion of the slide-valve D, while during the same the suction-port *b* is closed by the split ring or band E. As soon as the piston changes its direction of motion the air or the gaseous body in the cylinder is forced through the opposite channel of the cylinder and the corresponding port of the slide-valve into the latter and delivered by the opening of the delivery-valve to the delivery-channel at the opposite end of the valve-chest, and thence to the delivery-port, as customary in pumps of this class. The lap of the slide-valve over the induction and eduction ports of the pump-cylinder and the split ring or band that is connected with the contracted portion of the slide-valve forms the novel features of my invention, as the remaining accessories—such as the spring-cushioned delivery-valves, the guide-spindle, and the oil packing of the piston-rod of the pump-cylinder—are well known.

My improved valve is applicable to vacuum-pumps and all other pumps in which gaseous bodies have to be moved. It is also applicable to air-compressors and blowing-engines, in which, however, the pressure is not produced by the suction but by the compression of the air or gaseous body. In every application of the slide-valve, however, an equilibrium or compensation of the pressure is produced at the commencement of each stroke of the piston by means of the annular space formed around the middle contracted portion of the slide-valve, which annular space is connected for a short time by the induction and eduction ports with the dead space of the cylinder and with the delivery-port of the valve-chest, while the suction or inlet port is closed for the time when the pressure is compensated by the split-ring arranged at the contracted portion of the slide-valve.

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

1. The combination of a pump-cylinder having induction and eduction ports, a valve-chest, a guide-cylinder in said valve-chest, provided with a lateral suction-port, and delivery-channels in the bottom of the guide-cylinder, a slide-valve guided in said cylinder, spring-cushioned delivery-valves arranged at the ends of the slide-valve, a contracted portion at the central portion of the slide-valve, said contracted portion being arranged to lap over the induction and eduction ports of the pump-cylinder when the piston arrives at one of its dead-point positions, and a split ring or band connected with the contracted portion of the slide-valve, so as to keep the suction-port closed while the compensation of pressure between the dead-spaces of the cylinder takes place, substantially as set forth.

2. The combination, with a pump-cylinder having induction and eduction-ports, of a valve-chest, a guide-cylinder in said valve-chest, open at the ends, a slide-valve in said guide-cylinder, provided with openings at the ends and with a contracted portion at the middle portion of the slide-valve, spring-pressed delivery-valves at the ends of the slide-valve, delivery-channels communicating with the ends of the guide-cylinder and the delivery-port, and a split ring that is connected by a web with the contracted portion of the slide-valve and adapted to close the suction-port when the piston arrives at one of its dead-point positions, so that the annular space formed by the contracted portion can be used for compensating the pressure in the cylinder at the opposite sides of the piston, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in the presence of two subscribing witnesses.

JOHN PHILIP BOETTIGER.

Witnesses:
PAUL GOEPEL,
CHARLES SCHROEDER.