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A. SIEGEL.

MULTISTAGE PUMP FOR PRODUCING A VACUUM OR COMPRESSING GASES.

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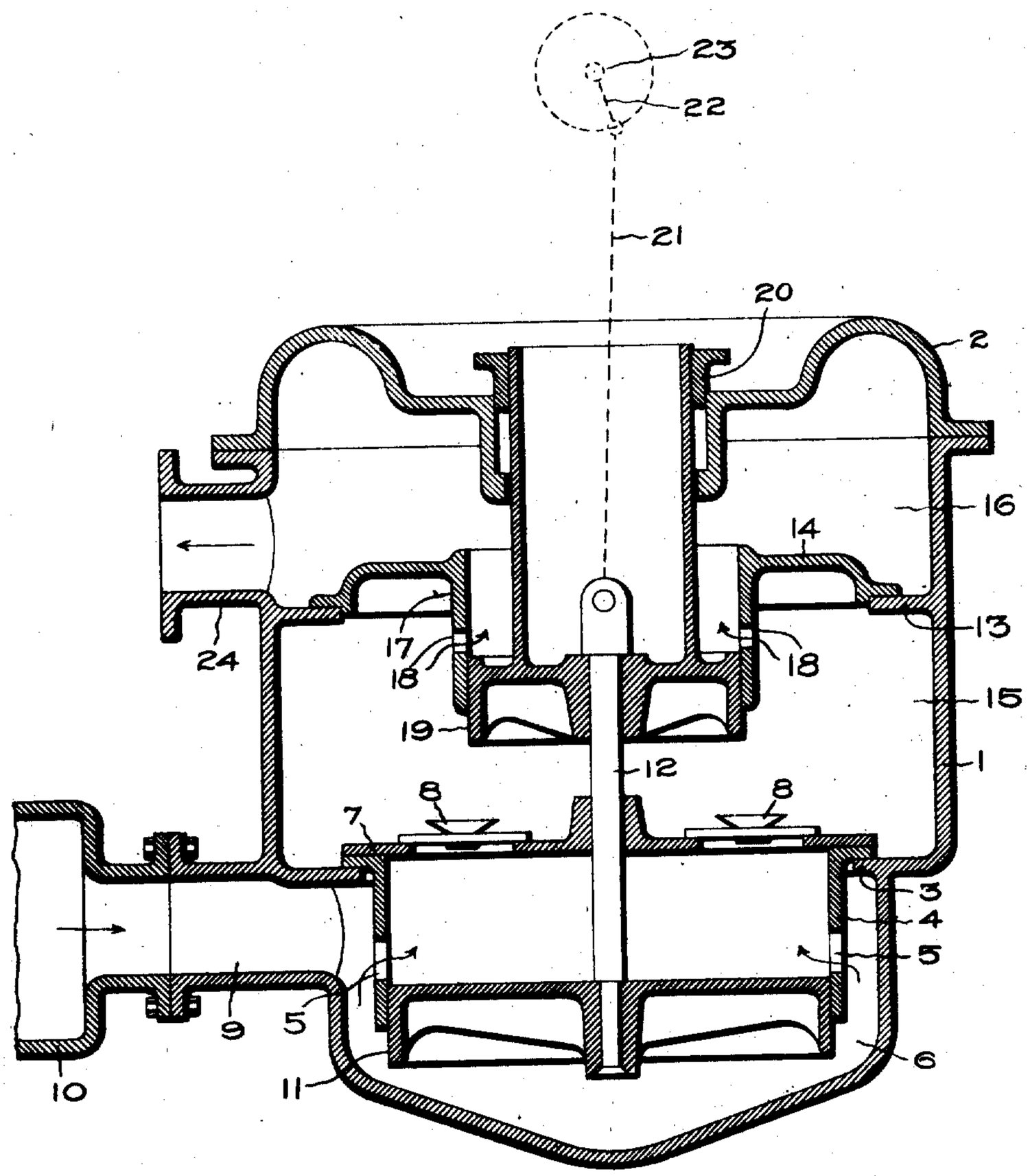

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UNITED STATES PATENT OFFICE.

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MULTISTAGE PUMP FOR PRODUCING A VACUUM OR COMPRESSING GASES.

No. 897,498. Specification of Letters Patent. Patented Sept. 1, 1908.

Application filed December 26, 1907. Serial No. 408,056.

To all whom it may concern:

Be it known that I, AUGUST SIEGEL, a subject of the King of Würtemberg and of the Emperor of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Multistage Pumps for Producing a Vacuum or Compressing Gases, of which the following is a specification.

The present invention has for its object to provide a multi-stage pump which will efficiently extract air from a condenser or compress gases.

In the accompanying drawing is illustrated one of the embodiments of my invention in vertical section.

1 indicates the casing of the pump which is provided with a cover or head 2. The casing is provided with an internal flange or shoulder 3 to receive and support the flanged end of cylinder 4 of the low-pressure stage. The cylinder is provided with one or more ports or slots 5 which admit air and water to the cylinder space when the pump is connected to a condenser. The cylinder being smaller than the casing, air and water can freely circulate around the cylinder in the annular chamber 6 and enter the ports when uncovered by the piston. The cylinder is provided with a head 7 which is fastened to the flange thereof and is provided with pressure-actuated outlet valves 8. Air and water enter the chamber 6 from the inlet conduit 9 connected to the hot-well of the surface condenser, or other apparatus 10. Mounted within the cylinder is a piston 11 having a rod 12 extending through the head 7. The casing is also provided with an internal flange or shoulder 13 upon which is seated a partition 14 that divides the upper part of the casing into intermediate and discharge chambers 15 and 16. The partition also carries the open-ended cylinder 17 having one or more inlet ports or slots 18. Located within the cylinder and mounted on the piston rod 12 is a piston 19 smaller than the piston 11 and working at a higher pressure. This piston is provided with a tubular guide or trunk that passes through a stuffing box 20 in the head 2 of the casing. The pistons are connected to the connecting rod 21, shown to simplify the illustration as a broken and dotted line. The rod is connected to a crank 22 driven by a shaft 23 from any suitable source of power. The discharge chamber 16 is provided with an outlet conduit 24 connected to any desired receptacle by the usual piping.

In the present illustration a pump having two stages has been shown and connected in series but I may connect a greater number of stages in series if desired.

The air to be lifted enters with the water from the condenser through the conduit 9 and passes into the annular chamber 6 from which it flows through the ports or slots 5 into the space above the piston 11. As the piston moves upward the ports 5 are closed by it, and the air in the cylinder is compressed, the outlet valves 8 temporarily remaining closed until the pressure in the intermediate chamber is reduced. As the piston 11 moves upward so does the upper piston 19. Just as soon as the upper piston closes the ports 18, the pressure in the intermediate chamber 15 decreases and continues to do so until it has fallen to the same value or slightly below that in the lower cylinder space. At or about this instant the outlet valves 8 open and air and water from the lower cylinder pass through them into the intermediate chamber. In the meanwhile the upper piston 19 has forced air and water into the upper pressure chamber 16 from which it escapes by the conduit 24.

When the upper piston reverses its movement and starts to move downward it compresses the mixture of air and water in the intermediate chamber 15 until the ports or slots 18 are again uncovered. As soon as the ports are uncovered, the piston continuing its movement, air and water pass into the pressure or discharge chamber 16, the pressure and intermediate chambers being at this portion of the cycle of operation in direct communication. While this part of the cycle is being performed the lower piston creates a vacuum in the low-pressure cylinder up to or substantially up to the lower end of its stroke when the operation is repeated.

It will be noted that only one set of valves is required for a two-stage compression and owing to their arrangement they open very easily and the wear thereon is reduced to a minimum. Owing to these facts the speed of the pump can be high which is a material advantage.

In case a greater pressure than atmosphere is to be overcome the invention can be carried out as a double acting pump with the

displacing device of the high pressure stage formed as a differential piston and the introduction of a compressed air vessel. This arrangement is particularly advantageous with high-speed pumps.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. An apparatus of the character described, comprising a piston and cylinder, the latter containing an inlet port or slot controlled by the piston, an inlet for the cylinder, an outlet valve, a second piston and cylinder, the latter being provided with an inlet port controlled by the piston, a chamber which receives the fluid directly from the second cylinder, and is always in uninterrupted communication therewith, and an outlet.

2. An apparatus of the character described, comprising a piston and cylinder, the latter having a port controlled by the piston, a chamber communicating with the source of supply and the port, a valve-controlled outlet, a second piston and cylinder, the latter having an inlet port controlled by the piston, an intermediate chamber communicating with said valve-controlled outlet and the inlet port of the second cylinder, a discharge chamber in unrestricted communication with the second cylinder, and an outlet for the discharge chamber.

3. An apparatus of the character described, the combination of a casing, a ported cylinder supported therein and separated from the wall by a supply chamber, a partition which divides the casing into intermediate and discharge chambers, a ported cylinder supported by the partition, pistons which move in the cylinders and control the ports, a pressure-controlled valve between the space of the first mentioned cylinder and the intermediate chamber, an inlet for the supply chamber, and an outlet for the discharge chamber.

4. In an apparatus of the character described, the combination of a piston and cylinder, a port in the cylinder controlled by the piston, a supply chamber communicating with the port, an intermediate pressure chamber, a valve controlling the passage of fluid from the cylinder to the chamber and which is held on its seat by the pressure in the chamber so long as it is superior to that in the cylinder, a second piston and cylinder, a port for the latter controlled by the piston and communicating with the intermediate chamber, a discharge chamber in unrestricted communication with the second cylinder, and an outlet for the discharge chamber.

In witness whereof, I have hereunto set my hand this tenth day of December, 1907.

AUGUST SIEGEL.

Witnesses:
JULIUS RUMLAND,
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