H. C. SNOOK AND O. E. BUCKLEY.

VACUUM PUMP.

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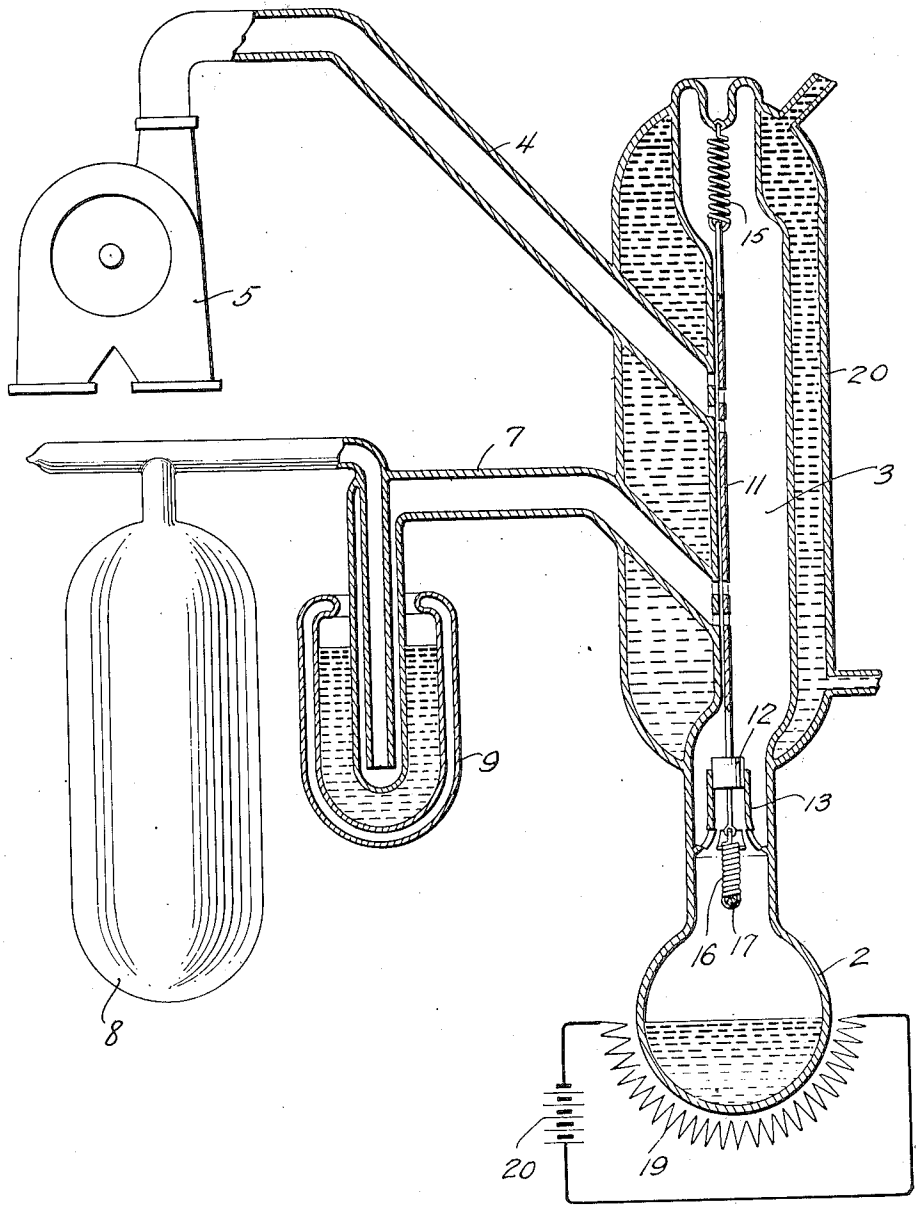
1,434,851. Patented Nov. 7, 1922.



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UNITED STATES PATENT OFFICE.

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VACUUM PUMP.

Application filed December 23, 1920. Serial No. 432,670.

To all whom it may concern:

Be it known that we, HOMER CLYDE SNOOK and OLIVER E. BUCKLEY, citizens of the United States of America, residing at South Orange, in the county of Essex and State of New Jersey, and at Maplewood, in the county of Essex and State of New Jersey, respectively, have invented certain new and useful Improvements in Vacuum Pumps, of which the following is a full, clear, concise, and exact description.

This invention relates to an auxiliary pump adapted to cooperate with a roughing pump for exhausting to low pressures. It is particularly, although not exclusively, useful for the production of high vacua necessary in vacuum tubes of the pure electron discharge type.

The general object of the invention is to provide a new and improved auxiliary pump which is simple in construction, efficient in operation and is capable of exhausting to the desired low pressures.

More specifically stated, the invention relates to an auxiliary pump employing as pumping medium a suitable vapor; and the invention is characterized by the fact that instead of using a continuous stream of vapor, puffs of vapor are employed which drive the gas to be exhausted toward the roughing pump.

One embodiment of the invention is illustrated sectionally and diagramatically in the drawing.

Referring to the drawing, the auxiliary pump is shown as comprising a boiler 2 and a mixing chamber 3, the latter being connected by a tube 4 with a roughing pump 5 and by a tube 7 with a vessel 8 which is to be exhausted, a liquid air trap 9 of the usual form being connected in the tube 7 between the auxiliary pump and the vessel 8. Mounted within the boiler 2 and the chamber 3, is a valve mechanism which is shown as comprising a metal strip 11 having openings therein adapted to cooperate with openings through the wall of the chamber 3 into the tubes 4 and 7, and a piston 12 adapted to enter a nozzle 13 located in the top of the boiler 2. The strip 11 has secured to its upper end a spring 15 attached to the upper end of the chamber 3; and secured to the lower end of said strip 11 is a spring 16 which is attached to a rod 17 bridging the top of the boiler and sealed into the walls thereof. The springs 15 and 16 are so designed and adjusted that when the pressures in the boiler 2 and the chamber 3 are the same, the piston 12 will lie within the nozzle 13, the lower openings in the strip 11 will register with the openings from the chamber 3 into the tube 7, and the upper openings in the strip 11 will be below the openings from the chamber 3 into the tube 4. While the strip 11 and the piston 12 act as valves controlling the passages from the chamber 3 into the tubes 4 and 7 and into the boiler 2, there are no mechanically rubbing surfaces in these valves. It is not intended or necessary that these valves shall be gas-tight; it is merely necesary that they shall serve to vary to a substantial degree the impedance or resistance to the flow of gas through the openings with which said valves cooperate.

The material used in the boiler 2 to furnish the vapor which acts as a pumping medium, may be mercury, tin, lead, bismuth, thallium, tellurium, aluminum, zinc, lithium, or other suitable material. Such material is heated to a suitable temperature in any suitable manner, as by a heating coil 19 receiving current from battery 20. The vapor employed as the pumping medium should be condensable at the temperature of the walls of the chamber 3; and if necessary the chamber 3 may be surrounded and cooled by a water jacket 20. The vapor condensed on the walls of the chamber 3 flows down the walls and back into the boiler 2 through small openings provided for that purpose in the bottom of the nozzle 13.

When the device is in operation, the piston 12 will act as a relief valve for the boiler 2 and will move in and out of the nozzle 13, thereby admitting puffs of vapor from the boiler 2 into the chamber 3. The movement of the piston 12 will also cause vertical movement of the strip 11 with the consequent periodical opening and closing of the valves at the mouths of the tubes 4 and 7. While the boiler valve is open and vapor is escaping from the boiler 2 into the chamber 3, the valve at the mouth of the tube 7 will be closed and the valve at the mouth of the tube 4 will be open; and when the

boiler valve is closed, the valve at the mouth of the tube 7 will be open and the valve at the mouth of the tube 4 will be closed. As a consequence, the diffusion of gas from the vessel to be exhausted through the tube 7 and into the chamber 3 will take place during what may be called a condensation period, that is, while the chamber 3 is closed-off from the boiler 2 and from the roughing pump 5. In this way, diffusion of vapor from the chamber 3 into the tube 7, and from the tube 4 into the chamber 3, is substantially prevented.

During the operation of the auxiliary pump, the piston 12 and the strip 11 will vibrate rapidly, and the puffs of vapor admitted to the chamber 3 will drive toward the roughing pump the gas which diffuses into the chamber 3 from the vessel to be exhausted. The auxiliary pump thus cooperates with the roughing pump in the exhaustion to low pressures of the vessel to be evacuated.

What is claimed is:

1. An auxiliary pump adapted to cooperate with a roughing pump for exhausting to low pressures comprising a chamber connected to the roughing pump and to the vessel to be exhausted, and means for producing puffs of vapor and causing them to traverse said chamber, whereby gas diffusing into said chamber from the vessel to be exhausted will be driven toward the roughing pump.

2. An auxiliary pump adapted to cooperate with a roughing pump for exhausting to low pressures comprising a chamber connected to the roughing pump and to the vessel to be exhausted, a source of vapor connected to said chamber, and means for intermittently admitting vapor to said chamber, whereby gas diffusing into said chamber from the vessel to be exhausted will be driven toward the roughing pump.

3. An auxiliary pump adapted to cooperate with a roughing pump for exhausting to low pressures comprising a chamber connected to the roughing pump and to the vessel to be exhausted, a source of vapor connected to said chamber, and means for controlling the passages from said chamber to the source of vapor and to the roughing pump and to the vessel to be exhausted, whereby when the passage to the source of vapor is open the passage to the vessel to be exhausted is closed and the passage to the roughing pump is open, and whereby when the passage to the source of vapor is closed the passage to the vessel to be exhausted is open and the passage to the roughing pump is closed.

4. An auxiliary pump adapted to cooperate with a roughing pump for exhausting to low pressures comprising a chamber connected to the roughing pump and to the vessel to be exhausted, a boiler furnishing pumping vapor connected to said chamber, an escape valve controlling the passage from the boiler into said chamber, and valves controlling the passages from said chamber to said roughing pump and to the vessel to be exhausted, said valves being so connected that when the boiler valve is open the valve to the vessel to be exhausted is closed and the valve to the roughing pump is open and when the boiler valve is closed the valve to the vessel to be exhausted is open and the valve to the roughing pump is closed.

In witness whereof, we hereunto subscribe our names this 20th day of December, A. D., 1920.

HOMER CLYDE SNOOK.
OLIVER E. BUCKLEY.