(No Model.) 3 Sheets—Sheet 1.

H. J. MÜLLER.

VACUUM PUMP.

No. 264,329. Patented Sept. 12, 1882.

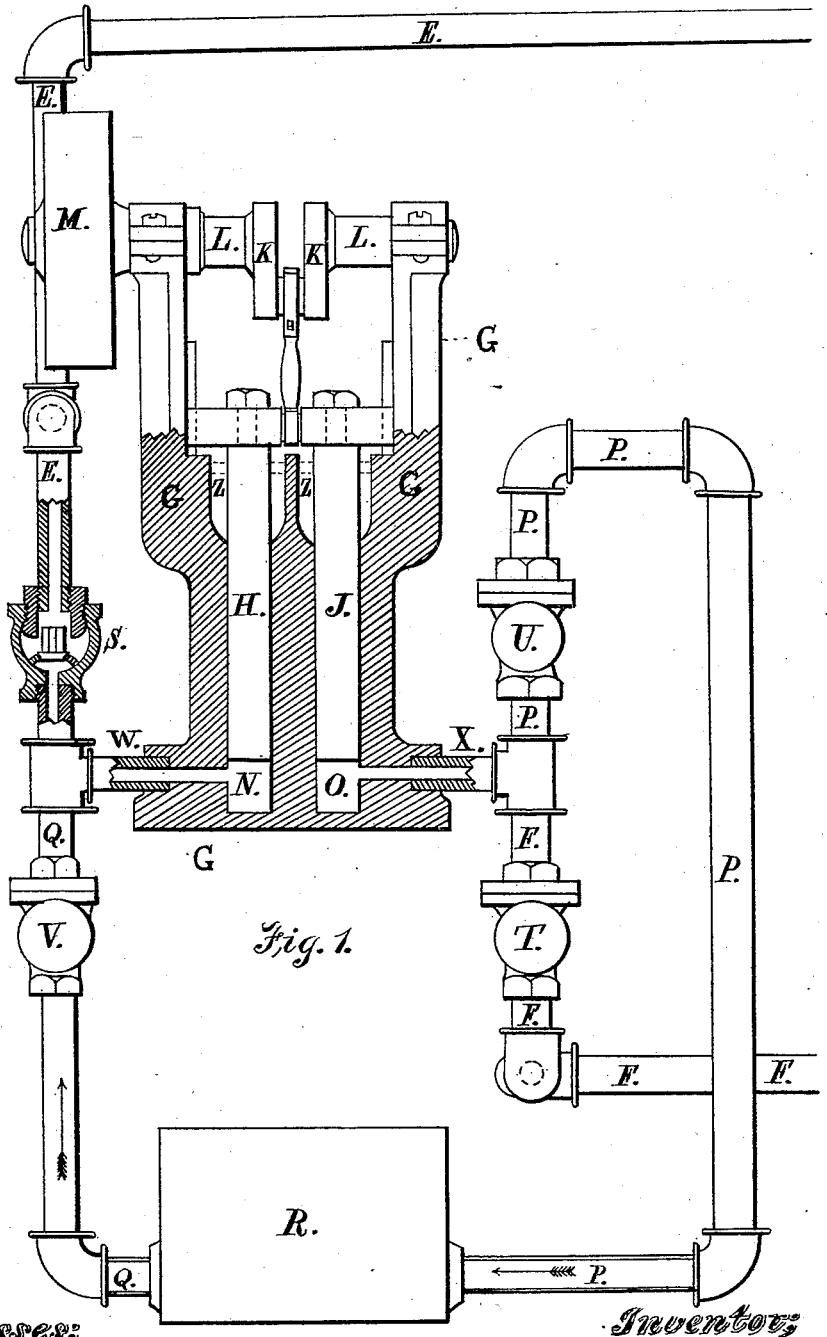

Fig. 1.

Witnesses:
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H. S. Hoyt Jr.

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(No Model.) 3 Sheets—Sheet 2.

H. J. MÜLLER.

VACUUM PUMP.

No. 264,329. Patented Sept. 12, 1882.

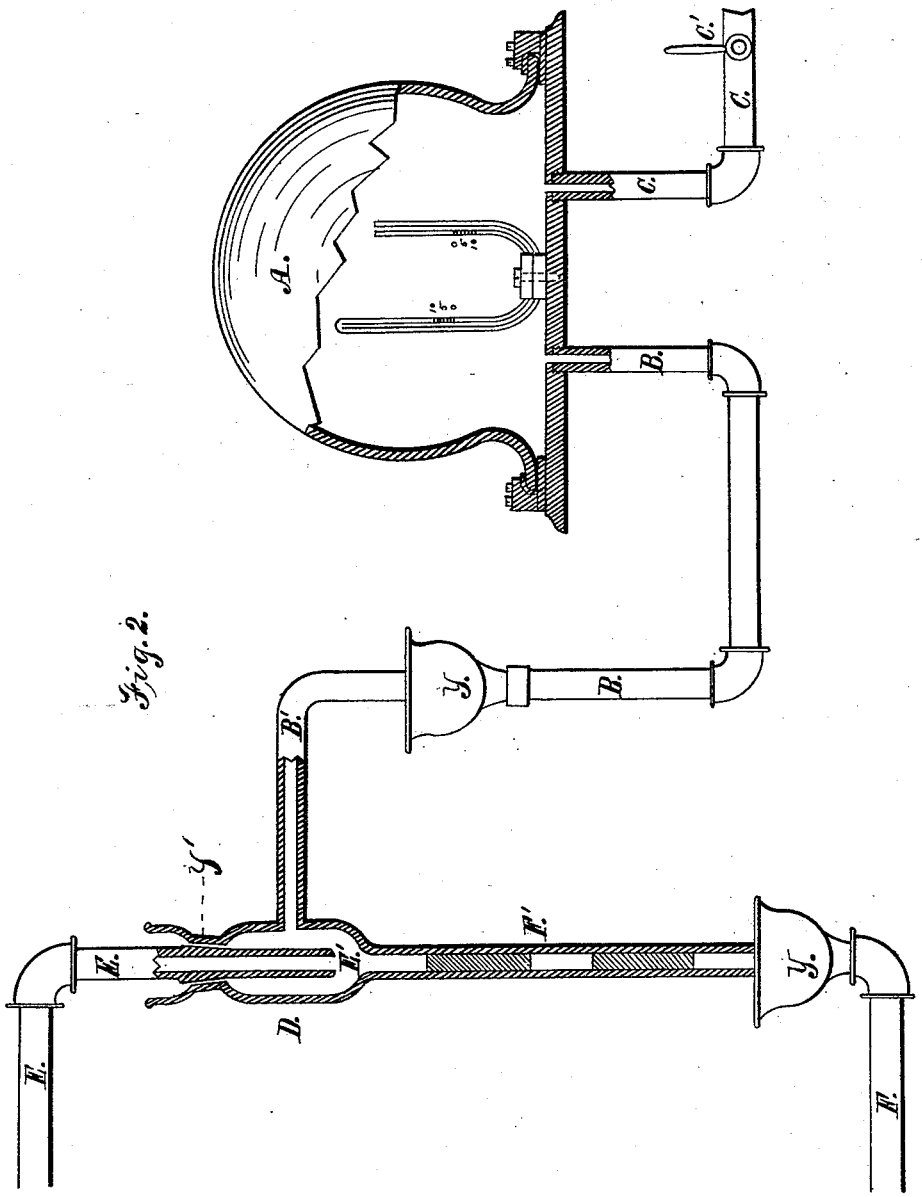

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

H. J. MÜLLER.

VACUUM PUMP.

No. 264,329. Patented Sept. 12, 1882.

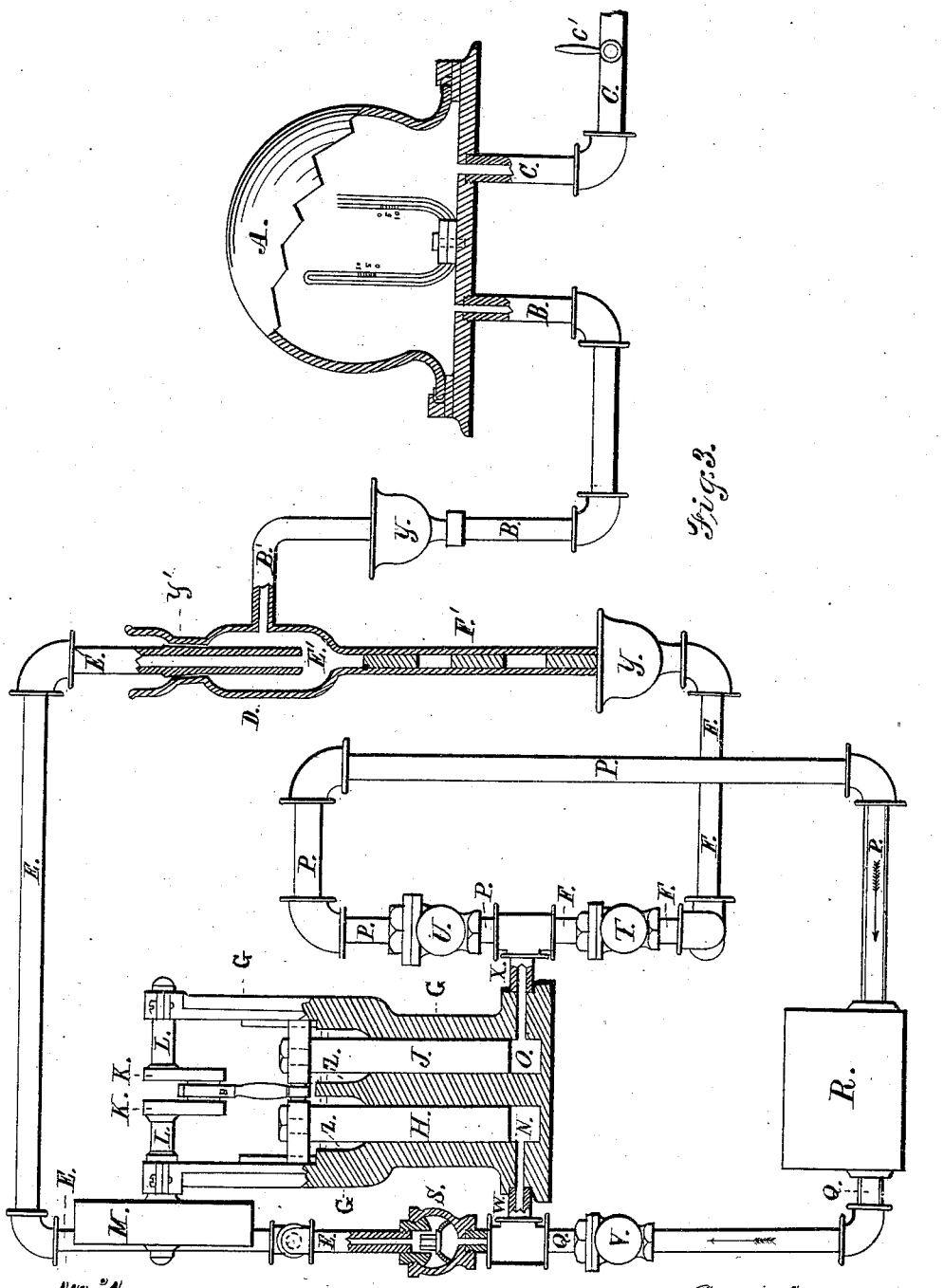

Fig. 2.

Witnesses;
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Inventor;
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UNITED STATES PATENT OFFICE.

HANS J. MÜLLER, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO ALEXANDER LEVETT, OF SAME PLACE.

VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 264,329, dated September 12, 1882.

Application filed April 28, 1882. (No model.)

Be it known that I, HANS J. MÜLLER, of the city, county, and State of New York, have invented a new and useful Improvement in Vacuum-Pumps, of which the following is a specification.

The object of my invention is to obtain all the advantages of the Sprengel or gravity pump in regard to completeness of vacuum, and to assist its action by means of the mechanical pump, while at the same time the mechanical pump continually supplies the mercury to the gravity-pump, the mercury being continually drawn from and returned to the well in which the air escapes that is drawn from the vacuum-chamber.

In the accompanying drawings, Figure 3 represents a side view of the device embodying my invention, the principal parts being represented in vertical longitudinal section. Figs. 1 and 2 show the same enlarged.

Similar letters indicate like parts.

A represents the vacuum-chamber, constructed in any suitable manner. It is here shown as a glass globe fastened upon a bottom plate, and within the chamber is the usual device for indicating pressure. From the bottom plate of said vacuum-chamber a tube, B B′, leads toward the pump, and a second tube, C, with suitable cut-off valve at C′, leads toward any electric lamps or other devices which are to be attached and exhausted.

D is the Sprengel or gravity pump, constructed in the usual form, consisting of a glass air or vacuum chamber, having the tube E′ extending from the top nearly to the bottom and the tube F′ leading from the bottom directly beneath the tube E′. The tube E leads to the top of the tube E′ from the mechanical pump, and the tube F leads from the bottom of F′ to the mechanical pump.

G is the mechanical pump, containing two pistons or plungers, H and J, both of which are actuated, in the usual manner, by means of the crank K upon the shaft L, to which motion is imparted by the wheel M. The plungers H and J move vertically in the cylinder-chambers N and O. From the cylinder-chamber O the tubes X P lead to the mercury-well R, and to the cylinder-chamber N the tubes Q W lead from the mercury-well R. This well R is open at the top for the escape of air. The valves S T U V upon the tubes E, F, P, and Q, respectively, are all constructed so as to open upward automatically by means of pressure from below or suction from above, as shown in S, which represents, in vertical section, an ordinary globe-valve. The tubes E and Q are both connected with the cylinder-chamber N by means of the common tube W, and the tubes F and P are both connected with the cylinder-chamber O by means of the common tube X. At points where leakage of air is likely to occur in the pump I make mercury joints Y Y′ Z by means of caps filled with mercury, in a manner well known in the art, and shown in section at Y′. Z Z are two such mercury joints at the top of the cylinder-chambers N O, the plungers passing through the mercury in the cups forming said joints. I also cover the mercury in all these joints, as well as the mercury in the well R with oil, to prevent corrosion.

The operation of the device is as follows: The mercury-well R is first filled with mercury. When power is applied to the shaft L the plungers H and J rise simultaneously in the cylinder-chambers N and O, and by suction lift the valves V and T, respectively, while the valves S and U by the same power of suction remain closed. Mercury is drawn from the mercury-well R up the tube Q and through the valve V and tube W into the chamber N, and air is drawn from the vacuum-chamber A through the tube B B′, and from the gravity-pump D through the tubes F′ F, and from the tubes E E′ through the valve T and tube X into the chamber O, this exhausting action extending through the entire device into which the valve T opens, but the suction from the plunger J not being sufficiently strong at any time to open the valve S against the suction caused by the plunger H. The two plungers now being lifted and the chamber N being thus filled with mercury and the chamber O with air, the plungers H and J next descend simultaneously, and by pressure upon the contents of the chambers close the valves V and T and open the valves S and U, thus forcing the mercury through the valve S into the tube E, and forcing the air through the valve U into the tube P. By the action of this double-piston

pump, as above described, the tube E E′, leading to the Sprengel or gravity pump D, is, after a few strokes, filled with mercury, and a portion of the air in the tube P is forced at the same time to the mercury-well R, and, rising to the top of the well, escapes. The action of the gravity-pump commences when the mercury begins to flow from the bottom of the tube E′ into the top of the tube F′. This flow of mercury from the tube E′, caused by the fall of the plunger H, and also by the gravity of the mercury itself, will be in regular pulsations corresponding with the strokes of the mechanical pump, and in the interval between each of these pulsations—namely, while the plungers H and J are rising—the exhaust action of the plunger J will carry the mercury from the gravity-pump D into the tube F′, leaving an air-space above it in the tube, as shown at the top of F′, air being drawn at the same time from the vacuum-chamber A through the tube B into the chamber D. The exhaust action of the plunger J must always draw the mercury down into the tube F′ so far that there will be an air-vacuum space around the lower end of E′ and extending some distance into the tube F′. When the mercury again flows from E′ at the next descent of the plungers, it will fall into the tube F′, but will leave the air-space in that tube above the mercury that flowed in the preceding pulsation. Thus the tube F F′ will soon be filled with mercury and air in alternate layers, and this will be drawn into the chamber O. The plunger J, in its descent, will then force the mercury and air through the valve U into the tube P, and thus down into the mercury-well, the air escaping, as before described, and as much mercury flowing into the well at each downward stroke of the pump as is drawn from the well by the upward strokes. The well is thus continuously supplied. The air in the vacuum-chamber is thus continuously exhausted, and its tenacity will be measured not only by the gage within the chamber, but by the size of the air-spaces in the tube F′, for the air-chamber of the gravity-pump D, together with its arms B′ and F′, should preferably be made of glass blown in one piece, in order that the operation of the pumps may be examined. When the air-spaces in the tube F′ disappear, and the mercury in falling from the tube E′ comes in direct contact with the mercury in the tube F without any air-space between them, then it will be that a complete vacuum is formed in the chamber A.

That which I claim is—

1. The combination, with a gravity-pump, of a mechanical pump having two pistons operated simultaneously, and with tubes connecting said mechanical pump with the gravity-pump, substantially as described, whereby liquid is forced into said gravity-pump and discharged therefrom, substantially as set forth.

2. The combination, with a gravity-pump, of a mechanical pump and a well or reservoir, and tubes connecting the reservoir with the mechanical pump, and the mechanical pump with the gravity-pump, substantially as described, so that the liquid for said gravity-pump may be forced into the same in regular pulsations.

3. The combination of a gravity-pump with a mechanical pump, well or reservoir, and tubes connecting the reservoir with the mechanical pump, and the mechanical pump with the gravity-pump, and the gravity-pump with the reservoir, whereby liquid for the gravity-pump may be automatically drawn from the well, supplied to the gravity-pump, and returned therefrom to the well, substantially as described.

HANS J. MÜLLER.

In presence of—
C. WYLLYS BETTS,
JOSEPH H. MARVIN.