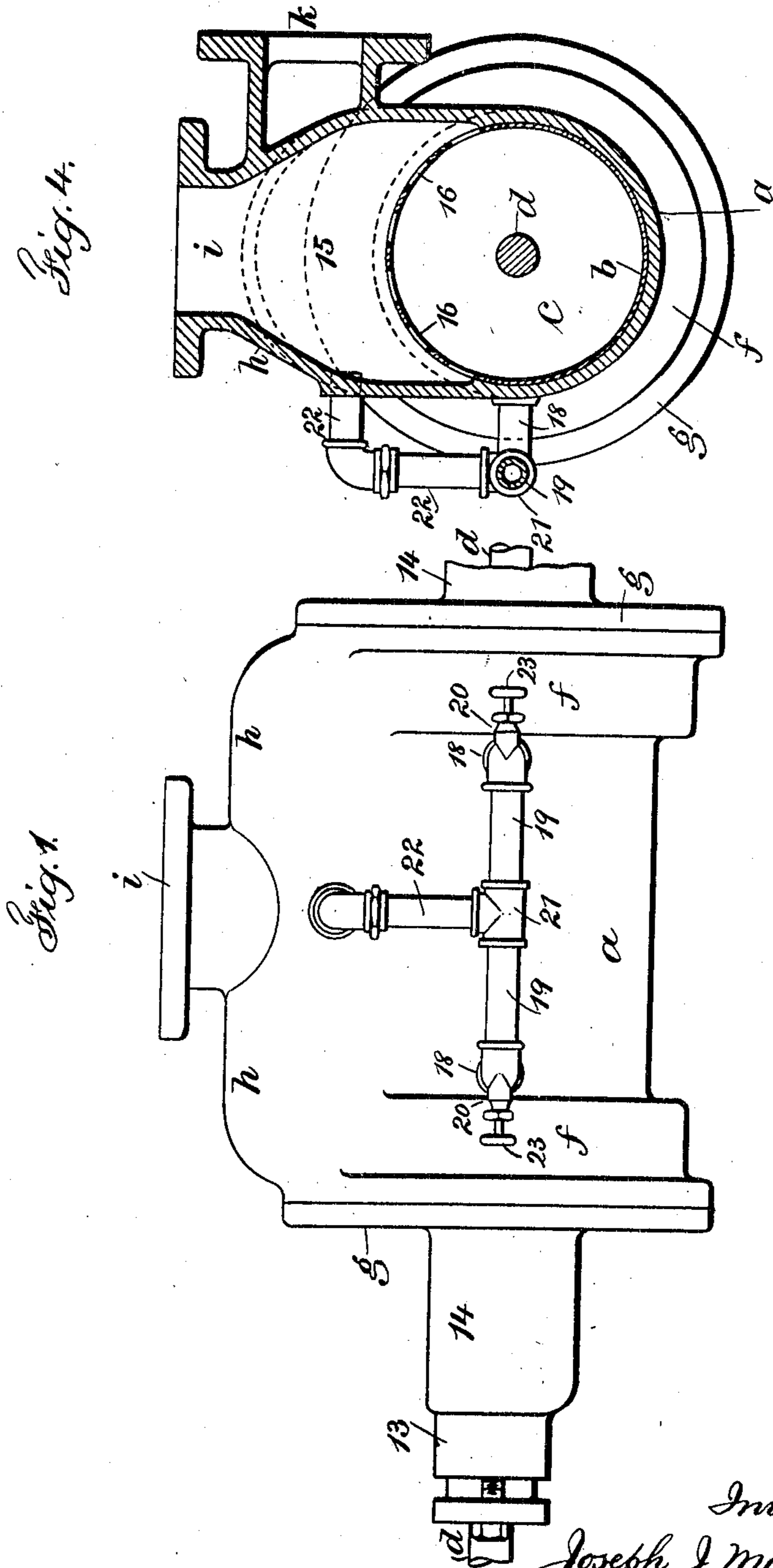


No. 844,734.

PATENTED FEB. 19, 1907.

J. J. MULLAN.
VACUUM PUMP.
APPLICATION FILED AUG. 4, 1905.

3 SHEETS—SHEET 1.



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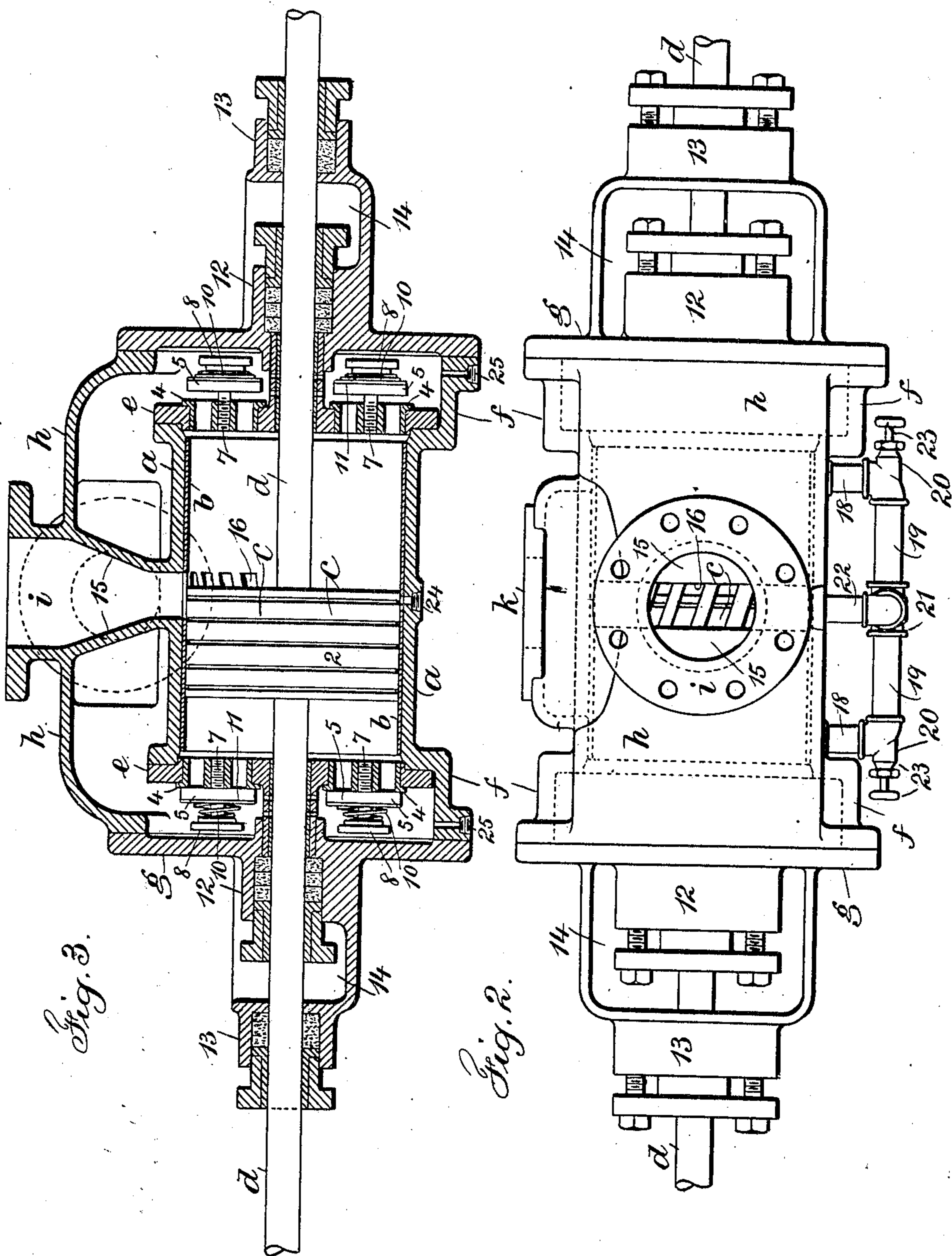
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

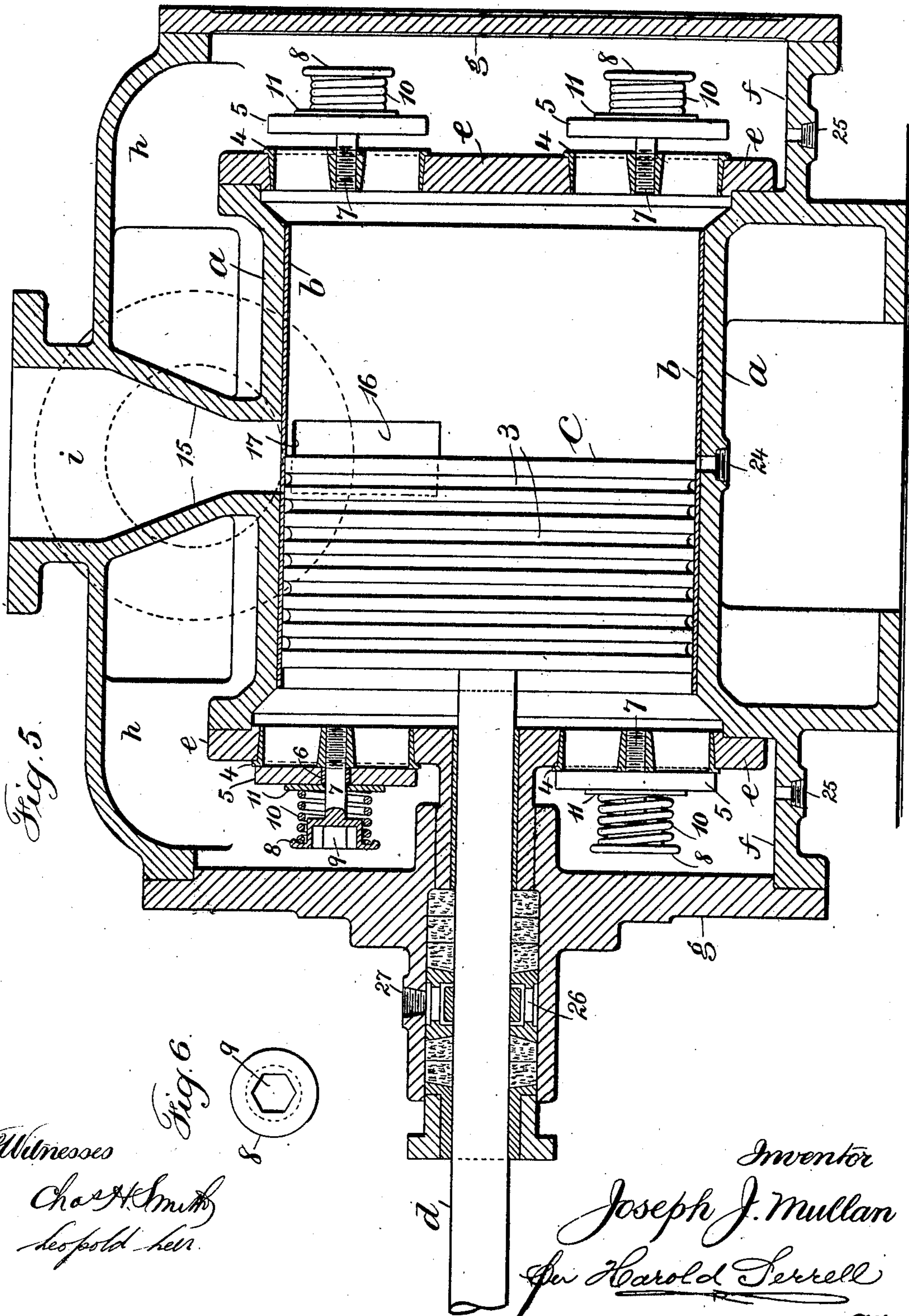
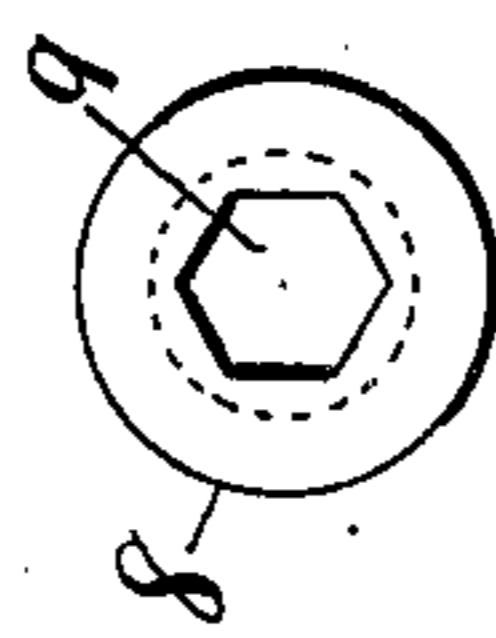


Fig. 5.

Fig. 6.



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VACUUM-PUMP.

No. 844,734.

Specification of Letters Patent.

Patented Feb. 19, 1907.

Application filed August 4, 1905. Serial No. 272,655.

To all whom it may concern:

Be it known that I, JOSEPH J. MULLAN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented an Improvement in Vacuum-Pumps, of which the following is a specification.

My invention relates to vacuum-pumps, and particularly to that type which may be termed a "valveless" suction double-acting wet vacuum-pump. I am aware that valveless suction-pumps *per se* are not new; but this class of pump as heretofore constructed embodied features—such, for example, as an excessive clearance between the ends of the piston travel and the discharge-valves—making it necessary to employ excessively large pumps or run the pumps at an abnormally high speed to perform a given duty and also causing these pumps to be of general low efficiency.

In carrying out my invention I employ a cylinder, a lining therefor, a piston therein, heads for said cylinder having valve-seats therein and valves connected thereto, casings surrounding said cylinder-heads, heads for said casings providing water-chambers between the same and the said cylinder-heads, a longitudinal casing extending between the aforesaid casings and preferably integral therewith, providing a communicating passage between said water-chambers, a suction-inlet connection on said longitudinal casing extending through the said passage therein and communicating with the interior of the said cylinder through suitable openings provided in the cylinder-lining adjacent to the inner orifice of the said inlet connection, a discharge-outlet connection also on said longitudinal casing, and means for equalizing the pressure on opposite sides of the said piston, all of which will be hereinafter more particularly set forth.

In the drawings, Figure 1 is a side elevation of my improved vacuum-pump. Fig. 2 is a plan of the same. Fig. 3 is a central vertical longitudinal section of the pump. Fig. 4 is a central transverse section, the hereinbefore-described figures being illustrations of a double pump. Fig. 5 is a central vertical longitudinal section of a single pump, and Fig. 6 is an end view of the stem of a discharge-valve.

Referring to the drawings, *a* designates a pump-cylinder provided with a lining *b*, of

bronze or any other suitable material. Within the lining *b* a piston *c* is employed, as is customary, the peripheral surface of which may be provided with snap-rings 2, as indicated in Fig. 3, for the purpose of packing the piston, or the peripheral surface of the piston may be provided with a series of circumferential grooves 3, as indicated in Fig. 5, for the same purpose. A piston-rod *d* is connected to the piston *c* in any customary manner, and the ends of the cylinder *a* are provided with heads *e*, secured thereto in any desired manner and provided in suitable positions with valve-seats 4.

Each of the valves 5 employed in my improved pump is preferably provided centrally with a bushing 6, through which the valve-stem 7 passes, and is secured centrally in a valve-seat, the head of the valve-stem being enlarged and provided with a suitably-shaped recess 9 to receive a tool for fitting the valve in place and adjusting the same to the proper tension, which is obtained by a helical or other spring 10, extending between the head 8 of the valve-stem and a disk 11, surrounding said stem and bearing against the outer surface of the valve 5, and the bushing 6 sliding on the stem in the actuation of the valve relieves the valve *per se* of the wear caused by the movement thereof. The ends of the cylinder are provided with casings *f*, preferably concentric with the same, but of considerably greater diameter, and the said casings *f* are each provided with a head *g*, secured thereto in any desired manner and providing between the same and the heads of the cylinder water-chambers into which the air and water in the operation of the pump are discharged through the said valves 5, and *h* is a casing extending longitudinally between the casings *f, f* and providing a communicating passage between said chambers.

The casing-heads *g* are preferably so constructed as to be provided with immediate packing-glands 12 and remote packing-glands 13, a well 14 being provided between the glands 13 and 14 for the reception of water or other liquid to effect a seal. A suction-inlet connection *i* is provided, extending from a point exteriorly of the longitudinal casing *h* through the same, through the communicating passage formed by the longitudinal casing *h* by means of the walls 15, and into the interior of the cylinder *a* by way of suitable ports or openings 16, arranged in the

lining *b* adjacent to the inner orifice of the said section-inlet connection. The ports 16 may be arranged at an angle, as indicated in Figs. 2 and 3, this being necessary when the snap-rings are employed as a piston-packing in order to prevent the displacement of the same, or, as indicated in Fig. 5, a central strengthening-rib 17 may be provided in the cylinder-lining at the inner orifice of the suction connection *i*, the ports or openings extending circumferentially at either side of the said rib 17 between the opposite walls of the said orifice, and *k* designates a discharge-outlet connection, preferably also on the longitudinal casing *h* and communicating with the passage provided thereby from the said water-chambers at the ends of the cylinder. I also find it necessary to employ a means for equalizing the pressure on opposite sides of the piston, which is found particularly necessary in starting the pump. In the present case and as illustrated such a means may constitute pipe connections 18, communicating at opposite ends of the cylinder with the interior thereof, and pipe connections 19 with the intervening check-valves 20, the adjacent ends of the pipes 19 being secured in the opposite ends of a T 21, from which a pipe 22 communicates with the passage provided by the longitudinal member *h*, and the check-valves 20 are preferably provided with stems and hand-wheels 23. After the pump is fully under way these valves may be closed, as the same are not then absolutely necessary.

The pump structure hereinbefore described may also be conveniently provided with suitable taps in the cylinder and casings *f* thereof for the reception, respectively, of suitable plugs 24 and 25 for drainage purposes, and, as indicated in Fig. 5, in the single pump structure, or, for that matter, in lieu of the liquid seals (shown in Figs. 1, 2, and 3) I may employ a cage-seal, (indicated at 26,) centrally above which a tap 27 is provided for the reception of a suitable vessel for containing the liquid to effect the seal.

From the foregoing description and the drawings it will be apparent that the body of the pump, which is an integral structure of cast metal, comprises the following parts: the pump-cylinder *a*; the casings and flanged portions *f* at each end of the cylinder, which extend therefrom to the full length of the pump-body; the casing *h*, in width agreeing with the diameter of the cylinder and extending up and arched over; the centrally-disposed flanged section-inlet *i*, which in cross-section, Fig. 4, broadens to the inner diameter of the cylinder and in longitudinal section, Fig. 3, contracts appreciably by the walls 15, and the discharge-outlet *k*, formed by outward extensions from opposite sides of the section-inlet (see Fig. 2) around the same, and which terminate in a flange to which a discharge-pipe is to be secured.

I claim as my invention—

1. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, a piston and piston-rod therefor, of heads for the end of said cylinder, valves and valve-seats therein, casings surrounding the ends of said cylinder, a casing extending between the aforesaid casings, a suction connection passing through the said casing and leading into said cylinder, and a discharge connection leading from the said casing.

2. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, a piston and piston-rod therefor, of heads for the ends of said cylinder, valves and valve-seats therein, casings surrounding the ends of said cylinder, a casing extending between the aforesaid casings, a suction connection passing through the said casing and leading into said cylinder, a discharge connection leading from the said casing, and means for equalizing the pressure on opposite sides of the piston.

3. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, piston and piston-rod therefor, of a lining fitting within said cylinder, heads for the said cylinder, valves and valve-seats in the cylinder-heads, casings surrounding the ends of said cylinder, a casing extending between the aforesaid casings, a suction connection passing through said casing and leading into said cylinder through suitable ports provided in the said lining adjacent to the inner orifice of said suction connection and a discharge connection also leading from the said casing.

4. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, piston, and piston-rod therefor, of a lining fitting within said cylinder, heads for the said cylinder, valves and valve-seats in the cylinder-heads, casings surrounding the ends of said cylinder, a casing extending between the aforesaid casings, a suction connection passing through said casing and leading into said cylinder through suitable ports provided in the said lining adjacent to the inner orifice of said suction connection, a discharge connection also leading from the said casing, and means for equalizing the pressure on opposite sides of the piston.

5. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, a piston and piston-rod therefor, of a lining fitting within said cylinder, heads secured to the ends of said cylinder, discharge-valves and valve-seats therefor in the said cylinder-heads, casings surrounding the ends of said cylinder, heads for the said casings providing chambers between the same and the said cylinder-heads into which the vapor and liquid are discharged through said valves, a longitudinal casing extending between the aforesaid casings and providing a communicating passage between the said

chambers, a suction-inlet connection leading through the said communicating passage in the longitudinal casing into the said cylinder, through suitable openings provided in the said lining adjacent to the inner orifice of the said suction-inlet connection, and a discharge-outlet connection on the said longitudinal casing and communicating with the passage provided thereby.

6. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, a piston and piston-rod therefor, of a lining fitting within said cylinder, heads secured to the ends of said cylinder, discharge-valves and valve-seats therefor in the said cylinder-heads, casings surrounding the ends of said cylinder, heads for the said casings providing chambers between the same and the said cylinder-heads into which the vapor and liquid are discharged through said valves, packing-glands secured to the last aforesaid heads, intermediate liquid seals between the said packing-glands, a longitudinal casing extending between the aforesaid casings and providing a communicating passage between the said chambers, a suction-inlet connection leading through the said communicating passage in the longitudinal casing into the said cylinder, through suitable openings provided in the said lining adjacent to the inner orifice of the said suction-inlet connection, and a discharge-outlet connection on the said longitudinal casing and communicating with the passage provided thereby.

7. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, a piston and piston-rod therefor, of a lining fitting within said cylinder, heads secured to the ends of said cylinder, discharge-valves and valve-seats therefor in the said cylinder-heads, casings surrounding the ends of said cylinder, heads for the said casings providing chambers between the same and the said cylinder-heads into which the vapor and liquid are discharged through said valves, a longitudinal casing extending between the aforesaid casings and providing a communicating passage between the said chambers, a suction-inlet connection leading through the

said communicating passage in the longitudinal casing into the said cylinder through suitable openings provided in the said lining adjacent to the inner orifice of the said suction-inlet connection, and a discharge-outlet connection on the said longitudinal casing and communicating with the passage provided thereby, pipe connections leading from the opposite ends of the said cylinder into the communicating passage provided by said longitudinal casing, and check-valves suitably placed in the said pipe connections.

8. In a double-acting valveless suction vacuum-pump, the combination with a cylinder, piston and piston-rod therefor, of heads for the ends of said cylinder, discharge-valves and valve-seats therein, casings surrounding the ends of said cylinder, a casing extending between the aforesaid casings, a suction connection leading centrally to the said cylinder, a lining for the said cylinder provided with a series of apertures placed at an angle adjacent to the inner orifice of said suction-inlet connection, snap-rings for packing said piston, and a discharge-outlet connection leading from the said longitudinal casing.

9. In a vacuum-pump, a body of integral structure comprising a cylinder, casings and flanged portions at the ends of said cylinder which extend therefrom to the full length of the pump-body, a casing in width agreeing with the diameter of the cylinder and extending up and arched over a centrally-disposed flanged suction-inlet which in transverse section broadens to the inner diameter of the said cylinder and in longitudinal section contracts appreciably by walls within the said casing, and a discharge-outlet formed by outward extensions from the opposite sides of the said suction-inlet around the same and which terminate in a flange, substantially as described.

Signed by me this 26th day of July, 1905

JOSEPH J. MULLAN.

Witnesses:

RODNEY MORRISON,
WM. B. SOUDER.