No. 891,026. PATENTED JUNE 16, 1908.

J. ZEITLIN.

VACUUM PUMP.

APPLICATION FILED APR. 8, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

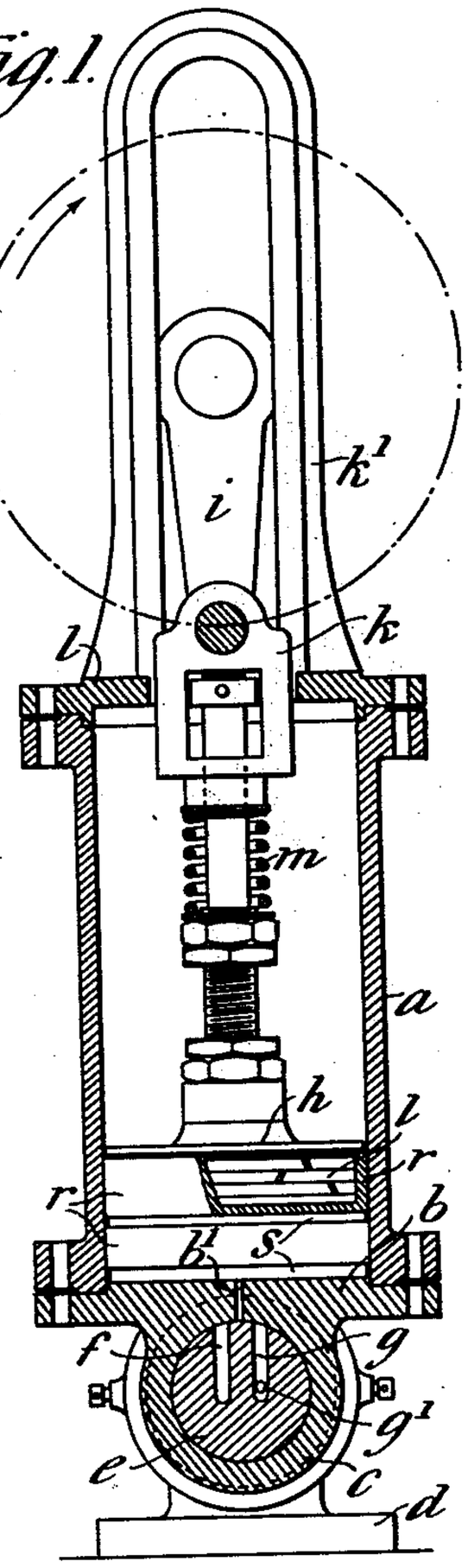
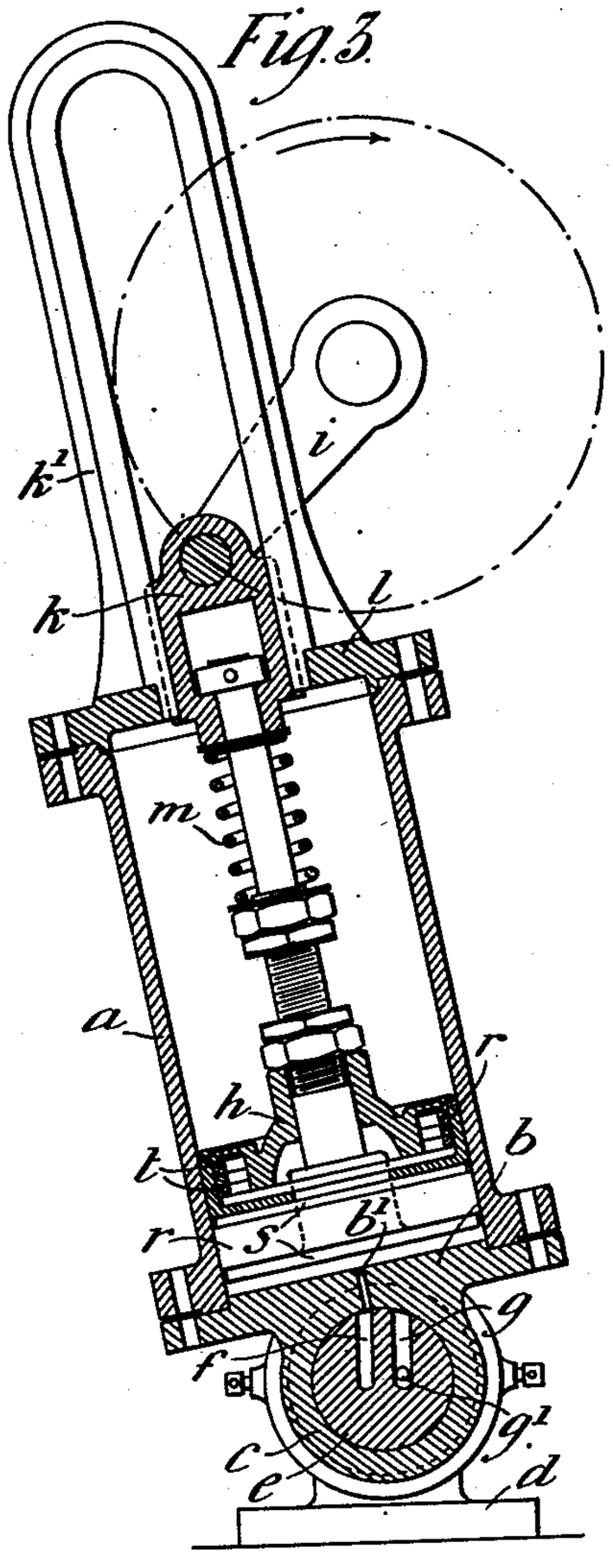


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 2.

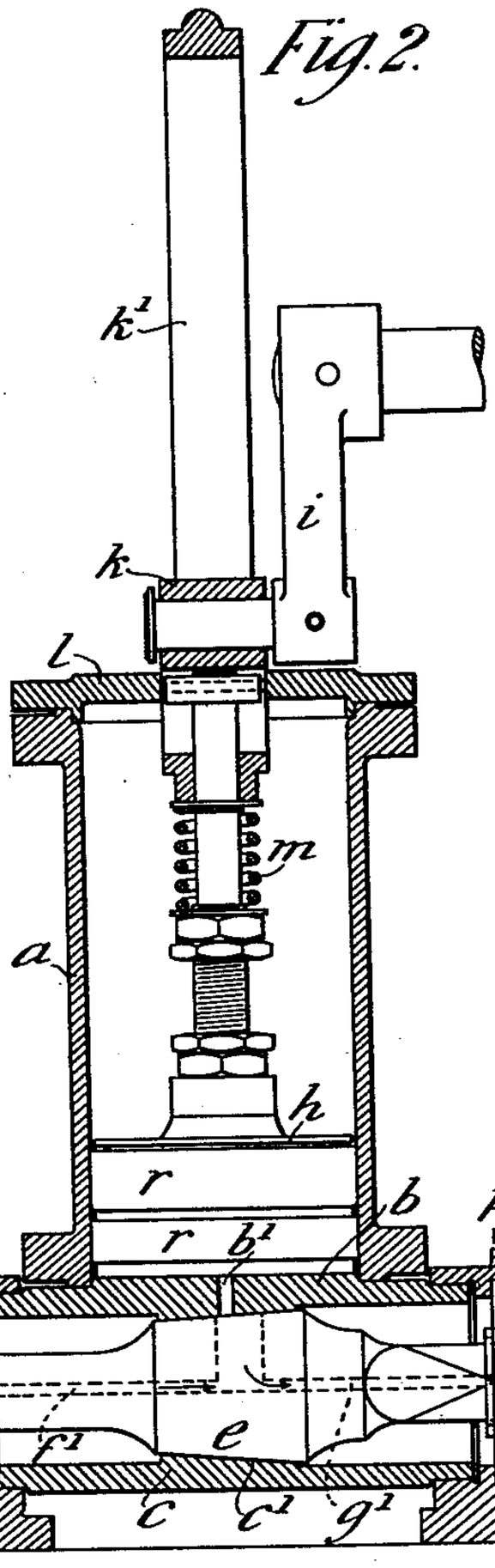


Fig. 6.

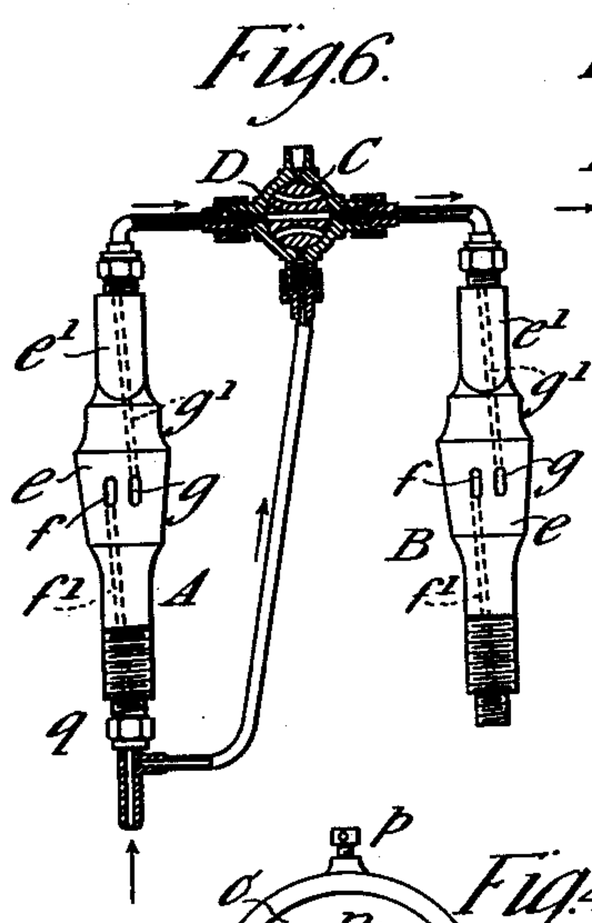


Fig. 7.

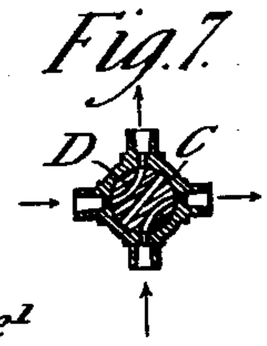


Fig. 4.

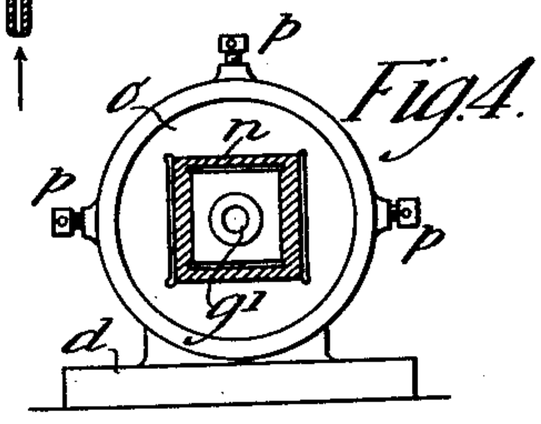
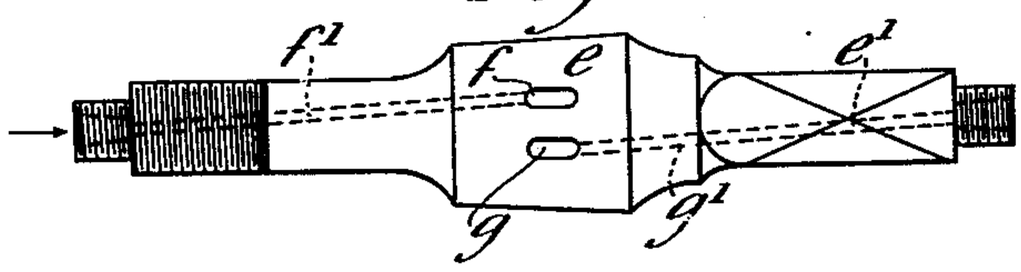


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOSEPH ZEITLIN, OF KENSINGTON, ENGLAND.

VACUUM-PUMP.

No. 891,026. Specification of Letters Patent. Patented June 16, 1908.

Application filed April 8, 1905. Serial No. 254,463.

To all whom it may concern:

Be it known that I, JOSEPH ZEITLIN, a citizen of Russia, but at present residing at 5 Gilston road, Kensington, in the county of London, England, student, have invented a certain new and useful Improved Vacuum-Pump, of which the following is a specification.

This invention relates to a vacuum pump in which by the oscillation of the pump cylinder, the cylinder is connected alternately with an inlet and a discharge passage. The piston is connected with the driving crank through an elastic piston rod which enables the piston to be closed against the end of the cylinder without damage thereto and to be held there while the communication between the cylinder and one passage is being closed and that between the cylinder and the other passage is being established. By thus eliminating all valves, in the ordinary sense, and all clearance between the piston and cylinder end at the end of each discharge and the beginning of each suction stroke, a very high vacuum can be speedily attained.

The invention is illustrated in the accompanying drawings in which

Figures 1 and 2 are central longitudinal sections taken at right angles to each other of the pump cylinder and distributing valve; Fig. 3 is a view similar to Fig. 1, but with the pump piston and cylinder in another position; Fig. 4 is an end elevation partly in section, showing the preferred manner of supporting the distributing valve plug; Fig. 5 is a plan view of the said valve plug; Fig. 6 is a sectional elevation showing a pair of distributing valve plugs coupled for series working; and Fig. 7 is a detail showing the intercommunication cock in position for parallel working.

The pump cylinder *a* is closed at one end only by a cover *b* attached to or combined with which is a hollow casing or sleeve *c* the ends of which are journaled in fixed bearing blocks *d*. The interior of the casing is cone-shaped throughout part of its length as shown at *c'*, in which part is fitted a corresponding coned plug *e* which is stationary in working but which is provided with means for adjustment whereby a gas tight joint may be maintained between the coned plug and its enveloping sleeve. The plug *e* has near the middle of its conical part two partial transverse passages *f g* in a common transverse plane, which extend from the periphery of the plug into the interior thereof, and communicate at their inner ends respectively with two longitudinal passages *f'' g'* leading to the respective ends of the plug *e*. Suitable provision is made for coupling the ends of the plug *e* with pipes as shown in Fig. 6.

The cylinder cover *b* remains fully open and is provided with a single port *b'* which is arranged to place the interior of the cylinder into alternate communication with the passages *f* and *g*, when the cylinder and the sleeve *c* are rocked about the axis of the latter. By this means during the suction stroke of the piston the pump cylinder is placed in communication only with the vessel to be exhausted, and during the delivery stroke only with the atmosphere or with the vessel into which the exhaust gases are to be delivered.

The piston *h* is reciprocated by any suitable driving mechanism, as by a revolving crank *i* which is connected with a crosshead *k* sliding in guides *k'* fixed to or formed with the open cover *l* of the pump cylinder. The piston is connected with the crosshead in such manner that there is a certain lost motion between the two at each change of direction of movement of the crosshead, and a spring *m* interposed between the crosshead and piston tends to keep the piston rod at its maximum elongation.

The throw of the crank is arranged to be greater than is required to return the piston *h* against the cylinder cover *b*, so that when the piston reaches this position it is held there during a part of the revolution of the crank, during which the spring *m* is compressed between the crosshead and piston as shown in Figs. 1 and 2, and the pump cylinder is rocked through the angle required to cut off communication through the port *b'* between the interior of the cylinder and the delivery passage *g g'*. The continued movement of the cylinder establishes communication with the suction inlet passage *f f''* as shown in Fig. 3, and the spring is again extended.

It will be obvious that instead of an oscillating cylinder and a stationary distributing

valve, the cylinder may be stationary and the distributing valve operated by any suitable means from a moving part of the apparatus so as to place the cylinder in communication with the suction and delivery passages alternately at the required intervals. It will also be obvious that by reversing the rotation of the driving crank, the functions of the passages $f f'$ and $g g'$ will be interchanged.

The piston h has usually one or more leather packing rings r preferably cup-shaped which are clamped between disks s with the natural inside surface of the leather against the cylinder wall, and pressed outwards against the cylinder by means of spring packing rings t of the usual description which are inclosed within the cup leather. The internal spring packing rings form a yielding abutment surface for the soft leather packing while pressing it into close contact with the cylinder wall, this construction forming an effective gas tight joint, which also may be lubricated by a dry lubricant instead of oil.

As shown in Figs. 2, 5 and 6, the plug e is preferably formed with one end e' squared and mounted with a small amount of freedom in one lateral direction in a block n which is also squared externally and is in turn mounted in another block o with a small amount of lateral freedom in the transverse direction. The block o is mounted and centered in the bearing block d in which it is secured by means of set screws p. This arrangement renders the plug e practically self-centering and self-adjusting when it is tightened in the sleeve c by means of the nut q on its other end.

Two or more pumps such as described may be used simultaneously to exhaust a vessel and may be arranged either in parallel with each other as a single pump having a capacity equal to the sum of the capacities of the separate pumps, or in series with each other, one exhausting from the vessel and delivering to the next of the series, and so on, the last of the series delivering to the atmosphere. A check valve may be interposed in the final delivery passage to prevent ingress of air thereto at the beginning of the discharge stroke.

It is sometimes convenient, in order to obtain quickly a high vacuum such as is required in electric incandescence lamps, to effect the preliminary exhaustion by means of two or more pumps arranged in parallel, and the final exhaustion by these pumps arranged in series, and the change from the one arrangement to the other may be quickly effected by connecting the suction and delivery passages of the pumps with each other through suitable intercommunication cocks. Such a device for two pumps A, B is shown in Fig. 6 of the drawings, in which the suction and delivery passages of pump A, and the suction passage of the pump B are connected to the shell C of an intercommunication cock having a three-way plug tap D. With the tap shown in the position of Fig. 6, the pump A delivers into the pump B which in turn delivers to the atmosphere, the pumps being connected in series. With the plug in the position shown in Fig. 7, the suction passages of both pumps are in communication with each other, while their delivery passages communicate with the atmosphere, the pumps being then in parallel.

Having thus described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim:—

1. A vacuum pump comprising a cylinder, a cylinder cover, a single port in said cover and adapted to be always fully open, a piston connected elastically with the driving motor, such elastic connection permitting the piston to be safely driven against the cylinder end and held there during the last portion of the exhaust stroke and commencement of the suction stroke, a distributing valve plug having in a common transverse plane suction inlet and exhaust openings, and means whereby said cylinder is disconnected from the exhaust opening and connected with the inlet opening while the piston is stationary against the cylinder end; substantially as described.

2. In combination with two or more reversible vacuum pumps such as herein described, means for connecting such pumps in series or in parallel with each other, substantially as described.

3. In a vacuum pump having an oscillating cylinder such as herein described, a distributing valve comprising a hollow valve casing integral with the cylinder head and journaled in fixed bearings supporting the weight of the pump, a conical plug having in a common transverse plane suction inlet and exhaust openings, one end of said plug mounted with limited lateral freedom in one direction in a block mounted in a second block having lateral freedom in a transverse direction, whereby said plug can be adjusted centrally with respect to the axis of the valve casing; substantially as described.

4. A reversible vacuum pump comprising an oscillating cylinder, a cylinder cover, a single port in said cover and adapted to be always fully open, a cross head, a piston, an elastic connection between the piston and driving motor operating during the last portion of the exhaust stroke and commencement of the suction stroke, and a distributing valve plug having in a common transverse plane suction inlet and exhaust openings alternately put in communication with

the cylinder by the oscillation thereof, with means for disconnecting the cylinder from the exhaust opening while the piston is stationary against the cylinder end and means for oscillating the cylinder and for reciprocating said cross head; substantially as described

In testimony whereof I have signed my name to this specification in the presence of w o subscribing witnesses.

JOSEPH ZEITLIN.

Witnesses:

JOSEPH WILLARD,

WALTER J. SKERTEN.