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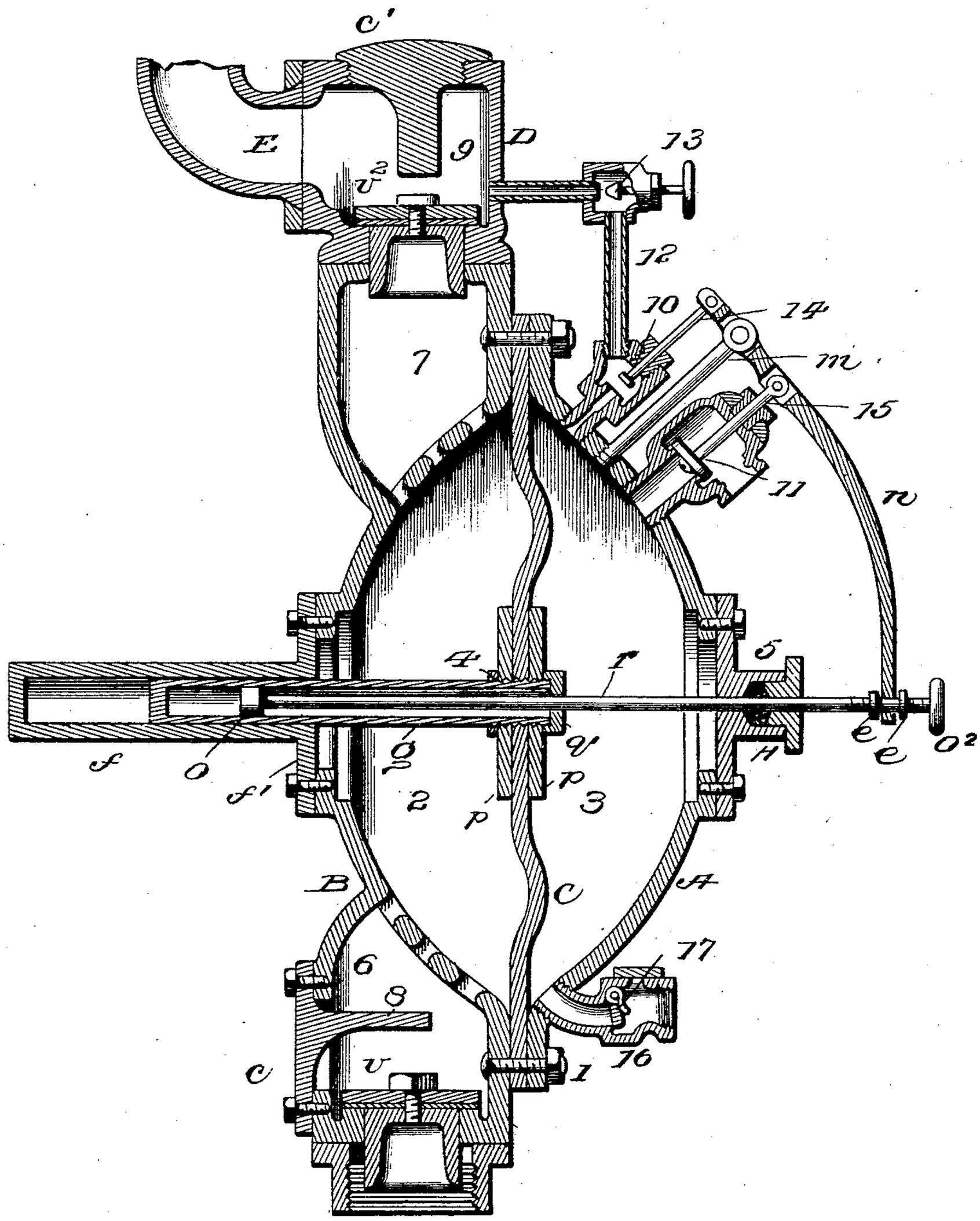
E. B. RAYNER.

STEAM VACUUM PUMP.

(Application filed Jan. 25, 1901.)

(No Model.)



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UNITED STATES PATENT OFFICE.

EDWIN B. RAYNER, OF PIQUA, OHIO, ASSIGNOR TO A. G. KERNS, W. A. SNYDER, AND W. J. LAWDER, OF SAME PLACE.

STEAM VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 684,379, dated October 8, 1901.

Application filed January 25, 1901. Serial No. 44,726. (No model.)

To all whom it may concern:

Be it known that I, EDWIN B. RAYNER, a citizen of the United States, residing at Piqua, in the county of Miami and State of Ohio, have invented certain new and useful Improvements in Steam Vacuum-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention has relation to pumps operating by vacuum-pressure to elevate water or other liquid to be raised and utilizing a flexible diaphragm for separation of the working and motor chambers. The pump is designed to operate singly or in multiple series, as desired, and when coupled in series of two or more they will be arranged to operate successively or in rotation, so as to deliver an uninterrupted stream of water. The motive medium may be either live or exhaust steam, according as the point of discharge is above or below the level of the pump. Exhaust-steam can be used where the discharge is about on a level with the pump or below said level; but where the water is to be lifted or delivered under pressure live steam must be employed under a pressure proportionate to the work or load.

The drawing shows a vertical central section of a pump embodying the invention.

The pump-casing comprises two parts or sections A and B of similar construction, bolted or otherwise secured together, with a flexible diaphragm C held between them. These parts or sections A and B are of dish or concavo-convex form and are placed with their concave or hollow sides facing, and their edge portions are flanged and pierced to receive the fastenings 1, by means of which they are held together. The diaphragm C subdivides the casing into two chambers 2 and 3, the latter being the motor-chamber and the former the working chamber. A hollow stem *g* is secured centrally to the diaphragm C and is closed at its outer end and is provided at its inner end with a flanged ring *q*, which acts in the capacity of a stop and a nut. Plates *p* are placed upon opposite sides of the central portion of the diaphragm C and are secured to the hollow stem *g* by means of the flanged ring *q* and a nut 4. These plates *p* reinforce the middle portion of the diaphragm C and prevent injury thereto when the pump is in operation. A tubular guide *f* is secured centrally to the section or part B, and its inner end is formed with an outer flange *f'*, which is pierced to receive the bolts or fastenings employed for securing the guide *f* to the casing. The outer end portion of the hollow stem *g* operates in the tubular guide *f*. A gland 5 is secured to the center of the section A and receives a rod *r*, a stuffing-box H being applied to the gland to secure a steam-tight joint between it and the rod *r*. The hollow stem *g* and the rod *r* are telescopically fitted, and the inner end of the rod is provided with a head *o*, constituting a stop to engage with the closed end of the stem *g* and the flange of the ring *q*. The stem *g* moves with the diaphragm C and effects a longitudinal movement of the rod *r* to open and close the steam and jet ports. The closed end of the stem *g* constitutes one stop and the flange of the ring *q* forms a second stop, and when the diaphragm is pressed into the working chamber 2 against the wall B the stop *q* engages with the stop *o* and moves the rod *r* to the left, thereby shutting off the steam and opening the jet-port, and when the said diaphragm is pressed into the motor-chamber 3 against the wall A the closed end or stop at the outer end of the stem *g* engages with the stop *o* and moves the rod *r* outward, whereby the steam-port is opened and the jet-supply cut off.

A suction-chamber 6 is provided at the lower portion of the working chamber 2, and a corresponding chamber 7 is provided at the upper portion, both chambers having communication with the chamber 2 by means of openings in the section or port B. An upwardly-opening valve *v* controls the suction-chamber 6, and a corresponding valve v^2 controls the delivery-chamber 7. A cap *c* closes an opening in a side of the suction-chamber 6 and is provided with a stem 8 to overhang the valve *v* and limit its upward movement. A corresponding cap *c'* closes an opening in the top side of the valve-chamber D, bolted or otherwise secured to the delivery-chamber 7, and has a pendent stem 9 to limit the upward movement of the valve v^2. A coupling

E is connected by a swivel-joint with the valve-chamber D, so as to be turned up or down or to any desired angle.

Valves 10 and 11 are connected to the upper portion of the motor-chamber 3 and constitute the jet and the steam-ports. A pipe 12 connects the valve 10 with the valve-chamber D and is provided in its length with a regulating-valve 13. A rocking lever *n*, fulcrumed to a post *m* projecting from the pump-casing, has connection with the stems 14 and 15 of the respective valves 10 and 11. This lever *n* is curved, and its outer end embraces the sides of the outer portion of the rod *r* and is controlled in its movements by stops *e*, fitted thereto. These stops *e* are adjustable upon the rod *r* and receive the free end portion of the lever *n* between them. By a proper adjustment of the stops *e* the steam can be cut off or admitted at any point in the length of movement of the stem *g*, which is controlled by the amplitude of vibration of the diaphragm C. A grip o^2 is applied to the outer end of the rod *r* to enable manual operation of the said rod and lever *n* when starting or priming the pump. The valve-stems 14 and 15 have pivotal connection with the lever *n* upon opposite sides of its fulcrum. Hence when the valve 11 is closed the valve 10 is open, and vice versa.

A relief or blow-off 16 is provided at the lower end of the working chamber 3 and is provided with an outwardly-opening valve 17. This relief 16 is comparatively small, so as to prevent any material loss of steam, and yet is sufficiently large to insure a complete outlet for the water of condensation and the inflowing water by means of which the steam is condensed, so that the action of the pump may not be impeded in the slightest. When a vacuum-pressure is created in the motor-chamber 3, the valve 17 closes; but when steam is admitted to the motor-chamber the valve 17 opens automatically, so as to provide a free escape for the accumulated water of condensation and jet-water, as previously stated.

When the pump is installed or properly positioned for work, the valve 11 is coupled to the steam-supply, the chamber 6 is connected to the suction-pipe, and the coupling E is joined to the delivery-pipe. It being required to start the pump, the grip o^2 is moved outward by hand, thereby opening the valve 11 and closing the valve 10, and the steam entering the motor-chamber 3 forces the diaphragm C into the chamber 2 and toward the wall B. The rod *r* is now pushed in and serves to close the valve 11 and open the valve 10, when water will pass from the chamber B through the pipe 12 and valve 10 into the motor-chamber 3 in a jet and condense the steam therein and create a vacuum, and the water or liquid is elevated under atmospheric pressure and will rush into the working chamber 2. As the diaphragm C moves to the right it carries the stem *g* along with it, and just prior to reaching the limit of its movement the closed end of the stem *g* will strike the head or stop *o* of the rod *r* and move the latter outward and cause an opening of the valve 11 and a closing of the valve 10, when the operation will be repeated and the pump continue to operate automatically so long as the steam is supplied thereto. The speed of the pump can be governed within certain limits by regulating the admission of steam and the supply of jet-water, the latter being controlled by the valve 13 and the former by the throttle (not shown) on the steam-supply pipe.

Having thus described the invention, what is claimed as new is—

1. A pump comprising a casing composed of dish-shaped parts placed with their concave sides facing, a diaphragm secured between the said parts and subdividing the casing into working and motor chambers, valve-controlled suction and discharge chambers in communication with the working chamber, valve-controlled steam-admission and jet-supply ports connected with the motor-chamber, and controlling means actuated by the said diaphragm to simultaneously open and close the steam and jet ports, substantially as set forth.

2. A pump comprising a casing, a diaphragm subdividing the casing into motor and working chambers, valve-controlled suction and discharge ports connected with the working chamber, valve-controlled jet and steam ports connected with the motor-chamber, and telescopically-related parts for controlling the jet and steam ports, one of said parts being connected to the diaphragm and movable therewith and provided with stops to actuate the other part, substantially as set forth.

3. In a pump, a casing, a diaphragm subdividing the casing into motor and working chambers, valve-controlled suction and discharge ports connected with the working chamber, valve-controlled jet and steam ports, a tubular stem connected with the diaphragm and provided with spaced stops, and a rod connected with the valves of the jet and steam ports having its inner end portion operating in the tubular stem and provided with a stop to coöperate with the stops of said tubular stems, substantially as and for the purpose set forth.

4. In a pump, a casing, a diaphragm subdividing the casing into working and motor chambers, valve-controlled suction and discharge ports connected with the working chamber, valve-controlled jet and steam ports connected with the motor-chamber, a tubular stem having its outer end closed and constituting a stop, a ring fitted to the inner end of said stem and provided with a flange constituting a second stop, means coöperating with said flanged ring to secure the tubular stem to the diaphragm, and a rod having its inner end portion entering the tubular stem

and provided with a stop to coöperate with the stops of said stem, said rod being connected with the valves of the jet and steam ports for actuation thereof, substantially as set forth.

5. In a pump, a casing, a diaphragm subdividing the casing into motor and working chambers, a valve-controlled suction-chamber connected with the working chamber, valve and delivery chambers connected with the working chamber and provided with an intermediate valve, a valved steam-port and a valved jet-port connected with the motor-chamber, a valved pipe connecting the jet-valve with the valved chamber connected with the delivery-pipe, and automatic means for controlling the valves of the jet and steam ports actuated by means of the diaphragm, substantially as set forth.

6. In a pump, a casing, a diaphragm subdividing the casing into motor and working chambers, valve-controlled suction and delivery ports applied to the working chamber, a tubular guide projecting from the working chamber, a tubular stem attached at its inner end to the diaphragm and having its outer end portion working in said guide, a rod operating through the motor-chamber and having telescopic connection with the tubular stem, coöperating stops between said rod and tubular stem, valve-controlled jet and steam ports connected with the motor-chamber, and a lever adapted to be actuated by the said rod and connected with the stems of the valve, jet and steam ports, substantially as set forth.

7. A pump comprising a casing, a diaphragm subdividing the casing into motor and working chambers, valved suction and delivery chambers connected with the working chamber, valved jet and steam ports connected with the motor-chamber, controlling means actuated by the diaphragm for operating the jet and steam ports, and a valved relief or blow-off connected with the lower portion of the motor-chamber, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN B. RAYNER. [L. S.]

Witnesses:
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