2 Sheets—Sheet 1.

J. E. GARY.

STEAM AND VACUUM PUMP.

No. 187,841. Patented Feb. 27, 1877.

Fig. 1.

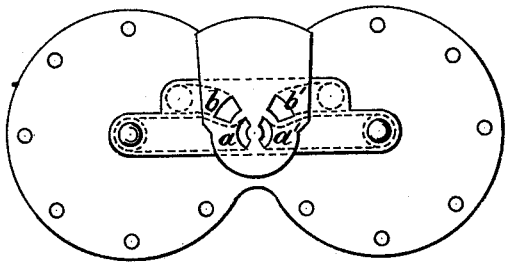


Fig. 2.

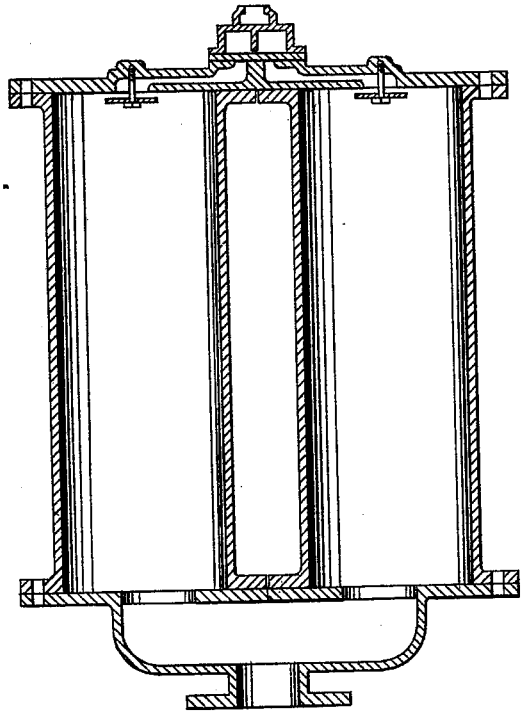


Fig. 4.

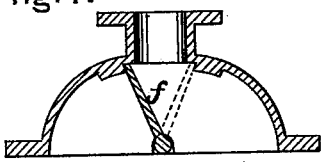
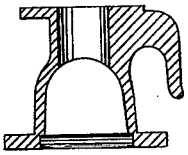


Fig. 5.



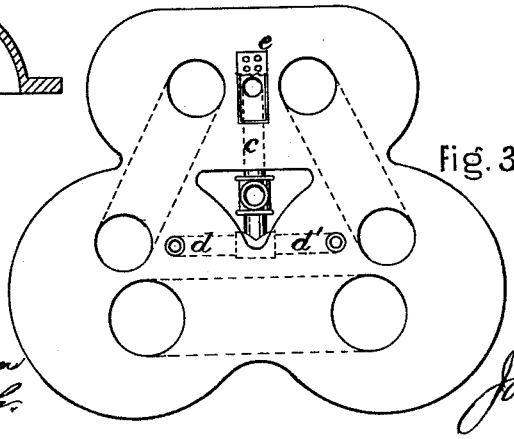


Fig. 3.

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STEAM AND VACUUM PUMP.

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Fig. 8.

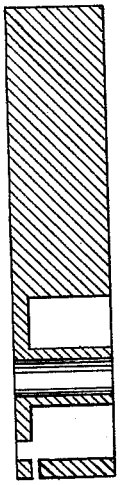


Fig. 9.

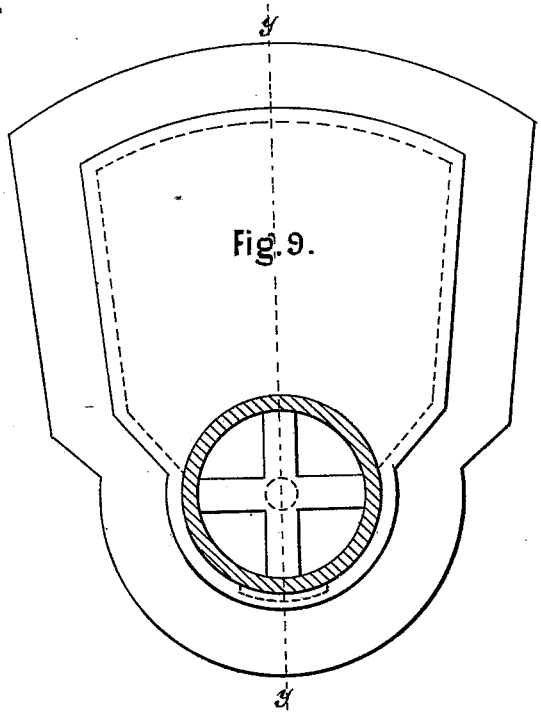


Fig. 10.

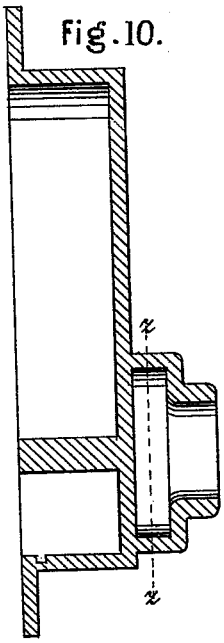


Fig. 7.

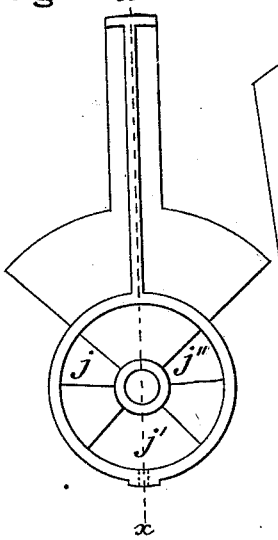
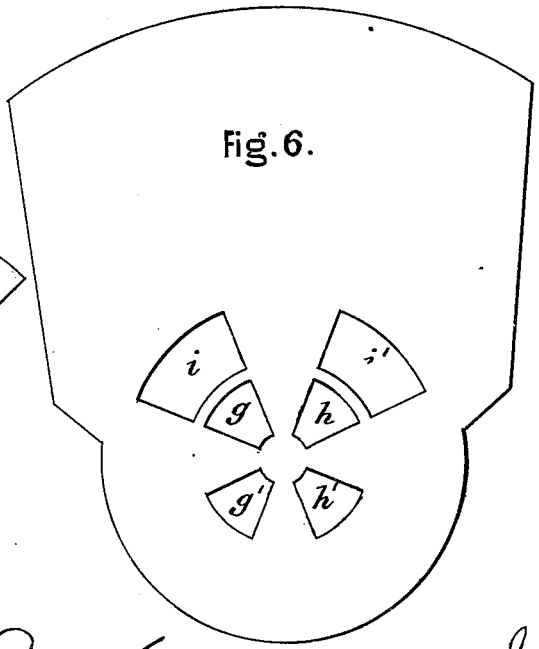


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOSEPH E. GARY, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN STEAM AND VACUUM PUMPS.

Specification forming part of Letters Patent No. **187,841**, dated February 27, 1877; application filed December 16, 1876.

To all whom it may concern:

Be it known that I, JOSEPH E. GARY, of the city of Chicago, in the county of Cook, in the State of Illinois, have invented certain new and useful Improvements in Steam and Vacuum Pumps, of which the following is a specification:

The nature of this invention relates to improvements in steam and vacuum pumps; and consists in a new and improved automatic valve for admitting steam to the cylinders. It also consists in the construction of the discharge-chamber, from which the water passes to the discharge-pipe; and in an improved arrangement and mode of construction of the passages of the water to form jets in the cylinders for the condensation of steam therein, to produce the necessary vacuum, as hereinafter more fully set forth.

In the accompanying drawings, forming part of this specification, Figure 1 is a plan of the top of the pump, with the pieces forming the steam-valve removed, and the steam-passages to the cylinders dotted through. Fig. 2 is a vertical sectional view through the center of the cylinders, showing also a cross-section of the seat and cover of the steam-valve, but not of the movable piece constituting the valve proper. Fig. 3 is a plan of the base of the pump, with the passages for the water from the suction-pipe to each cylinder, and from each cylinder to the discharge-chamber, dotted through, and also so much of the passages for the water to form the jets from the discharge-chamber to the cylinders as is covered by the base, dotted through, and a top view or plan of so much of them as is not so covered. Fig. 4 is a vertical longitudinal sectional view, and Fig. 5 is a vertical cross-sectional view, of the discharge-chamber, with one of the lugs or hooks by which to suspend the pump.

It will be clearer to describe the parts represented by these figures before proceeding to the other figures by which the steam-valve is shown. As to the cylinders, top and base, and discharge-chamber, it is enough to say that they are not unlike such as are in common use, except in the particulars hereinafter described.

The top has four steam-ports—*a* and *a'* for admitting steam to the cylinders along the straight dotted passages shown in Fig. 1, and in section in Fig. 2, and *b* and *b'* for the return of steam from the cylinders to the steam-valve along the curved passages shown in Fig. 1. All of these passages terminate in openings into the cylinders, as shown by the dotted circles in Fig. 1. In the upper flange of each cylinder a small check-valve is inserted, with a channel cut in the flange from it to the inside of the cylinder, and a small hole through the flange under it, so as to close against the outlet of steam, but open to admit air, so that in the filling of the vacuum the water shall not enter the steam-passages in the top of the pump. The passages for the water from the discharge-chamber to the cylinders to form the jets are made of wrought-iron pipe, and consists of a main pipe, *c*, from a recess sunk in the discharge-chamber, with branches *d* and *d'* to each cylinder, as shown by the dotted lines in Fig. 3. In the center of the base, where it is not covered by the cylinders or discharge-chamber, is an opening, through which is shown in Fig. 3 a steam-fitter's T, or cross, in the main pipe *c*, in which to fix, if desired, an upright pipe for purposes hereinafter explained; and these pipes are carried as far below the base as may be desired, without danger of external injury, so that the steam, in forcing water out of a cylinder, will not pass through the pipes, thus avoiding heating them, so that the water for the jets will come colder and quicker than through heated passages filled with steam.

A strainer, *e*, two-thirds of which is broken away in Fig. 3, covers the end of pipe *c* in the discharge-chamber, to prevent anything from entering the pipe that will not easily pass through the nozzles erected on the cylinder ends of the pipes *d* and *d'*, to form the jets. In the discharge-chamber a rocking partition, *f*, is set, dividing the chamber into two equal parts, as shown in Fig. 4, so shaped as to fit closely without catching the cross-section of the chamber, shaped as shown in Fig. 5.

The mode of keeping this partition in place is by recesses cast in the bottom of the sides of the chamber, to receive the ends of the journal upon the lower corners of the partition, as shown in Fig. 5. These journals rest upon

the base of the pump, and the bottom of the partition rests upon the strainer *e*. The openings into the cylinders of the water-passages from the suction-pipe, as well as the openings into the discharge-chamber of the water-passages from the cylinders, are covered, in the usual manner, by common trap-valves; but these latter open from the center of the chamber outward, and the water from an opening valve is prevented from running under and keeping open a closing valve by the rocking partition *f* standing between them. A lug or hook, as shown in Fig. 5, is cast upon each cylinder also, at some point between the middle and top of the cylinder, and, as nearly as may be, equally distant from each other and the one on the discharge-chamber.

I now come to the steam-valve.

Fig. 6 is a valve-seat—a plate of any suitable metal for a valve-seat—with the ports *g* and *g'* to admit steam to the port *a*, and *h* and *h'* to admit steam to the port *a'*, and the port *i* for the return of steam from the cylinder through the port *b*, and the port *i'* for the return of steam through the port *b'*. *a* and *a'*, *b* and *b'* are shown upon Fig. 1.

The purpose in making two ports in the valve-seat to admit steam into one in the top of the pump is, that thereby a shorter movement of the valve suffices.

Fig. 7 is a plan of the valve proper, which consists of a ring partially filled or floored in the bottom; a wing extending outward from one side of the ring, with a web on the bottom of it for wearing-surface, flaps on each side of the wing, to cover alternately the ports *i* and *i'*, and a vertical bar slightly projecting from the side of the ring opposite to the wing, to fit the cover of the valve, to save the labor of making the whole ring so fit. In the center of the ring stands a hollow pin, to receive and vibrate or rotate upon a pin projecting downward from the cover. In the floor of the ring are cut the ports *j*, *j'*, and *j''*, of such size and shape that by the intervening metal and the flaps, by the rotation or vibration of the valve from one side of the cover to the other and back again, all the ports on either hand of the valve-seat will be alternately opened and closed.

Fig. 8 is a vertical longitudinal sectional view of the valve through the line *x x* in Fig. 7, showing the hollow pin and part of the floor of the ring.

Fig. 9 is a plan of the cover of the valve, the profile of the flanges of which conforms to the shape of the valve-seat, the outline of the outside of the raised portion shown in full lines, and of the inside in dotted lines, except so much of the latter as is covered by the section of the dome. The upper part of the dome, into which the steam-pipe is fitted, is cut off, in this figure, at the line *z z*, (shown in Fig. 10,) in order that the cross-bars at the bottom of the dome, by which the pin projecting downward into the hollow pin of the valve are supported, might be shown.

The interior of the circular end of the cover at the bottom of Fig. 9, which coincides with the outer line of the dome as cut off in that figure, so far as it extends on the sides, fits with sufficient looseness, however, to allow for expansion, the vertical bar before mentioned on the ring of the valve, while the interior of the other end of the cover is on a circle which only permits, with the same allowance for expansion, the wing to vibrate in it from one side of the cover to the other. With the like allowance the elevation of the cover conforms to the height of the valve. Fig. 10 is a vertical longitudinal sectional view, through the line *y y* in Fig. 9, of the cover, showing the pin, the dome, and the elevation of the space in which the valve operates. Through the vertical bar on the ring of the valve, in the center of its width, one or more small holes are made, and in the circular end of the cover a small channel cut, horizontally, at the same altitude as the hole or holes, extending only along so much of the space as the hole or holes vibrate across, to assist in supplying steam to move the valve, as hereinafter explained.

The operation of my steam and vacuum pump is as follows: The pump having been partly filled with water, steam is let in through a steam-pipe fitted into the dome of the cover of the valve, and thence passes into the cylinder, the ports leading to which are not then covered by the valve, and immediately, by returning through the port outside of the ring communicating with the same cylinder, fills the space between the wing and the side of the cover on that side of the wing. The continued influx of steam pushes the water and air in that cylinder through the passage into the discharge-chamber, and, filling that, the surplus is pushed up the discharge-pipe, whence the air escapes, leaving a column of water in the pipe. In this operation the trap-valve in the discharge-chamber, covering the opening of the passage from that cylinder, has been raised, and the rocking partition pushed to the stop at the outlet to the discharge-pipe over the other trap-valve, thus offering an escape up the discharge-pipe by easy curves, instead of compelling the water to double on itself, as is the case when the trap-valves open from the outer ends inward, and the water makes the circuit around the ends of the valves to the pipes. When all the water has been forced out of that cylinder, and the steam begins to follow it in a horizontal direction, the condensation becomes more rapid than the supply through the ports; the pressure in that cylinder, and consequently in the cover of the valve on that side of the wing communicating with that cylinder, is reduced by the rapid expansion until the pressure of the steam which has leaked over the ring and wing to the opposite side of the wing, aided also by the steam which has gone and is going there through the hole or holes in the bar on the ring of the valve, is not counterbalanced, and it throws the wing across the space

in the cover of the valve to the other side, thereby closing the ports first open and opening the others, when the same operation is repeated through the other cylinder. So soon as the steam is shut off from a cylinder the pressure of the column of water in the discharge-pipe closes the trap-valve in the discharge-chamber last open, forces a stream through the pipe *c* and the branch pipe *d* or *d'*, leading to that cylinder, thus sending a jet through the nozzle in that cylinder, which, striking against the top of the cylinder, forms a spray that condenses the steam and creates a vacuum, which is at once filled with water through the suction-pipe from below. Should the pump run dry or blow through, as often happens in mining-shafts from not shutting off steam when the supply of water is exhausted, a pipe fitted into the T or cross in the pipe *c*, and extending to a tank at the top of the shaft, affords a convenient means of cooling the pump, and giving a new supply of water to begin anew with.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a steam vacuum-pump, a valve having the webbed wing-flaps and the ports *j j' j''*, operating in combination with a valve-seat, having ports *g g'*, *h h'*, and *i i'*, substantially as and for the purpose specified.

2. The main pipe *c* and the branches *d* and *d'*, in combination with the steam-fitter's T, or cross, and strainer *e*, arranged and constructed substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 11th day of December, A. D. 1876.

JOSEPH E. GARY.

Witnesses:
AUGUSTUS JACOBSON,
CHARLES HALBECH.