G. A. HAGEMANN.

Pneumatic-Machine.

No. 165,569. Patented July 13, 1875.

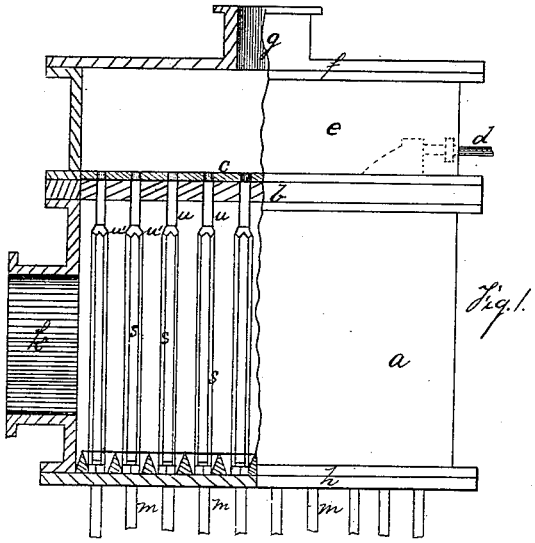
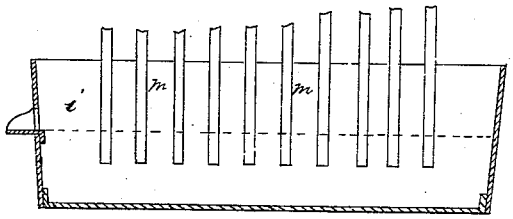


Fig. 1.



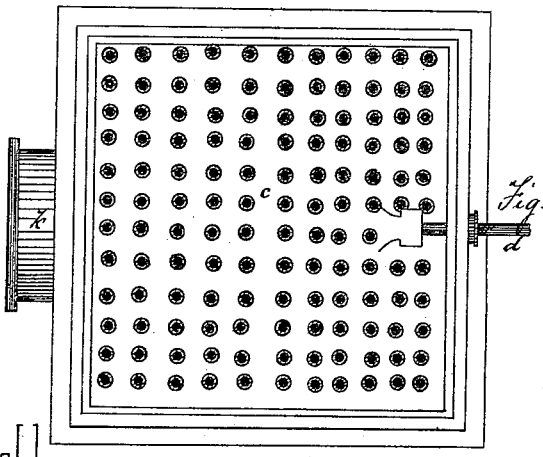


Fig. 2.

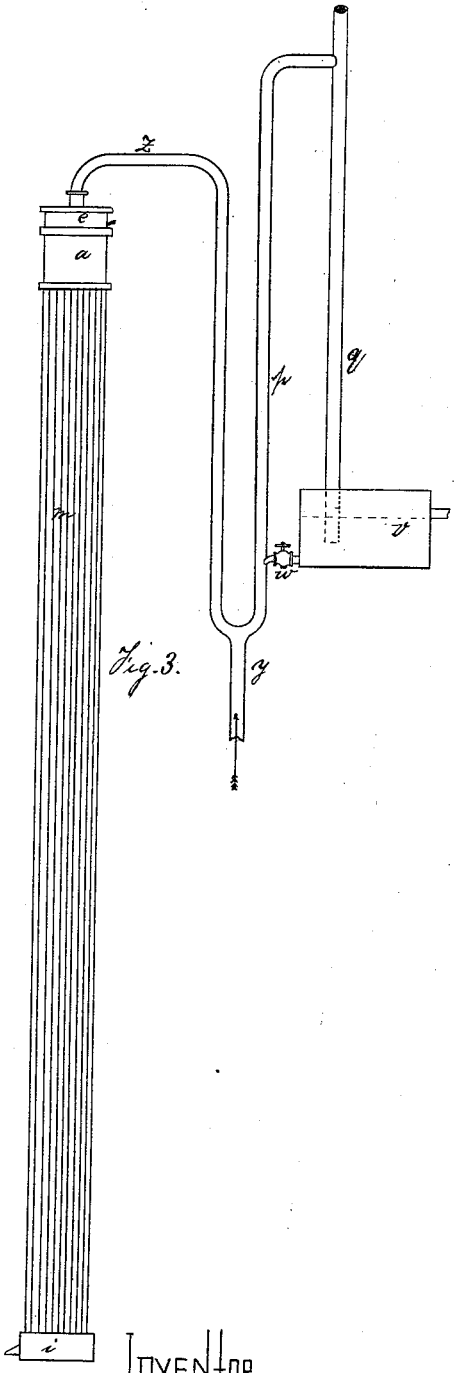


Fig. 3.

WITNESSES.

R. C. Hunshaw

James L. Kay

INVENTOR.

Gustav A. Hagemann

by Bakewell & Kerr

Attys

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GUSTAV A. HAGEMANN, OF COPENHAGEN, DENMARK.

IMPROVEMENT IN PNEUMATIC MACHINES.

Specification forming part of Letters Patent No. **165,569**, dated July 13, 1875; application filed May 21, 1875.

To all whom it may concern:

Be it known that I, GUSTAV A. HAGEMANN, of Copenhagen, Denmark, have invented a new and useful Improvement in Pneumatic Machines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing forming a part of this specification, in which—

Figure 1 is a view of the vacuum-head or sucker, partly in section. Fig. 2 is a top view of the sliding plate for controlling the water-head; and Fig. 3 is a view of the complete devices, showing the water-supply vat and the siphon connections.

My invention relates to the construction of what is known as the water-fall pump, or Bunsen pump, commonly employed in chemical laboratories, and has for its object the production of a vacuum-pump, which can be used to advantage in general manufactories, such, for instance, as in working vacuum-pans in the manufacture of sugar, and for like purposes.

It consists, first, in dividing up the water-currents, in their passage through the vacuum-head or sucker, into thin films by means of filaments, or similar devices, which cross the chamber, whereby a large condensing-surface is presented to any vapors coming over, said vapors—air or gas—being rapidly condensed and cooled, facilitating the production of a vacuum; and, secondly, in providing the head with a slide or equivalent device for controlling and regulating the flow of water.

I will now proceed to describe my invention so that others skilled in the art may apply the same.

In the drawing, *a* indicates a box, of cast-iron or other suitable material, closed at the top by a plate, *b*, perforated for the insertion of a series of short tubes, *u*, and above plate *b* is a second box or frame, *e*, closed in its turn by a plate, *f*, having an opening or pipe, *g*. The box *a* is closed below by a plate, *h*, perforated for the insertion of a series of vertical pipes or tubes, *m*. This plate *h* is crossed upon its upper face by a series of ridges, which divide it into cups or depressions surrounding the ends of pipes *m*. The parts above specified may be secured together by bolts passing through flanges, or in any other suitable manner, and form two chambers, one, which is termed the vacuum-head or sucker, connecting, by a pipe, *k*, with the chamber or vessel to be exhausted, and the other, which is termed the water-head, connecting, by a pipe, *z*, with the supply or water-vat. Within the vacuum-head or sucker, and projecting from the upper plate thereof, are a series of short pipes, *u*, tipped with cones *u'*, of copper or other suitable material, from which filaments or wires *s* extend down to the little squares or depressions in the bottom plate *h*. Upon the bottom of the water-head is arranged a perforated sliding plate, *c*, controlled by a rod or screw, *d*, which extends through the side of box or frame *e*. The holes in the sliding plate *c* should correspond with the openings in plate *b*, as the object of the device is to regulate the quantity of fluid passing to the vacuum-head below. The pipes *m*, the length of which will depend on the space and fall required, are suspended from lower plate *h* and extend down to and dip in the water contained in the vessel *i*, so as to be sealed thereby. *y*, Fig. 3, the discharge-pipe for the water-pump, divides to form pipe *z* leading to and connected with the pipe *g* of the water-head, and a pipe, *p*, which, by means of a vertical pipe, *q*, delivers into a water-supply vat, *v*. This water-vat *v* is connected with the pipe *p* by a cross-pipe, *w*, provided with a suitable stop-cock, so that communication between *p* and *v* may be established when required.

These constitute the devices employed by me, and their operation is as follows: The vacuum-head having been connected by means of *k* and other suitable connections with the vessel to be exhausted—say, for instance, a vacuum-pan—the stop-cock *w* is closed and the usual pump operated to force the water through *y* into *z* and *p q*, and from *z* into the water-head of the sucker. When the vacuum required has been obtained the operation of the pump is discontinued, and the stop-cock *w* opened to establish communication between the water-vat *v* and the pipes *p z*, when it will be found that the suction is sufficient to draw from the water-vat *v* the amount of fluid requisite to maintain the vacuum. The fluid passing through the sucker is divided and

spread out into a thin film by the filaments or wires *s*, so as to present a large surface on which the vapors—air or gases—from the vessel to be exhausted are condensed and cooled rapidly, thus increasing the power of the apparatus. With a sucker working with a hundred tubes or pipes, *m*, each one-half inch in diameter and forty-five feet long, I have found it possible, with a water-supply of sixty-two cubic feet per minute, to maintain a vacuum equal to twenty-two inches in a double evaporating-pan, in which was concentrated in twenty-four hours all the juice obtained by diffusion from two hundred thousand pounds of beet-root.

The apparatus is particularly adapted for use where the cooling-water, circulating through the condenser used in connection with the vacuum apparatus, can not be obtained cool enough; and the quantity is therefore necessarily large. It can be made and operated at less expense than the air-pumps commonly employed, has no parts liable to get out of order or require repairing, and maintains the vacuum more steadily.

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

1. In combination with the vacuum or sucker-head a series of inlet and exit pipes, *u u m m*, substantially as and for the purpose specified.

2. In combination with the exit-pipes *m m* of the sucker-head, plate *h*, having cup-shaped depressions, as and for the purpose specified.

3. In combination with the inlet-pipes *u u* of the sucker-head the conical tips *w' w'*, substantially as and for the purpose specified.

4. The combination of the inlet and exit pipes *u u m m* of a sucker-head, and a series of filaments or wires within the head, substantially as and for the purpose specified.

5. As an improvement in working vacuum apparatus, the method herein described of increasing the power thereof by means of films or sheets of water within the sucker-head, substantially as specified.

6. In combination with the water-head *e*, an adjustable slide or gate, *c*, substantially as and for the purpose specified.

7. The combination of the sucker-head siphon-pipes *z p*, vat *v*, and cross pipe *w*, having a suitable stop-cock, substantially as and for the purpose specified.

In testimony whereof I, the said GUSTAV A. HAGEMANN, have hereunto set my hand.

GUSTAV ADOLPH HAGEMANN.

Witnesses:

J. V. ROODAMME,

AUG. TRHAG.