Oct. 7, 1930. W. P. WHITTINGTON 1,777,817

VACUUM PUMP

Filed June 22, 1928

Fig. 1.

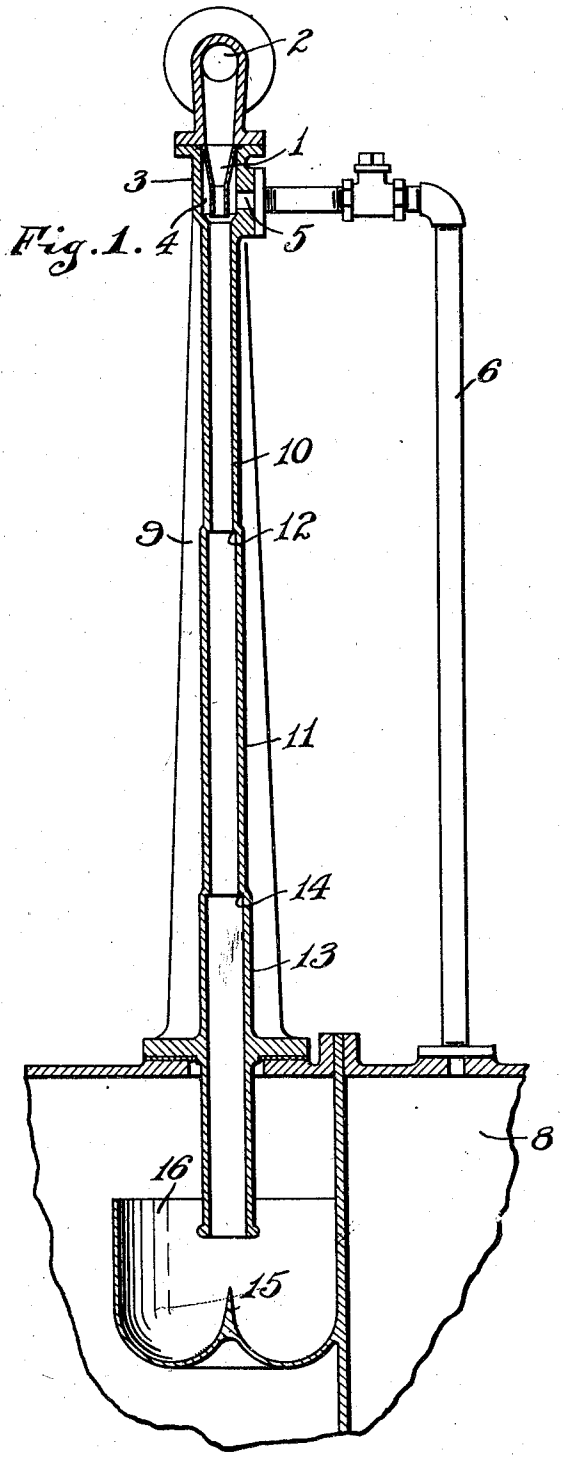
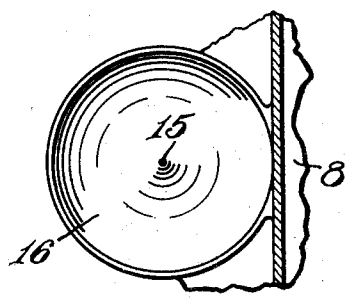


Fig. 2.



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Patented Oct. 7, 1930 1,777,817

UNITED STATES PATENT OFFICE

WILLIAM P. WHITTINGTON, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO ILLINOIS ENGINEERING COMPANY, A CORPORATION OF ILLINOIS

VACUUM PUMP

Application filed June 22, 1928. Serial No. 287,446.

My invention relates to apparatus for producing a vacuum and particularly to that type of apparatus employing a hydraulic motive stream for producing a vacuum in a conduit.

My invention is primarily designed for the production of a vacuum by hydraulic motive stream for the purpose of entraining gases and fluids and combinations thereof.

It is one of the objects of my invention to produce an apparatus of the above characteristics and one wherein a hydraulic jet exhausts into a barometric column which shall be highly efficient in its operation and the cost of which shall be reduced to a minimum.

For the purpose of disclosing my invention I have illustrated one embodiment thereof in the accompanying drawings in which

Fig. 1 is a sectional view of the apparatus for producing the vacuum, the conduit in which the vacuum is produced being shown in full lines and

Fig. 2 is a plan view of the barometric leg into which the discharge takes place.

In the embodiment of the invention illustrated I provide a nozzle 1 which may be of the ordinary jet type and is supplied by fluid under pressure from the conduit 2, any means for pumping or otherwise delivering the fluid under pressure being adaptable. This nozzle is located in a housing 3 and in what may be termed a suction chamber 4 within said housing which chamber communicates by means of the port 5 with a conduit 6 adapted to be connected with any system or apparatus in which it is desired to produce a vacuum or partial vacuum or from which it is desired to remove by vacuum or partial vacuum air or gas or mixed gas and liquid. In the present instance the conduit 6 as shown is in communication with a chamber 8 in which the vacuum is produced and into which is discharged mixed air and gas or mixed air and liquid from a heating system for instance.

The jet nozzle discharges into a tube 9, the jet being centered with respect to the intake end of the tube and this tube 9 is divided into a series of stages, the stage 10 receiving the discharged liquid column directly from the nozzle 1. This stage 10 receives the motive stream from the nozzle 1 in combination with the entrained stream which is admitted through the port 5 and due to the force of gravity the combined stream tends to increase in velocity through the stage 10 and forms a suction upon the motive stream delivered from the nozzle 1 and upon the entrained stream delivered through the port 5 and thereby coordinates to increase the entraining power of the apparatus. As a rule the combined stream consists partially of intermingled gases and is, therefore, of much greater volume than the motive stream from the nozzle 1. For this reason the stream entering the stage 10 is less compact at its entering end than in the lower portion thereof, as contraction of the gaseous contents to a slightly higher absolute pressure causes a greater density in the lower portion of the stage 10 creating a piston effect. Due to this fact a frictional resistance of the mixture against the tube walls would result if the tube stage were of indefinite length, having a tendency to offset the increased velocity, due to the force of gravity with a resultant choking effect.

The stage 10 discharges into a second tube stage 11 which is abruptly enlarged at its intake point as at 12 thereby providing a second stage having a capacity in excess of the capacity of the stage 6. As the stream passes into the second tube stage 11 the capacity thereof is in excess of the capacity of the stage 6 resulting in a slightly lower velocity in the second stage 11 but with sufficient inertia at its outlet to overcome both the slightly higher absolute pressure into which it discharges and the contraction of the excess at its inlet, thus creating a further suctional effect in this stage which is communicated upward to the suction chamber 4 and to the motive nozzle 1.

The tube stage 11 in turn discharges into a larger tube stage 13 which abruptly increases in diameter as at 14 and this creates a further additional suction which is communicated through stages 11 and 10 to the inlets. By this arrangement the successive tube stages utilize the effect of the condensing

volume of gases to impart additional suction upon the entrained stream and the motive stream and, therefore, cause a greater portion of the entrained fluids or gases to be induced, by a motive stream of given characteristic, than has been accomplished heretofore.

The tube stage 13 discharges against a cone shaped point 15, centered with respect to the stage 13 and formed in the bottom of a bowl shaped seal 16, the bottom of the seal being rounded and merging into the cone shaped point in such a manner as to reverse the flow of the discharge with an easy curve and without the production of back pressure and without undue agitation of the liquid content in the seal which liquid is adapted to seal the bottom end of the tube to prevent back air flow therein.

In effect I have provided a columnar tube receiving at its upper end a liquid stream and having an inlet port said tube having at its lower end a barometeric seal and said tube increasing in diameter toward its lower end in a series of abrupt enlargements.

I claim as my invention:

1. In a device of the character described the combination with a liquid motive nozzle, of a barometric tube into which said motive nozzle discharges, increasing in diameter toward its discharge end in a series of abrupt enlargements the entry from one enlargement to the next succeeding being unrestricted and having an inlet port adjacent said liquid motive nozzle.

2. In a device of the character described the combination with a liquid motive nozzle, of a barometric tube into which said nozzle discharges, increasing in diameter toward its discharge end in a series of abrupt enlargements the entry from one enlargement to the next succeeding being unrestricted and discharging against not exceeding atmospheric pressure.

3. In a device of the character described the combination with a liquid motive nozzle, of a tube within which said nozzle discharges, increasing in diameter toward its lower end in a series of abrupt stages the entry from one stage to the next succeeding being unrestricted and having an inlet port therein adjacent said nozzle, said tube discharging at its lower end against a cone.

4. In a device of the character described the combination with a liquid motive nozzle, of a tube into which said nozzle discharges having an inlet port adjacent said nozzle and increasing in diameter toward its lower end in a series of abrupt stages the entry from one stage to the next succeeding being unrestricted and a bowl shaped seal at the bottom of said tube having a cone shaped bottom.

5. In a device of the character described, the combination with a liquid motive nozzle of a tube increasing in area toward its lower end and having an inlet port adjacent said liquid motive nozzle the passage through said tube being unrestricted throughout its length.

6. In a device of the character described, the combination with a liquid motive nozzle into which said motive nozzle discharges increasing in area toward its discharge end in a series of abrupt enlargements the entry from one enlargement to the next succeeding being unrestricted and having an inlet port adjacent said liquid motive nozzle.

In witness whereof, I, WILLIAM P. WHITTINGTON, have hereunto set my hand at Indianapolis, Indiana, this 8th day of June, A. D. one thousand nine hundred and twenty-eight.

WILLIAM P. WHITTINGTON.