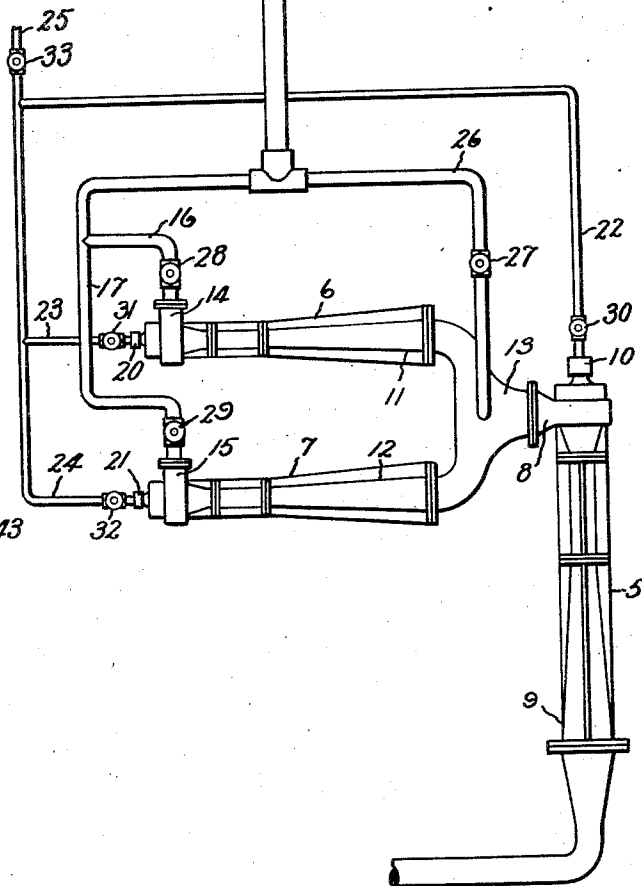
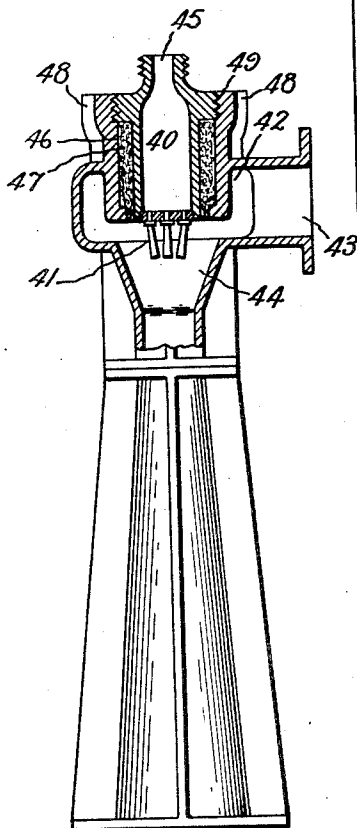


1,385,884.

Fig. 2.



Inventor,
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UNITED STATES PATENT OFFICE.

SANFORD A. MOSS, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

EJECTOR FLUID-PUMP.

1,385,884.

Specification of Letters Patent.

Patented July 26, 1921.

Application filed October 8, 1919. Serial No. 329,378.

To all whom it may concern:

Be it known that I, SANFORD A. MOSS, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Ejector Fluid-Pumps, of which the following is a specification.

The present invention relates to pumps such as are used to remove air and other non-condensable gases and vapors from a condenser or the like, in order to maintain a vacuum therein and particularly to such pumps which comprise two or more ejectors arranged in series, and operated by a suitable elastic fluid such as steam.

The object of my invention is to provide an improved structure and arrangement of ejector pump whereby I am enabled to obtain good efficiency under varying conditions of operation, and for a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Figure 1 is a diagrammatic view of an ejector pump embodying my invention, and Fig. 2 is a view partly in section of one of the individual ejectors.

In carrying out my invention, I provide a multi-stage ejector pump, the final stage of which comprises a single ejector, and in series with such final stage I provide a plurality of earlier stage ejectors arranged in parallel with each other and discharging into the suction inlet of the final stage ejector. I then arrange the piping and valves in such manner that either one or all of the earlier stage parallel ejectors may be used as found desirable under the particular circumstances existing.

In the drawing, a two-stage pump is illustrated comprising a second stage ejector 5, and two first stage ejectors 6 and 7 connected in parallel with each other and in series with the second stage ejector 5. The inlet or suction conduit of ejector 5 through which the fluid being pumped enters is indicated at 8, its discharge conduit is indicated at 9, and its inlet conduit for the admission of pumping fluid is indicated at 10. The discharge conduits 11 and 12 of ejectors 6 and 7 are connected by a branched conduit 13 to the inlet conduit 8 of ejector 5. The inlet or suction conduits 14 and 15 of ejectors 6 and 7 for the fluid being pumped are connected

in parallel by pipes 16 and 17 to a pipe 18 which leads from a condenser or the like 19 from which fluid is to be pumped. 20 and 21 indicate the pumping fluid inlets of ejectors 6 and 7. Pumping fluid inlets 10, 20 and 21 are connected by pipes 22, 23 and 24 to a common supply pipe 25 which may lead from any suitable source of supply. Usually the pumping fluid used is steam and under such circumstances pipe 25 may lead from a steam boiler or other source of steam supply. Connecting pipe 18 to the inlet 8 of ejector 5 is a by-pass pipe 26 in which is a valve 27. In pipes 16, 17, 22, 23, 24 and 25 are valves 28, 29, 30, 31, 32 and 33 respectively.

The casing 19 from which gases are to be exhausted to maintain a vacuum therein is indicated as being a surface condenser of well-known type and needs no description.

In operation, when the load is comparatively heavy, that is, there are considerable gases to be pumped from condenser 19, ejectors 6 and 7 are both used in series with ejector 5 pumping fluid in parallel thereto. Under these circumstances all the valves shown will be open with the exception of valve 27 in conduit 26. This enables me to handle a comparatively large volume of fluid in an efficient manner and at the same time maintain a good vacuum. On the other hand, when the load is lighter, that is, when there is less fluid required to be pumped in order to maintain the desired vacuum, (a condition which exists when the condenser is tight) then one of the first stage ejectors, 6 or 7, can be shut off and the desired vacuum maintained with the other alone.

By means of my invention therefore, I am enabled to maintain a good vacuum in a most economical manner under conditions of either heavy load or light load, and effect a substantial saving in pumping fluid under conditions of light load. It is to be understood that by the term "light load" and "heavy load" I mean the relative quantities of fluid which it is necessary to pump in order to hold a given vacuum which of course, depends upon the leakage into the vacuum.

In this connection it is pointed out that with a two-stage ejector arrangement as shown in Fig. 1, the second stage ejector handles mostly steam from the first stage ejector or ejectors and handles compara-

tively little air. On the other hand, the first stage ejector or ejectors handle mainly air and non-condensable vapors. This means that a change in the amount of air load makes little or no difference in the load on the second stage ejector. It makes a substantial difference in the load on the first stage ejector or ejectors. By my improved arrangement, therefore, wherein I provide a variable number of first stage ejectors, I can use all or part of them according to the air load. This enables me to obtain high efficiency in operation.

In case, for any reason, it becomes desirable to put both first stages out of commission, then valves 28 and 29 can be closed and valve 27 opened, thus enabling the second stage ejector to be used alone to pump fluid from condenser 19, the inlet 8 being then connected to condenser 19 by way of pipes 26 and 18. In other words, pipe 26 forms a by-pass around the two first stage ejectors 6 and 7.

In the operation of an ejector, it is desirable to prevent, as far as possible, the transfer of heat from the pumping fluid to the fluid being pumped, since raising the temperature of the fluid being pumped means an increase in its volume. In order to prevent such transfer of heat, I preferably construct an ejector as shown in Fig. 2 wherein 40 indicates the pumping fluid chest or nozzle box from which leads the ejector nozzles 41, and 42 indicates the chamber from which the fluid is being pumped. Chamber 42 has an inlet conduit 43 and a discharge conduit 44, and chest 40 has an inlet 45 for the admission of the pumping fluid. Fluid chest 40 is made comparatively long, extending some distance into chamber 42 and is located within a cylinder 46 formed integral with a wall of chamber 42. Between chest 40 and cylinder 46 is a layer of heat insulating material 47 which serves to prevent the transfer of heat from the pumping fluid in chest 40 to the fluid to be pumped in chamber 42. Also chest 40 and cylinder 46 are connected together only at their outer ends as indicated at 49, and on the outer surface of the portion of cylinder 46 which is outside chamber 42 are heat radiating fins 48 which dissipate heat transferred through the metallic connection at 49 thus preventing the portion of cylinder 46 which is located in the chamber 42 from becoming heated. In other words, the pumping fluid chest is made comparatively long and is connected at its outer edge only to the wall of the chamber containing the fluid to be pumped by an annular wall or cylinder 46 which in turn is cooled by heat radiating fins.

The connection at 49 between chest 40 and cylinder 46 is preferably in the form of a screw thread and by turning chest 40 it

will be seen that the position of nozzles 41 may be adjusted axially relatively to the throat of discharge conduit 44. Such adjustment is desirable in order to obtain the highest efficiency under different conditions of operation and it is to be noted that with my improved arrangement adjustments can be made without dismantling the ejector and while the ejector is in operation.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. In an ejector fluid pump, a last stage ejector, and a plurality of earlier stage ejectors connected in parallel to each other and in series with said last stage ejector.

2. In a multi-stage ejector fluid pump, a second stage comprising a single ejector and a first stage comprising two ejectors connected in parallel with each other.

3. The combination with a chamber from which a fluid is to be pumped, of an ejector pump comprising a plurality of ejectors connected in parallel to said chamber and a single ejector having its inlet connected to the discharge conduits of said plurality of ejectors.

4. In an ejector, the combination of walls forming a flat chamber having an opening on one side for the admission of the fluid to be pumped and openings in its top and bottom, a discharge tube connected to the bottom opening, a cylinder mounted in the top opening and projecting beyond it in both directions, a chest for the pumping fluid mounted in said cylinder and connected to it at its outer end only, the remainder of the chest being spaced from the cylinder, and heat insulating material located in the space between said chest and cylinder.

5. In an ejector, the combination of walls forming a flat chamber having an opening on one side for the admission of the fluid to be pumped and openings in its top and bottom, a discharge tube connected to the bottom opening, a cylinder mounted in the top opening and projecting beyond it in both directions, a chest for the pumping fluid mounted in said cylinder and connected to it at its outer end only, the remainder of the chest being spaced from the cylinder, heat insulating material located in the space between said chest and cylinder, and heat radiating fins on the outer portion of said cylinder.

In witness whereof, I have hereunto set my hand this third day of October, 1919.

SANFORD A. MOSS.