

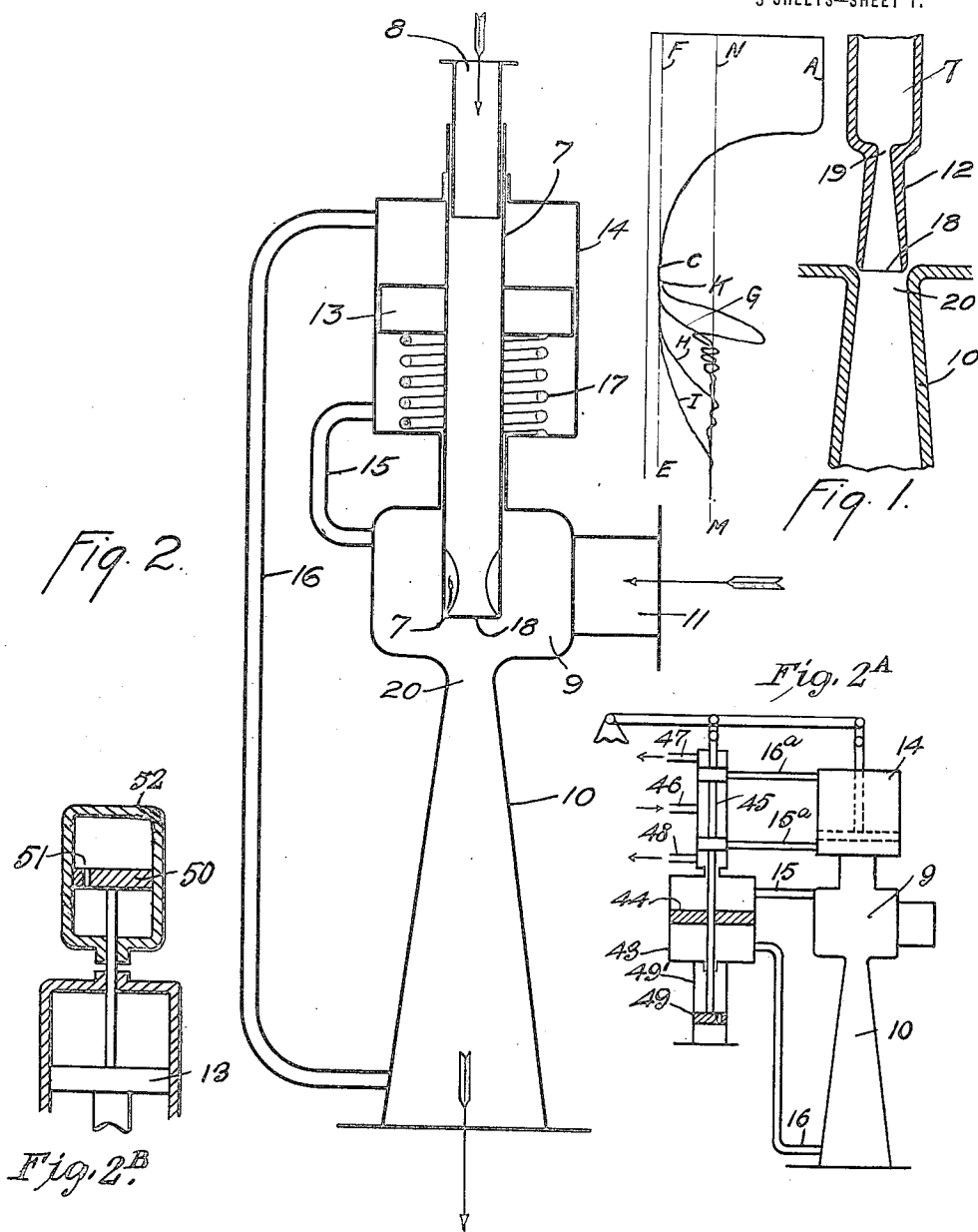
H. F. SCHMIDT.
FLUID-TRANSLATING DEVICE.

APPLICATION FILED SEPT. 14, 1914. RENEWED DEC. 30, 1921.

1,421,843.

Patented July 4, 1922.

3 SHEETS—SHEET 1.



WITNESSES:

B. M. Tero.
E. M. Callister

INVENTOR.

Henry F. Schmidt.

BY

J. A. Green

HIS ATTORNEY IN FACT

H. F. SCHMIDT.
FLUID TRANSLATING DEVICE.

APPLICATION FILED SEPT. 14, 1914, RENEWED DEC. 30, 1921.

1,421,843.

Patented July 4, 1922.

3 SHEETS—SHEET 2.

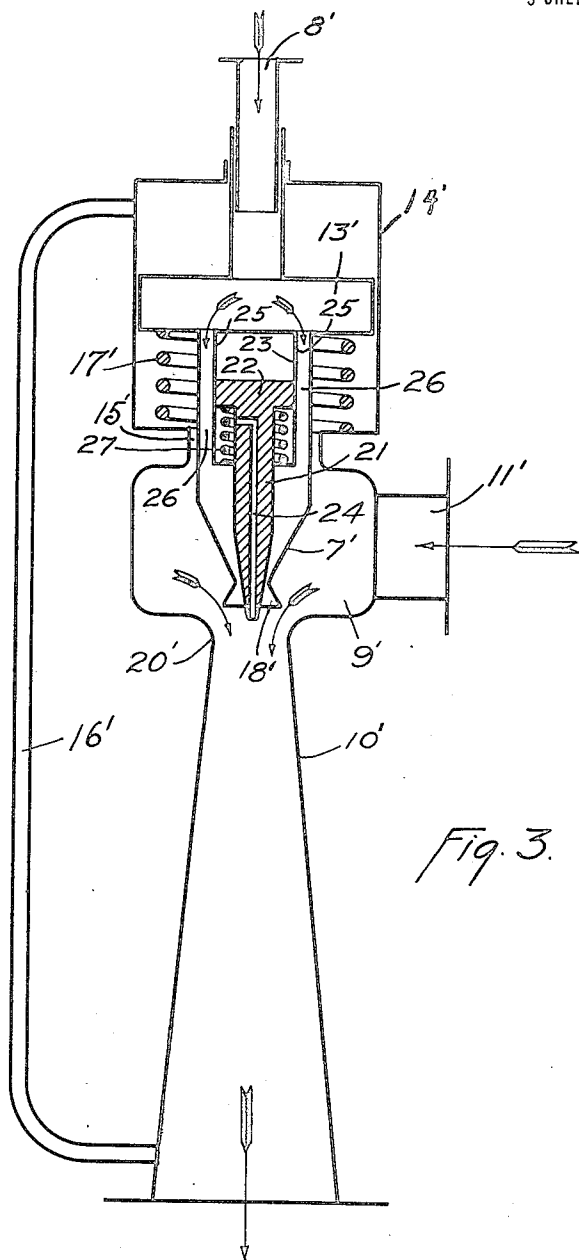


Fig. 3.

WITNESSES.

W. J. H. H.
E. M. Callister

INVENTOR.

Henry F. Schmidt
BY *J. S. Green*
HIS ATTORNEY IN FACT

H. F. SCHMIDT.

FLUID TRANSLATING DEVICE.

APPLICATION FILED SEPT. 14, 1914. RENEWED DEC. 30, 1921.

1,421,843.

Patented July 4, 1922.

3 SHEETS—SHEET 3.

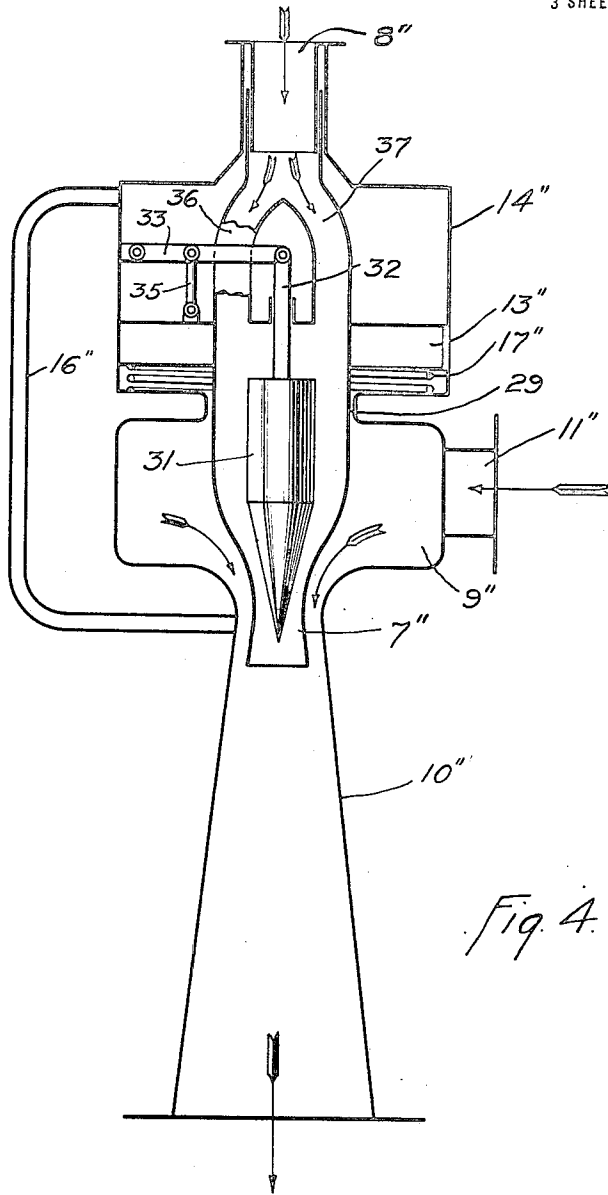


Fig. 4.

WITNESSES.

D. M. Tero.
E. W. McCallister.

INVENTOR.

Henry F. Schmidt.

BY

James D. Green.
HIS ATTORNEY IN FACT

UNITED STATES PATENT OFFICE.

HENRY F. SCHMIDT, OF SWARTHMORE, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

FLUID-TRANSLATING DEVICE.

1,421,843.

Specification of Letters Patent.

Patented July 4, 1922.

Application filed September 14, 1914, Serial No. 861,633. Renewed December 30, 1921. Serial No. 526,031.

To all whom it may concern:

Be it known that I, HENRY F. SCHMIDT, a citizen of the United States, and a resident of Swarthmore, in the county of Delaware and State of Pennsylvania, have made a new and useful Invention in Fluid-Translating Devices, of which the following is a specification.

This invention relates to fluid translating devices and particularly to devices for maintaining a high vacuum in condensers or similar apparatus.

An object of the invention is to produce a fluid translating device of the kinetic type in which means are employed for maintaining the operation of the device substantially constant for practically all varying conditions.

A further object is to produce a fluid translating device employing the kinetic or velocity energy of the motive fluid delivered to it in transferring fluid from a region of lower to a region of higher pressure, which automatically adjusts itself to variations in the quantity of fluid to be conveyed, thus preventing objectional fluctuations of pressure in either the region of lower or higher pressure.

A further object is to produce means in an ejector for automatically varying the quantity of motive fluid, delivered to the ejector, in response to variations in the initial pressure of the motive fluid, that is, the pressure of the fluid prior to expansion.

These and other objects I attain by means of apparatus embodying the features herein described and illustrated in the drawings accompanying and forming a part of this application.

In the drawings, Figure 1 is a diagrammatic view illustrating a preferred arrangement of expansion nozzle and diffuser in an ejector embodying my present invention, and is shown in connection with a pressure diagram for graphically illustrating variations in pressure encountered throughout the fluid passages of the diffuser and nozzle for different positions of the nozzle with relation to the diffuser.

Figure 2 is a diagrammatic sectional view of an ejector embodying my invention and which may be equipped with a delivery or expansion nozzle, such as shown in Figure

1, and it will be understood that an arrangement of nozzle and diffuser similar to the arrangement shown in Figure 1 is preferable.

Fig. 2^A is a diagrammatic view of a modification of the apparatus illustrated in Fig. 2.

Fig. 2^B is a diagrammatic sectional view of another modification of the apparatus illustrated in Fig. 2.

Figure 3 is a diagrammatic sectional view of an ejector embodying a modification of the present invention. The arrangement of the fluid delivery or expansion nozzle is merely illustrative, and it will be understood that an arrangement of the nozzle and diffuser similar to that shown in Figure 1 is desirable.

Figure 4 is a view corresponding to Figure 1 in which a still further embodiment of my invention is diagrammatically illustrated. The fluid delivery or expansion nozzle and the diffuser of the ejector illustrated in this view, like that of the ejector and diffuser illustrated in Figure 2, should preferably be proportioned so as to correspond to the nozzle and diffuser shown in Figure 1.

This invention particularly consists in providing a fluid delivery nozzle and diffuser, which are movable relatively to each other in response to variations in the amount of fluid or medium to be ejected or compressed in accordance with variations in the pressures existing in the suction or combining chamber and at the outlet of the diffuser.

The apparatus illustrated in Figures 1 and 2 includes a fluid delivery nozzle 7, which receives motive fluid from any suitable source through a port 8, and which after expanding the fluid, is adapted to deliver it through a suction and combining chamber 9, into the diffuser tube 10, which communicates with the chamber 9, and is preferably axially aligned with the nozzle 7. The chamber 9 is provided with a port 11, adapted to communicate with the receptacle to be exhausted, or from which fluid is to be compressed to the pressure existing at the outlet of the condenser. As illustrated, the nozzle 7 consists of a long tubular member, which terminates in an expansion nozzle,

such as is illustrated at 12 in Figure 1. The tubular member is also provided with a plunger or piston 13, which is located within a cylinder 14, and which is adapted to move the nozzle longitudinally, so that it occupies different positions relatively to the diffuser. As shown, the end of the cylinder 14, adjacent to the nozzle, is placed in communication with the suction and combining chamber 9 by means of a passage 15, and the opposite end is placed in communication with the outlet, or any intermediate point of the diffuser 10, as conditions may require, by means of a passage 16. I have also shown a coiled spring 17, located in the cylinder 14, which acts upon the plunger 13 in opposition to the pressure admitted through the pipe 16.

The operation of the apparatus is as follows: Motive fluid entering the nozzle is expanded as it passes through the divergent portion of the nozzle and is delivered, in the form of a fluid jet, into the suction and combining chamber 9, through which it passes into the diffuser tube. In passing through the combining chamber and in entering the diffuser tube, the jet of fluid entrains fluid or medium existing in the chamber 9 and moves it through the diffuser tube in which the velocity of the combined media is converted into pressure.

The expansion nozzle is preferably so proportioned that it will expand the fluid from initial pressure to the pressure normally existing in the chamber 9. In order, therefore, to provide for variations in the pressure existing in the chamber 9 above and below the normal pressure, the nozzle is so arranged that it will move to different positions, with relation to the diffuser, in response to different existing pressures in the chamber. That is, as the pressure builds up in the chamber 9 above the normal pressure, the nozzle will move away from the inlet to the diffuser, thereby causing the fluid jet to traverse a greater portion of the chamber than under ordinary conditions and, at the same time, increase the inlet area of the diffuser. On the other hand, as the pressure diminishes in the chamber 9, the nozzle will move towards the diffuser until at a determined pressure it will occupy a position substantially as illustrated in Figure 1. The nozzle will only take this position, however, when the conditions are such that little or no medium is entering the chamber 9, or in other words, when the work of translation or compression of medium imposed upon the jet of motive fluid is reduced to a minimum.

In Figure 1, I have shown a pressure diagram which illustrates the pressures encountered throughout the expansion nozzle 12 and in the diffuser tube 10 for different positions of the nozzle with relation to the tube.

As shown by the pressure diagram, the impelling fluid enters the nozzle 12 at a pressure A and, expanding in the nozzle, the pressure falls as indicated by line AC, reaching a minimum pressure FE, which is determined by the expansion ratio of the nozzle, or ratio of the outlet area 18 of the nozzle to that of its smallest cross section, or the throat 19 of the nozzle. Now, it has been shown experimentally that in the nozzle expanding a fluid, the pressure at any point within the nozzle remains substantially constant, regardless of the back pressure against which the nozzle is discharging, except that in expanding nozzles, a recompression will take place in the nozzle itself when the back pressure is materially increased above that for which the nozzle is designed. However, for any given ratio of inlet to actual outlet or back pressure, under which an expanding nozzle is operating, an expansion ratio can be selected such that up to a predetermined point in the nozzle the pressure will remain constant. In Figure 1, the latter condition is obtained, since the diffuser tube 10 in effect forms a continuation of the nozzle 12, and the point at which recompression in the nozzle begins—considering nozzle 12 and combining tube 10 as a continuous nozzle—will be at some point as K of the pressure diagram, which is located within the diffuser tube 10 and beyond outlet 18 of the nozzle 12. If no medium is entering the chamber 9 through the port 11, the nozzle 12 will occupy the position shown in Figure 1, and impelling fluid will expand along the line AC K, recompression occurring at some point K, causing the expelling fluid to be recompressed to the pressure M N at the discharge of the diffuser 10. When the various amounts of medium are entering the chamber 9 through the port 11, the outlet 18 of the nozzle 12 will move away from the entrance of the diffuser 10, a distance proportional to the quantity of medium to be transferred; and the compression in the diffuser will vary with the position of the nozzle as indicated by the compression curves, G, H, or I in Figure 1.

It will be apparent from the preceding description that the position of the effective throat of the diffuser when little or no medium is being discharged from the chamber 9, is shifted from its normal position at 20, to a point 19, which corresponds with the position of the throat of the expansion nozzle and consequently, assuming that the nozzle 12 is supplied with motive fluid at a constant normal pressure, upsetting of the diffuser or fluctuations of the pressure in the chamber 9 are prevented. This, it will be apparent, also holds for all positions of the nozzle 12, since, the gap between the outlet 18 of the nozzle 12 and the entrance to the diffuser is filled with the medium entering

from the chamber 9, which, in effect, forms a fluid wall connecting the nozzle 12 with the diffuser 10.

For the reasons above outlined, the area of the plunger 13 and the strength of the spring 17 are so proportioned that the nozzle 12 will move to such positions, in response to the pressure within the chamber 9, that the medium from the chamber 9 will always be just sufficient to fill the gap between the nozzle and the inlet of the diffuser. It will, of course, be understood that the pressures transmitted to opposite ends of the cylinder 14 through the passages 15 and 16 may not be of sufficient magnitude to ensure a reliable operation of the nozzle and that therefore a relay operating on the pressures delivered through the passages 15 and 16 may be interposed, which will deliver actuating pressure to the cylinder 14 in response to variations of pressure within the chamber 9. It may also be desirable to provide a dashpot or similar device for the relay or plunger, for steadying its operation and thereby prevent the plunger from vibrating in response to immaterial fluctuations of pressure which may occur either in the chamber 9 or in the condenser 10.

In Fig. 2^A I have shown a relay mechanism which may be employed in controlling the piston 13 and hence the motive fluid nozzle 7. As illustrated this mechanism comprises a cylinder 43 in which a piston 44 operates in response to variations in pressure to the two pipes 15 and 16, which connect the inlet chamber 9 and the diffuser 10 with opposite ends of the cylinder 43. A pilot valve 45 is shown as adapted to be operated by the piston 44 and controls the delivery of a relatively high pressure actuating fluid to and from the cylinder 14 through the pipes 15^a and 16^a. Actuating fluid, preferably oil, may be supplied to the pilot valve by means of a pipe 46 and is carried off by means of exhaust pipes 47 and 48. I have also shown a piston 49 connected to the piston 44 for preventing slight fluctuations in pressure from affecting the operation of the piston 44. The piston 49 loosely fits in a closed cylinder 49', or may be provided with a restricted hole or passageway so as to allow a limited flow of fluid past the piston so that it may move only under the influence of a force of reasonable duration.

In Fig. 2^B I have shown a dash pot as connected directly to the nozzle controlling piston 13 in order to prevent movements in response to minor and also discontinuous fluctuations in the pressures. As shown, the dash pot consists of a piston 50 having a restricted opening or bypass 51 and adapted to slide in a cylinder 52. The cylinder 52 may be filled with oil or any other fluid.

In Figure 3 I have shown an embodiment

of my invention in which means are employed for varying the position of the delivery or expansion nozzle 7' with relation to the diffuser 10', in response to variations in the amount of fluid or medium admitted to the suction and combining chamber 9', through the port 11', which is similar in details of construction to the disclosure of Figure 2. In addition to this, I have provided means for varying the amount of motive fluid delivered to the suction and combining chamber 9' in response to variations in the pressure maintained within the throat of the diffuser, or in the region of the outlet of the delivery of the nozzle 7'. This is accomplished in the illustrated embodiment of the invention by providing a needle valve 21 within the nozzle 7', which is adapted to move to different positions in response to variations between the initial pressure of the motive fluid and the pressure existing in the throat 20' of the diffuser, or at a point immediately beyond the outlet 18' of the nozzle 7', so as to vary the amount of impelling or expelling fluid delivered by the nozzle. As illustrated, the needle valve is provided with an operating plunger 22, which is located within the cylinder 23 and is exposed on the valve side to the pressure at the discharge end of the nozzle, through a passage 24 formed within the valve 21. The opposite end of the cylinder, and consequently the opposite face of the plunger, is exposed to the initial pressure of the expelling fluid through one or more ports 25. These ports communicate with a passage 26, which supplies motive fluid directly to the nozzle 7', and which communicates with the port 8' through a passage formed within the piston 13'. The pressure of the fluid admitted to the cylinder 23, through the ports 25, is opposed by a coiled spring 27, which operates between the piston 22 and the end of the cylinder 23, and which tends to move the valve 25, so as to deliver more fluid to the nozzle.

With this arrangement, it will be seen that if the tension of the spring 27 is properly proportioned with relation to the area of the plunger 23, the valve 21 will move in response to variations in the initial pressure of the motive fluid as well as variations in the pressure existing at the throat 20', and that if the initial pressure of the motive fluid drops for any reason, the valve 21 will rise and increase the opening of the nozzle 7', thus increasing the ratio of the weight of motive fluid supplied to the nozzle to the weight of medium to be moved from the suction and combining chamber 9'. This is necessary since the available energy of the motive fluid decreases with the pressure of the motive fluid. On the other hand, if the initial pressure of the motive fluid increases, the valve will move to decrease the

delivery of fluid through the nozzle 7', thus reducing the ratio of the weight of motive fluid delivered to the weight of medium to be expelled from the chamber 9'.

5 I have also shown the nozzle 7' as adapted to be moved by a piston 13' in the same manner as the nozzle 7 of Fig. 2 is controlled by the piston 13. The piston 13' operates in a cylinder 14' which is connected at its upper end to the lower end of the diffuser 10' by means of a conduit 16' and at its lower end is directly connected with the inlet chamber 9' by means of the annular opening 15' at the point where the nozzle 15 7' passes through the lower end of the cylinder 14'. A spring 17', below the piston, opposes the pressure of the fluid on the upper side of the piston.

In Figure 4, I have shown a further embodiment of my invention, in which means are employed for varying the amount of motive or expelling fluid delivered to the delivery nozzle 7'' in response to variations in the amount of fluid or medium delivered 25 to the suction and combining chamber 9'', through the port 11''. As illustrated, the ejector is provided with means analogous to the means illustrated in Figure 2 for varying the positions of the nozzle in response to variations in the amount of fluid or medium to be moved from the suction and combining chamber 9'' through the diffuser 10''.

The nozzle is provided with a piston 13'', which operates within a cylinder 14'', to one end of which the pressure existing at the throat of the diffuser 10'' is admitted, through a passage 16'', while to the other end the pressure existing in the chamber 9'' is admitted through a leakage passage 29, similar to the passage 15' of Figure 3. The motion imparted to the piston 13'' by the pressure admitted through the passage 16'' is opposed by a coiled spring 17'', the tension of which is proportioned as described 45 in connection with the spring 17 of Figure 2, so that the nozzle 7'' will move with relation to the diffuser 10'' in such a way as to properly proportion the area of the outlet of the suction and combining chamber 9'', in response to variations in the amount of fluid or medium to be withdrawn from the chamber through the diffuser.

The motive fluid supplied to the nozzle 7'' is varied by means of a conical plug or needle valve 31, which is located within the nozzle and is adapted to move longitudinally, or axially, with relation to the nozzle, as the nozzle moves in response to variations in pressure on the piston 13''. In the illustrated embodiment, this is accomplished by means of a link and lever connection between the plug or needle valve 31 and the piston 13'', which is so arranged that a movement of the piston relatively to its cylinder, will occasion a movement of the valve

relatively to the nozzle. The valve is shown provided with a stem 32, to which one end of the lever 33 is pivotally connected; the other end of the lever is fulcrumed on a bracket formed on the inner wall of the cylinder 14'', and the lever is connected at an intermediate point to the piston 13'' by means of a link 35. The lever of course projects through a suitable opening 36, which extends through the steam passage 37, and the stem 32 is provided with a suitable packing to prevent the leakage of fluid from the passage 37 into the cylinder 14''.

With the arrangement illustrated in Fig. 4, variations in the position of the nozzle 7'' will occasion variations in the position of the plug 31 with relation to the nozzle, and consequently will vary the amount of motive fluid delivered through the nozzle. As illustrated, the conical wall of the plug 85 is so proportioned with relation to the inner walls of the nozzle that as it moves downwardly with relation to the nozzle to reduce the amount of fluid delivered through the nozzle, it will also increase the expansion ratio of the nozzle, and conversely, as it moves in the opposite direction, to increase the amount of fluid delivered through the nozzle, it will decrease the expansion ratio of the nozzle. With this arrangement, the motive fluid supplied is proportioned in response to variations in the amount of fluid or medium to be moved from the suction and combining chamber 9'', and the nozzle ratio is also varied in the most economical and effective manner since it is necessary to increase the nozzle ratio as the amount of fluid or medium to be moved from the chamber 9'' decreases in order to obtain the most efficient results.

In connection with the invention herein disclosed, I call attention to my copending application entitled "Fluid translating devices", Serial No. 861,629, filed September 14, 1914, which discloses and claims an ejector in which means are provided for varying the effective area of the diffuser, or the effective area of both the diffuser and nozzle, in response to variations in the pressures encountered within the ejector. As there illustrated, a conical plug or needle valve is adapted to be moved into and out of the throat of the diffuser and is controlled in a manner similar to that illustrated in connection with the nozzle 7, Fig. 2, of the apparatus illustrated in this application. In one embodiment illustrated in application 861,629 the effective area of the nozzle is varied by the tip of a conical plug which is located within the diffuser and projects through the throat of the diffuser and into the nozzle when the pressure conditions within the ejector are such as to require a decrease in the throat area of the diffuser and also a variation in the expansion ratio

of the nozzle or a variation in the amount of expelling or motive fluid delivered by the nozzle.

In my copending application entitled "Fluid translating devices", Serial No. 861,630, filed September 14, 1914, I have disclosed and claimed an ejector in which means are employed for varying the effective area or the expansion ratio of the motive fluid delivering nozzle. The ejector there illustrated is provided with a needle valve which extends through the steam inlet chamber and into the throat of the nozzle, and is controlled either directly or indirectly by a piston subjected on one side to the pressure of the fluid entering the ejector, and on the other side to the pressure of the fluids traversing through the diffuser. Variations in the pressures acting on the piston cause the needle valve to move into or out of the nozzle, thereby changing the effective area and expansion ratio of the nozzle.

In my copending application entitled "Fluid translating devices", Serial No. 861,631, filed September 14, 1914, I have disclosed and claimed an ejector in which the main nozzle is surrounded by accelerating nozzles. The flow of motive fluid to the accelerating nozzles is controlled by means responsive to variations in pressure conditions within the ejector, and the position of the main nozzle is similarly controlled. The controlling means there described and illustrated is similar to the means, illustrated in Fig. 2 hereof, for controlling the position of the nozzle 7. The delivery of motive fluid to the accelerating nozzles of application 861,631 is controlled by ports formed in a movable tubular extension of the movable main delivery nozzle.

In my copending application, Serial No. 861,634, filed September 14, 1914, and entitled "Fluid translating device", I have illustrated, described and claimed an ejecting device provided with a passage from which medium is to be ejected communicating with a diffuser through which the medium from the passage is expelled. A fluid delivery nozzle delivers expelling fluid through a diffuser and a means responsive to variations in the amount of medium entering the passage is provided for controlling direct communication between the diffuser and the passage. I have further illustrated and claimed a two-stage ejector in which both stages are provided with inlet members capable of being placed in communication with a source of medium to be expelled. The first stage is shown in open communication with the source of medium to be expelled, whereas the second stage is provided with ports located substantially at the throat of its converging-diverging diffuser and communicating with the source

of medium to be expelled through a passage which in effect forms a by-pass around the first stage. This passage is provided with a valve which operates in response to variations in pressure at the throat of the second stage diffuser and therefore controls the delivery of medium to be expelled to the ports of the second stage diffuser.

In my copending application, Serial No. 861,634, filed September 14, 1914, and entitled "Fluid translating devices", I have disclosed and claimed a multi-stage ejector in which means are employed for permitting a subsequent stage of the ejector to operate either in series or in parallel with the initial stage, depending upon pressure conditions within the ejector and at the inlet to the ejector. A two stage ejector is illustrated. The initial stage discharges into the inlet end of the diffuser of the second stage. The second stage is, however, provided with one or more ports, which are adapted to communicate with the source of fluid to be ejected through a valve controlled passage. The valve of this passage is illustrated as a spring restrained check valve and is responsive to variations in the difference of pressure existing at the source of fluid to be ejected and within the diffuser of the second stage.

In my copending application, Serial No. 861,635, filed September 14, 1914, and entitled "Fluid translating devices", I have disclosed and claimed a multi-stage ejector in which the diffuser of the final ejector of the series is movable for the purpose of varying the delivery of motive fluid through the nozzles of the second stage or the expansion ratio of those nozzles. In addition to the above, the application discloses and claims a diffuser for the final stage which is movable in response to variations in pressure within the ejector for the purpose of delivering fluid from the source of medium to be expelled around the initial stage or stages directly to the final diffuser.

It will be apparent that various modifications, substitutions, changes and omissions may be made in the apparatus herein illustrated and described without departing from the spirit and scope of the invention as set forth by the claims hereto appended.

What I claim is:

1. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, means for delivering a jet of fluid through the diffuser for translating medium entering the port through the diffuser, and means responsive to variations in the amount of medium entering the port for varying the position of the fluid delivery means relatively to the diffuser.

2. In combination in an apparatus of the character described, a diffuser communicat-

- ing with a suction port of the apparatus, an expansion nozzle for delivering a jet of impelling fluid through the diffuser for moving the medium entering the port through the diffuser, and means responsive to variations in the amount of medium to be moved for moving said nozzle relatively to the diffuser and to in effect form with the diffuser a continuous expansion nozzle.
- 10 3. In combination in an apparatus of the character described, a divergent diffuser communicating with a suction port of the apparatus, an expansion nozzle for delivering expelling fluid through the diffuser, and means responsive to variations in pressure at the suction port for converting said diffuser into an extension of the expansion nozzle.
- 20 4. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, an expansion nozzle for delivering a jet of fluid through the diffuser to expel medium entering the port through the diffuser, and means responsive to variations in the amount of medium entering the port for shifting the effective throat of the diffuser to the throat of the nozzle.
- 30 5. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, an expansion nozzle for delivering a jet of fluid through the diffuser for moving medium entering the port through the diffuser, and means responsive to variations in the amount of medium entering the port for varying the relative position of said nozzle and the diffuser, and communication between said port and the diffuser.
- 40 6. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, means for delivering a jet of fluid for expelling medium entering the port through the diffuser, and means responsive to variations in the amount of medium entering the port for varying the relative positions of the fluid delivery means and the diffuser, and for varying the amount of fluid delivered.
- 50 7. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, a nozzle for delivering a jet of fluid to move medium entering the port through the diffuser, and means responsive to variations in the amount of fluid entering the port for varying the amount of fluid delivered by the nozzle and the relative position of the nozzle and the diffuser.
- 65 8. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, a nozzle for delivering a jet of fluid to move medium entering the port through the diffuser, means responsive to variations in the amount of medium entering the port for varying the expansion ratio of said nozzle and the relative position of the nozzle and diffuser.
- 70 9. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, a nozzle for delivering a jet of fluid to move medium entering the port through the diffuser, and means responsive to variations in the amount of medium to be expelled for varying the relative positions of said nozzle and said diffuser, and for varying the expansion ratio of the nozzle.
- 75 10. In combination in an apparatus of the character described, a chamber for receiving medium to be ejected, a diffuser communicating with the chamber, a nozzle for delivering expelling fluid through the chamber and into the diffuser, and means responsive to variations between the pressure at the throat of the diffuser and said chamber for occasioning relative motion between the nozzle and the diffuser.
- 80 11. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, means for delivering a jet of fluid through the diffuser for translating medium entering the port through the diffuser, said means being movable toward and away from said diffuser.
- 85 12. In combination in an apparatus of the character described, a diffuser communicating with a suction port of the apparatus, and a nozzle movable relatively to said diffuser for delivering motive fluid to the apparatus.
- 90 13. In combination in an ejector, a mixing chamber, a diffuser communicating therewith, a nozzle movable toward and away from the mouth of the diffuser for delivering motive fluid through the diffuser, and means for varying the effective area of the nozzle.
- 95 14. In combination in an ejector, a mixing chamber, a diffuser communicating therewith and a nozzle movable to different positions relatively to the diffuser for delivering motive fluid into and through the diffuser.
- 100 15. In combination in an apparatus of the character described, a diffuser, a chamber communicating therewith, means for delivering a jet of motive fluid through the diffuser for translating medium contained in the chamber through the diffuser, and means responsive to variations in the amount of medium to be translated for varying the effective area of the throat of the diffuser.
- 105 16. In combination in an apparatus of the character described, a diffuser, a chamber communicating therewith and provided with an inlet port for fluid medium to be ejected, means for delivering a jet of motive fluid through said diffuser, and means for varying the area of the path of communication be-
- 110
- 115
- 120
- 125
- 130

tween said port and said diffuser in response to variations in pressure at the inlet to the diffuser.

17. In combination in an apparatus of the character described, a diffuser, a chamber communicating therewith and provided with an inlet port for fluid medium to be ejected, a nozzle for discharging a stream of motive fluid into and through said diffuser, and means for varying the relative positions of the nozzle and diffuser and thereby varying the path of communication between said inlet port and the inlet to said diffuser in response to variations in the amount of fluid medium entering said chamber.

18. In combination in an apparatus of the character described, a diffuser, a chamber communicating therewith and provided with an inlet port for fluid medium to be expelled, a nozzle for delivering a jet of fluid through said diffuser, means for varying the relative positions of the diffuser and nozzle in response to variations in the amount of fluid medium to be expelled from said chamber, and means for varying the delivery of fluid through said nozzle in response to variations in the pressure within the apparatus.

19. In combination in an apparatus of the character described, a chamber provided with an inlet port for medium to be expelled, a diffuser communicating with said chamber, a nozzle movable toward and away from said diffuser for delivering a stream of expelling fluid through said diffuser, means

responsive to variations in the amount of medium entering the chamber for controlling the position of said nozzle relatively to said diffuser, and means for controlling the delivery of expelling fluid through said nozzle.

20. In combination in an apparatus of the character described, a passage from which medium is to be exhausted, a diffuser through which medium from the passage is expelled, a fluid delivery nozzle for discharging expelling fluid through the diffuser, and means responsive to variations in the amount of medium entering said passage for controlling the delivery of motive fluid through said nozzle and communication between said diffuser and said passage.

21. In combination in an apparatus of the character described, a chamber provided with an inlet port for medium to be expelled, a diffuser communicating with said chamber, a nozzle for delivering a stream of expelling fluid through said diffuser, and means responsive to variations in the amount of medium entering said chamber for controlling communication between said port and said diffuser.

In testimony whereof, I have hereunto subscribed my name this 21st day of August, 1914.

HENRY F. SCHMIDT.

Witnesses:

C. W. MCGHEE,

E. W. MCCALLISTER.