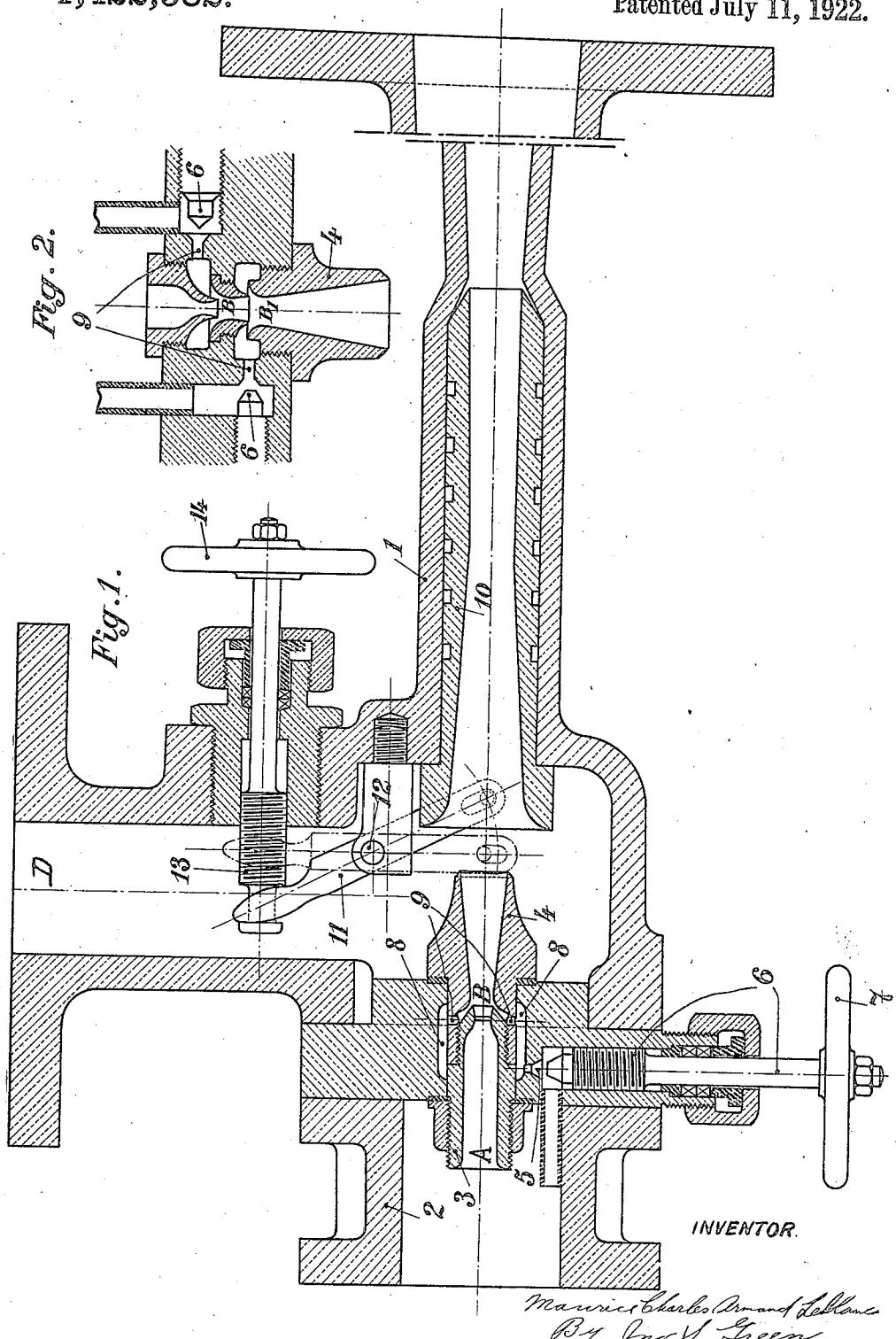
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STEAM EJECTOR.

APPLICATION FILED DEC. 19, 1919.

1,422,582.

Patented July 11, 1922.



INVENTOR.

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STEAM EJECTOR.

1,422,582. Specification of Letters Patent. Patented July 11, 1922.

Application filed December 19, 1919. Serial No. 346,196.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, MAURICE CHARLES ARMAND LEBLANC, a citizen of the Republic of France, residing in Val-sur-Seine, par Croissy (Seine and Oise), France, have made a new and useful Invention in Steam Ejectors (for which I have filed application in France, Oct. 3, 1918, Patent No. 492,073), of which the following is a specification.

This invention relates to fluid actuated ejectors and particularly to ejectors employed in connection with condensers or similar apparatus where the ejector performs the function of an air pump in withdrawing air or other noncondensible fluids from a region of low pressure and delivers or compresses it into a region of higher pressure.

An object of the invention is to produce an improved fluid actuated ejector capable of operating effectively and efficiently under widely varying pressure conditions and under varying pressures of the operating fluid.

This and other objects which will be made apparent throughout the further description are attained by means of apparatus embodying the features herein described and illustrated in the drawings accompanying and forming a part hereof.

In the drawings, Figure 1 is a longitudinal sectional view of an ejector embodying my invention. Figure 2 is a fragmental sectional view illustrating a modified arrangement of a detail of my invention.

The ejector illustrated consists of a casting 1 which is so constructed as to form a diffuser passage, one end of which is adapted to communicate with a receptacle to be evacuated through a port D and the other end of which is adapted to discharge into a region of higher pressure. Motive or actuating fluid, hereinafter termed steam, is expanded and delivered into and through the diffuser by means of an expansion nozzle which is illustrated as formed in two parts 3 and 4. The parts 3 and 4 are axially alined with each other and with the diffuser and are so spaced as to form a gap or annular passage B between them.

Fluid actuated ejectors are ordinarily designed to operate under predetermined conditions and a variation from the predetermined conditions detrimentally effects the efficiency and the effectiveness of the ejector. For example, variations in the initial pressure of the motive steam or variations in the amount of fluid to be ejected may not only detrimentally effect the operation of the ejector but may render it inoperative. In addition to this, ejectors designed to operate as air pumps and to maintain a high vacuum in such apparatus as condensers are seldom self-starting if their working passages are so proportioned as to develop high efficiency while operating under conditions of high vacuum. For the above reasons it is necessary to provide means for varying the relative positions of the working passages and the relative areas of certain of said passages in order to produce an ejector which is capable of operating with high efficiency under varying conditions of vacuum and steam pressure encountered.

With the illustrated embodiment of my invention, it is possible to vary the area of the effective throat of the steam delivery nozzle by admitting variable quantities of steam to the nozzle through the annular passage B. In other words the admission of steam to the nozzle at a point intermediate its actual throat and its discharge end has the effect of not only changing the effective position of the throat but also changing its effective area. In addition this shifting of the position of the effective throat varies the ratio of expansion of the nozzle.

As shown in the drawings steam is admitted to the two part nozzle 3—4 through a passage 2 and steam may also be admitted to the annular space B through an orifice 5 and an annular passage 8 which surround the part 3 and communicates with the passage B through one or more passages 9. The orifice 5 may as illustrated receive steam from the passage 2 and the delivery of steam to the passage B may be controlled by a needle valve 6 which is capable of being moved to different positions by means of a hand wheel 7.

The jet of steam issuing from the nozzle entrains fluid in its passage through the chamber which communicates directly with the port D and which is located between

the delivery end of the nozzle and the inlet end of the diffuser, and imparts velocity energy to the entrained fluid. The entraining and entrained fluid then pass through a diffuser in which the velocity or kinetic energy is converted into potential energy in the form of pressure. As illustrated the diffuser consists of a member 10 having a converging diverging passage formed therein and axially aligned with the nozzle. In the drawings the member 10 is so mounted within the diffuser casing that it is capable of moving longitudinally toward or away from the nozzle for the purpose of varying the distance between the throat of the nozzle and the throat formed by the junction of the convergent divergent portions of the diffuser. As shown the element 10 is moved to different positions by means of a lever 11 which is pivotally mounted on a pin 12 and which is in turn moved to different positions by a screw 13 and hand wheel 14.

The nozzle dimensions and the fluid passage of ejectors of the usual type are calculated for a predetermined steam pressure and a predetermined pressure of the fluid entering the port D. Thus both the throat and the ratio of expansion of the nozzle are fixed to correspond to predetermined conditions and as a result a variation in the steam pressure or a variation in the pressure at the outlet end of the nozzle detrimentally affects the operation of the nozzle and consequently the ejector. With my invention it is possible to vary the effective areas of the nozzle to compensate for widely varying pressure conditions and I preferably so design the nozzle that the orifice 5 is closed and is delivering no steam under normal operating conditions of the ejector. With this arrangement decreasing steam pressure may be compensated for by opening the nozzle more or less and decreasing or poor vacuum conditions may be similarly compensated for.

In Figure 2 I have illustrated a nozzle formed of three aligned parts and spaced to provide two gaps or passages B and B_1 through each of which steam may be admitted as described in connection with the gap B of the nozzle 3—4. This affords the opportunity of obtaining the advantage of a greater throat area and also makes it possible to vary the throat area between wider limits by proportioning the delivery of steam to one or both the passages B—B_1.

In addition to the above the movable part 10 contributes to the effectiveness and efficiency of the ejector when operating under varying operating conditions.

In ordinary ejectors the distance between the throat of the nozzle and the throat of the convergent divergent passage or diffuser is fixed and is proportioned for a predetermined condition of operation. Variations in operating conditions, however, make it desirable to vary the relative positions of the nozzle and diffuser although it is desirable that under no conditions should the receiving end of the diffuser contact with delivery end of the nozzle, since it is necessary to provide sufficient space between the nozzle and the diffuser to accomplish the desired entrainment of the fluid to be discharged or ejected. As the vacuum increases or improves the diffuser should be moved away from the delivery end of the nozzle and vice versa as the vacuum decreases, the space between the diffuser and the nozzle should be decreased. It is also desirable to adjust the position of the diffuser with relation to the nozzle for varying pressures of motive steam at the inlet to the nozzle. Consequently it will be apparent that an ejector equipped with a movable diffuser or one in which the position of the nozzle can be varied with relation to the diffuser will improve the operation of the ejector under abnormal operating conditions. For example, if the distance between the nozzle and the diffuser is adjusted to produce the most efficient operation when a small amount of air or fluid is being ejected, the ejector will be incapable of operating effectively and may even cease to operate if it is called upon to eject considerable quantities of air or fluid. The illustrated means for adjusting the relative positions of the nozzle and the diffuser will prevent such a stopping of the ejector and will make it possible to operate the ejector efficiently under widely varying conditions both as to the amount of air or fluid to be ejected and the initial pressure of the motive steam.

It will be apparent that the nozzle may be movable with relation to the diffuser and also that automatic means may be employed for varying the position of the nozzle and for varying the delivery of steam through the space B or the spaces B—B_1, or that any suitable means may be employed for accomplishing the regulation herein set forth and the supply of auxiliary steam to the nozzles may be varied by relative movement of the various parts constituting the nozzle.

While I have described and illustrated preferred embodiments of my invention it will be apparent that various changes, modifications, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of the invention as set forth by the appended claims.

I claim as my invention:

1. In combination in an ejector, a diffuser communicating at one end with a source of fluid to be compressed and at the other with a region of higher pressure into which fluid is to be compressed, a motive fluid delivery nozzle formed in parts arranged end to end and spaced to form an opening between the

parts for the admission of variable amounts of motive fluid to the nozzle.

2. In combination in an ejector, a movable diffuser, a diverging motive fluid delivery nozzle axially aligned therewith, and means for admitting variable amounts of motive fluid to the nozzle intermediate its throat and the outlet end thereof and for varying the position of the diffuser with relation to the nozzle.

3. In combination in an ejector, a diffuser, a nozzle for expanding motive fluid and delivering it into and through the diffuser, and means for varying the relative positions of the nozzle and diffuser, and the ratio of expansion of the nozzle.

4. In combination in an ejector, a diffuser, a nozzle for expanding and delivering motive fluid into and through the diffuser, and means for admitting regulable amounts of motive fluid to the nozzle at a point intermediate its ends.

5. In combination in an ejector, a diffuser, a nozzle for expanding and delivering motive fluid into and through the diffuser, means for admitting variable amounts of motive fluid to the nozzle intermediate its ends and means for varying the relative position of the diffuser with relation to the nozzle.

In witness whereof, I have hereunto signed my name.

MAURICE CHARLES ARMAND LEBLANC