H. CORBLIN.

DIAPHRAGM COMPRESSOR.

APPLICATION FILED OCT. 27, 1917.

1,332,806.

Patented Mar. 2, 1920.

2 SHEETS—SHEET 1.

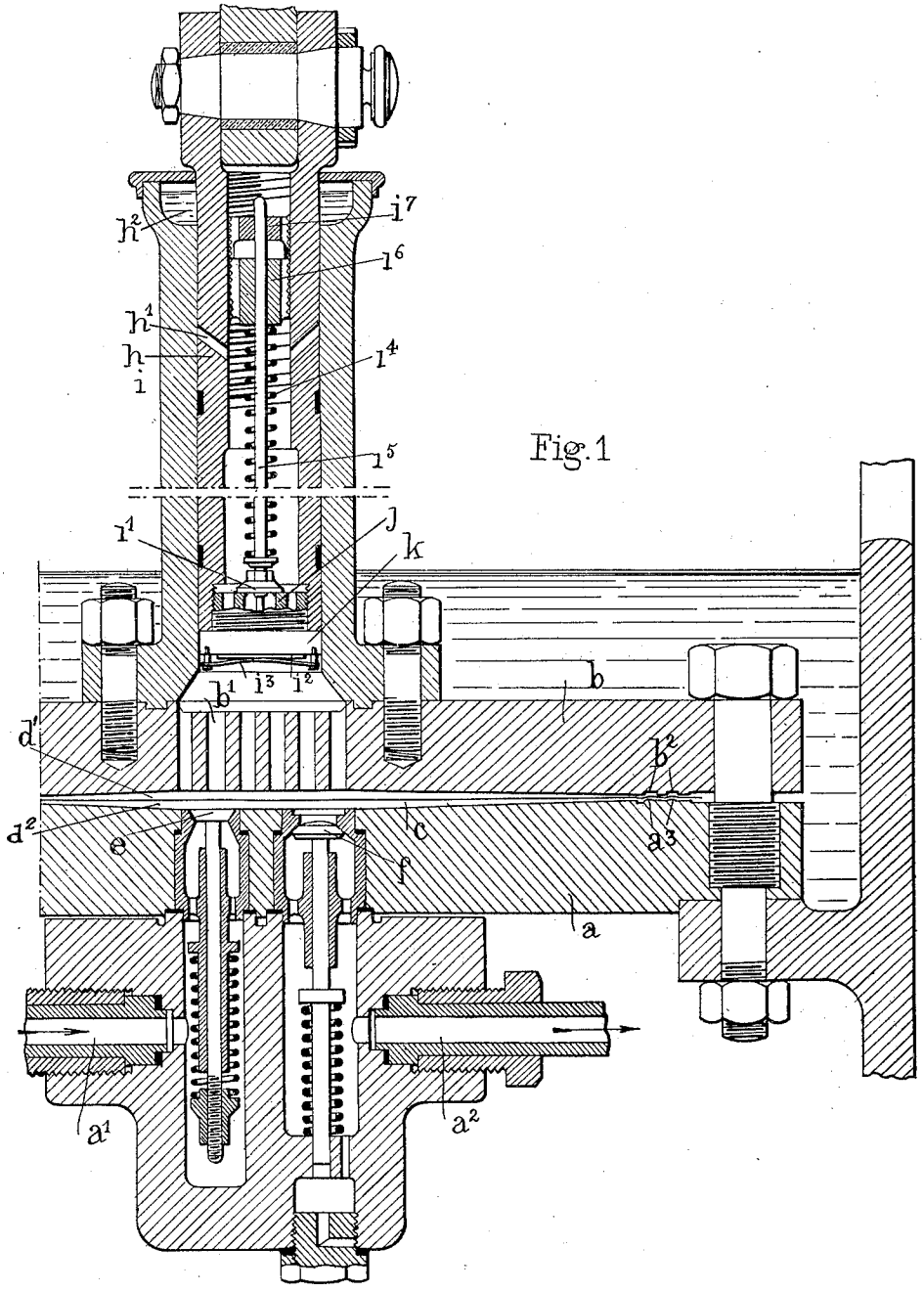


Fig. 1

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2 SHEETS—SHEET 2.

Fig. 2

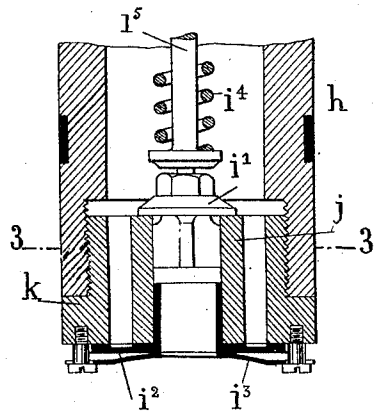


Fig. 3

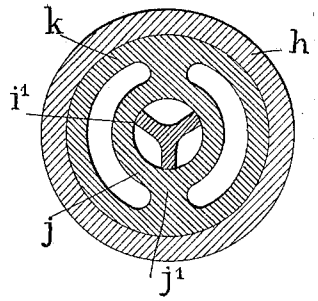


Fig. 4

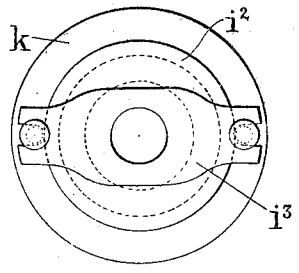


Fig. 5

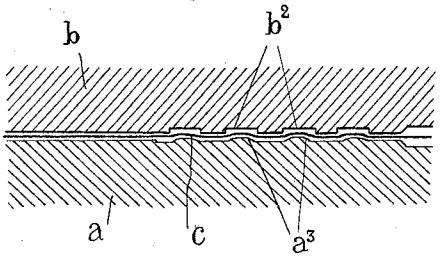


Fig. 6

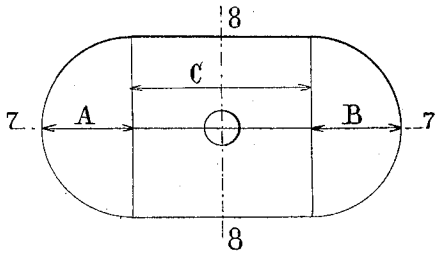


Fig. 8

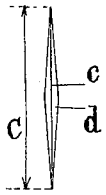
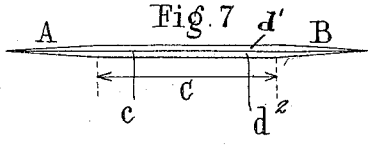


Fig. 7



INVENTOR

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UNITED STATES PATENT OFFICE.

HENRI CORBLIN, OF PARIS, FRANCE.

DIAPHRAGM-COMPRESSOR.

1,332,806. Specification of Letters Patent. Patented Mar. 2, 1920.

Application filed October 27, 1917. Serial No. 198,905.

To all whom it may concern:

Be it known that I, HENRI CORBLIN, a citizen of the Republic of France, and a resident of 67 Avenue Parmentier, Paris, France, have invented new and useful Improvements in or Relating to Diaphragm-Compressors, of which the following is a specification.

This invention relates to a compressor, more particularly intended for the compression of gases, in which a diaphragm oscillates in a chamber formed between two dished plates the edges of which grip the diaphragm, the suction and discharge valves being mounted in one of the plates, as far as possible flush with the surface facing the diaphragm which closely contacts with the said surface during the discharge without clearance.

A construction according to the invention is illustrated, by way of example, in the accompanying drawings, in which:

Figure 1 is a partial axial vertical section through the compressor.

Fig. 2 is a partial vertical axial section, on a larger scale, of the under part of the piston of the pump, operating the diaphragm.

Fig. 3 is a transverse section on line 3—3 of Fig. 2.

Fig. 4 is an end view of the lower face of said piston.

Fig. 5 is a detailed view showing the fastening means between the diaphragm and the dished plates.

Fig. 6 shows diagrammatically in plan another form of the compression chamber.

Figs. 7 and 8 are sections respectively on lines 7—7 and 8—8 of Fig. 6.

The compressor comprises two dished plates a and b bolted together at their edges; between said edges is gripped the diaphragm c which oscillates in the chamber d^1, d^2 formed between the plates a and b. In the construction shown in Fig. 1, the circular and flat diaphragm c oscillates in a shallow chamber d^1, d^2 of bi-conical form, both plates a and b having a conical form, with a very wide common base and a very small height, and with the same inclination from their common axis, in the opposite sense. The plate a carries the suction valve e and the discharge valve f, both arranged so as to be as flush as possible with the upper or internal surface of the said plate, but so that the diaphragm c does not interfere with the working of said valves.

In order to facilitate the machining of the plates and to avoid any clearance, the conical recess of each plate is cut off at its apex, so that the valves e and f may be mounted on a plane surface. The central portion of the plate b is perforated at b^1 so as to admit fluid to the upper surface of the diaphragm c by means of the pump i having a piston h, which forces and sucks in fluid between the diaphragm c and the perforated wall b^1. Said piston (see Figs. 2, 3 and 4) carries a valve i^1, mounted along its axis and guided by lateral wings in a cylindrical sleeve j, carried by a transverse member j^1 integral with the nut k screwed on the lower part of the piston h. Said nut is provided with a snifter, which opens at a certain vacuum and which consists in a disk i^2, guided at its central portion by an annular flange engaged in the sleeve j; said disk i^2 is constantly forced upward by a spring leaf i^3, provided with a central hole, and resting at its ends on two screws screwed in the nut k. The valve i^1 is maintained on its seat j by a helical spring i^4, arranged around the valve stem i^5 and resting on the nut i^6 and the lock-nut i^7, which are screwed in the inner wall of the piston h and which allow of varying the tension of said spring.

Previously to the starting of the compressor, the pump casing i has been filled with a suitable fluid, oil for instance, up to a level superior to half its height; the piston h has then been introduced into its pump casing i; the nut i^6 and lock-nut i^7 have previously been sufficiently unscrewed so that the valve i^1 may freely lift itself; when the lower face of the piston h reaches the level of the fluid, said fluid passes into the interior of the piston. The nut i^6 and lock-nut i^7 are then screwed for giving the spring i^4 the required tension.

The pump forces or sucks the fluid or liquid through the perforated wall b^1; said fluid or liquid escapes through the valve i^1, which lifts at a certain pressure, or is admitted by the snifter i^2, which opens at a certain vacuum; the piston h of the pump can thus displace a larger volume of fluid or liquid than that comprised between the two end positions of the diaphragm c. At the beginning of the downward or forcing stroke of the piston h, the diaphragm c is

close to the perforated wall b^1 of the plate b; during the descent of the piston h, the disk i^2 of the snifter closely contacts against the lower face of the piston; the valve i^1 is maintained on its seat j, the tension of the spring i^4 being greater than the pressure which may be obtained under the diaphragm c; said diaphragm c moves from its upper position and comes nearer to the plate a until it closely engages the said plate and also as accurately as possible the valves e and f. The gas which, during the preceding suction stroke of the piston, has entered the chamber d^2 through the pipe a^1 and through the suction valve e, is compressed by the diaphragm c and forced through the valve f, which automatically opens, and through the discharge pipe a^2 into a suitable tank. At the end of the downward stroke of the piston h, the liquid or fluid in excess escapes into the interior of said piston through the valve i^1, which lifts at this moment. The piston h then begins its suction or upward stroke; the diaphragm c returns to its upper position close to the plate b, under the suction of the pump the suction valve e is automatically opened and admits into said chamber d^2 a new charge of the gas to be compressed; at the end of the suction stroke of the piston, under the action of the vacuum created in the pump casing, the disk i^2 of the snifter yields and the liquid or fluid in excess, previously forced into the interior of the piston h through the valve i^1, returns beneath the under face of said piston into the pump casing.

The arrangement described, with snifter operating under predetermined vacuum and a valve opening under a predetermined pressure, assures the automatic elimination during operation of the pump, of all air bubbles or gas which may find its way into or be formed in the chamber d^1. Furthermore, it assures the lubrication of the pump, since all the oil or glycerin which passes between piston b and the body of the pump i and collects in the trough h^2, returns into the piston. Again it affords an easy and facile inspection of the snifter and pressure valve when necessary.

The level of the liquid or fluid establishes itself in the pump at the first strokes of the piston h by means of holes h^1, provided in the wall of said piston and which establish a communication, at the end of the upward stroke of the piston between the interior of said piston and a cup h^2 formed at the upper part of the pump casing i. If an excess of liquid or fluid has been introduced at first into the pump casing i before starting, this excess flows over into said cup h^2; in the contrary case, a little liquid is added in said cup.

It is to be noted that the nut i^6 and locknut i^7, screwed at the upper part of the piston h, are provided with lateral wings in order to guide the stem i^5 of the valve i^1 and to allow, if necessary, a sufficient section for the passage of the liquid or fluid.

Owing to the surface of the plate b being provided with holes of a small diameter, any distortion of the diaphragm c under maximum pressure is avoided.

The diaphragm c operates as an airtight piston, and the chamber d, formed between the two plates a and b, operates as a cylinder, so that there is suction and discharge through the valves e and f.

For strong compression and for large outputs, it is preferable to use several discharge valves which form a grating against which the diaphragm contacts.

By means of the shape of chamber d the diaphragm, as it moves toward an end position, is held on a larger surface against the plate, being applied progressively against the said plate a, starting from the circumference to the center. This gradual stoppage of the diaphragm avoids the formation of "knots" and "bellies" which appear in freely oscillating diaphragms, and it does away with the main cause of the deterioration of diaphragms, more particularly of metal diaphragms. According to this invention, a sufficiently large volume is obtained, not by using the maximum amplitude of oscillation of the diaphragm, but by employing a large surface and a very small oscillation, owing to which any diaphragm can be used, and more particularly any metal diaphragm, of sheet metal. This metal diaphragm c can be gripped or held at its circumference, as shown in Fig. 5, between sharp edged projections b^2 on the upper disk b and rounded projections a^3 on the lower disk a, which latter are of a height and width respectively smaller than the depth and the width of the recesses provided between the first projections a^3. Inasmuch as the grooves in plate b are deeper than the coöperating ribs a^3 on plate a, annular recesses remain after the diaphragm is clamped in position, and these recesses become filled with the pressure fluid which thus forms a fluid packing. During the period of pressure the innermost recess receives a small quantity of the pressure fluid which leaks through the joint and forms a pressure packing at the recess. A similar packing is gradually formed in the adjacent surrounding recess, and so on. This packing operates both during the pressure and the suction strokes to increase the tightness of the joint.

The working chamber d can also be given any desired suitable shape differing from that shown in Fig. 1. It can be constituted (see Figs. 6 to 8) by a space formed by two halves of a bi-conical cavity, A and B, connected together by a prism C, the plan of

which is a compressed lozenge, the diaphragm *c* still remaining flat. The extremely open angle of the cone and of the prism makes it possible to do without the rounded off shape, without the more or less spherical cups in the walls, these forms being certainly less suitable for the preservation of any diaphragm, more particularly of a metal one.

The diaphragm need not absolutely engage against the perforated wall of the disk. Finally, the nature and the arrangement of the valves can vary as in any compressors.

Obviously, a diaphragm compressor can be used as a vacuum pump in which the desired vacuum is obtained by regulating the snifter. It can also be used as a liquid pump in special cases, or for preserving to the liquid its full purity.

The diaphragm compressor makes it possible to do away with parts in frictional contact, and consequently to avoid the heating due to such friction, in addition to that produced by the compression; as well as the difficulties of lubricating caused by such heating. Lubrication is done away with, which is a considerable advantage when it is possible that the gases corrode the lubricants, or when it is desired to avoid altering in any way the gas or the liquid introduced into the pump. The use of these compressors is more particularly advantageous when gases are treated, the purity of which it is desired to preserve, which corrode the lubricants and the packing, are injurious or must not leak, and necessitate an energetic cooling during the compression; moreover, these compressors can be operated from a distance, they can be used as engines with expansion of compressed gas in the event of lubrication being difficult in refrigerating installations etc.

Obviously these diaphragm compressors can be utilized generally for any purpose in which they can replace pumps or compressors.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a diaphragm compressor, the combination of a pair of dished plates forming a working chamber between their opposed dished faces, a diaphragm secured between the edges of said plates and vibrating in said chamber, a pump for operating said diaphragm, suction and discharge valves mounted in one of said plates, means permitting the operation of the pump to displace a larger volume of fluid than the capacity of the compression chamber, and means associated with the pump for bypassing a portion of the liquid at predetermined pressure in the pump chamber.

2. A diaphragm compressor comprising a working chamber formed between two dished plates, a diaphragm securely held between the edges of said plates and oscillating in said chamber, a pump for operating said diaphragm, suction and discharge valves mounted in one of the plates, as far as possible flush with that surface of the latter which faces the diaphragm, the suction and forcing pump being provided with a valve, opening at a certain pressure, and a snifter, which opens under a given vacuum.

3. A diaphragm compressor comprising a working chamber of bi-conical form, formed between two dished plates, both plates having a conical form with a very wide common base and a very small height and with the same inclination from their axis, in the opposite sense, a diaphragm securely held between the edges of said plates and oscillating in said chamber, a pump for operating said diaphragm, suction and discharge valves mounted in one of the plates, as far as possible flush with that surface of the latter which faces the diaphragm, and means for engaging as closely as possible said diaphragm against said plate during the discharge.

In testimony whereof I have signed my name to this specification.

HENRI CORBLIN.

Witnesses:
J. LEJENNE,
M. DEFERIMONT.