

Jan. 24, 1939.

J. A. PAASCHE

2,144,662

COMPRESSOR UNIT

Filed April 30, 1937

Fig. 1

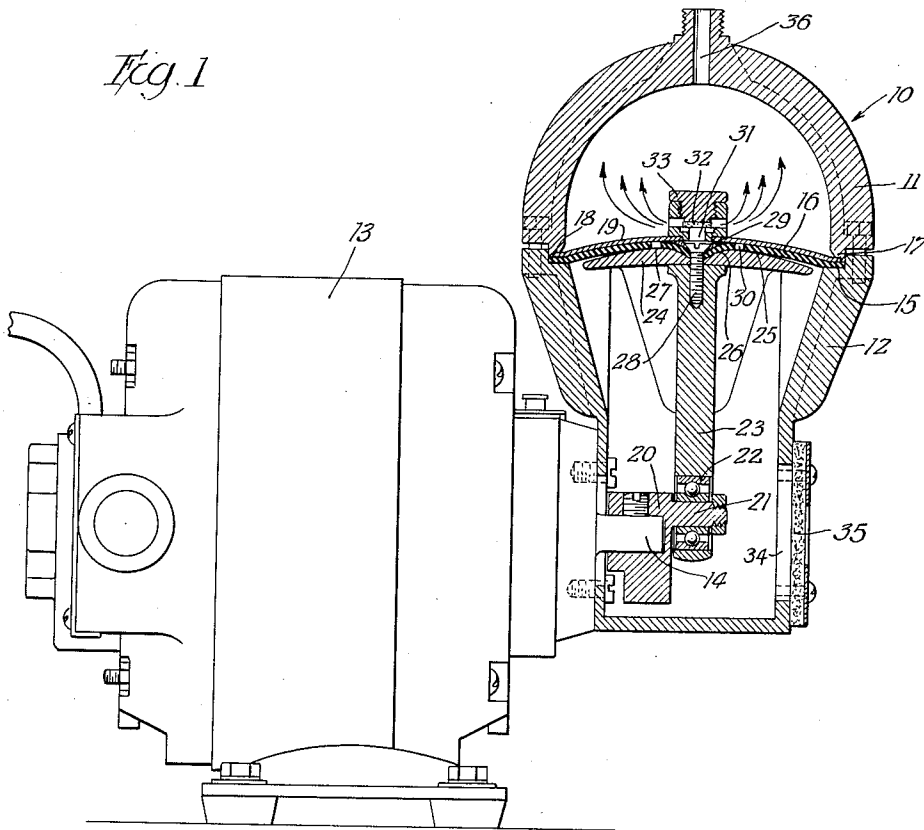


Fig. 2

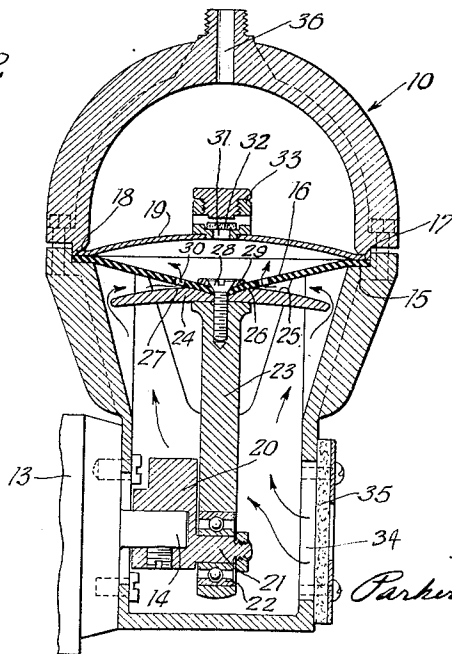
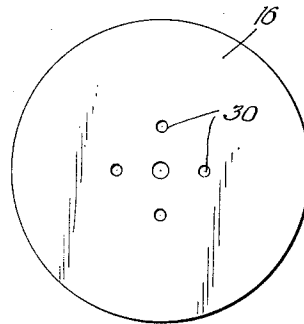


Fig. 3



Inventor
Jens A. Paasche

BY

Parker, Carlson, Pijner & Hubbard

Attorneys

UNITED STATES PATENT OFFICE

2,144,662

COMPRESSOR UNIT

Jens A. Paasche, Wilmette, Ill.

Application April 30, 1937, Serial No. 139,897

9 Claims. (Cl. 230—171)

The invention relates generally to compressor units or the like and more particularly to that type of unit which utilizes a flexible diaphragm as the means for applying a compression force.

5 An object of the invention is to provide a unit of this character which is of simple construction, for easy assembly, has relatively few moving parts, and in operation is exceedingly quiet and efficient.

10 Another object of the invention is to provide a unit in which the diaphragm itself is utilized in a novel and effective manner as a means for valving or controlling the flow of fluid through the unit.

15 More specifically stated, another object is to provide an improved compressor unit which embodies a casing having an internal partition arranged to cooperate with a movable diaphragm to place a fluid under pressure, and driving means 20 for the diaphragm which is so correlated with one or more flow apertures in the diaphragm as to control the flow of fluid into the space between the partition and diaphragm with high efficiency.

25 Other objects and advantages will become apparent in the following description and from the accompanying drawing, in which:

Figure 1 is a view of a compressor unit embodying the features of the invention, the unit 30 being shown in vertical central section.

Fig. 2 is a view similar to Fig. 1, but illustrates a different position of the operating mechanism.

Fig. 3 is a plan view of a diaphragm.

While the invention is susceptible of various 35 modifications and alternative constructions, I have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications 40 and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

With particular reference to Fig. 1, 10 designates generally a hollow casing which, in the present instance, is illustrated as being an upright, somewhat elongated dome-like structure formed of two horizontally divided parts, namely an upper section 11 and a lower section 12. These 50 sections are interfitting and are adapted to be suitably secured together. In this embodiment, the casing is supported by attaching its lower section to the housing of a driving motor 13, the armature 14 of which is arranged to extend into 55 the interior of the lower section.

Internally of the lower section, and spaced a short distance inwardly from its open face, is a shoulder 15 adapted to receive the marginal or peripheral portion of a flexible diaphragm 16 5 formed of a suitable material, such as rubber, leather or the like. The end face of the upper casing section has an axially concentric flange 17 projecting therefrom and adapted, when the casing sections are assembled, to abut the outer face of the diaphragm and bind it against the 10 shoulder 15. The flange 17 has an inwardly facing rabbetted groove 18 to receive the peripheral portion of a partition or wall 19 and binds the wall rigidly in place when the sections are assembled. Preferably, the face of the wall 15 15 which opposes the diaphragm, is concave.

The armature 14 of the driving motor has suitably affixed thereto a counterbalanced crank shaft 20 which includes a crank arm 21 located substantially centrally of the casing. Through 20 a suitable antifriction bearing 22, the crank arm 21 is connected with a pitman or connecting rod 23 disposed to extend generally upwardly along the axis of the casing. The upper end of the connecting rod carries a head 24 in the form of 25 a disk of substantial diameter adjacent to and underlying the diaphragm 16. The diaphragm opposing face 25 of the head is convex substantially complementary to the concave surface of the partition 19, and the parts are so arranged that 30 when the head is in its uppermost position, there is very little or no space between the head, the diaphragm and the partition.

Centrally, the face 25 is arcuately depressed, as at 26, to provide an annular peak 27 or high 35 point on the face of the head disposed concentrically of and relatively close to the axis. The diaphragm follows the surface contour of the face into the depression, and such means as a screw 28, passing through the head and into 40 screw threaded engagement with the connecting rod on the axis of the assembly, unites the diaphragm, head and connecting rod. Preferably, a washer 29 or the like is interposed between the head of the screw and the diaphragm, and this 45 washer may be of substantial diameter to bind the diaphragm against the head at a point relatively close to the peak 27. The diaphragm is apertured in substantial opposition to the high point on the head and, in this instance, a plu- 50 rality of apertures 30 (Fig. 3), arranged in generally circular series axially of the assembly, is employed.

In operation, and considering that the parts are in the relationship assumed at the end of the 55

compression stroke, as shown in Fig. 1, movement of the head downwardly results in a gradual separation of the diaphragm from the head due to the convex surface of the head. Because of the relationship between the apertures in the diaphragm and the high point on the head, it will be evident that when the head reaches the end of its reciprocatory stroke more remote from the partition, the apertures will be open permitting an inflow of fluid to the space between the diaphragm and the partition as indicated by the arrows in Fig. 2. Immediately upon the start of the compression stroke, the high point on the head moves into closing relation to the diaphragm apertures, thus trapping the fluid between the diaphragm and the partition without lost motion and without permitting the escape of any of the trapped fluid. As the compression stroke proceeds, fluid between the diaphragm and partition is placed under pressure and allowed to escape through a port 31 in the partition which is controlled by a check valve 32 mounted in a valve housing 33 carried axially by the partition. The convex and concave relationship of the head and partition insures that the full energy of the compression stroke will be utilized to expel all of the fluid from the space between the diaphragm and the partition.

In the present embodiment, in which the compressor unit is of the type adapted for placing air under pressure, intake of air to the low pressure side of the diaphragm is through an aperture 34 formed in the lower casing section opposite to the crank shaft assembly. Preferably the aperture is covered by a suitable air filter 35 of felt or the like. The outlet for compressed fluid is through a passageway 36 communicating through the upper casing section with the high pressure side of the diaphragm.

It will be evident from the foregoing that a novel compressor unit has been provided which is quite simple in construction and may be manufactured and sold at a relatively low cost. All of the parts are constructed and arranged for convenient and rapid assembly and are quickly available for inspection and repair. The unit is highly efficient in operation, since all of the pressure fluid which is drawn into the space between the diaphragm and the partition is trapped therein without loss of fluid immediately the compression stroke starts and all of the trapped fluid is expelled from said space. The general arrangement of the various elements constituting the unit and, in particular, the disposition of the fixed partition within the casing produces a unit which is exceedingly quiet in operation.

I claim as my invention:

1. A compressor for air or other fluids comprising, in combination, a hollow casing composed of a pair of complementary sections, a concave partition extending across the interior of said casing and peripherally supported between said sections, a flexible diaphragm disposed on the concave side of said partition and peripherally secured between said sections, a disk-like head on the side of said diaphragm opposite said partition having a convex face substantially the complement of the concave partition, means for securing said diaphragm substantially axially to said head, means for reciprocating said head to move said diaphragm toward and away from said partition, said diaphragm having a plurality of apertures therein arranged substantially concentrically about the securing means, said apertures being disposed closely adjacent to said securing

means in that part of the diaphragm which separates only a short distance from the head during the last portion of head movement away from said partition, whereby the apertures serve as valve ports and are only open substantially at the remote transition point of the head relative to the partition, inlet and outlet openings in the casing on the head and partition sides of the diaphragm respectively, and a check valve carried by the partition arranged to permit a flow only from the space between the diaphragm and partition.

2. A compressor for air or other fluids comprising, in combination, a hollow casing, a concave partition extending across the interior of said casing, a peripherally supported flexible diaphragm disposed on the concave side of said partition, a head of substantial size on the side of said diaphragm opposite said partition having a convex face substantially the complement of the concave partition, means for securing said diaphragm centrally to said head, means for reciprocating said head to move said diaphragm toward and away from said partition, said diaphragm having a plurality of apertures therein disposed closely adjacent to said securing means to be closed by abutment with said head during the major portion of a reciprocatory stroke and to be open only during movement of the head through its transition point remote from the partition, inlet and outlet openings in the casing on the head and partition sides of the diaphragm respectively, and a check valve carried by the partition arranged to permit a flow only from the space between the diaphragm and partition.

3. A compressor for air or other fluids comprising, in combination, a hollow casing, a partition extending across the interior of said casing, a peripherally supported diaphragm disposed adjacent to said partition, a head on the side of said diaphragm opposite said partition having a convex face, means for securing said diaphragm substantially centrally to said head, means for reciprocating said head to move said diaphragm toward and away from said partition, said diaphragm being apertured closely adjacent to said securing means for cooperation with underlying portions of said convex face to provide a valve action controlling the admission of fluid to the space between the diaphragm and partition, said convex face being shaped to permit of aperture exposing separation of the diaphragm therefrom substantially only at the remote transition point of the head relative to the partition, inlet and outlet openings in the casing on the head and partition sides of the diaphragm respectively, and a check valve arranged to permit a flow only from the space between the diaphragm and partition.

4. In a compressor unit, the combination of a hollow casing having a fixed partition therein and a reciprocatory head opposing said partition, a diaphragm interposed between said head and partition, means connecting said diaphragm substantially centrally with said head, said diaphragm being apertured to permit of a flow of fluid therethrough, said head having a convex face opposing said diaphragm arranged in the reciprocation of the head to occupy a spaced relation to the apertured portion of the diaphragm only when the head is remote from the partition, and passageways for allowing fluid to flow through said casing including a check valve for preventing a return flow through the partition into the space between the diaphragm and partition.

5. In a compressor unit of the character de-

scribed, the combination of a hollow casing having a transversely extending diaphragm therein dividing the casing into low pressure and high pressure sides, a fixed wall on the high pressure side of and adjoining said diaphragm and having a check valve thereon permitting a flow through the partition away from said diaphragm, and a reciprocatory head secured to said diaphragm on the low pressure side thereof, said diaphragm being apertured within the peripheral outline of said head for coaction with said head to open the apertures while said head moves away from said wall and close said apertures upon reverse movement of the head.

6. In a compressor unit of the character described, the combination of a hollow casing having a transversely extending diaphragm therein, a reciprocatory head having a diaphragm opposing face which is generally convex and has an axial depression providing an annular peak adjacent to the axis thereof, means for securing said diaphragm to said head with the diaphragm axially turned into the depression, said diaphragm being apertured in opposition to the peak so that the passage therethrough provided when the head is drawn away from the diaphragm is closed immediately upon initial movement of the head toward the diaphragm, and means for trapping the pressure fluid created by the movement of the diaphragm after the head has closed the aperture therein.

7. In a compressor unit of the character described, the combination of a hollow casing having a transversely extending diaphragm therein, a reciprocatory head having a diaphragm opposing face provided with a substantially annular

high portion, means for securing said diaphragm to said head to permit the diaphragm to follow the contour of said face, said diaphragm having apertures disposed to oppose said high portion so that fluid flow through said apertures is possible only when the head is drawn away from the diaphragm, said high portion being arranged to engage said diaphragm and close said apertures upon initial movement of the head toward the diaphragm, and means for trapping the pressure fluid created by the movement of the diaphragm after the head has closed the apertures therein.

8. In a compressor unit, the combination which includes a flexible diaphragm, a housing therefor having means for peripherally supporting said diaphragm, a reciprocatory member, and means for connecting said diaphragm to said member, said diaphragm having at least one aperture therein to permit a flow of fluid therethrough, said member having a high point in opposition to an aperture for cooperation therewith to prevent a flow therethrough except substantially in one extreme position of reciprocation.

9. In a compressor unit of the reciprocatory flexible diaphragm type, the combination of a flexible diaphragm apertured to permit a flow of fluid therethrough, and means for imparting reciprocatory movement to said diaphragm including a member having a surface adjoining the apertured part of said diaphragm and shaped for closing association therewith to prevent said flow except when said means is substantially at the point of transition from intake stroke to pressure stroke.

JENS A. PAASCHE.