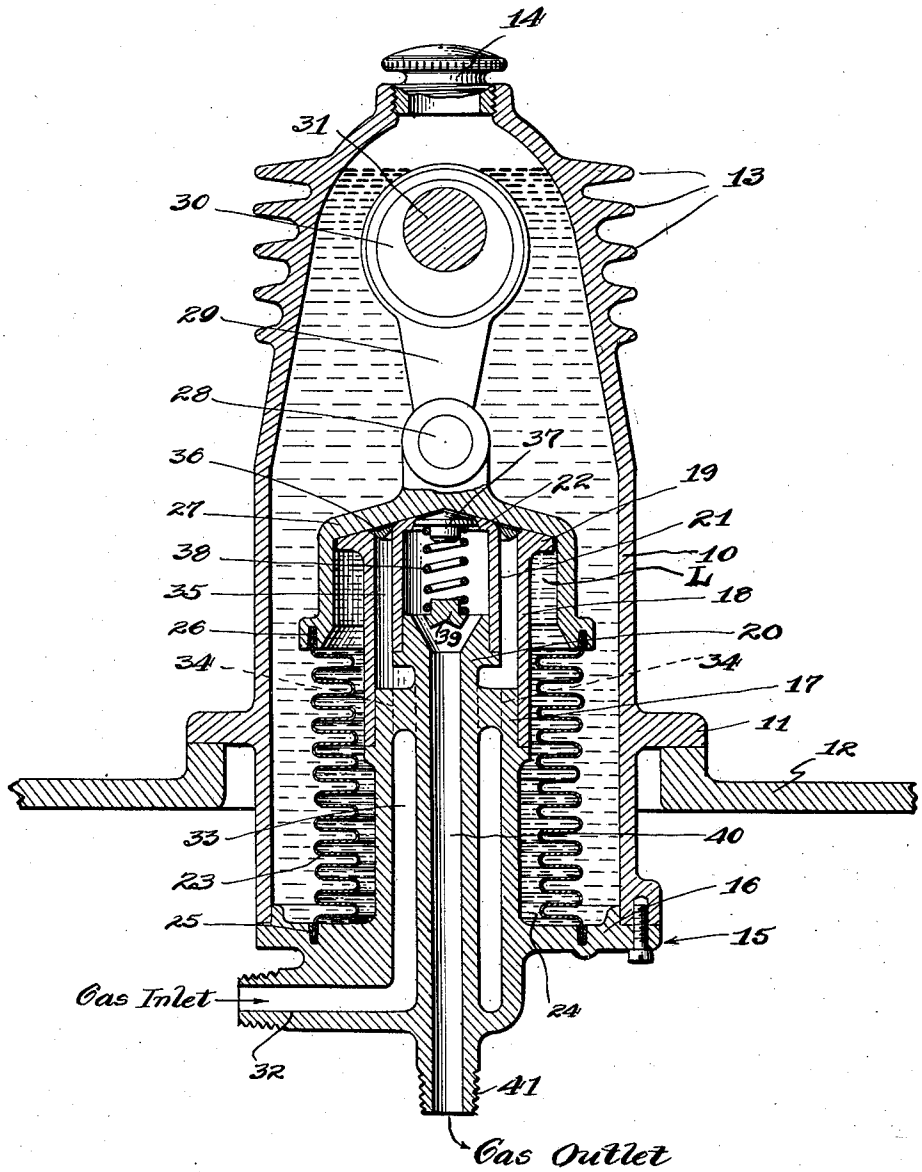
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COMPRESSOR

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COMPRESSOR

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This invention relates to pumps or compressors and more particularly to improvements in gas compressors involving a fundamentally new basic principle and a novel and ingenious construction or arrangement of parts and elements.

The invention contemplates, in a gas compressor or the like, the use of an elastic or expansible chamber filled with a fluid, liquid, semi-solid or solid or a combination of any two or more of these, for the purpose of reducing the clearance space to render possible the compression of a gas to a higher pressure than would be otherwise possible.

The use of an elastic or expansible chamber as a piston and compression chamber results in several noteworthy advantages, not the least of which is the prevention of leakage of the compressed gas past or around the piston. Obviously in using such a chamber the ends thereof may be permanently sealed so that the gas entering therein to be compressed is prevented from escaping.

However, the use of an expansible or elastic chamber requires the solution of several problems if such an apparatus is to function entirely satisfactorily and efficiently. One of the more important of these problems is that of reducing the clearance space in the chamber so that the gas or the like may be compressed to the desired degree as obviously too great clearance in the chamber will result in the attainment of only a low pressure and a consequent inefficient pumping action. Furthermore with elastic or expansible chambers, which are customarily constructed of metal or the like, it is necessary that the bending or flexing action transmitted or imparted to the several folds or pleats of the chamber, be of a degree well within the elastic limits of the material so as to prevent fatigue and failure thereof. Consequently the greatest efficiency is attained when the elastic or expansible chamber is of a relatively large size including a relatively large number of folds or pleats so that the flexing or bending of each pleat, during the collapsing and expanding of the chamber, is at a minimum. With a relatively large expansible chamber the need for a reduction in the clearance space is more forcibly emphasized as otherwise the relative inefficiency of the pumping operation would preclude its adoption commercially.

The invention therefore contemplates an elastic or expansible chamber filled, as aforesaid, with fluid, liquid, semi-solid or solid or a combination of two or more of any of these, for the purpose of reducing the clearance space within the chamber so that as the chamber is expanded and collapsed, the head constituted by the level of any of the filler mediums aforementioned, will be displaced to compress and expel the gas or vapor as is customary in compressors of the conventional designs.

While it is readily apparent that the invention finds practical utility in many types of apparatus, it may be used to particular advantage in apparatus wherein it is desired to pump a gas or the like wherein special efforts are necessary to prevent a leakage of the gas past the piston. Thus, the invention may be used to advantage in refrigerating apparatus as a compressor pump for compressing the refrigerant because in some characters of refrigerating apparatus considerable difficulty is experienced in preventing a leakage of the refrigerant past the piston of the compressor where it frequently escapes and mixes with the lubricant with consequential detrimental effect or escapes from the system where the driving shaft goes through compressor housing.

Various other objects, advantages and novel details of construction of the invention will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings wherein two illustrative embodiments of the invention are shown and wherein

The figure is a longitudinal sectional view through a pump constructed in accordance with my invention.

Referring now particularly to the figure, it will be noted that I have shown a casing or jacket 10 constituting the outer housing of the pump which may conveniently be supported as, for instance, by supporting legs or lugs 11 to a fixed support 12. The jacket

10 may be provided with one or more ribs 13 to increase the radiating surface thereof for effecting a more efficient cooling and further with a removable closure 14 whereby the interior of the jacket 10 may be filled with the oil or the like which not only constitutes a lubricating medium but also a cooling medium for the parts immersed therein.

The reference character 15 indicates a casting including a circular plate-like head portion removably secured to the open end of the jacket 10 and with a concentrically arranged portion 17 projecting interiorly of the jacket 10. The end of the projecting portion 17 is here shown as shouldered to support a sleeve-like member 18 which is provided at its upper end with a laterally extending flange or projection 19. The relatively reduced end 20 of the extension 17 is likewise shouldered to receive and support a sleeve-like element 21 provided at its upper edge with an inwardly directed flange or extension 22.

The reference character 23 indicates a bellows or elastic or expansible member defining a chamber 24, this member being joined as at 25 to the head 16 and as at 26 to a cup-shaped cap member 27. Obviously the joints 25 and 26 will be sealed to prevent the escape of the contents of the chamber 24. The cap member 27 has a wrist pin connection 28 with a connecting rod 29 connected to an eccentric 30 of a shaft 31. Upon the rotation of the shaft 31 the connecting rod 29 will be vertically reciprocated to impart a like motion to the cap member 27 which in turn will expand and collapse the elastic chamber member 23.

The gas inlet nozzle is indicated by the reference character 32 and connects with an annular passage 33 formed in the extension 17. This annular passage communicates by one or more openings 34 with an annular passage 35 provided by the spaced sleeves 18 and 21. The upper ends of these sleeves adjacent the end of the annular passage 35 are shaped to provide a valve seat for a valve 36, here shown as a gravity seated ring valve. The annular flange 22 on the sleeve member 21 is formed with a valve seat for a valve 37 which is herein shown as being held in seated position by means of a spring 38 bearing thereagainst and against a nipple or lug 39 projecting from the end of the extension 17. The reference character 40 indicates a central bore or passage which connects with a nipple 41 and constitutes the gas outlet. The lateral flange 19 on the sleeve 18 extends to a point adjacent the circular side wall of the cap member 27 but a clearance is provided between these parts as the annular flange 19 functions purely as an anti-splash element for the contents of the chamber 24 when liquid is employed.

The operation of this invention is as follows: The liquid or fluid is placed in the chamber 24 to a level, for instance, substantially coincident with the lower surface of the annular flange 19 so as to reduce the clearance between the lower end of the expansible chamber and its upper end. When, thereafter, the crank shaft 31 is rotated to reciprocate the cap member 27 the elastic element 23 will be successively expanded and collapsed, it being shown in the present instance in collapsed position. During the expanding movement the cap member 27 is moved upwardly and gas to be compressed is drawn in through nipple 32, passage 33, openings 34 and passage 35 and past valve 36 which is thereupon lifted and into the chamber defined by the cap member 27 on the one hand and the level of the liquid L and the solid elements 19 and 22 on the other. Upon the collapsing of the member 23 or the movement of the cap member 27 in a downward direction, the valve 36 will close and the valve 37 will open against the pressure of spring 38 to permit the escape of the gas compressed upon this compression operation of the pump. The compressed gas will flow through the passage 40 and out through the nipple 41.

Obviously there is no likelihood whatsoever of the gas which enters the expansible chamber leaking therefrom as the chamber is sealed throughout. Consequently there is no loss of gas and no likelihood of the same becoming mixed with the lubricant or other medium which surrounds the expansible chamber and which is contained within the jacket 10. Obviously the continued expansion and collapsing of the element 23 and the movement of the other parts will generate heat but the lubricant contained within the jacket 10 will function effectively as a cooling medium in addition to lubricating the parts. The clearance in the expansible chamber may be varied at will by adding or removing the medium L placed in the chamber 24. It will be noted that the inner diameter of the cap 27 is somewhat less than the greatest diameter of the bellows so that upon the collapsing of the bellows the rise of the medium L will be at a faster rate than if the diameters of the aforesaid members were of the same size. In other words a long stroke of the piston may be obtained by a relatively short stroke or movement of the bellows by such an arrangement.

It will be readily apparent that this provides for a more efficient operation of the pump and greatly facilitates the compression of the material upon the downward movement of the cap and bellows.

The underlying principle of the present invention as disclosed in the illustrative embodiment herein shown and described, is capable of expression in numerous forms of

construction and it should accordingly be understood that no limitation should be imposed upon the invention by reason of any of the details of construction or specific arrangements of parts herein shown and described. Reservation is therefore made to make such changes in the essential and all of the non-essential details of the invention as may come within the purview of the accompanying claims.

What I claim as my invention is:

1. In a compressor, a variable member cooperating with a portion of the compressor to form a chamber wall for receiving and enclosing the material to be compressed and a medium in said chamber for reducing the clearance space of said chamber.

2. In a compressor an expansible member cooperating with a portion of the compressor to form a chamber wall for receiving and enclosing the material to be compressed and a medium in said chamber for reducing the clearance space thereof.

3. In a compressor, a bellows-like member sealed at one end to a part of the compressor structure, a reciprocating element having a sealed connection with the other end of said bellows-like member, said bellows-like member and the said associated parts constituting the wall of a chamber for receiving the material to be compressed, and a medium in said chamber for reducing the clearance space thereof.

4. In a compressor, a bellows-like member sealed at one end to a part of the compressor structure, a reciprocating element having a sealed connection with the other end of said bellows-like member, said bellows-like member and the said associated parts constituting the wall of a chamber for receiving the material to be compressed, a medium in said chamber for reducing the clearance space thereof and means for actuating said reciprocating element to expand and collapse said bellows-like member.

5. In a compressor construction, a bellows-like element connected respectively to fixed and reciprocating parts of said compressor and constituting therewith the wall of a chamber, a valve controlled inlet and outlet passages communicating with said chamber and a medium for reducing the clearance space of said chamber.

6. In a compressor construction, a bellows-like element connected respectively to fixed and reciprocating parts of said compressor and constituting therewith the wall of a chamber, valve controlled inlet and outlet passages communicating with said chamber and fluid means for reducing the clearance space of said chamber.

7. In a compressor construction, a bellows-like element connected respectively to fixed and reciprocating parts of said compressor and constituting therewith the wall of a chamber, valve controlled inlet and outlet passages communicating with said chamber, means for reducing the clearance space of said chamber and a medium for expanding and collapsing said bellows-like element.

8. In a compressor, a bellows-like member sealed at one end to a part of the compressor structure, a reciprocating element having a sealed connection with the other end of said bellows-like member, said bellows-like member and the said associated parts constituting the chamber for receiving the material to be compressed, means in said chamber for reducing the clearance space thereof and constituting a piston, the fluid piston being of greater diameter within the bellows-like member than above the same when said member is extended, whereby a long stroke of the piston may be effected by a relatively short stroke of the bellows-like member.

9. In a compressor, a cylindrical bellows-like member sealed at one end to a part of the compressor structure, a cylindrical reciprocating element having a sealed connection with the other end of said bellows-like member, said bellows-like member and the associated parts constituting the chamber for receiving the material to be compressed, a fluid in said chamber constituting a piston for compressing the material, the fluid piston being of greater diameter within the bellows-like member than above the same when said member is extended whereby a short stroke of said bellows-like member will produce a relatively long stroke of said piston.

10. In a compressor, a bellows-like member secured at one end to a part of the compressor structure, a cap-like element secured to the other end of said member and constituting therewith a chamber for receiving the material to be compressed, and filler means in said chamber for reducing the clearance space thereof.

11. In a compressor, a bellows-like member secured at one end to a part of the compressor structure, a cap-like element secured to the other end of said member and constituting therewith a chamber for receiving the material to be compressed, filler means in said chamber for reducing the clearance space thereof, and means for expanding and collapsing said bellows-like element including a part secured to said cap-like element.

12. In a compressor, a bellows-like member secured at one end to a part of the compressor structure, a cap-like element secured to the other end of said member and constituting therewith a chamber for receiving the material to be compressed, filler means in said chamber for reducing the clearance space thereof, valve controlled inlet and outlet passages communicating with said chamber adjacent said cap-like element, and means for reducing the clearance space of said chamber.

13. In a compressor, a bellows-like member

secured at one end to a part of the compressor structure, a cap-like element secured to the other end of said member and constituting therewith a chamber for receiving the material to be compressed, filler means in said chamber for reducing the clearance space thereof, and constituting a fluid piston for compressing the material in said chamber.

14. In a device of the class described, a bellows, a piston at one end of and operatively connected to said bellows, a medium within the bellows and substantially filling the same when contracted, and means operable when the bellows is expanded for admitting a fluid between the piston and the head of the medium whereby as the bellows is again contracted the fluid will be compressed between said head and piston.

15. In a device of the class described, a fixed part and a reciprocating part, a contractible and expansible bellows terminally connected to said parts, a medium within the bellows and substantially filling the same when contracted, and means operable when the bellows is expanded for admitting a fluid between the reciprocating part and the head of the medium, whereby as the bellows is again contracted the fluid will be compressed between said head and piston.

In testimony whereof I affix my signature.

HAROLD A. GREENWALD.