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HIGH PRESSURE COMPRESSORS

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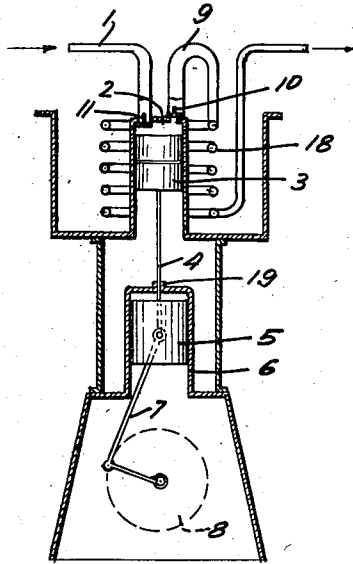


FIG. 1

FIG. 2



FIG. 2a

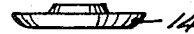


FIG. 2b

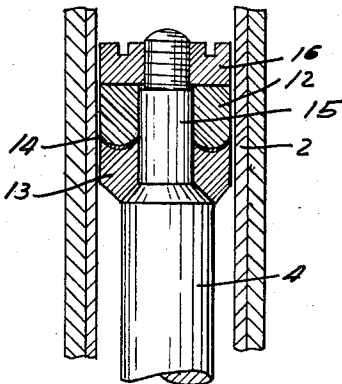
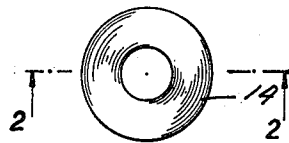


FIG. 3

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HIGH PRESSURE COMPRESSORS

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1 Claim. (Cl. 309—23)

This invention relates to improvements on high pressure compressors, particularly, those employed in filling cylinders with oxygen for their distribution to the users.

The great pressures required in the operation of filling cylinders with oxygen demand the closest clearances, specially where the walls of the piston and cylinder of the compressor are in contact.

In compressors not specially made for bottling oxygen, the preceding condition is satisfied by means of leather or fiber packings lubricated with oils of adequate density. Pistons provided with metal expansion rings lubricated with mineral oils are also used.

Due to the fact that the use of lubricating oils is not permissible when compressing oxygen, the employment of pistons with metallic rings and the use of packings made of materials requiring some type of lubricants must be discarded.

With respect to this problem, the solution adopted up to the present has consisted in the employment of pistons provided with packings made of leather or vegetable fibers lubricated by water to which a certain amount of glycerin was added. This solution is not satisfactory because it causes two important troubles. The first one derives from the very intense wear of the packings due to the hard conditions of work. The second one, perhaps the more important, derives from the fact that the lubricant, water and glycerin, produces a humidification of the oxygen that, in general, exceeds the specified tolerances. In such cases, the oxygen must be submitted to drying processes which delay the bottling operations and raise the cost of the product.

The said troubles are satisfactorily solved by using an improved piston of constructive characteristics such that an elastic packing, of particular conditions, is apt to perform its function without the intervention of lubricants of any kind.

The elimination of the drying processes of the oxygen, added to the fact that the wear of the elastic packing is practically null, allows to affirm that the improvements of the invention have solved the only great problem that the bottled oxygen industry has faced up to the present.

From a strictly constructive point of view, the elimination of the lubricant is justified by two cooperating factors: the cooling system of the piston, which makes possible the continuous cooling of the packing, whose temperature rises considerably due to the heat developed by friction and by the compression of the gas; and the nature of the packing material, which is apt to suffer, without considerable wear and without losing its elastic characteristics, the very hard working conditions derived from the lack of lubricant.

In this way, the introduction of a packing made of a new material, not used before in this type of work, associated to the development of an adequate cooling system for the said packing, all these features being based on the particular characteristics of the piston whereon the packing is mounted, are the fundamental novelties of the present invention.

In particular, with respect to the packing, it may be said that the elastic material offering the best conditions in this case is nylon. This product is apt to be molded in the shape more adequate to that purpose and, at the same time, has the following advantages: maximum resistance against wear by friction; great elasticity, which allows the packing to adapt itself to the shape and diameter of the cylinder during the work of the piston and to recover immediately its original shape and main tension when at rest; dry-work, not requiring lubricating fluids of any kind. Furthermore, a nylon packing is very terse and smooth, thus permitting the complete sealing of the portions in contact between the peripheral nylon and the cylinder sleeve.

Thus, the resistance of this material in relation to the very high pressures developed during the compression assures, in other way, the efficiency and good performance of each stroke due to the elimination of gas leakages between the packing and the cylinder sleeve during both the compression and expansion strokes.

With reference to the piston, in relation to its particular constitution and its cooling system, it is possible to affirm that a particularly satisfactory construction is that constituted by two solid metal sections reciprocally adjustable by means of adequate means.

The reciprocally facing surfaces of the said two sections, between which the packing is imprisoned, have corresponding concave and convex surfaces in order to allow their assemblage as a unit.

The concave and convex surfaces are shaped so that the progressive compression of the packing results in the proportional increase of thickness of the free periphery of the packing. This condition renders possible to increase or decrease the bearing surface of the packing edge against the cylinder sleeve.

It is possible, in this way, that the nylon disk constituting the packing presents, in a cross-sectional view, flat opposed faces and also thicker portions provided with slits and folds and adopting a regularly concentric disposition.

It is also possible, according to the requirements of each case, that the packing adopts the shape of a cap.

The assembly is water-cooled; the water being cooled by a refrigerating agent flowing through a coiled-tube surrounding the cylinder.

Thus, the heat developed by the friction of the packing against the cylinder body is partially transmitted to the cylinder body and partially absorbed by the packing itself. The heat transmitted to the cylinder body is delivered to the liquid bathing the said cylinder body, and the heat absorbed by the packing is transmitted by conductivity to the large metallic mass constituting the piston and it is easily delivered to the outside due to the fact that the said piston is in permanently cooled medium.

In this way, and applying exclusively the resorts of the invention, all the problems derived from overheating, and the ruin of the packing derived from the lack of lubricant, are avoided.

Another characteristic of the improved compressor, directly resulting in a better performance of the unit, is the fact that the piston is provided with guiding means for its correct alternative movement.

The said means are constituted by a rod fixed at one end to the piston and coupled at the other end to a piston slidably lodged inside a guiding cylinder well lubricated. The latter piston is in relation with a connecting rod coupled to the driving unit of the assembly.

The rod coupling the said elements runs inside a stuffing box provided in the wall of the guiding cylinder, the oil-tightness of the said stuffing-box being such that there

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is no possibility at all for the lubricating oil to get into the cylinder wherein the oxygen is compressed.

Fig. 1 is a sectional and schematic view of the improved compressor of the invention.

Fig. 2 illustrates different views of a nylon packing.

Fig. 3 shows a detail of a section of the piston and the cylinder wherein the former is lodged.

According to Fig. 1, the oxygen in gaseous condition is fed through the pipe 1 to the inside of a cylinder 2 inside of which a piston 3, when moved by the rod 4, operates. The rod 4 is associated to a guiding piston 5 lodged inside a guiding cylinder 6 which is satisfactorily lubricated. The piston 5 is related to a pair of connecting rods 7 which transmit the drive of a driving organ 8.

The exhaust of compressed oxygen takes place through the exhaust valve 10 and the pipe 9 following the latter, the exhaust valve operating in the sense opposed to that of the intake valve 11 placed at the end of the pipe 1. The piston 3, represented in detail in Fig. 3, is constituted by two metallic sections 12 and 13 whose facing surfaces are convex and concave, respectively.

The particular shape of these surfaces, as Fig. 3 clearly illustrates, allows for the compression and deformation, in a particular way, of the nylon packing 14 by means of a screw 15 and the nut 16. In effect, the packing 14, Fig. 2, when progressively compressed, modifies its shape enlarging its peripheral circumference, intensifying thus its contact against the cylinder sleeve.

The assembly is completed by a coiled tube 18 inside of which circulates a refrigerating agent apt to cool the

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liquid bathing the cylinder 2 and contained in the recipient enclosing the said cylinder.

It is also remarkable the fact that the guiding cylinder 6 is provided with a stuffing box 19 which prevents the lubricating oil to pass to the cylinder 2 wherein the oxygen is compressed.

The compressor of the invention operates in a way similar to that of the compressors already known, only differing in relation to the novel details.

What is claimed as new and desired to be secured by Letters Patent is:

In a compressor for oxygen or the like, in combination, a cylinder; a piston slidable in said cylinder; a packing contacting said piston and cylinder and made of a material having the properties of nylon, said packing being free of lubricant; means cooperating with said packing for cooling the same, said piston having a pair of portions respectively provided with concave-convex faces and said packing having a disc-shaped central portion gripped between said faces; and adjusting means cooperating with said piston portions for adjusting the latter with respect to each other to deform said packing so as to adjust the circumference thereof which engages said cylinder.

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