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PISTON-TYPE COMPRESSOR WITH AUTOMATIC CHECK VALVES

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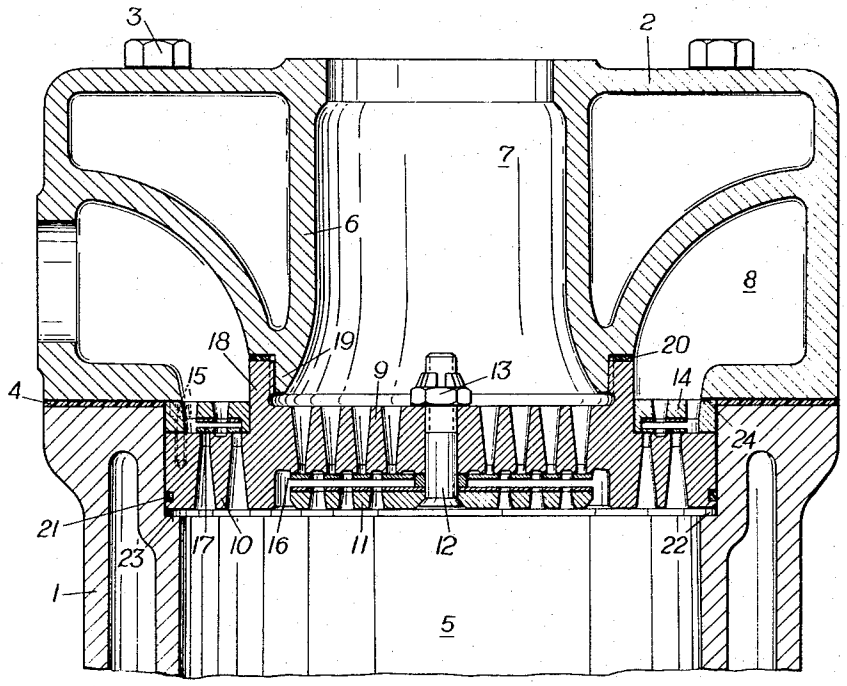

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PISTON-TYPE COMPRESSOR WITH AUTOMATIC CHECK VALVES

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This invention relates to a piston-type compressor comprising two automatic check-valves, at least one of which is secured to the cylinder head in coaxial relation to the cylinder, said valve protruding into the cylinder and being sealed off against same at its outer shell.

In a conventional compressor of this type the suction and delivery valves are combined to form a concentrical valve assembly comprising a valve seat and a valve guard formed by two disk-shaped members interconnected by means of a central bolt located in the valve axis, said central bolt having an extension and serving also for the attachment of the concentrical valve assembly to the cylinder head of the compressor, thereby pressing the concentrical valve assembly between the internal suction valve and the external delivery valve against the tubular partition between the suction chamber and the delivery chamber of the cylinder head. The said concentrical valve assembly protrudes into the cylinder bore against which the outer shell of the valve assembly is sealed off by means of a gasket.

As compared with conventional types wherein the valves are clamped between the cylinder head and the front end of the cylinder, this design offers the advantage of providing a single sealing surface between the cylinder head and the cylinder only. Furthermore, the attachment of the valves to the cylinder head facilitates the assembling of the compressor. Against this, a drawback of this design resides in the fact that the central bolt serving for the attachment of the valve assembly to the cylinder head and also the seat and guard members of the valves are to be of comparatively rugged construction so as to provide adequate stability, which causes a generally objectionable increase of the dead space of the compressor. If the central bolt breaks, the valve assembly is liable to fall into the cylinder causing considerable damage or even the destruction of vital elements of the compressor. Another shortcoming is due to the occurrence of leakage losses between the suction chamber and the pressure chamber of the cylinder head, since in particular high pressures are liable to produce leaks in the contact surface between the valve assembly and the partition of the cylinder head.

It is the object of the invention to improve upon the design of compressors as hereabove described and to avoid the drawbacks of the conventional design.

The invention consists in a piston-type compressor with automatic check-valves, at least one of which is secured to the cylinder head in coaxial relation to the cylinder, said valve protruding into the cylinder and being sealed off against the cylinder on its outer shell, the seat body of the said valve being provided with a cylindrical thread lug on the side facing the cylinder head, the said thread lug being screwed onto a tubular lug of the cylinder head. By this means the valves of the compressor are positively connected with the cylinder head, either in addition to their attachment by means of the said central bolt or instead of same at a point located farther outside the valve axis, so that the risk of loosening of the connection between the valve and the cylinder head during the operation of the compressor and the shortcomings connected therewith are eliminated to a considerable extent. In that case, the seat and guard members of the valve can be considerably thinner than with the conventional design, thereby saving materials and reducing the objectionable dead space of the compressor.

The design according to the invention is suitable both for compressors comprising a single valve secured to the cylinder head, for example for uniflow-type compressors, and for compressors comprising a concentrical valve assembly composed of a suction and a delivery valve and secured to the cylinder head. In connection with the latter design the invention provides for a thread lug between the suction and pressure chambers of the cylinder head on the seat body of the suction valve preferably cast integral with the seat body of the delivery valve, the tubular lug of the cylinder head separating the suction chamber from the pressure chamber. The fact that the concentrical valve assembly and the cylinder head are screwed together also provides positive sealing between the suction and pressure chambers. For the purpose, either the thread may be appropriately sealed or a soft packing may be used, if necessary. Leakage losses between the suction and pressure chambers are thereby positively avoided also when higher pressures prevail.

The valve according to the invention may protrude into a cylindrical extension on top of the cylinder bore of the compressor. In that case, the installation cross-section of the valve and/or of the concentrical valve assembly is larger than the cross-section of the cylinder bore of the compressor, at least the marginal area of the valve where no ports are provided being located outside the periphery of the cylinder so that it will be possible to take better advantage of the available cross-section for flow purposes. Another advantage of this arrangement resides in the fact that the valve is prevented from falling into the cylinder bore.

According to another embodiment of the invention the valve or the valve assembly may, in addition to being screwed onto the cylinder head, abut against the latter with its outer periphery, the said cylinder head preferably presenting a continuous annular surface protruding from the outside over and above the rim of the valve or valve assembly. This provides a positive seat of the valve or valve assembly on the cylinder head without the need for a tight fit of the threaded connection, thus precluding the risk of seizing of the thread. In addition, the lugs provided on the cylinder head or the continuous annular surface, particularly of valves consisting of a concentrical valve assembly, can also be used for the locking of such bolts as may be provided for the interconnection of the seat body and the valve guard of the external valve.

Further optional details of the invention will appear from the following description of an embodiment of the invention with reference to the accompanying drawing illustrating a piston-type compressor according to the invention, wherein the cylinder head and the top of the cylinder carrying the valve are shown in an axial cross-section.

In the embodiment illustrated the compressor comprises a cylinder **1** and a cylinder head **2** secured to the cylinder **1** by means of bolts **3**. Sealing between the cylinder **1** and the cylinder head **2** is provided by a gasket **4**. The cylinder **1** presents a cylinder bore **5**, and a cylindrical partition **6** defining the suction chamber **7** is provided inside the cylinder head **2**. The pressure chamber **8** is concentrically arranged around the suction chamber **7** in the cylinder head **2**.

The valves of the compressor are designed as a concentrical valve assembly comprising an internal suction valve and an external delivery valve, the seat body **9** of the suction valve being cast integral with the seat body **10** of the delivery valve, whereas the two valve guards are manufactured as separate units and secured to the associated seat bodies. The valve guard **11** of the suction valve is connected with the seat body **9** by means of a

central bolt **12** with nut **13** and inside the valve guard **14** of the delivery valve countersunk bolts **15** are distributed over its periphery and serve to secure the valve guard **14** to the seat body **10**. In both valves a valve plate and spring plates for the biasing of the valve plate are provided between the valve seat and the valve guard. The valve plate of the suction valve is designated by reference number **16** and that of the delivery valve by reference number **17**.

On the side facing the cylinder head **2** the concentrical valve assembly is provided with a cylindrical thread lug **18** screwed together with a tubular lug **19** of the cylinder head **2** provided at the lower end of the partition **6**, the said tubular lug extending from the seat body **9** of the internal suction valve and being located between the suction chamber **7** and the pressure chamber **8** of the cylinder head **2**, so that these two chambers are separated from each other by means of the tubular lug **19**, a soft packing **20** being inserted between the two lugs **18** and **19** for the purpose of ensuring positive sealing. The concentrical valve assembly screwed onto the cylinder head **2** protrudes into the cylinder **1** and is sealed against the latter on its outer shell by means of a gasket **21**.

In order to obtain the largest cross-sectional area of flow possible, the concentrical valve assembly is of a larger diameter than the cylinder bore **5**, which is topped by a cylindrical extension **22**, the valve assembly protruding into the said extension **22**. The step **23** thus defined between the cylinder bore **5** and the extension **22** is located in the proximity of the seat body **10** of the external delivery valve and prevents the valve removed from the cylinder head, for example, prior to assembling, from falling into the cylinder bore **5**. As can also be seen from the drawing, the upper outer rim of the concentrical valve assembly abuts tightly against an annular surface **24** of the cylinder head **2** serving as a contact surface and protruding from the outside over and above the rim of the valve assembly. When the valve assembly is screwed on to the cylinder head **2**, the annular surface **24** provides a limit stop so that the threaded portion between the lugs **18** and **19** is not required to be screwed in as far as its end, thereby precluding the risk of seizing even if unduly tightened. Preferably the annular surface **24** also overlaps the screws **15** countersunk in the valve guard **14**, thereby preventing them from falling out of place.

Various modifications of the embodiment of the invention shown are possible within the scope of the present invention. In particular, in addition to the screw connection between the valve assembly and the cylinder head **2** by means of the thread lugs **18** and **19**, the central bolt **12** may be extended and secured to the cylinder head **2** by means of an additional nut. For the purpose, the cylinder head **2**, may, for example, present radial ribs in the suction chamber **7** in which the central bolt engages. However, the invention may also be applied in connection with compressors comprising a single valve only arranged in coaxial relation to the cylinder, whereas the other valve is preferably located in lateral pockets or in the piston of the compressor. The thread lug serving to bolt the cylinder head **2** together with the valve is preferably located at a considerable distance from the valve axis, so as to hold the valve down positively and reliably under all operating conditions. Due to the positive connection between the valve and the cylinder head, the valve may protrude in the cylinder bore proper without the risk of the said connection getting loose during the operation of the compressor. All embodiments provide for a single sealing surface between the cylinder and the cylinder head, which greatly facilitates the assembly of both the valve and the compressor.

I claim:

1. A piston-type compressor comprising a cylinder and a cylinder head, automatic check-valves of which at least one is secured to the cylinder head in coaxial relation to the cylinder and protruding into the said cylinder and sealed off against the cylinder on its outer side, wherein the valve secured to the cylinder head comprising a seat body provided with a cylindrical threaded lug on a side facing the cylinder head, and a tubular lug on the cylinder head onto which the seat body of the valve is tightly screwed by means of the cylindrical threaded lug.

2. A piston-type compressor comprising a cylinder and a cylinder head, automatic check-valves consisting of a valve assembly secured to the said cylinder head and composed of a suction valve and a delivery valve arranged in concentric relationship to each other, the cylinder head having a tubular lug and suction and pressure chambers therein separated from each other by means of the tubular lug of the cylinder head, each of the said valves comprising a seat body, a cylindrical threaded lug provided on the seat body of the suction valve, and the said cylindrical threaded lug being screwed together with the tubular lug of the cylinder head.

3. A piston-type compressor as claimed in claim **2**, wherein the seat body of the suction valve is integral with the seat body of the delivery valve, the said cylindrical threaded lug being arranged on the seat body of the suction valve between the suction chamber and the pressure chamber of the cylinder head.

4. A piston-type compressor as claimed in claim **1**, wherein the cylinder presents a cylindrical extension at its end facing the cylinder head, the said valve being secured to the cylinder head in coaxial relation to the cylinder, protruding into the said extension.

5. A piston-type compressor as claimed in claim **1**, wherein the said valve secured to the cylinder head in coaxial relation to the cylinder abuts with its outer rim against the cylinder head in addition to the screw connection provided between the said tubular lug of the cylinder head and the cylindrical threaded lug provided on the seat body of the valve.

6. A piston-type compressor as claimed in claim **1**, wherein the cylinder head is provided with a continuous annular surface protruding from the outside over and above the rim of the valve secured to the cylinder head in coaxial relation to the cylinder, the said valve abuting with its outer rim against the continuous annular surface.

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