FLUID CONNECTOR FOR UNLOADER OF A RECIPROCATING COMPRESSOR

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This invention relates to an unloader element for a reciprocating compressor and more particularly to a fluid conducting aligning means which operates to provide working fluid to the unloader and at the same time maintains the unloader in operative position during compressor unloading action.

A schematic representation of a similar type of fluid connector is shown in the copending application of Andrew J. Nicholas, S.N. 769,364, filed October 24, 1958, now Patent No. 2,971,690, for an Unloading Means for a Reciprocating Compressor.

While many types of fluid connectors have heretofore been devised for conducting fluid from a source through a movable element to a source of use they are undesirable from many standpoints, such as, excessive friction between moving parts causes early and untimely breakdowns, cost of manufacture is high due to necessity of providing for positive sealing, failure to compensate for manufacturing tolerance limits and inaccessibility for maintenance.

The present invention comprehends a fluid conducting aligning means for connecting the fluid chamber of a movable unloader element of a reciprocating compressor to a source of pressurized operating fluid which eliminates the foregoing objections presented by prior type devices; is made or constructed of readily available standard materials, is of simple construction thereby lending itself to manufacture at low cost; and the parts are so shaped so that it provides a positive type seal and also compensates for misalignments caused within the limits of manufacturing tolerances.

Other objects and advantages of the invention including the basic design and the nature of the improvements thereon will appear from the following description taken in connection with the following drawings, in which:

FIGURE 1 is a fragmentary view partly in section of a reciprocating compressor including the fluid connector.

FIGURE 2 is an enlarged fragmentary section showing the piston of the compressor and the details of the fluid connector.

In advance of a discussion of the details of the fluid conducting aligning means herein shown it will be helpful first to consider the general organization of the reciprocating compressor including the movable unloader means as best shown in FIGURE 1 of the drawings.

Refer now to the drawings more in detail, FIGURE 1 shows a portion of a reciprocating compressor including a movable unloader element of the type shown in copending application of Andrew J. Nicholas and David N. Shaw, S.N. 815,757, filed May 25, 1959, for an Unloader Means for a Reciprocating Compressor. The compressor generally designated 1 includes a casing 2 having a first partition 3 therein for dividing the compressor into a compression portion generally designated 4 wherein system fluid is acted upon and a crankcase compartment 5, usually housing the driving components of the compressor. A second partition 6 as best shown in FIGURE 2 is formed in the vicinity of the compression portion 4 and provides a motive chamber 7 and a discharge chamber 8. The discharge chamber 8 including threaded compressor 34 of the usual cylinder 9 in which a piston 10 operates. A valve cage shown in part and designated 11 includes the usual discharge valve and suction valve 12 disposed over the suction port 13 which communicates with the suction manifold 7 as is shown in FIGURE 2.

While FIGURE 1 illustrates only one cylinder of an open type compressor it will be understood by those familiar with this art that the present arrangement may be also used in single or multi-cylinder compressors of the open or hermetic type.

The cylinder 9 is shown as comprising an elongated cylindrical liner 14 having a flange-like element 15 disposed about the upper end thereof. The outer edge of the flange in assembled position having a sliding fit with the opening 16 formed in the partition 6. The lower end of the cylinder liner has a slip fit with the opening 17 in the partition 3 and is of lesser diameter but coaxial with the opening 16 in the upper partition 6.

The above described elements are connected in operable position by any well understood fashion to support the liner in position in compressor 1.

A second flange-like means shown as an annular boss 18 is preferably fashioned as a unitary portion of the liner 14 and about the central peripheral portion thereof. The boss 18 is adapted to coat with the movable unloader as is clearly described in above application Ser. No. 815,737.

In order to operate the compressor at substantially constant speed but at increments of its full capacity, means taking the form of a movable annular element 19 is disposed about the liner and in close clearance with boss 18 and in such fashion as to provide a fluid chamber 20 therewith. Seal means 21 and 22, shown as O-rings are disposed respectively in an annular groove 23 formed in element 19 and an annular groove 24 formed in boss 18 to coat with liner 14, boss 18 and elements to provide a substantially fluid-tight confine for fluid passed to chamber 20.

The movable unloader element 19 is normally held in abutment with flange 15 of liner 14 by resilient means or spring 25 disposed in bore 26 on the bottom portion of unloader element 19 and in engagement with the first partition 3 as at 27.

As will be evident from the foregoing, during the stage of compressor operation when element 19 is in abutment with flange 15, if functions to preclude passage of gas from the suction chamber 7 to cylinder 9 through port 13. Thus far, the structure and operation that has been described forms the subject matter of the above application, S.N. 815,737 and in addition to the foregoing said application discloses means which take the form of a one-piece fluid connector element for conducting fluid from a source to the chamber 20 to move the element 19 downwardly to permit operation of the compressor at maximum capacity. However, as discussed above it has been found that connectors of the type referred to above are objectionable, accordingly what now follows is a description of the component parts of the fluid conducting aligning means generally designated 30 which is considered to be the crux of the present invention and operation of the control system for supplying motive fluid to the chamber 20.

The movable element 19 includes means shown as in the bottom portion thereof taking the form of a valve 31 for receiving the fluid aligning means 30 as will be described hereinafter. A passage 32 is formed in element 19 to connect chamber 20 with bore 30.

The fluid-conducting aligning means comprises a body portion 33 including a guide portion 33 disposed in bore 30 of the unloader element 19, and a connector portion 34 for connection in the same into partition 3 as is clearly shown in FIGURE 2. A flange-like stop member 35 of greater dimension than the
guide or connector portions of the body 33 seats in counterbore 36 formed in partition 3 above threaded portion 34 to provide the required alignment. Flow passage means taking the form of a bore 37 is provided in the body 33 to permit passage of fluid from the fluid source to chamber 20. A flow-receiving end 38 having a greater dimension than bore 37 is connected to line 39 of control element 40.

Boring the outer dimension of guide portion 33' so that it is of lesser dimension than bore 31 to form clearance 52 it is possible to provide proper alignment of the element 19 during its movement about cylinder liner 14 within the limits of prescribed manufacturing tolerances.

In order to provide means whereby fluid passing through housing 41 through controller 40 and line 39 from escaping an independent coupling element 42 preferably formed of a plastic-like material such as "Teflon" is disposed so that a portion thereof is contained by the bore 31 of the unloader element 19 and another portion thereof is contained within the flow passage means or bore 37 of the body 33. A bore 43 formed in the coupling member 42 provides passage of fluid to chamber 20 through bore 32 as is clearly shown.

Referring to the coupling 42 with more particularity it is preferably a unitary element having ball-like ends 44 and 45 which respectively have sealing contact with the same dimensions as bore 31 and bore 37 to snug the walls of said bores to preclude escape of fluid passed to the chamber 20.

In addition, provision of ball-like ends permits pivotal movement of the coupling at trunnion points 50 and 51 in their respective bores and provide fluid seals by compression of the ball-like ends at those trunnion points.

In actual operation provision of clearance 52 as a result of the difference in dimensions between bore 37 and guide member 33' and an independent coupling 42 with ball-like ends eliminates interference effects that may result during manufacture of the compressor components.

Furthermore, forming the coupling 42 of a unitary piece of "Teflon" or like material permits rapid replacement in the event of wear. While it is implied that a unitary member is preferable it is pointed out that coupling 42 may be a steel body having seal-like ends connected thereto as will be readily understood by one skilled in the art.

Although this invention has been described with reference to specific apparatus it will be appreciated that a wide variety of changes may be made within the ability of one skilled in the art without departing from the scope of this invention. For example, some of the components may be made as separate elements, and equivalents may be substituted for the apparatus, all within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. In a reciprocating compressor having a movable unloader element for cooperation with said compressor, a source of pressurized operating fluid, and fluid conducting means, said movable unloader including: a fluid chamber, means defining an opening, and a passage communicating said means defining an opening with the fluid chamber, said fluid conducting means connecting said fluid chamber to said source of operating fluid and comprising a body including a fluid passage defined therein, a fluid receiving portion on said body and connected to the source of fluid, a guide portion on said body and received by said means forming an opening in the movable unloader element, an independent coupling means having a portion disposed within the means forming said opening and another portion disposed within the flow passage formed in said body, said coupling means including a flow passage connecting the fluid source to the fluid chamber, and seal means formed on both the portion of the coupling means disposed within the means forming the opening and within the body to engage the walls of said flow passage and said means forming an opening to prevent fluid passing from said fluid source to said fluid chamber from escaping.

2. The device claimed in claim 1 wherein said guide portion is of lesser dimension than the means forming the opening.

3. The device claimed in claim 1 wherein said seal means respectively have substantially the same dimension as the means forming the opening and the inner portion of said body receiving same.

4. The device claimed in claim 1 wherein both said seal means include means permitting pivotal movement of said coupling means relative said means forming the opening and the body.

5. In a reciprocating compressor having a movable unloader element with a bore for cooperation with said compressor, a source of fluid pressure, and fluid conducting means, said movable unloader including: a substantially fluid tight chamber, a passage in communication with said fluid tight chamber to conduct fluid thereto, said fluid conducting means forming said fluid tight chamber to the source of fluid pressure, said fluid conducting means comprising, a body including a flow passage formed therein and having a fluid receiving end connected to said source of fluid pressure, a guide portion at the end of said body remote from said fluid receiving end and a flow passage means forming on the respective ends of said unloader element, an independent coupling means disposed within said bore and within the flow passage formed in the body of the fluid conducting means, said coupling means including a flow passage connecting the fluid source to the substantially fluid tight chamber, and ball-like sealing members forming on the respective ends of the coupling means to engage the inner portions of the bore of the movable unloader element and the body to prevent fluid passing from said fluid source to said fluid chamber from escaping.

6. The device claimed in claim 5 wherein said guide portion is of lesser dimension than said bore.

7. The device claimed in claim 5 wherein said ball-like sealing members respectively have substantially the same dimension as the inner portion of the bore and the body member permitting pivotal movement of the coupling means at the ball-like ends relative the bore and body.

8. In a reciprocating compressor having a movable unloader element for cooperation with said compressor, a source of fluid pressure, and fluid conducting means, said movable unloader including: a fluid tight chamber, a bore in said movable unloader at one end and a flow passage means disposed within the bore of substantially fluid tight chamber, said fluid conducting means connecting said fluid tight chamber to the means supplying a source of fluid pressure and comprising, a body having a guide portion formed on one end thereof and connecting means on the other end thereof, an axial bore through said body forming a flow passage therein, said flow passage being connected to a source of fluid, the portion of said body comprising said guide portion being disposed within the bore of said movable unloader element and being of lesser dimension than said bore, an independent coupling means of a plastic-like material and having one end disposed within the bore of said movable unloader element and the other end disposed within the flow passage means formed in said body, said independent coupling means including a flow passage connecting the fluid source to the substantially fluid tight chamber, and ball-like sealing members forming on the ends of the independent coupling means having a portion disposed within the bore of the movable unloader element being of substantially the same dimension as said bore, and the ball-like member formed on the end of the coupling means disposed within the bore forming the flow passage means of said body being of substantially the same dimension as said bore whereby said ball-like members pivot relative the bore and flow passage means respectively to compensate for misalignment.
caused during assembly and prevent fluid passing from said fluid source to said fluid chamber from escaping.

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