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BY A. P. C.

F. NEUGEBAUER
PISTON COUPLING
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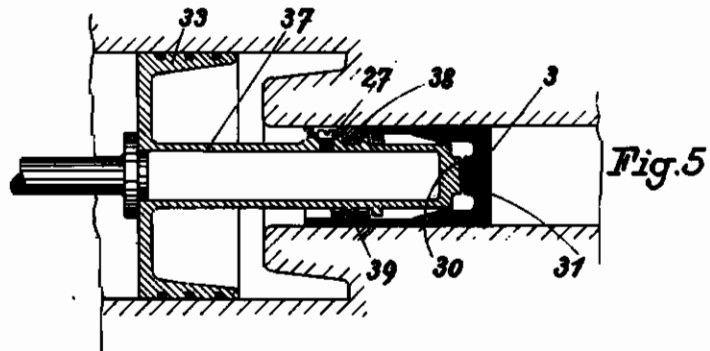


Fig. 7

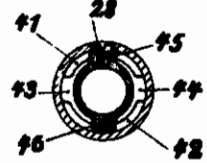


Fig. 6

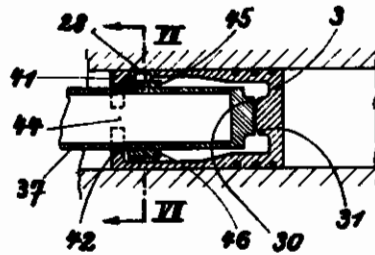
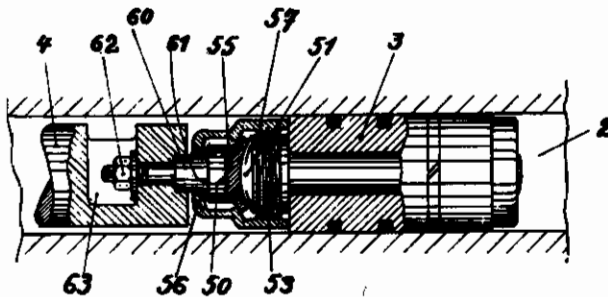


Fig. 8



Inventors:
Franz Neugebauer
by Paul Kerschbaum
Attorney

ALIEN PROPERTY CUSTODIAN

PISTON COUPLING

Franz Neugebauer, Munich-Allach, Germany;
vested in the Alien Property Custodian

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This invention relates to improvements in piston couplings in connection with piston engines, more especially compressors.

In piston engines, for instance, compressors having a piston working in one direction and being permanently subjected during working to the action of a force tending to shift the piston away from its dead space outwards, it is well known to connect this piston with the engine element taking up this force, for instance, with another piston or a piston rod, by means of a "shape-joint" connection (i. e. a joint effected by the peculiar shape of the parts to be connected in such a manner that their parts are held together against forces acting in any of two opposite directions) leaving to the piston with respect to the other engine element a movability across the direction of the stroke, and moreover a certain play in the direction of the stroke. Such connection acts in normal working under the influence of the permanent force like a bare force-joint connection (with which two bodies by an external force are kept in permanent contact with each other, whereas they are allowed to separate from each other in the absence of the action of this force). The force-joint connection allows the piston to follow readily any displacement of the axis of its cylinder with respect to the direction of stroke of the other engine element. The completion of this force-joint connection to a shape-joint connection is intended to maintain the conjunction between the piston and the other engine element also in the case that the force effecting the force-joint, for instance, the gas pressure produced in the preceding stage acting upon the compressor piston of a higher stage, is absent or is yet too small. This, for instance, is the case when a multistage compressor in order to facilitate starting firstly pushes out the aspired gas without increasing the pressure or when the engine containing such piston is to be brought by hand into a determined position (for instance, starting position) or is to be moved in an idle course. As a rule this shape-joint connection is only compelled to take up the relatively small force of the friction of the piston.

In the well-known arrangement a piston rod penetrating the piston with radial play is provided carrying abutments which engage the piston at its front ends leaving a slight play in the direction of the stroke. The abutment adjacent the working space of the piston is formed as a screw-nut capable of being removed in the direction toward the working space. In this case the cavity receiving the piston rod which is open

toward the two front sides must be tightened against the working space. For this purpose a shut-off cap covering the end of the piston rod is screwed upon the end of the piston opposite the working space. This especial shut-off member is inconvenient inasmuch as it increases the number of elements and complicates the disconnection of the joint, because it must be previously released from the piston.

The object of the present invention is to provide a connection of a single acting piston with another engine element which in normal working acts as a bare force-joint connection and in which at the same time a shape-joint with a certain play across the direction of stroke and in this direction is provided, which connection is further of simple shape and composed of a few parts, and may be readily disconnected, especially without previous removal of shut-off members tightening against high pressure.

According to the invention the connection is constructed in such a manner that the part of the shape-joint connection taking along the piston in the absence of the force-joint during the outward stroke can be removed from the piston in a direction other than that toward the working space, i. e. either laterally or away from the working space.

If the member of the shape-joint connection taking along the piston can be laterally removed from the latter, a most simple configuration and manipulation of the connection results provided that the elements of the force-joint connection as well as the elements completing this connection to a shape-joint connection are arranged wholly outside the piston on its side remote from the working space.

If the part of the shape-joint connection taking along the piston during the outward stroke can be removed from the piston in a direction away from the working space, all elements of the joint may be positioned inside the cavity of the piston. The elements completing the connection to a shape-joint connection are in this case advantageously shaped to form a thread-or bayonet-joint so that they can be separated from one another by turning and axially displacing the piston with respect to the other part of the engine. In this case there is further required a safety member preventing this relative turning motion during working which however is not encumbered by the forces acting on the piston. After releasing this safety member the joint may be at once disconnected.

With this construction of the joint according

to the invention the piston needs no bore toward the working space, so that also removable members for closing such bores are dispensed with. The connection is consequently simpler and safer and can be disconnected more easily and more rapidly than the construction heretofore used.

The invention will now be more fully described with the aid of the annexed drawings of which Figs. 1, 2, 3, 4, and 8 show connections the elements of which are positioned outside the piston;

Figs. 5, 6 and 7 show connections the elements of which are positioned inside the piston.

Figs. 1, 4, 5, 6, and 8 are longitudinal axial cross-sections, partly in elevation;

Fig. 2 is a cross-section on the line II—II of Fig. 1;

Fig. 3 is a plan view corresponding to Fig. 1;

Fig. 7 is a cross-section on the line VII—VII of Fig. 6.

Referring first to Figs. 1, 2, and 3, 1 is a cylinder having a working space 2 in which the piston 3 connected by force-joint with the piston rod 4 reciprocates. The latter is provided for this purpose with an end face 10 against which the head 11 of a stem 12 fixed in the piston 3 bears with its slightly convex end face 13 under the pressure existing in the space 2. To complete this force-joint connection to a shape-joint connection the head 11 of the stem 12 is provided with an annular recess 15 whereas the end of the piston rod 4 opposite the piston 3 contains a cavity 16 open at one side, the inwardly projecting front wall 17 engaging the recess 15. When in the absence of pressure in the working space 2 the piston rod 4 is displaced in the direction of the arrow-a, i. e. to the left, the front wall 17 takes along the head 11 of the stem 12 and therewith the piston 3. Between the head 11 and the cavity 16 sufficient play is provided to preserve the possibility of freely adjusting the piston 3 in view of the piston rod 4, should the faces 10 and 13 come in contact (force-joint position).

For being disconnected the piston 3 is first wholly withdrawn out of the cylinder 1 by means of the piston rod 4 and then displaced across its axis so that the head 11 gets entirely clear of the cavity 16 of the piston rod 4. In the same simple manner the connection may be reestablished.

Fig. 4 shows the connection between a smaller piston 3 and a greater piston 33. The hub of the greater piston 33 presents an even cross-face 20 against which the smaller piston 3 bears with the convex end face 21 of its frontal projection 22. For establishing a shape-joint connection two lugs 34, 35 are provided at the hub of the greater piston 33 overlapping the projection 22 of the smaller piston. A screw-bolt 25 is passed through a cross-bore 24 in the projection 22 and the lugs 34, 35 and secured by screw-nuts. For inserting the bolt 25 a threaded bore is provided in the jacket of the piston 33 which may be closed by a screw-plug 36. The lugs 34, 35 and the bolt 25 may be given sufficient play in view of the projection 22 and the bore 24 respectively, to permit of free adjustment of the piston 3 in view of the piston 33 during working.

For disconnection both pistons are withdrawn out of their cylinders, then the nuts of the bolt 25 are removed, and finally the bolt 25 is withdrawn out of the bore 24 in the projection 22.

In the modification shown in Fig. 5 the piston 3 touches with a convex abutment face 31, only a little projecting from its bottom, an even cross-face 30 of a piston rod 37 secured to a greater

piston 33. To establish a shape-joint connection, an inner thread 38 is provided in the jacket of the piston 3, and an outer thread 38 is cut on the piston rod 37. After screwing into each other the threads, the parts 3 and 37 are fixed with respect to each other in circumferential direction by a screw 27 penetrating both parts in radial direction in such a manner that the threads which have a radial and axial play in view of each other permit of the free adjustment of the piston 3 in view of the piston rod 37, when the force-joint connection is effective, i. e. when the face 30 touches the face 31.

For being disconnected both pistons are withdrawn out of their cylinders, the safety screw 27 is released and then the piston 3 is unscrewed from the piston rod 37.

The example illustrated in Figs. 6 and 7 differs from that shown in Fig. 5 by the fact that the members effecting the shape-joint connection are formed according to the bayonet-joint principle. The piston 3 carries at its front end remote from the dead space two inwardly directed arcuate projections 41, 42 leaving passages 43, 44 between their ends. On the other hand, the piston rod carries two diametrically opposed projections 45, 46. When being composed the two parts 3 and 37 are in such relative angular position that the projections 45, 46 can be passed through the recesses 43, 44. After being passed the two parts 3 and 37 are turned about each other through 90° and secured in this position by screw bolts 28 radially penetrating both parts. Hereby the shape-joint connection is established. The projections 41, 42 and 45, 46 have when face 30 touches face 31 sufficient play against one another to warrant the free adjustment of the piston 3 in view of the rod 37.

The disconnection is effected by the reversed manipulations.

In the modification shown in Fig. 8 an intermediate member 55 is inserted between the piston 3 and the piston rod 4, which member has the form of a hollow sphere on one side and is even on the other side. The hollow sphere engages a spherical projection 53 of the piston 3, whereas the plane face is in contact with the even cross-face 50 of the piston rod 4, whereby both parts 3 and 4 are allowed to freely undergo parallel and angular displacements, and at the same time the transmission of forces over large faces is permitted. For establishing a shape-joint connection the even abutting face 50 formed on a peculiar body 60 which may be secured to the piston rod 4 and is provided with an outwardly projecting shoulder 61. This shoulder is engaged by a collar 56 of the prolongation of a union-nut 57 screwed upon the projection 53 of the piston 3 provided with the spherical face 51, which union-nut serves for holding the intermediate member 55 on the spherical face 51. The body 60 is secured, after applying the union-nut, to the piston rod 4, for instance, by means of a nut 62 positioned in a cavity 63 of the piston rod and being accessible from the outside. After the union-nut has been screwed upon the thread of the projection 53, the shape-joint connection between the parts 3 and 4 is established. The disconnection is simply effected by unscrewing the union-nut 57 from the projection 53 of the piston.

The male thread receiving the nut may also be provided on the piston rod 4, and the body 60 engaged by the nut 57 and provided with the shoulder 61 may be secured to the piston 3.

FRANZ NEUGEBAUER.