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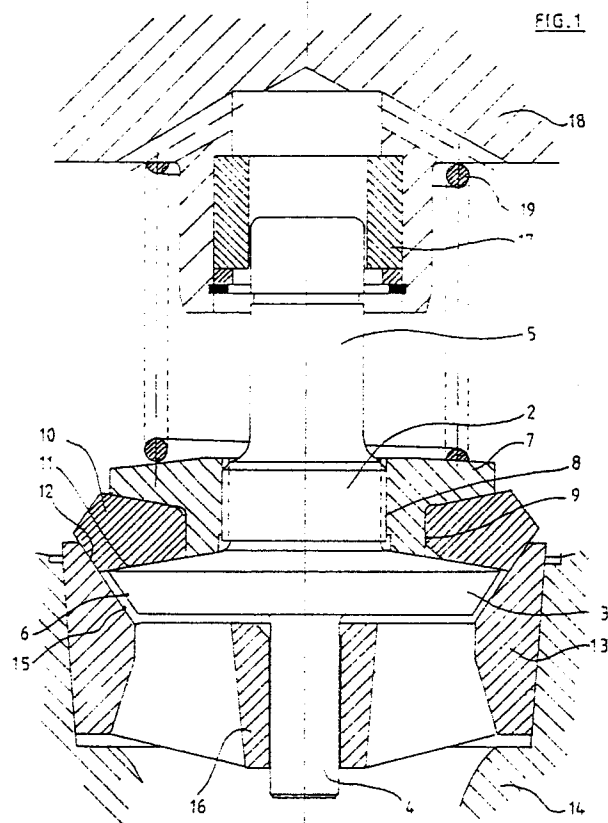
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Valve arrangement for use in a displacement pump.

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Valve arrangement for use in a displacement pump comprising a valve being guided centrally and a valve seat, the valve and the valve seat being provided with co-operating closing faces (6, 15), and in which further a sealing ring (10) of an elastic material is provided. One of the co-operating closing faces (6, 15) is provided with a number of grooves, whereby in the closed position the spaces on both sides of the co-operating closing faces (6, 15) are connected with each other.



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Valve arrangement for use in a displacement pump

The invention relates to a valve arrangement for use in a displacement pump comprising a valve being guided centrally and a valve seat, the valve and the valve seat being provided with co-operating closing faces, and in which further a sealing ring of an elastic material is provided.

Valve arrangements of this kind are used inter alia with displacement pumps for pumping liquids being mixed with solid materials causing mostly abrasion or with corrosive solid materials, such as water and sand or other mixtures, e.g. in the chemical, coal, oil industry and the like. Pumping such mixtures, being known as slurries, makes strong demands as to the reliability and abrasive resistance of these pumps.

A problem involved herewith is the construction of both the suction valves and the press valves in these pumps. Especially during closing both types of valves are subjected to strong abrasive effects. To obviate that problem sealing rings of an elastic material are already used. However, per se quite other and novel problems are caused thereby. The object of the present invention is to provide a solution for these problems. Thereto the present invention is characterized in that one of the co-operating closing faces is provided with a number of grooves, whereby in the closed position of the valve the spaces on both sides of the co-operating closing faces are connected with each other.

By this measure it is obtained that fluid to be pumped, which can be present between the sealing ring and the valve, can be forced away without damaging the valve.

From SU -850.903 a valve arrangement is known per se, in which grooves are used. However, with this known arrangement the object aimed at by the present invention cannot be obtained. Preferably the said grooves are arranged in such a manner that they extend substantially in a radial direction.

By radial direction it is meant here a course along a describing line of a surface which generally will be a conical closing surface.

According to the invention the number of grooves will be between 2 and 12, the lowest number being applied preferably with small valves and higher numbers with greater valves.

According to the invention it has been found that it is advantageous to form a circular groove in a closing face of the valve and/of the valve seat.

Finally, according to the invention the substantially radially extending grooves can be formed in both the closing face of the valve and in such face of the valve seat.

Further advantages of the present invention will appear from the following description of some exemplary embodiments with reference to the drawings, in which:

Fig. 1 is a longitudinal cross section of a valve arrangement as used with pumps of the present kind;

Fig. 2 shows schematically the deformation of the sealing ring;

Fig. 3a shows a preferred embodiment of the invention;

Fig. 3b is a cross section along the line b-b in Fig. 3a, on an enlarged scale;

Fig. 4, 5 and 6 show three other embodiments of the invention.

Referring to Fig. 1 a valve arrangement is shown, which consists of a valve body 2 having a supporting element 3, a stem 4 and a guiding element 5. The element 3 having a greater diameter than the other parts is provided with a conical closing face 6. A ring 7 is secured on the valve body 2 by means of screwthread 8. The ring 7 has at its circumference a recess 9, in which a sealing ring 10 of an elastic material, such as rubber, is fitted. The ring 10 rests at its underside on a conical part 11, which joins the conical closing face 6 of the element 3. At its outer side the ring 10 has a conical portion 12 having a somewhat greater diameter than the conical face 6.

A valve seat 13 is arranged in a valve housing 14 and has a conical face 15, the upper part of which serves as a sealing face and the lower part of which serves as a closing face. The upper part of the conical face 15 together with the face 12 of the elastic ring 10 will form the co-operating sealing faces and the lower part of the conical face 15 together with the conical face 6 will form the co-operating closing faces.

Further the valve seat 13 is provided with a guiding ring 16 for guiding the valve stem 4.

At the top side the guiding element 5 extends through a bush 17 being provided in the valve housing 18. A spring 19 being provided between the housing 18 and the ring 7 maintains the valve in its closed position, as long as the valve will not be opened by a pressure difference caused by the displacement plunger (not shown) and overcoming the spring force.

In Fig. 2 the situation is shown which arises when the valve is closing. The ring 10 will be deformed thereby, in which a space 20 will be formed. That space contains material having the same composition as the fluid to be pumped. As ring 10 is subjected to the pressing pressure of the pump the material in the space 20 will be com-

pressed. That material will look for an outway into a space in which the pressure will be lower than in space 20 that will be underneath the valve (space 21). As the co-operating conical faces 6 and the lower part of 15 do not realise a complete sealing that fluid will thus be constrained to move between the conical faces 6 and 15 with high velocity. This causes abrasion at the surfaces of these conical faces, resulting quickly in a failure of the valve.

Fig. 3a shows an embodiment of the present invention which is preferred now by applicant. In this embodiment shallow grooves 22 and 23 respectively are formed either in the conical face 6 or in the conical face 15, through which the fluid being contained in space 20 can escape.

It is also possible to form the circular grooves 24 and 27 respectively in the face 15 and element 3 respectively. It is not necessary to form all grooves 22, 23, 24 and 27. Generally it will be sufficient to form a number of grooves 22 in the conical face 6. Further it will be an advantage that the surface of the grooves together with the face 6 and 15 respectively of the element 3 and seat 13 respectively can be hardened, as in Fig. 3b it is shown for groove 22 in face 6. In that figure, in a cross section b-b in Fig. 3a the hardened layer 25 is shown which includes also the surface of the groove 22.

Fig. 4 shows an embodiment in which the elastic sealing ring 10 is connected with the valve seat 13 instead of with the valve. In that case the grooves 22, 23, 24 and 27 can be formed in a similar manner as shown in Fig. 3a.

Fig. 5 shows a similar embodiment. Therein grooves 22, 23, 24 and 27 are also formed.

Finally, in Fig. 6 a third embodiment of this kind is shown. In this embodiment the elastic ring 10 is also mounted on the valve seat 13 by means of a ring 28. The grooves can be formed either in the element 3 (groove 23 in face 15) or in the seat 13 (groove 22 in face 6). Here the sealing faces 26 of element 3 and 12 of ring 10 are not the same as the sealing faces 6 and 15. Here groove 24 can also be formed in element 3 and groove 27 in seat 13.

number of grooves, whereby in the closed position the spaces on both sides of the co-operating closing faces are connected with each other.

2. Valve arrangement according to claim 1, characterized in that the grooves extend substantially in a radial direction.

3. Valve arrangement according to claim 1 or 2, characterized in that the number of said grooves will be between 2 and 12.

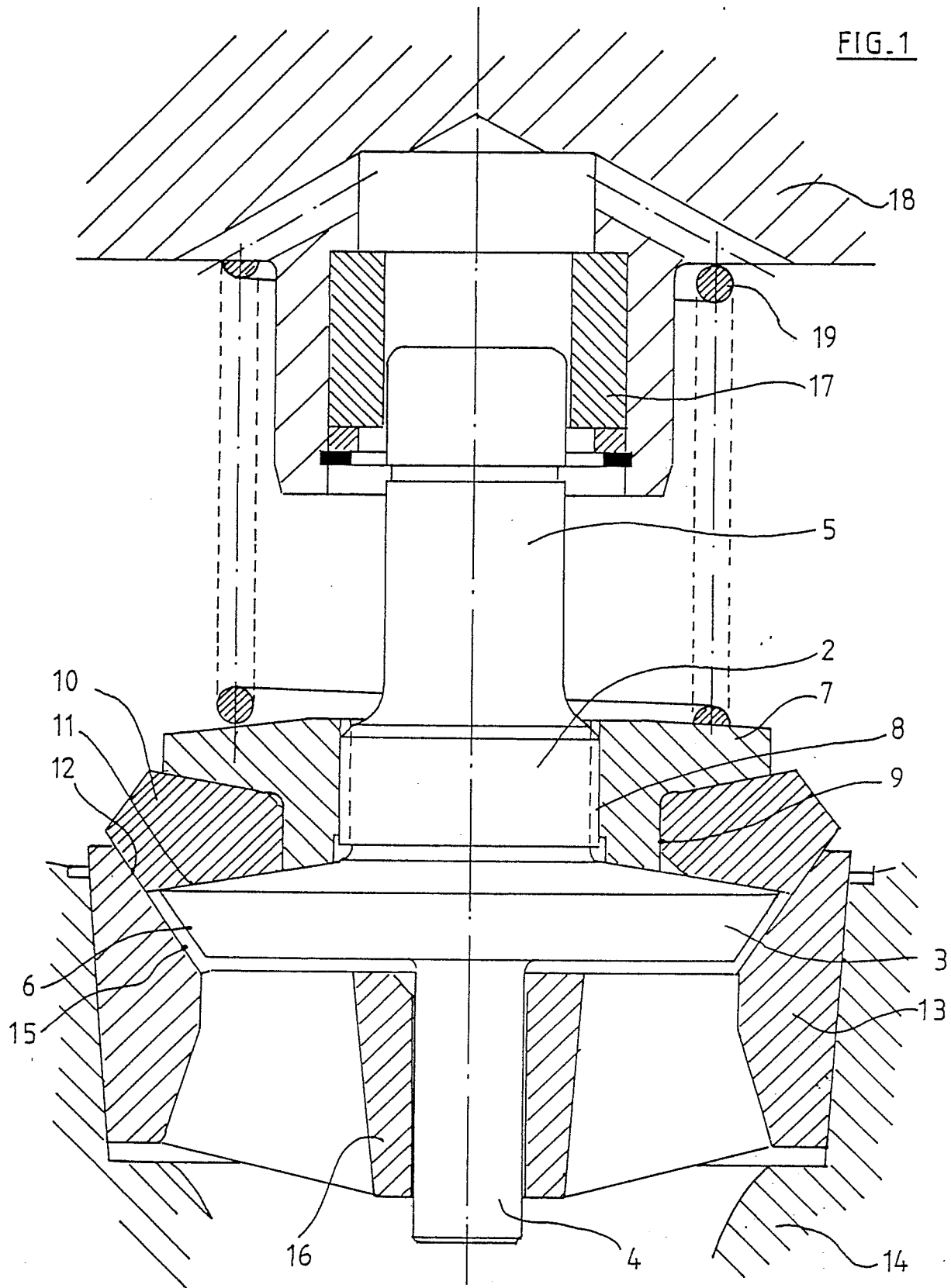
4. Valve arrangement according to one of the claims 1-3, characterized in that a circular groove - (24, 27) is formed in a closing face of the valve (3) and/or the valve seat (13).

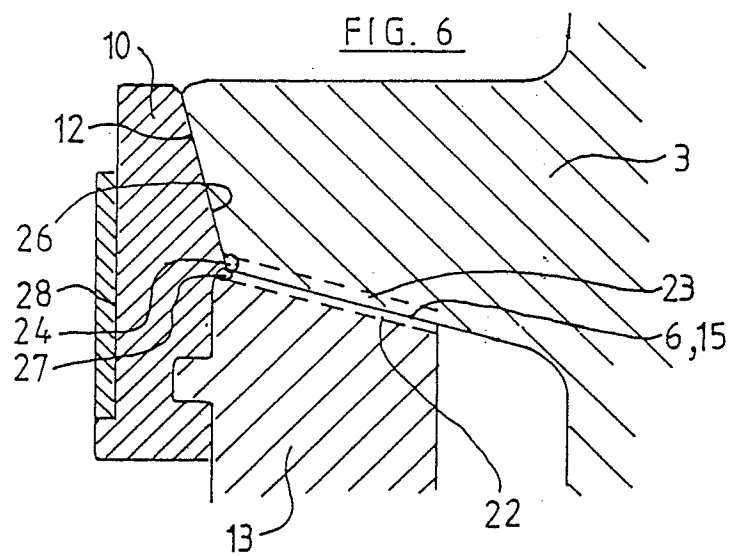
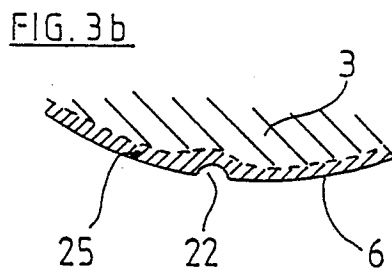
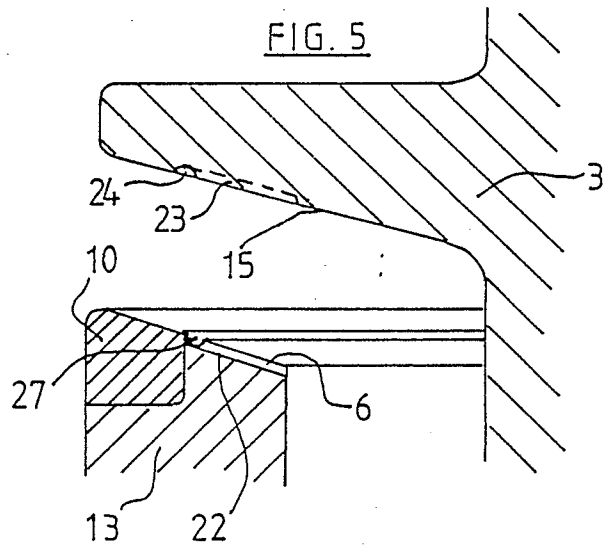
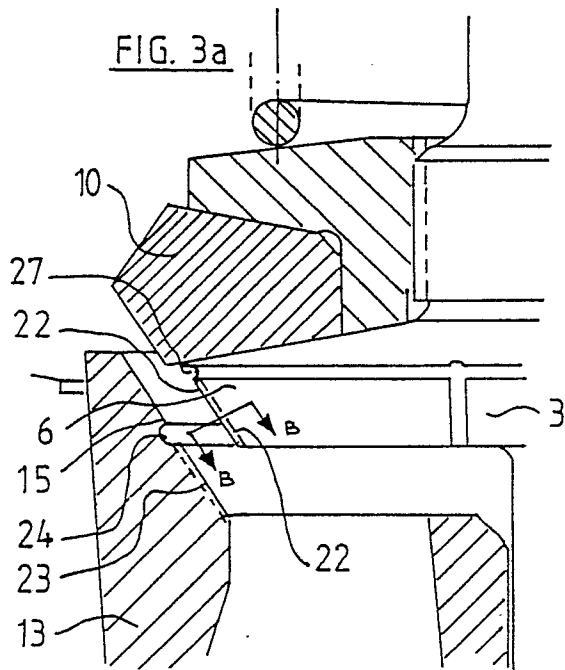
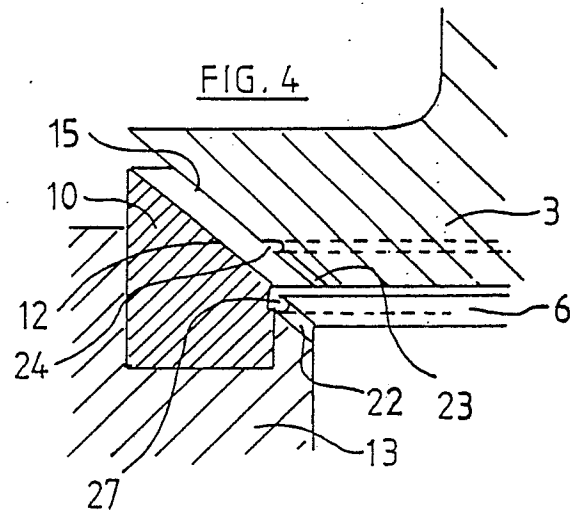
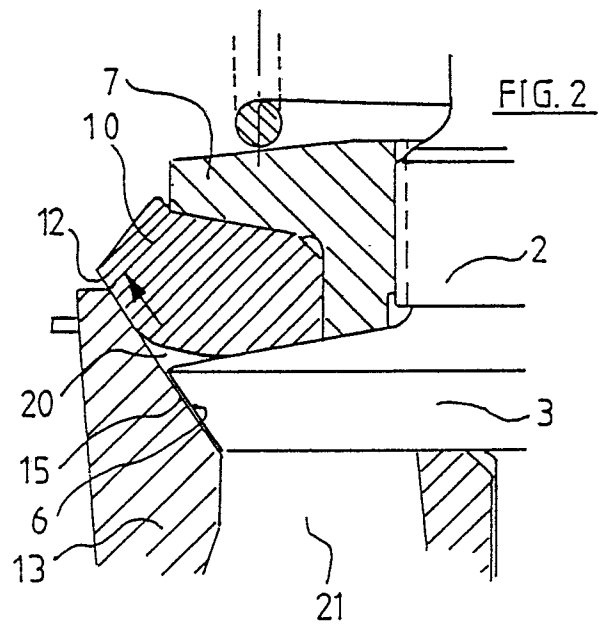
5. Valve arrangement according to one of the claims 2-4, characterized in that both substantially radially extending grooves (22) and grooves (23) are formed in the closing face (6) and the closing face (15) respectively.

Claims

1. Valve arrangement for use in a displacement pump comprising a valve being guided centrally and a valve seat, the valve and the valve seat being provided with co-operating closing faces, and in which further a sealing ring of an elastic material is provided, characterized in that one of the co-operating closing faces (6, 15) is provided with a

FIG. 1







DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	SOVIET INVENTIONS ILLUSTRATED, Derwent Publications Ltd, Section Mechanical, London, GB; Abstract no. Q56, F9222-E20- 30th June 1982; & SU-A-850 903 (SOYUZGEOTEKHNIKA) * Whole abstract *	1, 2, 4	F 04 B 21/02
A	Idem ---	3, 5, 4	
A	US-A-3 425 490 (CLAYTON) * Column 2, lines 4-7, 42-58; fig- ures 3, 4 *	1, 3	
A	US-A-2 103 503 (WHITE) * Page 2, right-hand column, lines 46-63; figure 2 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
A	US-A-2 148 850 (DEAKINS) * Page 2, left-hand column, line 9 - page 3, left-hand column, line 15; figures 2-4 *	1	F 04 B F 16 K
A	US-A-2 898 082 (VON ALMEN) * Whole document *	1	
A	US-A-3 314 372 (SUTTON) * Column 2, line 57 - column 3, line 75; figures 2, 3 *	1	

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17-06-1987	Examiner VON ARX H.P.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	