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**Pump, particularly plunger pump**

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(56) Related Art  
**US 4087213**  
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**US 4824342**

ABSTRACT:

A pump (1), particularly a plunger pump, comprises a crank mechanism (3) which, in an oscillating manner,  
5 drives a plunger (5) arranged in a housing and guided in a receiving device (51), and a pump head (6) fixed to the housing (2) for guiding the pressurized fluid withdrawn from a suction space (9), the housing (2) surrounding the crank mechanism (3) and the plunger (5).  
10 According to the invention, elastic sealing devices (7) are fastened to the plunger (5), which sealing devices (7) provide a pressure-tight sealing with respect to a lower housing space (19) containing the crank mechanism (3). As a result, a space (12) in the housing may be filled with  
15 air, which space is hermetically separated from the lower housing space (19) containing the crank mechanism (3).

**(Figure 1**

AUSTRALIA  
Patents Act 1990

**COMPLETE SPECIFICATION**  
**STANDARD PATENT**

**Applicant(s):**

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**Invention Title:**

PUMP, PARTICULARLY PLUNGER PUMP

The following statement is a full description of this invention, including the best method of performing it known to me/us:

PUMP, PARTICULARLY PLUNGER PUMP

The present invention relates to a pump, particularly a plunger pump, having a crank mechanism which, in an oscillating manner, drives a plunger arranged in a housing and guided in a receiving device, and having a pump head fixed to the housing for guiding the pressurized fluid, the housing surrounding the crank mechanism and the plunger.

10 Plunger pumps exist which are particularly used in the high-pressure water field because they have a compact construction and can be used in an operationally reliable manner at pressures between 100 and 3,000 bar. With respect to other pump constructions, such as rotating positive-displacement pumps, these plunger pumps have the advantage of a good energetic efficiency and are capable of delivering also under difficult fluid conditions, such as high temperature, barely viscous and very viscous media as well as solid-charged liquids. The plunger pumps run relatively quietly, cause low vibrations and are relatively easy to maintain. It is a disadvantage in the case of these vertically arranged plunger pumps that oil is present in the lower housing part having the crank mechanism, so that, in comparison to the upper housing area, this housing area has to be mounted by means of corresponding strippers or a suction space sealing whose installation requires high expenditures. For this purpose, the surface of the piston rod must be machined in order to accommodate a corresponding sealing ring.

30 The present invention provides a pump comprising:  
a housing including a pump head in an upper area of the housing and fixed to the housing for guiding a pressurized fluid withdrawn from a suction space;  
a crank mechanism in a lower housing space of the housing for oscillating a plunger in the housing and guided in a receiving device;  
35 a high pressure sealing element and a low

pressure sealing element adjoining an intermediate space and around the plunger; and

an elastic sealing device located in the intermediate space that is sealingly separated from the upper housing area by the sealing elements, the sealing device being  
5 fastened to the plunger and providing a pressure-tight sealing with respect to the lower housing space containing the crank mechanism.

If elastic sealing devices are fixed to the plunger  
10 which provide a pressure-tight sealing with respect to the lower housing space containing the crank mechanism, the plunger or a vertical sealing and guiding element fastened to the plunger no longer has to be guided in a receiving device with particularly high precision in order to  
15 generate a sealing with respect to the upper housing part. A machining of the surface of the plunger rod for sealing ring receiving devices, for example, can be eliminated, or a sliding ring or rotary shaft seal can be saved. In this case, the elastic sealing devices can be used, among other  
20 things, as a splash guard in order to avoid an admission of oil from the area of the crank mechanism into the upper housing part. Such a hermetic sealing-off of the lower housing part offers advantages particularly for chemical pumps, because such a medium- and water-jet-resistant  
25 sealing has so far only been possible by means of diaphragm pumps. In particular, when the fluid to be delivered contains dirt, is toxic, harmful, corrosive, explosive or combustible, the advantages of a hermetic sealing are important. When the fluid is poorly  
30 lubricating, a driving mechanism lubrication could be impaired without a corresponding sealing.

According to a preferred embodiment of the invention, a space is formed in the housing above the lower housing space and below the pump head. This space may be filled  
35 with air. This creates a clear separation between a fluid space in the pump head, the space which is filled with air, and the space of the crank mechanism containing oil.

The sealing device is preferably fastened to the plunger on one side and to the housing on the opposite side. The mounting is facilitated in this case when interior webs are constructed on the housing which  
5 surround the plunger in a ring-shaped manner so that the sealing devices are only clamped onto this housing section. In order to have sufficient elasticity for the movement of the plunger, the sealing device can be constructed as ring-shaped or conical bellows. A conical  
10 construction of the bellows has the advantage that a buckling is prevented. The waves provided on the bellows should be provided in such a number that no fluttering will occur even at high stroke frequencies. In the case of a gas-tight construction of the sealing devices, the  
15 pump can be used in an extreme environment.

The plunger may be constructed in several parts in order to be able to clamp the sealing device to a lower plunger element. In the upper area, the plunger is  
20 received in a piston-type manner in a bush or receiving device for the plunger sealing.

According to another embodiment of the invention, the pump has several adjacent plungers, sealing devices with  
25 respect to a lower housing space being provided around each plunger. The several plungers can then be combined to form a common pump unit in order to provide a high delivery volume. The pump is therefore preferably constructed as a high-pressure plunger pump.

30

The invention will be explained in detail in the following by means of an embodiment with reference to the attached drawings.

35 Figure 1 is a lateral sectional view of an embodiment of a pump according to the invention;

Figure 2 is a sectional top view of the essential parts of the pump of Figure 1;

Figure 3 is a detailed view of the lower plunger  
5 section.

A plunger pump 1 illustrated in Figures 1 and 2 comprises a one-part or multiple-part housing 2 in which a lower crank mechanism 3 is provided. The crank mechanism  
10 3 is used for driving a plunger 5, which is constructed in several parts and comprises a lower plunger section 4. The plunger 5 is made of a highly wear-resistant material, such as ceramics or hard metal and slides without any contact pressure in a running sleeve or receiving device  
15 51, which is not shown in detail, for sealing off the ring gap formed around the plunger 5. This receiving device 51 forms a high-pressure sealing and may be constructed as a labyrinth, packing or hydrodynamic sealing. Below the receiving device 51, a low-pressure sealing 52 is provided  
20 which is constructed as a packing or elastomer sealing ring. As a result of the vertical construction, the plunger pump 1 can operate in a weight-neutral manner.

A pump head 6 is provided in the upper area of the  
25 housing 2, in which pump head 6 ducts are constructed for guiding a fluid. The pump head 6 is fastened to the housing 2 by way of bolts 11.

For the pumping of a fluid, fluid is sucked into the  
30 space 8 from a suction space 9 during a downward movement of the plunger 5. As soon as the plunger 5 has passed through the lowest point, the plunger 5 moves upward and, by way of a valve, closes off the access to the suction space 9. In addition, a valve 50 is operated which opens  
35 an access to the pressure space 10. As a result of the upward movement of the plunger 5, starting with the generation of a certain pressure, the fluid is therefore

pumped into the pressure space 10 and is distributed by way of corresponding pipes.

For the sealing between a lower housing space 19, in which the crank mechanism 3 is arranged, and a space 12 filled with air, ring-shaped and conically constructed bellows 7 are provided. As a result of the conical and wave-shaped construction of the bellows 7, a buckling is prevented during the movement of the plunger 5. On one side, the bellows 7 are fastened to the plunger 5, a flange 43 being provided at the lower plunger section 4, to which flange 43 a ring-shaped section 14 being sealingly clamped by way of a clamping element 15. On the opposite side, the bellows 7 are sealingly fixed to a ring-shaped receiving device 17 by way of additional clamping elements. The receiving device 17 is integrally connected with the housing 2 by way of interior webs.

The bellows 7 are formed of a media-resistant and water-jet-resistant material so that the pump 1 can also be used under extreme conditions. The wall thickness of the flexible material of the bellows 7 amounts to approximately 1 to 2 mm.

In the illustrated embodiment, several plungers 5 are arranged side-by-side. In this case, the crank mechanism 3 is driven by way of a pinion shaft 30 whose pinions mesh with one or several gear wheels 29. The gear wheels 29 are connected with a crankshaft, as a result of the eccentric mounting of the crank pins, an oscillating movement of the plunger 5 being generated. In this case, the guiding element 21 is linked to a axis 22 at the piston rod 32. An oil pressure constant circulation lubrication is provided in the lower housing space 19. The guiding element 21 is guided in a receiving device 20, in which case no high-expenditures sealing devices have to be provided between the guiding element 21 and the



receiving device 20 because the bellows 7 provide a hermetic sealing and form a splash guard. This type of elastic sealing by means of bellows 7 also prevents a wear of sealing devices, such as sliding guides, etc.

5

As illustrated in Figure 2, in the illustrated embodiment, 3 plungers are mounted in the housing 2. It is also possible to combine fewer or more plungers in a pump unit.

10

As illustrated in Figure 3, the lower plunger section 4 comprises a flange 43 for fastening the bellows 7. Inside the flange 43, a stop 44 is provided for the connection with the upper part of the plunger 5. On the opposite side, a pin 41 is constructed which engages in the guiding element 21. The pin 41 has a reduced diameter so that pressure forces can be removed from the guiding element 21 by way of a shoulder 42.

15

20

For the purposes of this specification it will be clearly understood that the word "comprising" means "including but not limited to", and that the word "comprises" has a corresponding meaning.

25

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

30

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A pump comprising:

5 a housing including a pump head in an upper area of the housing and fixed to the housing for guiding a pressurized fluid withdrawn from a suction space;

a crank mechanism in a lower housing space of the housing for oscillating a plunger in the housing and guided in a receiving device;

10 a high pressure sealing element and a low pressure sealing element adjoining an intermediate space and around the plunger; and

15 an elastic sealing device located in the intermediate space that is sealingly separated from the upper housing area by the sealing elements, the sealing device being fastened to the plunger and providing a pressure-tight sealing with respect to the lower housing space containing the crank mechanism.

20 2. The pump according to claim 1, wherein the sealing device is fastened on one end to the plunger and on the opposite end to the housing.

25 3. The pump according to claims 1, wherein the sealing device is one of a ring-shaped bellow and conical bellow.

30 4. The pump according to claim 1, wherein the sealing device provides a gastight seal between the lower housing space and the intermediate space.

35 5. The pump according to claim 1, wherein the sealing device forms a splash guard against oil from the lower housing space.

6. The pump according to claim 1, wherein the plunger is constructed in two or more parts.

7. The pump according to claim 1, including two or more adjacent plungers in the housing and connected to the crank mechanism, and a sealing device is connected to each  
5 plunger to seal each plunger with respect to the lower housing space.

8. The pump according to claim 1, wherein the pump is constructed as a high-pressure plunger pump.  
10

9. The pump according to claim 1, wherein the intermediate space is filled with air.

15 Dated this 1st day of March 2004  
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20 Trade Mark Attorneys of Australia

Fig. 1

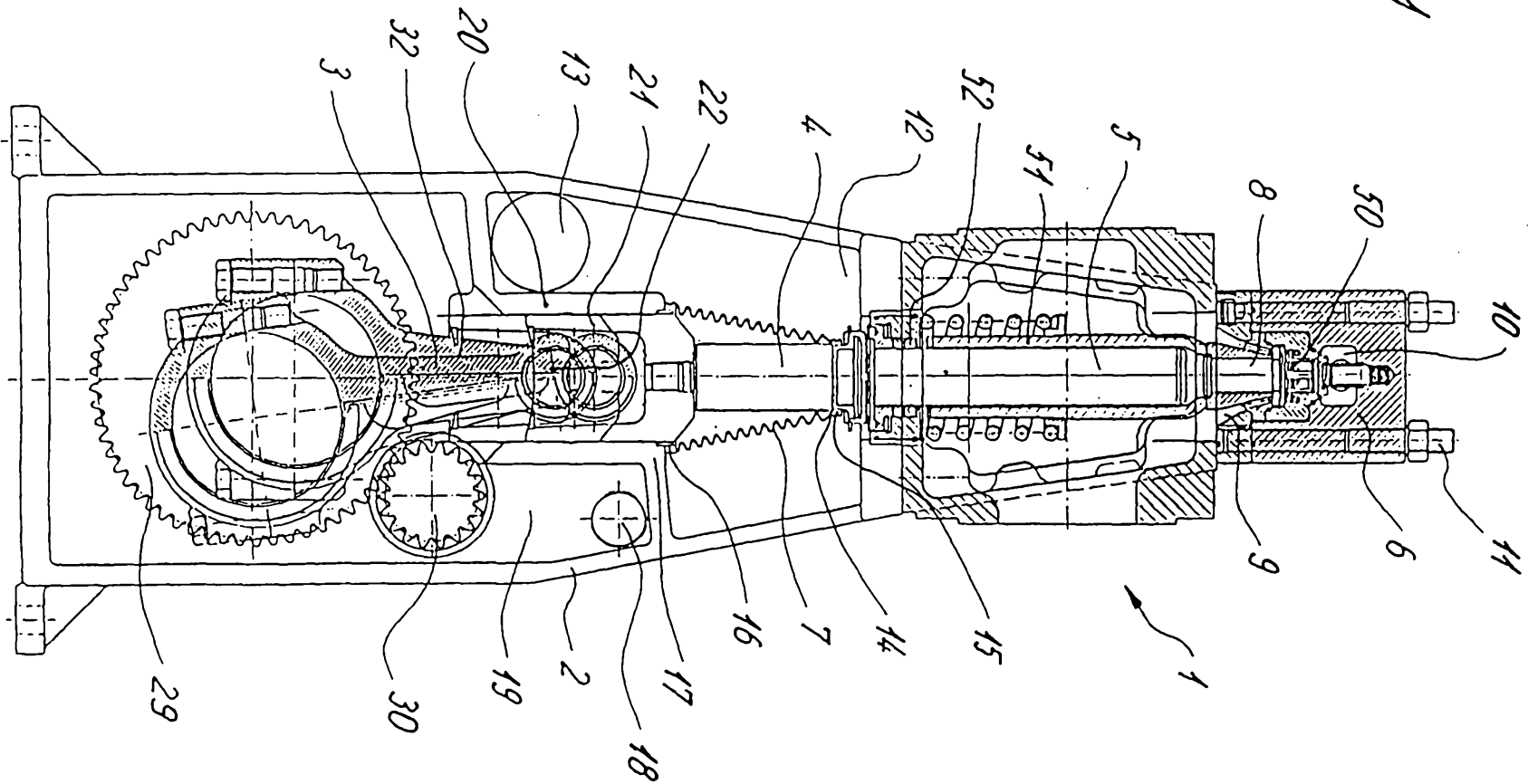
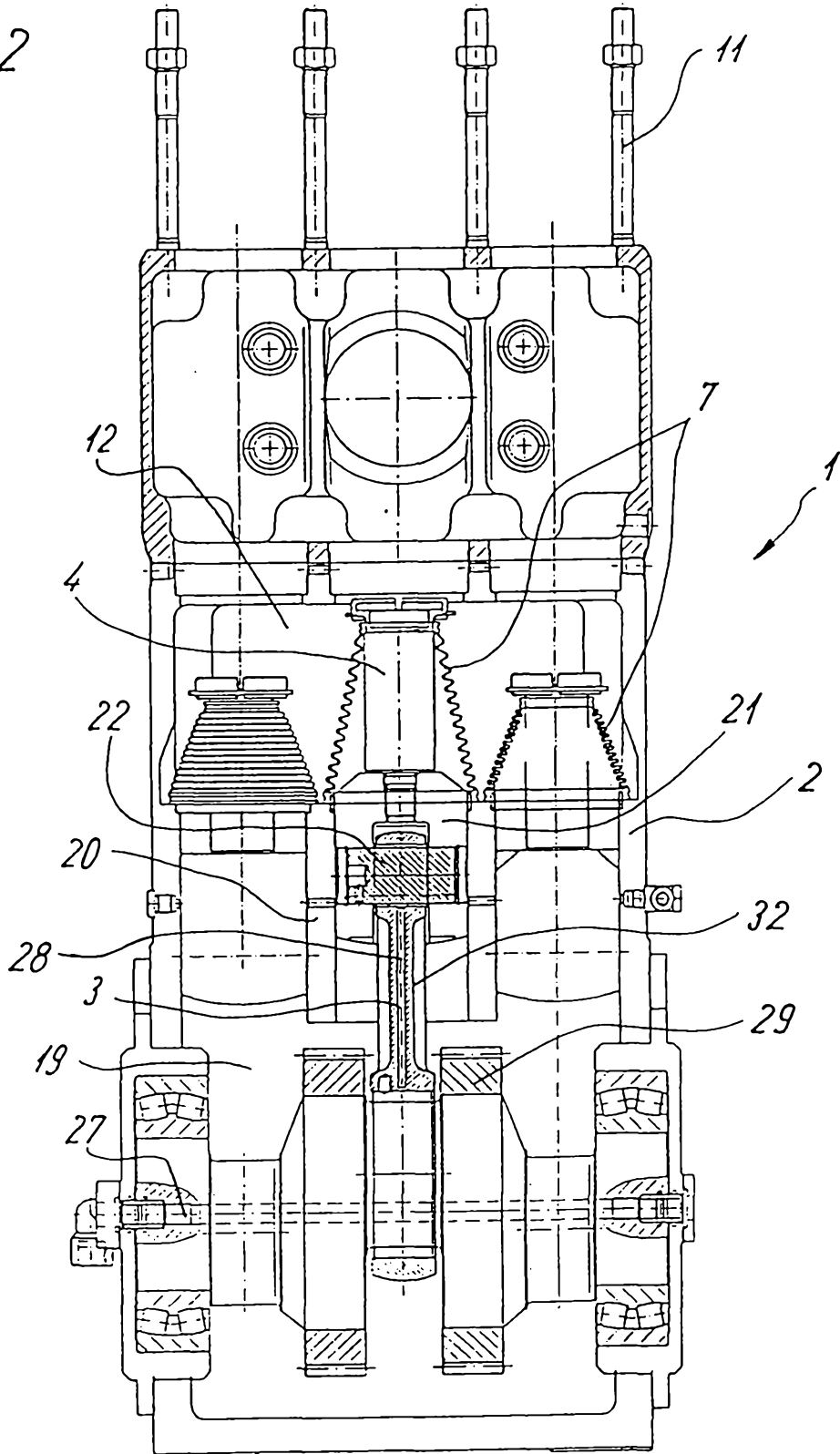


Fig. 2



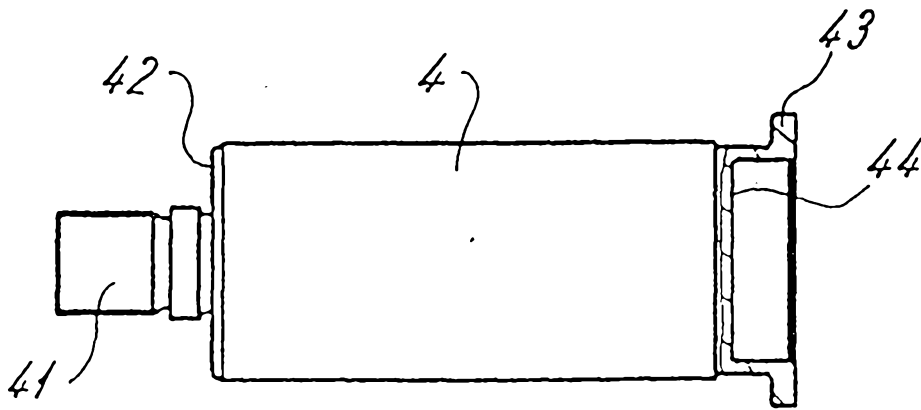


Fig. 3