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SEALING WATER SYSTEM

CROSS-REFERENCE TO PRIOR APPLICATION

[0001] Priority is claimed to German Patent Application No. DE 10 2011 075 172.6, filed on May 3, 2011, the entire disclosure of which is hereby incorporated by reference herein.

FIELD

[0002] The invention relates to a sealing water system for flushing at least one rotating mechanical seal.

BACKGROUND

[0003] In known sealing water systems for flushing at least one rotating mechanical seal, for example in a high-performance pump in beverage treatment or in beverage bottling technology, the sealing water, which is possibly contaminated, is disposed of or drained. This means a considerable waste of water which is, in particular in arid regions, disadvantageous, basically expensive and pollutes the environment, for such sealing water systems are optionally employed with a sealing water throughput of 100 l/h or more and optionally in permanent operation. In the Federal Republic of Germany, a sealing water system for a rotating mechanical seal of a high-performance pump can absolutely cause annual water costs of between €3,000 and €15,000, where not only the provision costs, but also waste water costs must be considered.

SUMMARY

[0004] In an embodiment, the present invention provides a sealing water system for flushing a rotating mechanical seal. The sealing water system includes a closed circuit. A supply pump is disposed in the closed circuit so as to act upon the rotating mechanical seal with sealing water. The closed circuit is configured to collect and recirculate the sealing water.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The present invention will be described in even greater detail below based on the exemplary figures. The invention is not limited to the exemplary embodiments. Other features and advantages of various embodiments of the present invention will become apparent by reading the following detailed description with reference to the attached drawings which illustrate the following:

[0006] FIG. 1 shows a block diagram of an embodiment of a sealing water system,

[0007] FIG. 2 shows a block diagram of a further embodiment of a sealing water system, and

[0008] FIG. 3 shows a schematic cross-sectional view of a pump with a rotating mechanical seal which can be incorporated in the sealing water system of FIG. 1 or 2.

DETAILED DESCRIPTION

[0009] In an embodiment, the invention provides a sealing water system that can be operated in an inexpensive and eco-friendly manner.

[0010] Departing from the principle known up to now, namely to dispose of the sealing water after flushing e.g. into the gully, sealing water is, according to an embodiment of the invention, collected downstream of the respective rotating mechanical seal and returned and reused. This results in considerable saving of water and relieves the environment.

[0011] In a suitable embodiment, in the circuit upstream of the respective rotating mechanical seal, a sealing water temperature adjustor is provided. The adjustor is suitable because the sealing water would increasingly heat up in a long-term operation of the system, or it is or must be provided at an elevated temperature. A constant temperature adjusted to the rotating mechanical seal is important for a perfect function also of the rotating mechanical seal.

[0012] Particularly suitably, collected sealing water can be regenerated, either in the circuit itself or in a treatment plant associated to the circuit. This is because sealing water is contaminated when the rotating mechanical seals are flushed, where contamination can possibly not be sufficiently trapped only with filters. However, filters that can be periodically backflushed can contribute to ensuring more stable operating conditions. Suitably, the sealing water system, however, can be cleaned manually.

[0013] In one suitable embodiment, a sealing water storage tank is incorporated in the circuit and provides a sealing water storage at least sufficient for the number of consumers. Advantageously, a fresh water or clean water refill device is associated to the storage tank as losses can occur in the circuit and/or at the rotating mechanical seals which have to be compensated. In cleaning the system from contaminations contained in the used sealing water, too, sealing water losses which have to be compensated can occur. The refill device can be, for example, operated with a float or with contactlessly operating level measuring elements.

[0014] In one suitable embodiment, a heat exchanger is installed in a flow pipe between the supply pump and the respective rotating mechanical seal as a sealing water temperature adjustor. The heat exchanger is suitably a cooler operated with cooling water which absorbs operational temperature rises or provides an optimal sealing water temperature. A cooler can also be suitable if very warm fresh or clean water is available at the operators site. In applications where the fresh or clean water must be provided in a very warm state, this is particularly advantageous.

[0015] The rotating mechanical seal is connected with the sealing water storage tank via a return line for collected sealing water, so that the circuit is closed. Preferably, a return pump for circulation is incorporated in the return line and permits, in cooperation with the supply pump, the exact adjustment of the throughput rate of sealing water via the rotating mechanical seal.

[0016] The sealing water system cannot only be used for a rotating mechanical seal of a pump or only a few rotating mechanical seals of the same pump but for an arbitrary number of consumers in the form of rotating mechanical seals which, in one embodiment, are connected in parallel, preferably downstream of the heat exchanger. The return line of each connected rotating mechanical seal leads into a common main return line of the closed circuit which can directly lead to the storage tank. In this case, one single supply pump acts upon all flushed rotating mechanical seals.

[0017] With a major number of rotating mechanical seals incorporated in the sealing water system, one supply pump each can be alternatively provided, so that optionally different throughput rates can be adjusted.

[0018] Especially in case of several rotating mechanical seals being incorporated in the sealing water system, it is suitable to install a pressure compensation tank in the return
line of at least one rotating mechanical seal, for example upstream of the respective return pump. The pressure compensation tank, for example, hydraulically decouples the rotating mechanical seal associated to it from the return line of other rotating mechanical seals to avoid pressure variations retroacting through different pipe cross sections, pipe lengths, start and stop situations.

In order, on the one hand, not to introduce any contamination from the storage tank into the respective rotating mechanical seal, or to prevent soiling from reaching the storage tank in the return line, at the delivery side of the supply pump and in the return line or in the main return line, filters can be installed each whose filter inserts are periodically exchanged and/or cleaned, or which are periodically back-flushed.

The sealing water system is operated by a suitably programmable system control. In the sealing water storage tank and/or the pressure compensation tank, at least one level measuring and/or monitoring probe is installed which is connected to the system control to communicate error conditions. A sealing water loss, for example, in the storage tank could indicate damage at the refill device or in the return line of the circuit, while a sealing water loss in the pressure compensation tank can even indicate possible damage in the rotating mechanical seal.

Since the sealing water system is subject to increasing contamination due to the recirculating sealing water in long-term or permanent operation, it is suitable to associate, for example, to the sealing water storage tank, an automatic or manual cleaning means. The storage tank could be embodied like a separator with separation means, wherein optionally separated impurities can be cleaned and disposed of without interrupting the operation.

Rotating mechanical seals G, for example as schematically indicated in FIG. 3, are used e.g. in efficient pumps because they provide constant and good sealing properties. A rotating mechanical seal G functions best within a predetermined temperature range because then a certain sealing clearance is maintained which can lead, however, to a certain leakage through the rotating mechanical seal. In pumps which are employed, for example, in the beverage conveying technology or bottling technology, conveyed food products must not be subject to any contamination, for example due to the leakage of rotating mechanical seals. In order to, on the one hand, adjust certain operating temperatures also of the rotating mechanical seals, on the other hand to discharge contaminations or prevent them from mixing with the conveyed food product, it is common to allow sealing water to act upon rotating mechanical seals.

FIG. 1 illustrates a sealing water system S for at least one rotating mechanical seal G of a pump P which, as is indicated, comprises a stationary pump part and at least one rotating pump part between which the rotating mechanical seal G seals.

The sealing water system S shown in FIG. 1 comprises a closed circuit 1 consisting of a flow line 2 starting from a sealing water storage tank 3 and a return line 13 to the storage tank 3. In the flow line, a supply pump 4 for the sealing water is arranged, where a filter 5 can be installed at its delivery side. In the return line 13, a return pump 6 can be arranged downstream of the rotating mechanical seal G, and also e.g. a further filter 7 before the sealing water is returned into the flow tank 3. The storage tank 3 can be provided with at least one level measuring and/or monitoring probe 8 which is connected to a system control. Furthermore, the storage tank 3 or the circuit 1 itself preferably comprises an automatic refill device 9 for fresh and/or clean water which compensates operational losses of sealing water. Suitably, the storage tank 3 is furthermore provided with an automatic or manual cleaning means, optionally also with an overflow 10.

A treatment means 11 for contaminated collected sealing water is alternatively provided in a dotted line, which is incorporated between the return line 13 and the storage tank 3. In a further alternative, the storage tank 3 could be embodied like a separator to separate off impurities contained in the collected sealing water, so that the supply pump 4 receives sealing water of good quality.

A measuring device 12 can be connected, for example, to the return line 13 and monitor the conductance in the circuit 1. The storage tank 3 could be temperature controlled to ensure a constant temperature already in the flow line 2. If the pump P contains, for example, two rotating mechanical seals G, these could be together incorporated in the circuit 1, so that sealing water with a certain temperature and a certain throughput rate can act upon each of them. The throughput rate can be, for example, about 100 l/h or even more.

In the embodiment of the sealing water system S in FIG. 2, first sealing water also acts upon the rotating mechanical seal G of the pump P similar as in the embodiment in FIG. 1, wherein employed sealing water is collected downstream of the rotating mechanical seal G and returned into the sealing water storage tank 3 via the return line 13 via a main return line 13'.

Between the supply pump 4 and an on-off valve 19 in a flow line branch 2' which branches off from the flow line 2 at a node 17, a heat exchanger 14 is arranged which adjusts the operating temperature of the employed sealing water and acts as sealing water temperature adjustor E. The heat exchanger 14 is, for example, a cooler upon which cooling water acts via pipes 15, 16. The on-off valve 19 is switched, for example, via a servo cylinder 18 to flush the rotating mechanical seal G.

As a further alternative, in FIG. 2 a pressure compensation tank 22 is provided in the return line 13 between the rotating mechanical seal G and upstream of the return pump 6, which can also be equipped with at least one level measuring and/or monitoring probe 8. The pressure compensation tank 22 avoids pressure variations in the flushing of the rotating mechanical seal G and is particularly suitable if, as in FIG. 2, several rotating mechanical seals are connected in parallel to the flow line 2 via nodes 20, 21 and flow line branches 2' upon which in FIG. 2 one single supply pump 4 acts, and which can be connected analogously to the shown rotating mechanical seal G, for example with on-off valves 19. These several rotating mechanical seals form several consumers I, II, III, etc. in the sealing water system S which are supplied in parallel and are connected with their return lines 13 to the main return line 13' to the storage tank 3. A pressure compensation tank 22 can be provided in each return line 13, or at least in one return line 13.

In a further alternative, the flow line 2 could be branched into a corresponding number of flow line branches 2' and contain a separate supply pump 4 in each flow line branch 2', optionally combined with one filter 5 and/or one heat exchanger section each analogously to the heat exchanger 14.
The pump P schematically shown in sections in FIG. 3 comprises a stationary pump part 23 and a rotating pump part 24 between which, in a sealing level 27, a rotating slirring 25 with an annulus sealing surface cooperates with a stationary slirring 26, 28 and 29 are, for example, O-rings acting as secondary seals. The rotating slirring 25 is pressed against the stationary slirring 26 by a spring means 30 and entrained by a dog 31 which can be employed for transmitting torques via a threaded joint 32. For example, the region restricted by the side seals 29, 28 at the rotating mechanical seal G can be acted upon, i.e. flushed, with the sealing water of the sealing water system S in FIG. 1 or FIG. 2. The employed sealing water does not only resist a predetermined operating temperature of the rotating mechanical seal G but also flushes out occurring leakages or contaminations.

While the invention has been described with reference to particular embodiments thereof, it will be understood by those having ordinary skill in the art that various changes may be made therein without departing from the scope and spirit of the invention. Further, the present invention is not limited to the embodiments described herein; reference should be had to the appended claims.

What is claimed is:

1. A sealing water system for flushing a rotating mechanical seal, the sealing water system comprising:
   a closed circuit and a supply pump disposed in the closed circuit so as to act upon the rotating mechanical seal with sealing water, the closed circuit being configured to collect and recirculate the sealing water.

2. The sealing water system according to claim 1, wherein the rotating mechanical seal is disposed in a pump.

3. The sealing water system according to claim 1, further comprising a sealing water temperature adjustor disposed in the closed circuit upstream of the rotating mechanical seal.

4. The sealing water system according to claim 1, wherein at least one of the closed circuit and a treatment plant associated with the closed circuit is configured to regenerate the collected sealing water.

5. The sealing water system according to claim 1, further comprising at least one sealing water storage tank disposed in the closed circuit.

6. The sealing water system according to claim 5, wherein at least one sealing water storage tank includes a clean water refill device.

7. The sealing water system according to claim 2, wherein the sealing water temperature adjustor is disposed in the closed circuit between the supply pump and the rotating mechanical seal and includes a heat exchanger disposed in a flow line of the closed circuit.

8. The sealing water system according to claim 7, wherein the heat exchanger includes a cooler operated with cooling water.

9. The sealing water system according to claim 5, wherein the rotating mechanical seal is connected with the at least one sealing water storage tank via a return line disposed so as to receive the collected sealing water.

10. The sealing water system according to claim 9, further comprising a return pump disposed in the return line and configured to pump the collected sealing water to at least one sealing water storage tank.

11. The sealing water system according to claim 1, further comprising a plurality of the rotating mechanical seals disposed in parallel in a flow line of the closed circuit such that the supply pump acts upon each of the rotating mechanical seals with the sealing water, each of the rotating mechanical seals including a return line, each of the return lines being connected to a common main return line of the closed circuit.

12. The sealing water system according to claim 11, further comprising a heat exchanger disposed in the closed circuit upstream of each of the rotating mechanical seals.

13. The sealing water system according to claim 1, further comprising a plurality of the supply pumps disposed in the closed circuit and a plurality of the rotating mechanical seals connected in parallel to a common sealing water storage tank via branched flow lines of the closed circuit, each of the branched flow lines being disposed such that a respective one of the supply pumps acts upon a respective one of the rotating mechanical seals with the sealing water.

14. The sealing water system according to claim 1, further comprising a return line being disposed with respect to the rotating mechanical seal so as to receive the collected sealing water and a pressure compensation tank disposed in the return line.

15. The sealing water system according to claim 14, further comprising a return pump disposed in the return line downstream of the pressure compensation tank and configured to pump the collected sealing water to at least one sealing water storage tank.

16. The sealing water system according to claim 1, further comprising a filter disposed at a delivery side of the supply pump.

17. The sealing water system according to claim 1, further comprising a return line being disposed with respect to the rotating mechanical seal so as to receive the collected sealing water and a filter disposed in the return line.

18. The sealing water system according to claim 14, further comprising at least one of a level measuring probe and a monitoring probe disposed at at least one of a sealing water storage tank disposed in the closed circuit and the pressure compensation tank.

19. The sealing water system according to claim 18, wherein the at least one of the level measuring probe and the monitoring probe is connected to a system control.

20. The sealing water system according to claim 5, further comprising an automatic or manual cleaning device associated with the at least one sealing water storage tank.

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