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SEALING DEVICE

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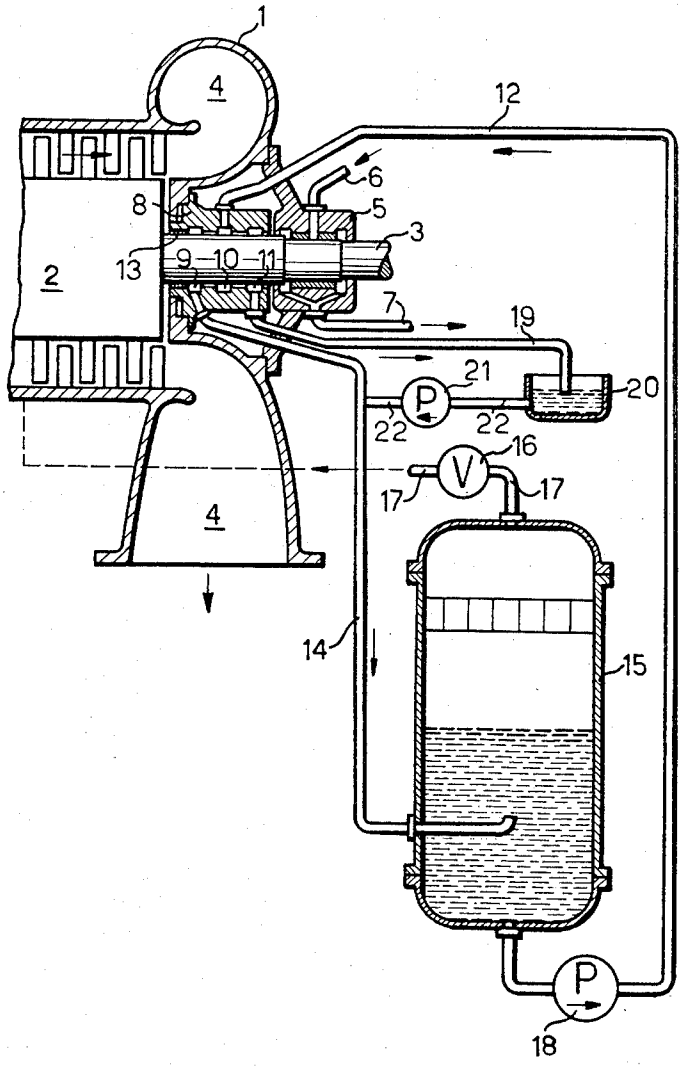

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SEALING DEVICE

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This invention relates to a device for sealing from its surroundings a space between relatively moving parts containing gaseous nuclear-reaction fission products.

If a space contains gaseous fission products caused by nuclear reactions, then, because of the harmful effect of the radioactive materials to organisms, there is often the problem of completely avoiding the escape of these materials to atmosphere. For example, such is the case when the gaseous working medium of a thermal power plant flowing in a closed circuit is led through a nuclear reactor whereby gaseous fission products could contaminate the working medium and possibly also split the working medium itself into radioactive components. A reliable way must then be found for avoiding the escape to atmosphere of such working media containing radioactive fission products.

With a view to obtaining a substantially gas-tight seal from atmosphere for the working medium of turbo machines at the place where the shaft passes through the housing, it has already been proposed to use a liquid seal, lubricating oil being preferred for this purpose. This does not, however, afford a complete seal, such as is required to keep radioactive fission products remote from the atmosphere because in these seals a part of the liquid flows off laterally to atmosphere thus making it possible that minute quantities of gas can escape with the liquid. In addition, lubricating oil decomposes under the action of the radioactive rays emitted by the materials with which it comes into contact and becomes unusable.

Now, in a device for sealing from its surroundings a space between relatively moving parts containing gaseous nuclear-reaction fission products, the invention aims reliably to prevent escape of such radioactive materials. This is achieved according to the invention by the provision of a liquid seal in which the sealing liquid is such as to receive these fission products, without itself decomposing even under the action of the radioactive rays from the fission products.

The sealing liquid is preferably a suspension of an adsorption substance in a solvent mixture.

If, for example, the working medium of a thermal power plant comes into contact with fission products of uranium or plutonium, then it is particularly important to prevent the escape from the working medium chamber to atmosphere of radioactive bromine, krypton, xenon or iodine. The preferred sealing liquid used in this case is a suspension of active carbon in a mixture of alcohol and water. The sealing liquid absorbs and then dissolves these fission products. Small quantities of sealing liquid which flow out can be easily collected and suitably treated without the radioactive materials in question reaching the atmosphere.

The important effect of the invention is thus that the radioactive materials are received by the sealing liquid and do not reach the atmosphere in a gaseous state. Instead of the above mentioned sealing liquid, other sealing liquids with similar properties can also be employed within the scope of the invention. Instead of active carbon for instance, the adsorption substance could also be a silicon-base substance. Further, instead of alcohol and water, a different solvent can be employed which is adapted to dissolve the gaseous fission products in question, but which is not decomposed itself by the radioactive rays.

The drawing illustrates an example of the sealing device according to the invention as applied to a working medium compressor of a closed-circuit thermal power plant. It is assumed that the working medium receives its heat from a nuclear reactor and is polluted by radioactive fission products emanating from this reactor.

Only the outlet side portion of the compressor where the shaft passes through the housing is illustrated. The compressor housing is designated **1**. The bladed runner **2** is connected to a driving machine (not shown) by a shaft **3** which penetrates the housing. The outlet-side end of the housing surrounds a discharge chamber **4** for the compressed working medium. The shaft **3** is mounted in a bearing **5** flanged to the housing **1**, the lubricant being supplied to the bearing by a conduit **6** whilst a conduit **7** serves to lead off the lubricant.

In order to seal from atmosphere the chamber **4** containing gaseous fission products, a liquid seal is provided where the rotary shaft **3** passes through the housing **1**. A sleeve **8** is flanged to the housing **1** and arranged between the runner **2** and bearing **5** to surround the shaft. Three annular chambers **9**, **10** and **11** are provided in the sleeve. The central chamber **10** is supplied with sealing liquid through a conduit **12**, which liquid is adapted to receive the aforementioned fission products contained in the chamber **4** and which is not decomposed under the action of the radioactive rays from the fission products. As mentioned earlier, it can be a suspension of an adsorption substance in a solvent mixture, for example active carbon in a mixture of alcohol and water.

A labyrinth type stuffing box **13** is arranged between the discharge chamber **4** in the housing and the annular chamber **9**. The chamber **9** communicates with a vessel **15** via a conduit **14**, a conduit **17** having a valve **16** leading from the vessel to a low pressure part of the circuit for the working medium.

A lower pressure obtains in the chamber **9** than in the discharge chamber **4** of the compressor housing. Thus a certain amount of working medium thus escapes from the chamber **4** toward the chamber **9**. It therefore flows through the conduit **14** into the vessel **15** and from there is returned to the circuit through the conduit **17**.

The sealing liquid supplied to the annular chamber **10** through the conduit **12** has a higher pressure than the working medium in the annular chamber **9**. This ensures a constant flow of a certain amount of sealing liquid through the gap between the sleeve **8** and the shaft **3** in a direction toward the annular chamber **9**. The flow of working medium to the outer end of the sleeve **8** is thus prevented. The sealing liquid reaching the chamber **9** together with the gas escaping through the labyrinth stuffing box **13**, is led through the conduit **14** into the vessel **15** and separated from the gas therein. The liquid collecting in the vessel **15** is returned to the conduit **12** by a pump **18** and again serves as sealing liquid.

A portion of the sealing liquid flows out of the annular chamber **10** through the gap between the sleeve **8** and the shaft **3** and toward the annular chamber **11** from which it is withdrawn through a conduit **19** into a container **20**. Thereafter a pump **21** returns it to the conduit **14** via a conduit **22** so that this portion of the sealing liquid recombines with the portion flowing from the chamber **9**.

Since the sealing liquid is adapted to receive by adsorption or dissolution the radioactive gaseous fission products in the gas escaping into the annular chamber **9**, these products always remain in the liquid. There is there-

fore no danger that dangerous radioactive gaseous components escape from the liquid withdrawn from the annular chamber 11. With time, the circulated liquid becomes more concentrated with such fission products. However, only minute quantities are involved and operation will be continued for a comparatively long time before the liquid becomes so saturated with fission products that it has to be replaced.

The feature described above thus has the advantage that outwardly penetrating radioactive fission products always remain bound to the liquid and do not escape as a gas. Consequently it is comparatively simple to remove the radioactive components in a convenient manner.

What is claimed is:

1. The method of sealing a space between relatively moving parts which contains gaseous nuclear-reaction fission products, which comprises providing a liquid seal for said space; and using in that seal a sealing liquid which does not decompose under the action of the radioactive rays emanating from the fission products and which comprises a fission product solvent mixture containing a suspension of a fission product-adsorbing substance.

2. The method of sealing a space between relatively moving parts which contains the gaseous nuclear-reaction fission products of uranium or plutonium, namely bromine, iodine, xenon and krypton, which comprises providing a liquid seal for said space; and using in that seal a sealing liquid consisting of a mixture of alcohol and water containing a suspension of active carbon.

References Cited in the file of this patent

UNITED STATES PATENTS

1,873,988	Van Ryswyk	Aug. 30, 1932
1,932,955	Van Ryswyk	Oct. 31, 1933
2,287,034	Hollander	June 23, 1942
2,820,652	Oechslin	Jan. 21, 1958

OTHER REFERENCES

Publication Boiling Water Reactor Plant from "International Conference of the Peaceful Uses of Atomic Energy," volume 3, pages 256–258.

"Proceedings of the International Conference on the Peaceful Uses of Atomic Energy," United Nations publication (New York), 1956 (volume 3, page 184, column 2, lines 28–42 relied on).