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LIQUID SEAL FOR ROTARY APPARATUS.

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924,836. **Patented June 15, 1909.**

Fig. 1.

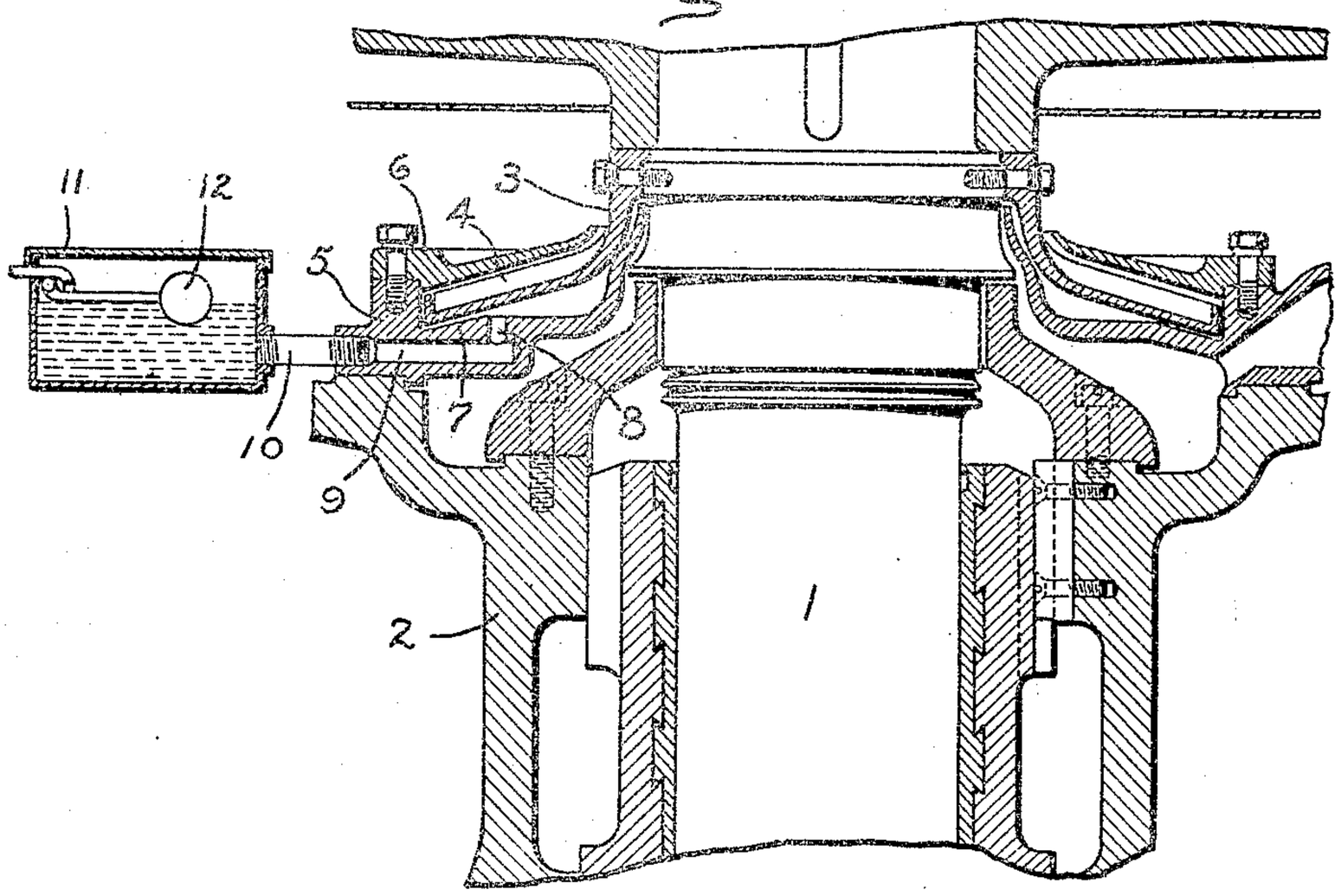

Fig. 2.

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UNITED STATES PATENT OFFICE.

FREDERICK SAMUELSON, OF RUGBY, ENGLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

LIQUID SEAL FOR ROTARY APPARATUS.

No. 924,836. Specification of Letters Patent. Patented June 15, 1909.

Application filed October 18, 1907. Serial No. 398,014.

To all whom it may concern.

Be it known that I, FREDERICK SAMUELSON, a subject of the King of Sweden, residing at Rugby, England, have invented certain new and useful Improvements in Liquid Seals for Rotary Apparatus, of which the following is a specification.

This invention relates to liquid seals of the type employed in high speed rotary engines such as turbines for the purpose of preventing air or steam leaking around the shaft where it passes through a partition having a difference of pressure on its two sides.

The object of my invention is to produce a liquid seal of the centrifugal type in which the liquid therein is automatically maintained at its proper level so that there shall neither be too little liquid, thus permitting leakage of air or steam, nor too much liquid, entailing priming over into the lower pressure.

The present invention may be applied to horizontal or vertical turbines either between stages or between the low or intermediate pressure stages and the atmosphere, and the following description is that of a seal as applied to a vertical shaft turbine; near the bottom of its shaft and between the last stage wheel, the underside of which is open to the condenser, and the bottom bearing, which is in communication with the atmosphere.

In the accompanying drawing which illustrates one of the embodiments of my invention, Figure 1 shows a part of a vertical shaft turbine with the seal situated between the last stage wheel and the lower bearings; the step bearing blocks having been omitted for the sake of clearness; and Fig. 2 shows a slightly modified form of liquid seal.

In the drawing 1 represents the shaft carrying the rotating element of the turbine which is supported in a casing 2 containing a step-and-guide-bearing of any suitable construction. On the shaft is secured a disk 3 provided with vanes 4 on its upper surface. This disk is curved downwardly and projects into an annular chamber which is formed in the casing 5 carried by the bearing casing 2. This chamber has top and bottom walls 6 and 7 which may be curved substantially similarly to the disk 3 and should fit fairly closely and also a peripheral wall that surrounds the disk. The lower wall 7, the underside of which is exposed to atmospheric pressure projects farther inwardly and upwardly than the top wall 6 so that when the turbine is standing, the liquid, should the chamber be flooded, will flow over the upper wall into the condenser, and not over the bottom wall into the bearing casing 2. I prefer to use water for filling the chamber because it will do no harm to the condenser if it enters it but other fluids may be employed if desired. A water inlet port 8 is provided in the lower wall and is connected by a passage 9 and pipe 10 with a water tank 11 placed in a convenient position in which the water is maintained by a ball cock 12 or other approved means at a level corresponding to that in the chamber so that when the machine is not rotating the water is not wasted by flowing over the top flange into the condenser.

In the modified form of my invention illustrated in Fig. 2 the disk 3 is provided with vanes 4, on both its upper and lower surfaces and the lower wall 7 of the chamber conforms more closely to the shape of the disk than that illustrated in Fig. 1. In other respects the two forms are identical.

It will be seen that the rotating disk forms the frustum of a cone as do also the upper and lower walls of the casing. The bore of the lower wall through which the shaft passes is enough above that of the upper wall to prevent liquid from the chamber flowing through it into the bearings below. Owing to the arrangement of the parts the periphery of the disk is always immersed in liquid so that an effective seal is formed whether the machine is in operation or not. This is of particular advantage in starting the machine into operation and also where two or more machines are connected to the same condenser system.

The operation is as follows: When the shaft rotates, the water contained in the chamber being put in motion by the disk creates an outward pressure by its centrifugal force, and if a difference of pressure exists between the two sides of the disk 3, the radial depth of water on the two sides will differ by an amount sufficient to balance the difference in pressure. Should the amount of water in the chamber be sufficient to cover the inlet port 8 an outward pressure will be created in the passage 9 and pipe 10 which will tend to force out the water. On the other hand if the inlet port is not covered by water

it will be exposed to atmospheric pressure and by arranging the position of the inlet port and the height of water tank suitably, it is possible to maintain water in the chamber at such a level that the lower side or peripheral portion of the disk will be sufficiently immersed to prevent leakage and the water on the upper side of disk will not, taking into account the difference of radial depth due to pressure as before mentioned, flow over top wall of the chamber. By means of this arrangement the water seal effectively excludes any air leakage into the condenser while the turbine is running, and also an excess of water is prevented from accumulating and giving trouble by overflowing into the bearings.

Other modifications than those described above and illustrated in the drawings may be made without departing from the spirit of the invention; for instance, the wheel may be stationary and the parts containing the chamber revolving, the water being admitted through passages in the wheel.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. A liquid seal for rotary machines comprising a chambered casing containing liquid, a rotary disk extending into the chamber whose entire periphery is at all times immersed in liquid, and a means for supplying an amount of liquid to the chamber which is insufficient to overflow the wall of said chamber when the machine is not running and is sufficient to form a seal to prevent the passage of elastic fluid.

2. A liquid seal for rotary machines comprising a chambered casing containing liquid, a rotary disk extending into the chamber whose entire periphery is always immersed, vanes on the disk, a source of liquid supply, a conduit for feeding liquid from the source to the chamber, and a port in the walls of the chamber through which the conduit delivers said liquid which is so disposed that the pressure created by the rotating disk balances the head of liquid so long as said port is covered by the moving mass of liquid.

3. A liquid seal for rotary machines comprising a chambered casing containing liquid, a rotary disk extending into the chamber whose entire periphery is always immersed, vanes on the disk, a source of liquid supply feeding into the chamber, means for maintaining such a level in the source that the liquid in the chamber will not overflow its wall, and a port connecting the source of supply and the chamber which is so disposed that the pressure created by the rotating disk balances the head of liquid so long as it is covered by the moving mass of liquid.

4. In combination, a vertically disposed shaft, a chambered casing through which the shaft passes, a disk mounted on the shaft and extending into the chamber whose periphery is at all times immersed in liquid, and means for maintaining a body of liquid in the chamber whose level is below the upper wall of the casing.

5. In combination, a vertically disposed shaft, a casing through which the shaft passes comprising a peripheral wall and upper and lower walls, the bore of one of the walls being located at a point above that of the other wall to prevent liquid from flowing through it, a disk rotating in the chamber formed between the walls whose periphery is always immersed in liquid, and a means for supplying liquid to the chamber.

6. In combination, a vertically disposed shaft, a casing having a bore through which the shaft passes and comprising a peripheral wall and conical top and bottom walls, a conical disk secured to the shaft and extending into the chamber bounded by the walls, a port admitting liquid to the chamber, and a means for maintaining a body of liquid in the chamber sufficient to cover the port.

7. In combination, a vertically disposed shaft, a casing having a bore through which the shaft passes and comprising a peripheral wall and top and bottom walls which rise as they approach the shaft, the bore of the lower wall being situated above the level of that of the upper wall to prevent liquid from overflowing it, a disk mounted on the shaft to rotate in the chamber bounded by said walls, and means for supplying liquid to the chamber.

8. In combination, a vertically disposed shaft, a casing containing a bearing therefor, a chambered casing located above the first through which the shaft passes and whose upper and lower walls rise as they approach the shaft, the bore of the lower wall being above that of the upper wall, a disk rotating in the chamber and conforming in shape to the walls of the chamber, a port admitting liquid to the chamber, a source of supply, and means regulating the amount of liquid supplied through the port to the chamber.

In witness whereof, I have hereunto set my hand this 30th day of September, 1907.

FREDERICK SAMUELSON.

Witnesses:
CHARLES H. FULLER,
J. A. FOSTER.