June 4, 1929. A. J. HAUG 1,715,597

PACKING

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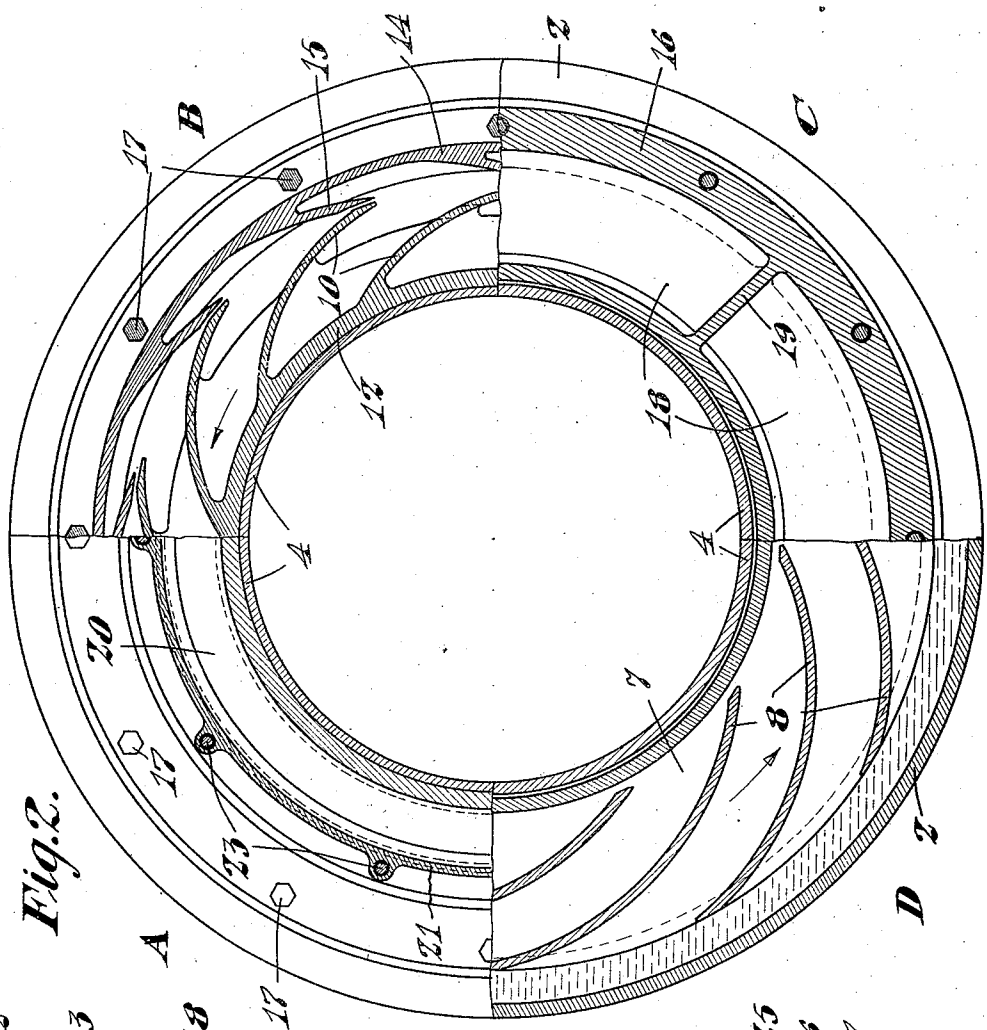


Fig. 2.

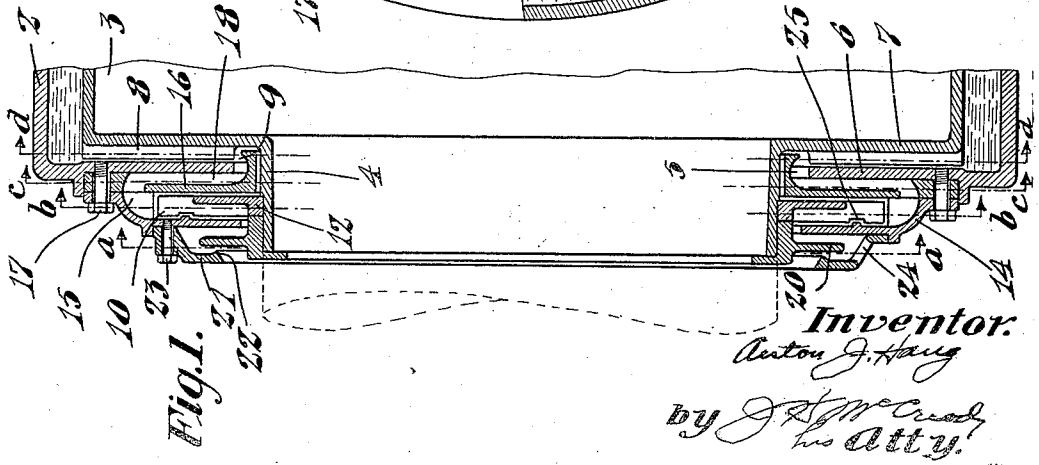


Fig. 1.

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PACKING.

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In those machines in which a rotating element revolves in a liquid container, it is necessary to use a packing of some character to close the clearance space between the shaft and the wall of the aperture through which the shaft projects in order to prevent the escape of liquid through this space. It has been the general practice heretofore to use a stuffing box for this purpose, the stuffing box containing a compressible packing and having a "gland" for pressing the packing firmly against the surface of the shaft. This necessarily results in applying a substantial frictional resistance to the rotation of the shaft. Also the packing wears, thus requiring the readjustment of the packing gland and ultimately necessitating the re-packing of the stuffing box.

The present invention relates to packing devices designed for use under the conditions above mentioned and to methods of packing clearances, and it has for its general object to avoid the use of packings that must be renewed, and to substantially reduce the friction and consequent loss of power which attend the use of such packings.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

Referring now to the drawings,

Figure 1 is a vertical, central, cross sectional view of a packing device embodying the present invention; and

Fig. 2 is a composite cross sectional view divided into four quadrants, the plane of section of the quadrant A being indicated in Fig. 1 by the line *a—a*, that of the quadrant B by the line *b—b*, that of the quadrant C by the line *c—c*, and that of the quadrant D by the line *d—d*.

The invention is especially applicable to pulp screening machines, and it is herein shown in connection with a pulp screen of the character shown and described in my Patent No. 1,551,953. This machine includes a stationary casing 2, and a revolving screen mounted in said casing and including a head 3. This head is integral with, or is fixed on, a shaft which may either be hollow, as indicated at 4, or solid, as shown by dotted lines. In this particular machine pulp is conducted into the screen, passes through the screen into the casing or container 2, and then flows out of the casing, the screen being revolved rapidly during the screening operation. Preferably the screen is constantly submerged in screened pulp and is under a substantial hydraulic head.

The shaft 4 passes through an aperture 5 formed in the end plate 6 of the container 2, and the screen head 3 includes an annular end plate 7 which lies parallel with, and closely adjacent to, the plate 6. These two plates thus are separated by a narrow annular chamber 9 which lies at right angles to the axis of the shaft 4. The aperture 5 opens directly into said chamber. Located in this chamber is a series of blades 8 which preferably are formed integral with the end plate 7, and these blades are curved or inclined with reference to their direction of rotation, as best shown in Fig. 2, so that when the screen is in motion the blades create a strong centrifugal force in the liquid in the chamber 9. This force is sufficient to effectually overcome the hydraulic head which tends to cause the liquid in the container to flow through the aperture 5. The blades 8 and the walls of the chamber 9 thus form, in effect, a centrifugal pump which forces any liquid approaching the aperture 5 backwardly away from said aperture and into the container.

In order to guard against the escape of liquid under unusual conditions, as for instance, when the machine is running at abnormally low speeds, or high heads, a second pump is provided. This pump comprises a series of blades 10, preferably integral with, and projecting from, a ring 12. The ring is seated on a shouldered portion of the shaft 4, and it is encircled by an annular disk 14 provided with an internal series of diffusion vanes 15. The disk 14 bears against an intermediate disk 16 which abuts against the end plate 6 of the stationary casing 2, both the disks 14 and 16 being secured to the end plate by bolts 17. A series of radial channels or ducts 18 is formed in the disk 16, these ducts being separated from each other by ribs, one of which is shown at 19, Fig. 2. The ducts 18 open at their outer ends into the spaces between the vanes 15 of the disk 14, and at their inner ends they open into the aperture 5. Consequently, as the ring 12 revolves with the shaft 4, the blades 10 exert a centrifugal action on the air or any fluid with which they are in contact, thus creating a flow of this air or other fluid through

the ducts 18, and thence through the aperture 5 into the inner end of the annular chamber 9 in which the blades 8 operate. The two pumps thus are in series, the outlet of the pump having the blades 10 discharging into the inlet of the pump which includes the blades 8. If, therefore, the screen should be operated at an abnormally low speed, or if for any reason liquid should force its way between the blades 8 and toward the aperture 5 it would be met by the air pressure created by the blades 10. It will be observed that the blades 10 rotate in a narrow annular chamber, as do the blades 8, and the blades in each case are of substantially the same width as the chamber in which they revolve, sufficient clearance only being provided to allow the blades to run freely without touching the walls of the chambers.

Preferably the blades 10 are grooved to cooperate with an annular bead or flange 25 which projects from the disk 14 parallel to the axis of the shaft 4 and acts as a trap to retard or prevent the flow of liquid along the wall of said disk toward the shaft 4 while the machine is running.

If the machine should be stopped for repairs, or for any other reason, without draining the liquid in the casing 2 down to a level below the lower edge of the aperture 5, some of this liquid would flow into the chambers of the packing device. Upon starting the machine again there would be a tendency for some of this liquid to work axially away from the screen and be thrown on adjacent machinery. In order to provide for this condition, a ring 20 having a radial flange is secured on the shaft 4 with its hub abutting against the ring 12, and it is encircled by a stationary guard ring 21 having a backwardly directed web or beading 22 at its inner edge. This ring 21 is secured to the disk 14 by bolts 23. It will be evident that any liquid which reaches the rotary ring 20 will be thrown outwardly against the stationary ring 21 and such liquid will run down the the walls of the latter ring to its lower side and will escape through the orifice 24.

It will now be understood that this invention provides a packing device which will effectually prevent the escape of liquids from the casings of pulp screening or other machines. This arrangement operates with comparatively little friction and it avoids entirely the necessity for the use of renewable packings.

While I have herein shown and described a preferred embodiment of my invention, it will be appreciated that the invention may be embodied in many other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. That improvement in the method of preventing the leakage of liquid through the clearance space between the wall of an aperture in a liquid container and a rotary shaft projecting through said aperture, which consists in opposing said leakage of liquid by pressure created through the motion of said shaft in the air immediately adjacent to said clearance space and in free communication therewith.

2. That improvement in the method of preventing the leakage of liquid through the clearance space between the wall of an aperture in a liquid container and a rotary shaft projecting through said aperture, which consists in opposing said leakage of liquid both by pressure created through the motion of said shaft in the air immediately adjacent to said clearance space and in communication therewith, and also by back pressure set up in the liquid tending to leak through said space, said back pressure being created centrifugally by the motion of said shaft.

3. The combination of a liquid container having an aperture through a wall thereof, a part projecting through said aperture, said part and said container being relatively rotatable and including members arranged to form a narrow annular chamber in free communication with the interior of said container and into which said aperture opens, and a series of rotary blades mounted in said chamber and arranged to place a pressure on liquid tending to approach said aperture to force it backwardly into said container and to keep it away from said aperture.

4. The combination of a liquid container having an aperture through a wall thereof, a rotary shaft projecting through said aperture, a rotary device carried by said shaft and mounted within the container for treatment of the container contents, said device and container having walls cooperating to form an annular chamber in said container, said chamber extending transversely to said shaft and closely surrounding said aperture, and a series of rotary blades located in said chamber, said blades being arranged to act on liquid adjacent to said aperture to force such liquid backwardly into said container and to keep it away from said aperture.

5. The combination of a liquid container having an aperture through a wall thereof, a rotary shaft projecting through said aperture, a rotary device carried by said shaft and mounted within the container for treatment of the container contents, said device and container having walls cooperating to form an annular chamber in said container, said chamber extending radially away from said shaft and closely surrounding said aperture, and a series of blades rotating with said shaft and located in said chamber, said blades being arranged to force liquid adjacent to said aperture backwardly into said container and to keep it away from said aperture.

6. The combination of a liquid container

having an aperture through a wall thereof, a rotary shaft projecting through said aperture, a rotary device carried by said shaft and mounted within the container, for treatment of the container contents, a series of impeller blades rotating with said shaft and located in the container closely adjacent to said aperture, and parts forming a narrow chamber extending transversely to said shaft in which chamber said blades are located, said blades being operative to keep the liquid contents of the container away from said aperture.

7. The combination of a liquid container having an aperture through a wall thereof, a rotary shaft projecting through said aperture, a rotary device carried by said shaft and mounted within the container, two circular series of blades rotating with said shaft and located closely adjacent to said aperture, and parts providing narrow chambers in which said blades are located, the outer edge of one chamber communicating with the inner edge of the other chamber, one of said chambers being arranged to receive liquid flowing from the container toward said aperture and the other chamber being open to the atmosphere.

8. The combination of a liquid container having an aperture through a wall thereof, a rotary shaft projecting through said aperture, and a packing for said shaft comprising two rotary pumps mounted, respectively, at the inner and outer sides of said wall close to said aperture, each of said pumps including a series of blades rotating with said shaft and the outer pump communicating with the atmosphere and being arranged to discharge into the intake end of the inner pump.

9. The combination of a liquid container having an aperture through a wall thereof, a rotary shaft projecting through said aperture, and a packing for said shaft comprising parts arranged to form two narrow annular chambers closely adjacent to and communicating with the inner and outer ends, respectively, of said aperture, and two series of blades mounted, respectively, in said chambers and each rotating with said shaft, the inner set of blades being arranged to force liquid inwardly away from said aperture and the outer set of blades being operative to force air inwardly through the aperture.

10. The combination of a liquid container having an aperture through a wall thereof, a rotary shaft projecting through said aperture, and a packing for said shaft comprising parts arranged to form two narrow annular chambers closely adjacent to and communicating with the inner and outer ends, respectively, of said aperture, two series of blades mounted, respectively, in said chambers and each rotating with said shaft, the inner set of blades being arranged to force liquid inwardly away from said aperture and the outer set of blades being operative to force air inwardly through the aperture, a ring having a radial flange extending therefrom and secured fast on said shaft outside of the outer set of blades, and a stationary ring encircling said flange.

11. The combination of a liquid container having an aperture through a wall thereof, a part projecting through said aperture, said part and said container being relatively rotatable, and a series of rotary blades mounted in said container for centrifugal action closely adjacent to said aperture and extending away from the axis of rotation, said blades being operative to place a pressure on any liquid tending to escape through said aperture to keep it away from said aperture and force it backwardly into said container.

12. That improvement in methods of preventing leakage of liquid through the clearance space between the wall of an aperture in a liquid container and a rotary shaft projecting through said aperture, which consists in acting centrifugally on liquid tending to flow outwardly through said space to force it back into the container, and acting centrifugally upon the air immediately outside of and closely adjacent to said aperture to urge it inwardly through said aperture.

13. The combination of a liquid container having an aperture through a wall thereof; a rotary shaft projecting through said aperture; and a packing for said shaft comprising two centrifugal pumps mounted, respectively, at the inner and outer sides of said wall close to said aperture, each of said pumps including a series of blades rotating with said shaft, the inner series of blades being arranged to act on liquid tending to escape through said aperture to force it backwardly into the container, and a casing cooperating with the outer pump to form a chamber for said outer pump in free communication with the atmosphere, said outer pump being operative to force air radially away from said shaft, and said casing serving to guide the air so acted upon into said aperture, whereby the current of air assists the inner pump in preventing the outward flow of liquid through said aperture.

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