Oct. 28, 1941. J. R. BARR 2,260,820

ROTARY LIQUID SEAL

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Fig. 1.

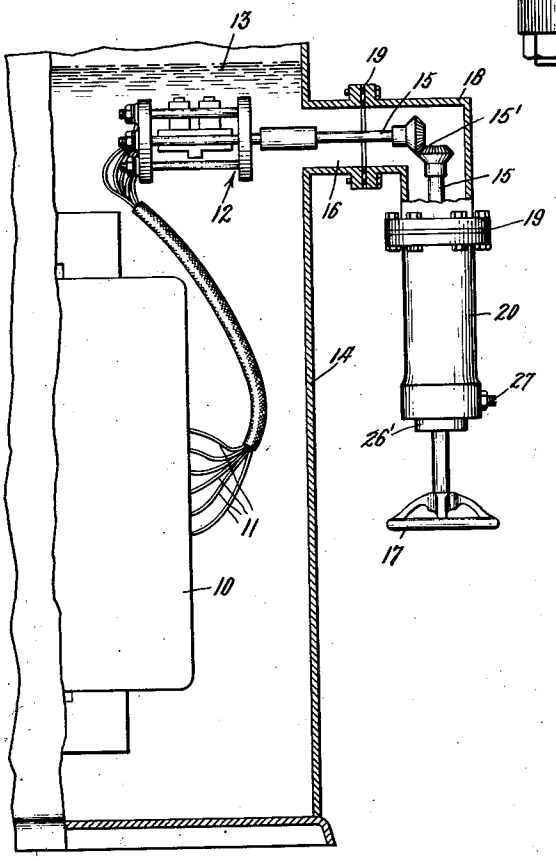
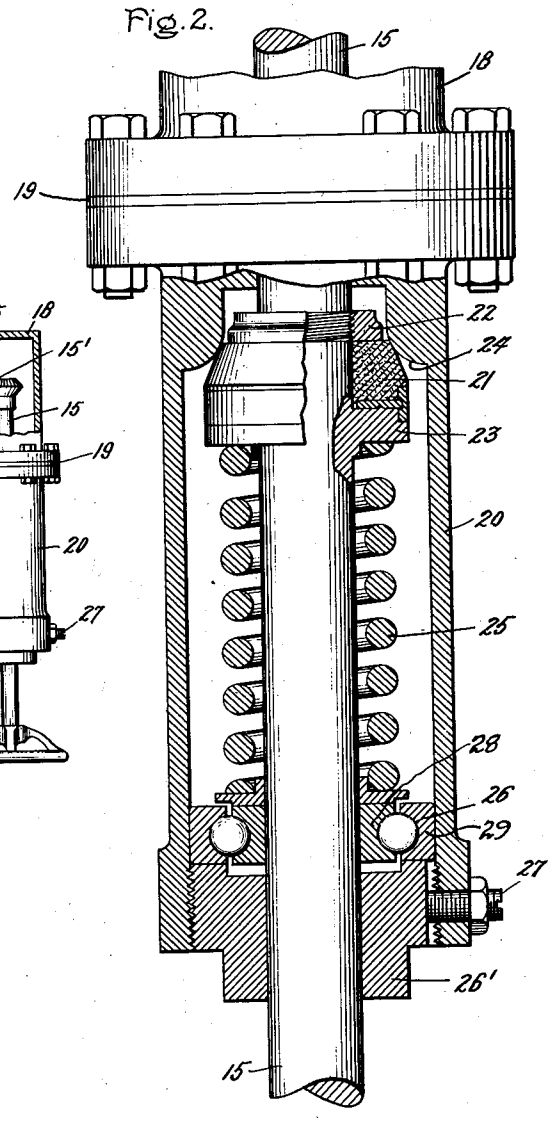


Fig. 2.



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ROTARY LIQUID SEAL

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3 Claims. (Cl. 308—36.2)

My invention relates to rotary liquid seals. An electrical transformer is frequently provided with taps in one of its windings, the taps being connected to a ratio switch so that the voltage ratio of the transformer may be adjusted. It is convient to locate the switch inside the transformer casing where both the transformer and switch may be immersed in an insulating liquid. As a convenient means for operating the switch, however, an operating shaft is often extended from the switch through the transformer casing to some conveniently accessible point outside the casing. This introduces the difficulty of preventing leakage and escape of the liquid along the shaft to the outside of the casing. The general object of the invention is to provide an improved seal for preventing escape or flow of liquid along a rotary shaft. While the invention will be described in connection with a liquid immersed transformer provided with a switch for varying or adjusting its voltage ratio, it will be obvious that the invention has many other applications wherever prevention of leakage of liquid along a rotary shaft is desirable.

The invention will be described in connection with the accompanying drawing, in which Fig. 1 shows a liquid immersed transformer provided with a ratio switch operated by a sealed shaft constructed in accordance with the invention, the view being shown partly in section; and Fig. 2 is an enlarged view of the switch operating shaft provided with a seal arranged in accordance with the invention.

Like reference characters indicate similar parts in both figures of the drawing.

The transformer 10 shown in Fig. 1 has one of its windings provided with taps connected by tap connections 11 with a ratio switch 12. The transformer 10, tap connections 11, and ratio switch 12 are immersed in an insulating liquid 13 within a casing 14. The ratio switch 12 is operated by a shaft 15, extending through an opening 16 in the side of the casing 14, the shaft being formed in two parts connected by beveled gears 15', so that its outer part may be extended downwardly to a hand wheel 17 conveniently accessible beside the transformer. The side opening 16 extends through a tubular extension 18 of the casing 14. This tubular extension 18 may be formed in sections for convenience of assembly, the sections being secured together by gasketed or other sealed joints 19. The outer section of the tubular extension 18, as shown in the drawing, forms a hollow casing 20 surrounding the shaft 15 and enclosing the sealing means for preventing escape of the liquid 13 along the shaft.

A seal disc 21 surrounds the shaft 15 and is secured and sealed to the shaft between a nut 22 and a flange 23, formed on the shaft. The disc 21 fits tightly against an internal seal seat 24 formed on the inner surface of the casing 20, the disc 21 being forced into constant engagement with the seat 24 by a spiral spring 25 surrounding the shaft and compressed between the flange 23 and the inner race 28 of a ball bearing 26, the bearing fitting around the shaft and inside the casing 20 near the outer end of this casing. The race 28 of the ball bearing 26 rotates with the shaft but is free to move along the shaft 15 and the outer race 29 is free to move along the inner surface of the casing 20 the latter race being held in adjustable position by a ring 26' surrounding the shaft and threaded into the outer end of the casing 20. The compression of the spring 25 may be adjusted by the ring 26' so that pressure sufficient to prevent leakage of the liquid 13 may be maintained between the seal disc 21 and its seat 24 throughout rotation of the shaft. The ring 26' may be held in adjusted position by a set screw 27. The seat 24 preferably faces toward the outer end of the casing 20 as shown in Fig. 2, so that the adjusting ring 26' may be easily accessible.

The seal disc 21 is secured to the shaft 15 so that it rotates with this shaft during any adjustment of the switch 12; the disc 21, therefore, rubs against its seat 24, whenever the ratio switch 12 is adjusted and it should, therefore, be formed of some tough materal, such as a suitably moulded compound, which will resist wear and have a reasonably long life. The spring 25 being arranged between the flange 23 and the inner bearing race 28 will rotate with the shaft so that a smooth constant pressure is exerted thereby against the flange to maintain the seal disc 21 upon the cooperating seat 24 throughout movement of the shaft. A shaft constructed with a seal in accordance with the invention for operating a transformer ratio switch has been operated under test conditions through a 90° angle several hundred thousand times and under a pressure between the seal disc 21 and its seat 24, sufficient to prevent any appreciable leakage of liquid throughout the test.

The invention has been explained by describing and illustrating a particular embodiment thereof, but it will be apparent that changes may be made without departing from the spirit of the invention and the scope of the appended claims.

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

1. A rotary shaft, a casing surrounding the shaft and having an internal seal seat, a seal disc secured to and sealed around the shaft and fitting said seat, a bearing for the shaft, said bearing having a part rotatable with said shaft and slidable thereupon, a spring compressed between said disc and said bearing part for forcing said disc against said seat and a member threaded in said casing operatively associated with said bearing for adjustably positioning said bearing including said part relative to said casing.

2. A rotary shaft, a casing surrounding the shaft and having an internal seal seat, a seal disc secured to and sealed around the shaft and cooperatively fitting with said seat, a bearing for said shaft, said bearing having a first part rotatable with said shaft and slidable thereupon, a spring compressed between said disc and said first bearing part for forcing said disc against said seat, said bearing including a second part slidably arranged in said casing, a member adjustably arranged in said casing for engaging with said second bearing part, said bearing including a third part whereby movement of said second part by said adjustably arranged member will effect a corresponding movement of said first bearing part.

3. A rotary shaft, a casing surrounding said shaft and having an internal seal seat, a flange on said shaft, a disc secured to and sealed around said shaft and against said flange, said disc cooperatively fitting with said seat, a bearing for said shaft, said bearing having a first part slidable on said shaft and rotatable therewith, said bearing having a second part slidably fitted in said casing, said bearing having a third part arranged between said first and second parts substantially precluding relative axial movement therebetween, a spring compressed between said flange and said first bearing part for forcing said disc against said seat, and adjusting means threaded into said casing engaging said second bearing part for varying the compression of the spring to adjust the pressure between said disc and said seat.

JAMES R. BARR.