Sept. 16, 1952 T. T. WOODSON 2,610,871

ROTATING SHAFT SEAL

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Fig. 1.

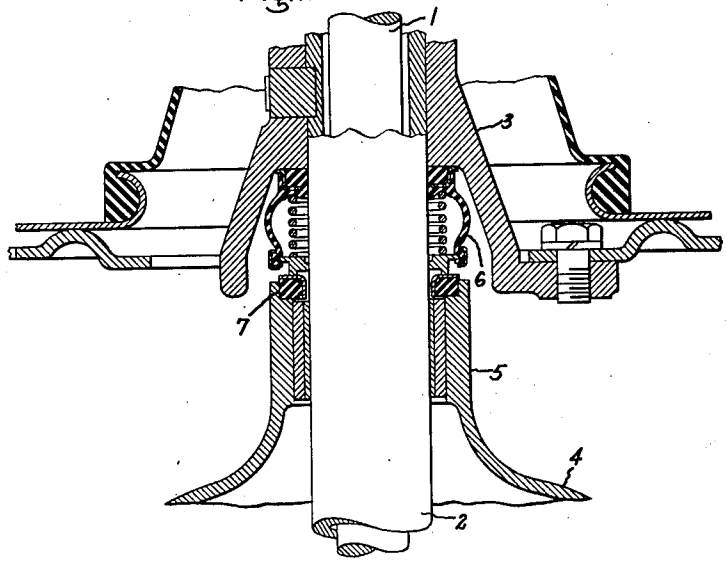
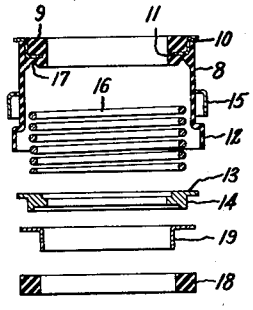


Fig. 2.



Inventor:
Thomas T. Woodson,
by Sheridan & Ross
His Attorney.

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ROTATING SHAFT SEAL

Thomas T. Woodson, Bridgeport, Conn., assignor to General Electric Company, a corporation of New York

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1 Claim. (Cl. 286—11)

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This invention relates to improved means for sealing rotating shafts against passage of fluids, and has for its particular objectives the provision of an inexpensive, easily applied shaft seal of high performance efficiency and long life.

Rotating shaft seals ordinarily embody pairs of relatively rotating elements maintained in resilient pressure engagement by means including a flexible boot structure carrying one of the elements. The meeting surfaces of the elements are lapped to provide an area contact which is tight against passage of fluids. Usually one of the elements is of a relatively soft material having inherent lubricity—for example, carbon, leaded bronze and the like—because the elements are in dry rubbing contact. The broad objectives of my invention are accomplished by mounting the boot on the rotating shaft in an improved sealing relationship therewith and by carrying the softer element at the distal end of the boot. The softer sealing element is effectively suported by the shaft and there is no relative rotation therebetween to accelerate the wear of the element. Spring means disposed within the boot maintains the necessary resilient contact between the rotating and stationary components of the seal. I have improved the sealing engagement between the boot and the shaft by molding a rigid ring concentrically within an enlarged end wall through which the shaft extends. The material of the boot—rubber for example—is squeezed radially between the shaft and the backing ring to maintain a leak-sealing relation between the shaft and the boot. The internal ring structure provides an improved base for the spring means, and it stiffens the end wall of the boot so as to constitute the latter a rigid neck by which the sealing assembly may be handled. Assembly is facilitated and performance life improved by crimping the end of the flexible boot over a projecting rim of the associated seal member. With due care and handling the crimping step is equally adaptable to carbon seal elements as well as less frangible materials such as leaded bronze and the like.

Other features and advantages of the invention will be apparent from the following detailed description of a presently preferred embodiment read in connection with the acompanying drawing in which Fig. 1 is a sectional elevation of a typical application of a sealing assembly embodying the invention, and Fig. 2 is an exploded view of the respective parts shown in half section.

My invention as shown in Fig. 1 is applied to

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an automatic washing machine of the type disclosed in my presently pending application Serial No. 551,096, filed August 25, 1944, now Patent No. 2,527,238, for "Clutch Structure for Spinner Type Washing Machines" and assigned to the assignee of this application. Such machines include a rotatable basket within which the clothes are washed by the operation of mechanical agitating means and in which they are centrifugally dried by rapidly rotating the basket after the free water has been removed. The agitator is carried on the end of a shaft 1 extending upwardly into the basket to above the normal water line thereof. The basket itself is carried by a tubular shaft 2 to which a hub portion 3 of the basket supporting structure is keyed. Mechanism for selectively oscillating the shaft 1 or rotating the shaft 2 is contained within a housing 4 having a neck portion 5, housing 4 and neck portion 5 constituting means for journaling shaft 2, i. e., a frame member on which shaft 2 is journaled.

As is explained in my aforesaid application the agitator has a central tubular post of substantially larger diameter than that of the shaft 1. Incident to the operation of the machine the water rises in the basket to overflow into the above-mentioned central post of the agitator through openings provided therein. Water flows between the agitator and the tubular shaft for passage into the tub, and is also discharged into the tub in large volume during the spinning of the tub. Water and suds may flood to above the casing neck 5, or may splash thereagainst and it is important to seal against seepage of liquid into casing 4 through the neck portion thereof. It is equally important to seal against the escape of lubricant from the casing so as to prevent contamination of washing liquid.

My improved seal construction comprises the mutually cooperating elements 6, 7 which are respectively the rotating and stationary portions of the structure. Element 6 includes a thin walled, flexible, rubber boot 8 having a thickened annular collar 9 within which is concentrically molded or otherwise disposed a rigid liner having the respective substantially vertical and horizontal wall portions 10, 11, each being concentric with the boot aperture. As is shown to better advantage in Fig. 2 the boot 8 is molded with a concentric offset portion 12 which rests upon an upper shoulder 13 of a nose piece 14 which may be of carbon, leaded bronze or other suitable metals. By a thin metal eyelet 15 the depending portion 12 of the boot may be crimped about the nose piece to maintain a fluid-tight contact

therewith. Within the boot I provide a light coil spring 16 which may seat within an annular groove 17 disposed within a seating part of collar 9, i. e., the projected area of the liner wall 11, and bear against the surface of the nose piece.

The fixed element 7 embodies a resilient washer 18 which seats snugly within a suitably provided pocket in the neck 5 of the casing 4. Said washer may, if desired, be cemented to the neck to insure a sealing contact with the casing wall. The cooperating seal member comprises a metal or equivalent ring 19 of angular cross section so as to provide a flat upper bearing surface engageable by the bottom wall or mating surface of the nose piece 14 and a side wall snugly engaging the side wall of the washer 18. The respectively engaging surfaces of the nose piece 14 and the ring 19 are carefully lapped so as to make an adequate area contact sealing against the flow of oil and water.

The wall arrangement of the liner contributes importantly to the maintenance of an efficient sealing relationship at the shaft and at the nose piece. It will be noted that wall 10 is disposed adjacent the radially outermost portion of the collar 9 and provides a concentric outer wall of a buttressing structure which includes the contacting surface of hub 3 and the liner wall 11. Within the rigid boundaries thus established the flexible material of the collar is radially distorted by the shaft 2, it being understood that the collar aperture is deliberately under-sized relative to the shaft diameter. Accordingly, the shaft is engaged by a relatively large volume of material under essentially radial elastic compression. The boot necessarily rotates with the shaft, and such rotation is transmitted to the nose piece 14 through the combined effort of the boot 8 and the spring 16. It will be noted that the spring receiving channel 17 is immediately beneath the wall 10, therefore providing a firm seat for the spring. There is no relative rotation between the nose piece and the shaft and the diameters thereof may have a close operational clearance; for example, a radial clearance of from .003 to .007 inch. Because of the absence of relative rotation this clearance will essentially be retained during use. An important advantage deriving from the support or centralizing effect of shaft 2 with respect to the nose piece 14 is the maintenance of the relative positions of the nose piece and the cooperating fixed sealing surface 19 for effective tracking. Rotating seals soon develop a groove at their mating surfaces which is of microscopic dimension but nevertheless important to provide exactly matching profiles. Lateral freedom of movement of the respective fixed and rotating elements allows one piece to "jump" the track or groove and destroy the sealing effect. The small radial clearance maintained by the support of the nose piece on the shaft 2 is within the elastic freedom of the fixed structure 7 and the dangers of accidental separation of the track surfaces is substantially eliminated.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the invention and therefore it is aimed in the appended claim to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

For use with a shaft and means for journaling said shaft, a fluid seal comprising an annular member carried by said journaling means concentric about said shaft, said annular member having a bearing surface normal to the axis of said shaft, a boot disposed about said shaft and comprising an elastic collar portion spaced along said shaft from said annular member and a flexible portion extending from said collar portion along said shaft toward said annular member, an annular rigid liner molded within said collar portion and integral therewith, said rigid liner having a first wall portion parallel to the axis of said shaft and a second wall portion extending transversely to the axis of said shaft from said first wall portion but circumferentially spaced from said shaft, a first part of said collar portion being held in compression between said shaft and said first wall portion and a second seating part of said collar portion being adjacent to and backed by said second wall portion, an annular nose piece concentric about said shaft and axially movable thereon, means for fastening said nose piece in sealed relation to said flexible portion, said nose piece having a mating surface thereon, and resilient means for urging said mating surface into sealing contact with said bearing surface, said resilient means being disposed between said boot and said shaft and bearing axially against said seating part which is reinforced thereagainst by said second wall portion.

THOMAS T. WOODSON.

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