

April 27, 1948.

G. I. COCKERILL

2,440,394

LIQUID SEAL DEVICE

Filed Oct. 11, 1944

2 Sheets-Sheet 1

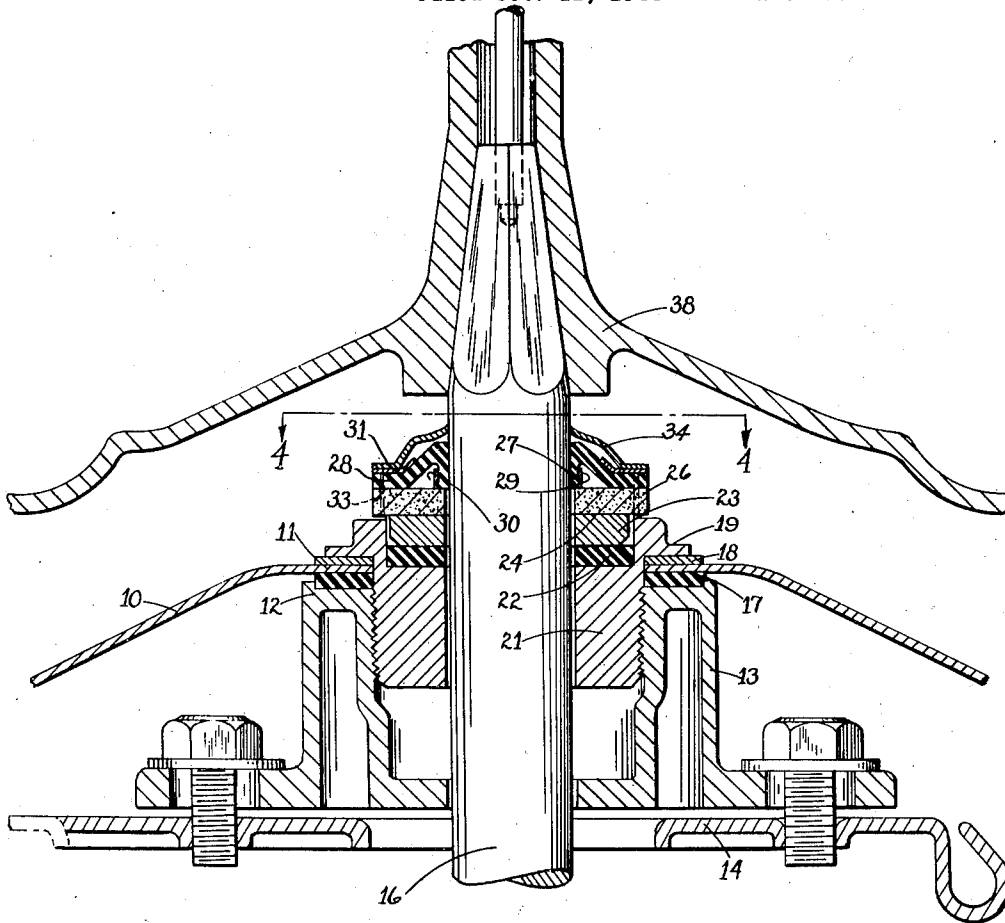


Fig. 1

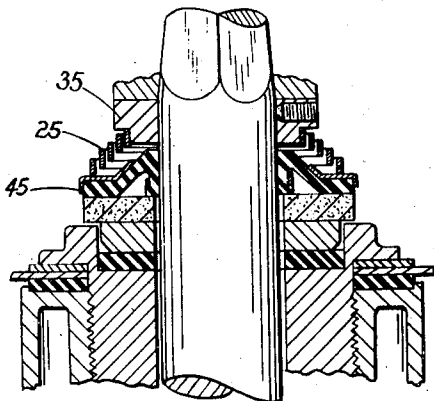


Fig. 2

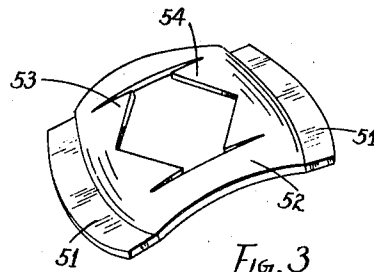


Fig. 3

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2 Sheets-Sheet 2

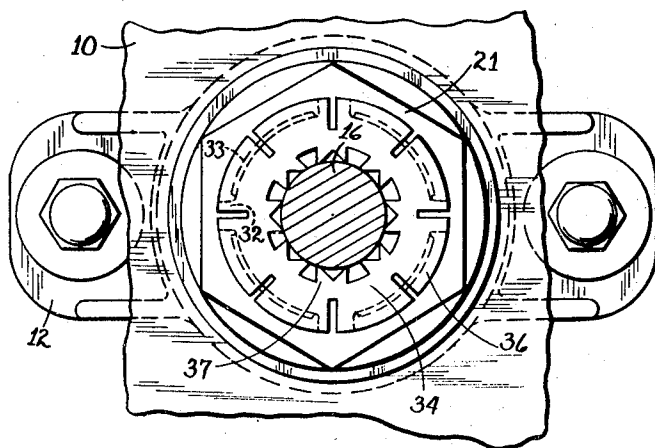


Fig. 4

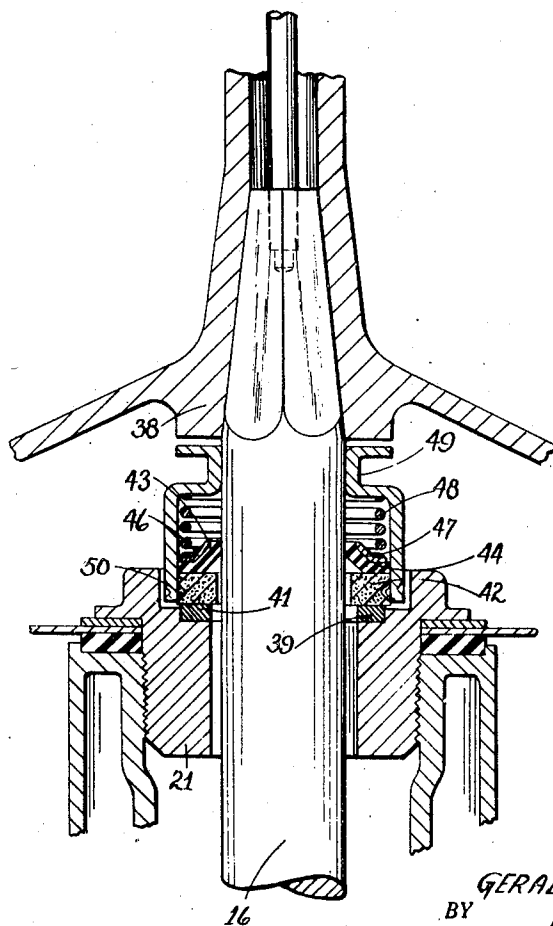


Fig. 5

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LIQUID SEAL DEVICE

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2 Claims. (Cl. 286—11)

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The present invention relates to liquid sealing devices, and more particularly to an improved liquid seal device between the base of a chamber adapted to receive liquid carrying abrasive material tending to settle in the base of the chamber and a rotatable shaft projected through said base.

The invention has been illustrated as effecting a seal between the agitator drive shaft of a washing machine and the tub base but the sealing device is not limited to such use. It has been common practice in a washing machine to provide a sealing means between the agitator drive shaft and tub base, but due to the necessarily limited distance that the agitator is disposed above the tub base and the axial extent of prior liquid sealing devices with which I am familiar, the sealing surface has been disposed below the tub base portion surrounding the sealing surface. As is well known, sand or other abrasive foreign matter settles in the base of the tub and when the sealing surface is below adjacent portions of the tub, a pocket of foreign abrasive matter surrounds the sealing surface and penetrates thereinto resulting in undue wear and leakage in a short time between the relatively rotatable parts of the seal.

It is a primary object of the present invention to provide a liquid seal between a rotatable shaft and the base of a liquid receiving chamber through which the shaft is projected, the seal having a sealing surface which is elevated relative to adjacent surround portions of the chamber base.

Another object of the invention is to provide a liquid seal of the above type which provides a sealing surface above the normal level of foreign abrasive material settling in the chamber.

Another object of the invention is to provide a liquid seal of the above type comprising an assembly rotatable with the shaft and wherein the assembly is of relatively small axial extent permitting the sealing surface to be disposed above the normal level of foreign abrasive matter settling in the chamber.

Another object of the invention is to provide a liquid seal of the above type which has relatively few parts and which can be easily and economically manufactured and assembled.

Another object of the invention is to provide a liquid seal of the above type which is adapted to maintain a tight seal over long periods without adjustment or replacement of parts.

According to the invention, a chamber or tub base is provided with a central opening through

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which an agitator drive shaft or the like projects upwardly into the tub. Associated with the tub base is a non-rotatable sealing surface encircling the shaft and elevated relative to adjacent radially outer portions of the base. A rotatable seal assembly carried by the shaft comprises a sealing ring engaging the sealing surface, a flexible sealing element having an axially extending flange sealingly gripping the shaft and a radially extending flange engaging the sealing ring, and resilient means maintaining the sealing ring in pressure contact with the sealing surface and sealing element. The entire rotatable assembly is relatively small in axial extent permitting the non-rotatable sealing surface associated with the tub base to be elevated relative to surrounding portions of the base while maintaining the distance the agitator is disposed above the base within desired limits.

Further objects of the invention and the invention itself will become increasingly apparent from a consideration of the following description and drawings wherein:

Figure 1 is a fragmentary vertical central section through a washing machine embodying the invention.

Figure 2 is a view generally similar to Fig. 1 showing a modified type of seal.

Figure 3 is a perspective view of a modified form of speed nut I may employ.

Figure 4 is a horizontal section taken along the line 4—4 of Fig. 1, and

Figure 5 is a view generally similar to Fig. 1 showing a further modification of the invention.

Referring now to the drawings, and particularly Figs. 1 and 4, the tub base indicated at 10 is sloped upwardly towards the central portion in a conventional manner to provide drainage to a suitable outlet (not shown). The base is centrally perforated and an annular portion 11 of the base surrounding the opening is sealingly secured to a support generally indicated at 12. The support comprises a generally cup shaped member 13 bolted to a cross support 14 forming part of the washing machine frame, the member 13 having a central opening in the base adapted to loosely receive an agitator drive shaft 16. A rubber or the like washer 17 is seated at the top of member 13 and engages the underside of base portion 11, the upper side of said portion being engaged by a lead or the like washer 18, and the washers and base portion 11 being sealingly clamped between the member 13 and an annular flange 19 of a nut 21 threaded to member 13. The nut is recessed to house a rubber

washer 22 and a super-posed metal washer 23 having a smooth or preferably polished sealing surface 24.

The nut 21 and washers 22 and 23 loosely encircle shaft 16 and I have found that when the seal is assembled there is sufficient friction between the engaged surfaces of the washers and the rubber washer 22 and nut 21 to prevent rotation of washer 23 when the shaft is rotating. It will be noted that the sealing surface 24 of washer 23 is disposed above the adjacent surrounding portion of the tub base so as to be elevated above the normal level or zone of sand or other abrasive foreign matter settling in the base of the tub. In various prior constructions with which I am familiar the sealing surface has been below this level resulting in abrasive matter penetrating to the sealing surface and causing undue wear and leakage in a short time.

Although I have shown and described a preferred construction providing an elevated sealing surface relative to the tub base, it is understood that any other suitable construction effecting a seal between the support and the tub base and providing an elevated sealing surface may be used.

The seal assembly which is rotatable with the shaft will now be described. A sealing ring 26 containing graphite or a suitable self-lubricating material loosely encircles shaft 16 and its lower surface is maintained in sealing pressure contact with sealing surface 24 in a manner to be described. A rubber or the like sealing element has an axially extending flange 27 sealingly gripping the shaft and a radially extending flange 28 engaging the top surface of sealing ring 26, the flanges being connected by a frusto-conical portion. The sealing element may be formed of any material which is flexible and is resistant to the action of detergents and other substances usually contained in the liquid or wash water. I preferably employ a metal band 29 circumferentially gripping flange 27 to aid in maintaining the flange in tight contact with the shaft although the resiliency of the rubber is normally sufficient to maintain an effective seal at this zone. Also, I preferably extend flange 27 to press against the upper surface of the sealing ring whereby a partial vacuum may be effected during assembly in the annular pocket 30 formed between the sealing ring 26 and sealing element 27 to assist in maintaining these parts in driving relation. I find that the frictional contact between flange 28 and the sealing ring 26 is sufficient to effect concurrent rotation of these parts, but they may be interlocked or otherwise secured together if desired.

A metal retainer ring 31 abuts the top surface of flange 28 and preferably the frusto-conical portion of the sealing element and forms a bearing surface for a speed nut 34. As illustrated, ring 31 may form an interlock between the sealing element and sealing ring 26. The sealing ring is formed or cut away to provide radially extending peripheral fingers 32 with arcuate grooves therebetween and flange 28 of the sealing element is similarly formed. The horizontal flange of ring 31 has portions 33 radially extended to substantially correspond in arcuate length to the grooves of the flange 28 and sealing ring. Slots defining the ends of the extended portions permit portions 33 to be bent downwardly intermediate the fingers of the sealing element and the sealing ring to interlock these parts. This leaves horizontal areas of the retainer ring flange cor-

responding to and bearing against the finger portions of the flange 28. The speed nut 34 comprises a sheet metal plate of generally frusto-conical form slotted to provide resilient fingers 36 flanged horizontally at their outer ends to bear against retainer ring 33. The shaft opening in the plate is serrated to form V-shaped prongs 37 adapted to lock with the shaft when the nut is in the desired position. Nuts of this general type can be quickly positioned by sliding the nut along the shaft and a slight reverse movement wedges the prongs against the shaft to lock the nut in position. Although I preferably employ a nut of this type for economy, ease and speed of assembly, and small axial extent of the nut, I contemplate that a collar may be secured to the shaft in any suitable manner and form an upper abutment for a pressure plate, spring or the like, exerting pressure on the sealing element or retainer ring.

It will now be understood that the sealing ring, sealing element, and pressure means rotate with the shaft and that the assembly comprising these parts is relatively small in axial extent permitting the sealing surface 24 to be elevated relative to the tub base while maintaining the distance between the tub base 10 and the bottom of the agitator hub, indicated at 38, within predetermined limits.

The provision of rubber washer 22 which forms a bearing for sealing washer 23 insures sufficient resilience to permit the sealing surface 24 to find its own level in case the agitator shaft 16 is slightly out of vertical alignment relative to the nut 21.

In Fig. 2, I have illustrated a modified type of seal wherein the speed nut 34 of Fig. 1 is replaced by a spiral form spring 25, preferably formed of material having a rectangular cross section, and an abutment collar 35. The collar may be fixed to the shaft in any suitable manner as by a set screw and is preferably provided with an axially extending shoulder which seats the uppermost convolution of the spring. In this instance, the retaining ring 45 does not form an interlock between the sealing element and sealing ring and is preferably provided with a downturned peripheral flange engaging the radially outer surface of the sealing element.

Referring now to Fig. 4, I have shown a modified type of seal wherein a metal washer 39 is non-rotatably seated in a recess provided in the top of nut 21 and has a sealing surface 41 disposed above the surrounding portion of the tub base. A sealing ring 42 of self-lubricating material engages the sealing surface of washer 39 and loosely encircles shaft 16. A sealing element formed of flexible material such as rubber is provided with an axially extending flange 43 sealingly gripping the shaft and a radially extending flange 44 engaging the top surface of the sealing ring, the flanges being inter-connected by a frusto-conical portion 46. I preferably provide a metal retaining ring 47 engaging the top surface of the sealing element and forming a bearing surface for the lowermost convolution of a helical spring 48. The top convolution of the spring abuts an annular shoulder formed on a metal ferrule or sleeve element 49 which is press-fitted or otherwise fixed to the shaft.

The lower portion of the ferrule 49 has inwardly projecting nibs 50 formed thereon which engage corresponding pockets provided in the radial outer face of the sealing ring 42. There is sufficient play between the sealing ring and

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ferrule to permit a slight relative axial movement to compensate for wear on the sealing ring and slight axial movements of the shaft. Thus, a positive drive connection is effected between the ferrule and sealing ring supplementing the driving effect due to frictional contact between the sealing ring and sealing element.

Referring now to Fig. 3, I have illustrated a modified form of speed nut which comprises a sheet metal plate of generally rectangular form to provide horizontal arcuate flanges 51 extending from a curved portion 52. Portion 52 is slotted to form generally V-shaped resilient fingers 53 adapted to jointly and wedgingly engage the shaft surface along edges 54 when the nut is positioned on shaft 16. This type nut may be substituted for the nut 34 illustrated in Figs. 1 and 4 and the nut is preferably positioned so that the central portion of the flanges 51 engage the finger areas of the retainer ring 31. If the interlock is omitted and the retainer ring is provided with an uninterrupted annular horizontal flange the relative positioning of the nut on the flange is immaterial. The resilience of the nut including the fingers 53 insures continued pressure engagement with the retainer ring.

The nut illustrated in Fig. 3 may also be employed with the seal illustrated in Fig. 5 and in this instance the ferrule 49 and spring 48 would be omitted and the flanges 51 of the speed nut would directly engage the horizontal annular flange of the retainer ring 47. In this arrangement no direct inter-lock between the drive shaft and sealing ring 42 is provided but the frictional contact between the flange 44 of the sealing element and the sealing ring maintained by the resilience of the speed nut is sufficiently greater than the frictional resistance between the sealing surface and sealing ring to insure the sealing ring rotating with the shaft.

Although I have shown and described preferred forms of the invention, I contemplate that numerous and extensive departures may be made therefrom without departing from the spirit of the invention and the scope of the appended claims.

I claim:

1. In a liquid seal adapted to effect a seal between the base of a chamber for sediment containing liquid and a rotatable shaft projected into the chamber through said base, said seal comprising a sealing surface encircling the shaft and elevated above the normal level of sediment tending to settle in the chamber, a sealing ring of self-lubricating material encircling the shaft and engaging the sealing surface, a sealing ele-

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ment of flexible material effecting a seal between the shaft and the sealing ring, means for exerting resilient pressure on the sealing element comprising a sheet metal plate of generally frusto-conical form having resilient fingers exerting pressure on the sealing element and generally V-shaped prongs directed at an angle to the shaft and in a direction away from the sealing ring, and said prongs defining an opening for receiving the shaft having an inner effective diameter slightly less than the shaft diameter adapted to permit the plate to slide along the shaft relatively rapidly in a direction toward the sealing ring and the prongs to be wedged into locking engagement with the shaft upon slight movement in a reverse direction.

2. Means for effecting a seal between a chamber adapted to receive liquid and a rotatable shaft projected through a wall of the chamber, said means comprising a washer loosely encircling the shaft and providing a sealing surface, a rotatable sealing ring of self-lubricating material encircling the shaft and engaging the sealing surface, a sealing element of flexible material having an axially extending flange sealingly gripping the shaft and a radially extending flange engaging the sealing ring, and means for exerting pressure on the sealing element comprising a metal plate of generally frusto-conical form having resilient fingers engaging the sealing element and provided with a central opening formed by a plurality of generally V-shaped prongs establishing an inner effective diameter slightly less than the shaft diameter, and said prongs being directed at an angle to the shaft and in a direction away from the sealing ring whereby the plate may be moved along the shaft relatively rapidly in a direction toward the sealing ring and the prongs thereof wedged into locking engagement with the shaft upon a slight movement in a reverse direction.

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