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WASHING MACHINE TRANSMISSION AND LUBRICATING COMPOSITION THEREFOR

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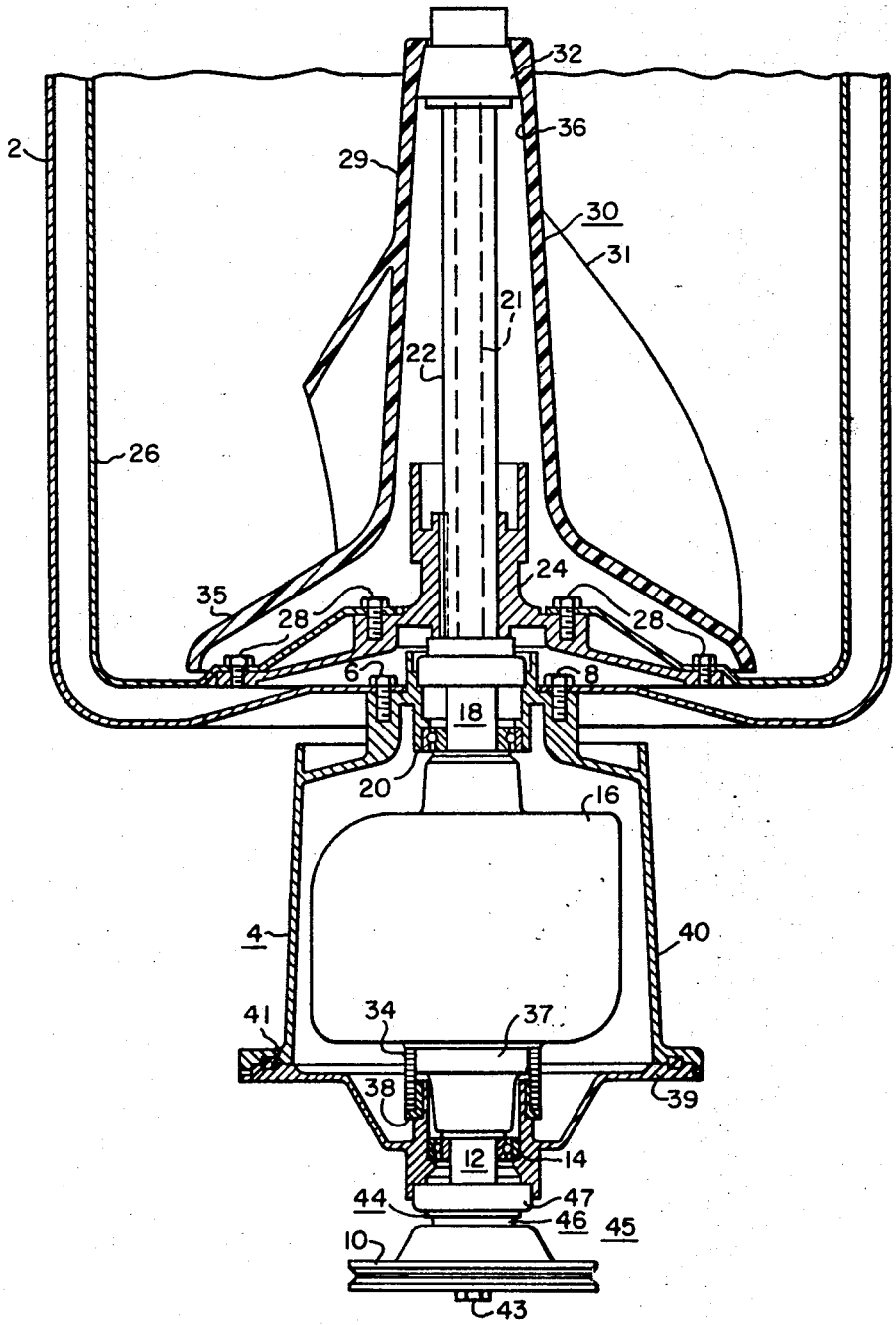

FIG. 1.

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AGENT

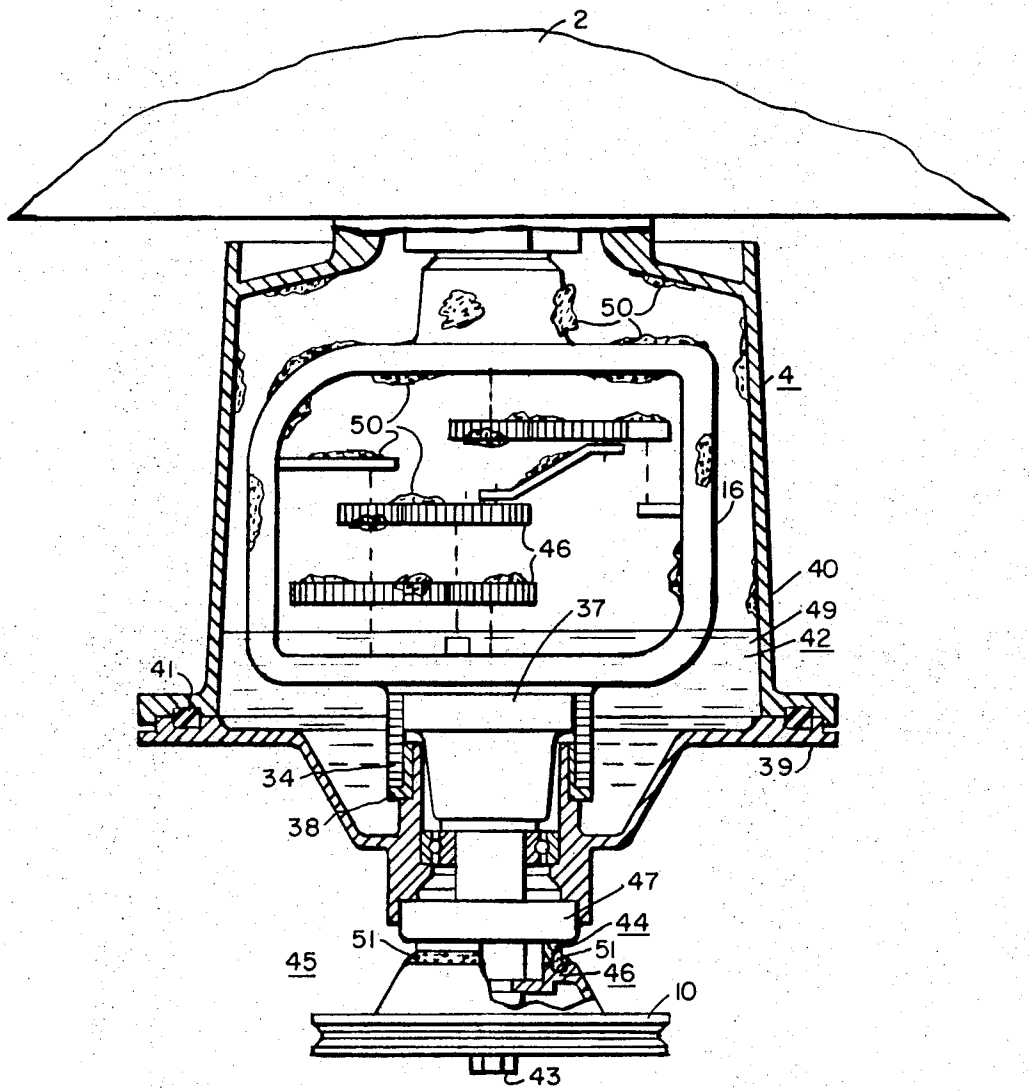

FIG. 2.

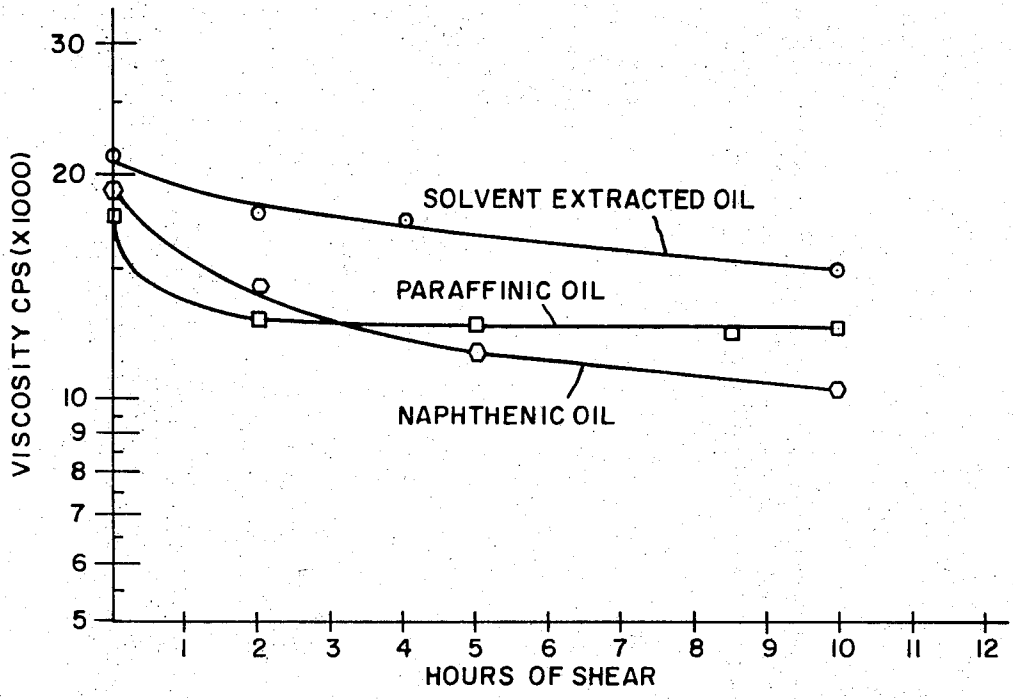
VISCOSITY CPS (X 1000)
30
20
10
9
8
7
6
5
SOLVENT EXTRACTED OIL
PARAFFINIC OIL
NAPHTHENIC OIL
1
2
3
4
5
6
7
8
9
10
11
12
HOURS OF SHEAR

FIG. 3.

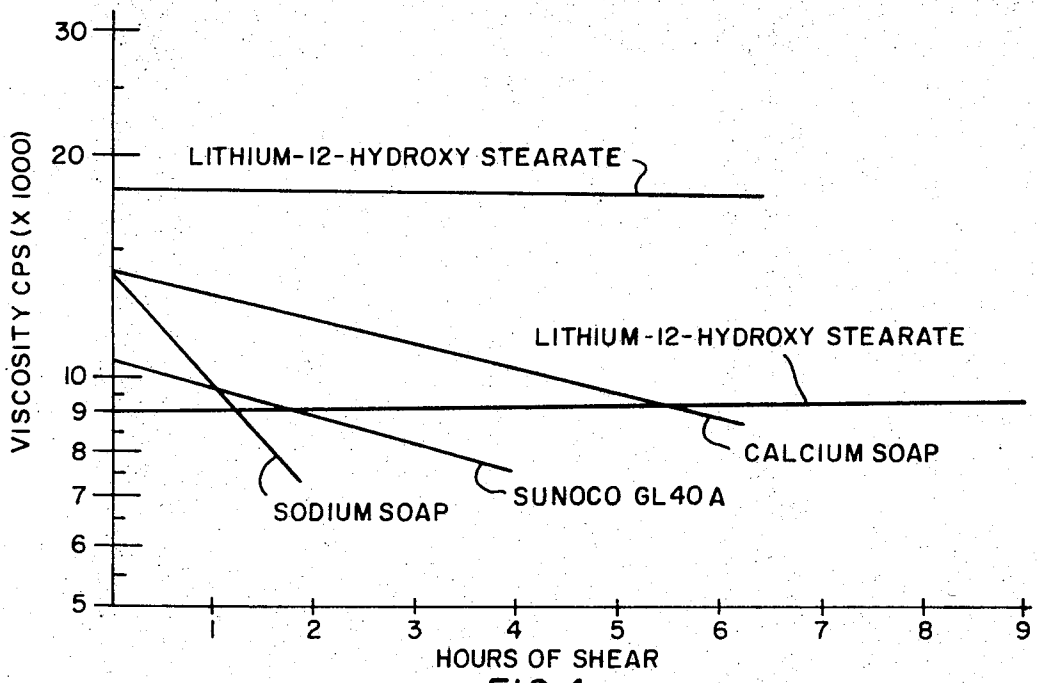
VISCOSITY CPS (X 1000)
30
20
10
9
8
7
6
5
LITHIUM-12-HYDROXY STEARATE
LITHIUM-12-HYDROXY STEARATE
CALCIUM SOAP
SUNOCO GL40A
SODIUM SOAP
1
2
3
4
5
6
7
8
9
HOURS OF SHEAR

FIG. 4.

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3,537,282

WASHING MACHINE TRANSMISSION AND LUBRICATING COMPOSITION THEREFOR

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Int. Cl. D06f 37/40
U.S. Cl. 68—23.7 5 Claims

ABSTRACT OF THE DISCLOSURE

Transmission and lubricant therefor, characterized by simplicity in construction coupled with capability for producing an efficient washing action. The lubricant is characterized by noise damping properties along with being compatible with a spring clutch, the functioning of which, requires a thin film lubricant. The spring clutch forms a part of the transmission including a gear train and frame which are disposed within a sealed casing structure containing the lubricant. The lubricant is further characterized by its capability of sealing leaks because of its bistable nature wherein it becomes a fluid when agitated and becomes a gel again when the source of agitation is removed, agitation being present within the casing structure and not without.

BACKGROUND OF THE INVENTION

This invention relates, in general, to clothes washing machines and, more particularly, to oscillating agitator type machines.

Machines of the type herein contemplated, have an agitator structure and drive means therefor which imparts oscillatory movement to an output shaft which is attached to the agitator structure. Within recent years, it has been found that to obtain uniform cleaning action, the clothes must be circulated, that is, change position with respect to each other. To effect such relative re-positioning, of the clothes, machines have been built wherein the spinner basket, in which clothes to be washed are placed, is free to move in one direction in response to oscillation of the agitator, but is prevented from moving when the agitator moves in the opposite direction. The restricted movement, in one form, is accomplished by means of a spring clutch which couples the gear frame forming a support for the drive means and a casing structure which is supported within cabinet structure such that it does not rotate but is free to move back and forth and from side to side. To provide the simplest possible construction, the clutch and drive means are enclosed by the casing structure.

The casing structure is sealed so that it can contain a suitable lubricant. It has been discovered that conventional washing machine transmission lubricants are not compatible with the operation of the spring clutch because relative slipping between the clutch and the coupling areas of the gear frame and casing structure, is present during movement of the agitator in the "opposite direction" which as discussed heretofore is intended to produce relative repositioning of the clothes. Where slipping occurs, the desired relative repositioning of the clothes is adversely affected.

In order to solve the problem of clutch slippage lighter weight or lower viscosity oils were tried, however, it was found that they do not dampen objectionable noises generated within the casing structure. Furthermore, oil leakage out of the casing structure is a problem which is magnified by the use of lower viscosity oils.

It will be appreciated that where conventional lubricants are utilized, the casing structure must be filled to almost

capacity to insure proper lubricantion of all working parts, which extend substantially the entire vertical height, of the casing structure.

In view of the foregoing, it is the general object of this invention to provide a new and improved clothes washer machine apparatus.

It is a more particular object of this invention to provide a new and improved clothes washing machine wherein superior circulation of the clothes to be washed is attained.

BRIEF DESCRIPTION OF THE INVENTION

Briefly, the above-cited objects are accomplished by the provision, in a clothes washing machine, of an agitator structure and oscillating drive means therefor combined with a spinner basket in such a manner that interaction between the agitator structure and the basket produces rotation of the basket in one direction, but not in the other. This is accomplished by utilization of a spring clutch which couples the frame supporting the drive means to the casing structure housing the drive means and the spring clutch. The spring clutch, in a well known manner operates to allow or prevent, depending on direction of rotation of the agitator, relative movement between the casing structure and the gear frame to which the spinner basket is indirectly attached.

The casing structure is sealed in order to contain lubricant which is in the form of a gelled oil formulated by the addition of a thickening agent to a base oil, having a relatively low viscosity. The gelled oil, under conditions requiring a thin film lubricant (i.e., tightening of spring clutch on coupled areas of the gear frame and casing structure) exhibits characteristics of the parent oil. Under conditions other than those requiring a thin film lubricant, the gelled oil clings to the components and serves to dampen the noises generated thereby so that the emission of noise from the casing structure is minimized. The clinging characteristic of the lubricant makes it possible to use less lubricant resulting in a substantial cost savings over lubricants used in the prior art.

During operation of the machine there is a tendency for lubricant leakage past mating surfaces of rigid seal members. This is due to marginal mating of seal surfaces due to imperfect parts and/or poor alignment of the seal faces at the time of assembly. It has been found during life testing of sample machines, that the gelled oil possesses self-sealing characteristics, in that, the oil in its liquid state exudes past the seal areas but once it gets past these areas, of high mechanical agitation, it reverts back to a thixotropic state thereby forming an effective barrier at the exterior of the seal areas, which eventually prevents further leakage out of the casing structure.

Further objects and advantages of the present invention will become more apparent when considered in view of the drawings, in detailed description of the preferred embodiment forming a part hereof.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side sectional view of a clothes washing machine representing the present invention;

FIG. 2 is a side elevational view of a casing structure housing the gear train incorporated in the machine shown in FIG. 1;

FIG. 3 is a graph showing a comparison of the shear stability of various lubricants wherein the difference is in used; and

FIG. 4 is a graph showing a comparison of the shear stability of various lubricants where the difference is in the specific thickening agent added to a particular base oil.

DETAIL DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Referring now to FIG. 1, an outer tub **2** is shown rigidly secured to a casing structure **4** through bolts **6** and **8**. Together the outer tub **2** and the casing structure **4** form a stationary unit. A pulley **10**, which is driven by an external motor, not shown, is connected to a driving shaft **12** which is supported by a bearing structure **14** and extends into a gear frame **16**. Within the gear frame **16** is a gear train to be discussed hereinafter, driven by the shaft **12**. The general arrangement of the gear train and frame is of well known construction in the art, with the output, provided at an output shaft **18**, driving the agitator in oscillating fashion during the wash and rinse portions of the washing machine cycle. The output shaft **18** is supported by a bearing structure **20** and extends up through the outer tub **2**.

The output of the transmission is of the coaxial type in which an inner shaft of the coaxial structure oscillates the agitator when the input shaft **12** is rotated in one direction, and the outer spin tube of the structure is used for the spin cycle of the washing operation, the spin cycle occurring when the input shaft **12** is rotated in the opposite direction.

In the present example, the inner shaft of the coaxial driving shaft **18** is the inner drive shaft **21**, and the outer tubular member is the upper spin tube **22**. Fitted over the upper tube **22** is a basket hub **24**, which is rigidly keyed to the spin tube **22**. Secured to the basket hub **24** is a spin basket **26** which is fixed to the basket hub through the bolts **28**. The spin basket **26** is concentrically disposed with respect to the outer tube **2** and serves to hold clothing to be washed. Raised apertures (not shown) are provided in the side walls of the spinner basket **26** so that washing fluid may readily pass into and out of the basket.

An agitator **30** is of the screw or spiral type having blades **31** which extend from the bottom of the agitator **30** and spiral around the agitator toward the top thereof. The agitator includes a shallow dome-shaped base **35** which serves as a clothes guard, a hollow post **36** secured by hub **32** to the drive shaft **21** and the blades **31**. The blades include inclined plane portions and generally vertical wall portions, not shown, which spiral inwardly from the bottom to top along the outer edges of the inclined plane portions. The screw action of an agitator having such a blade configuration is such that when the agitator is rotated in the counterclockwise direction the clothing contiguous thereto will be force or expressed in another way, screwed down, toward the bottom of the agitator, while on the other hand, when the agitator is rotated in the other direction (the clockwise direction) the clothing will be forced or screwed up, toward the top of the agitator. If the agitator is moved equal amounts in the clockwise and counterclockwise directions there will be a tendency to cancel any overall change in position of the clothes during one complete oscillatory cycle. However, the apparatus of the present invention overcomes this cancellation as described hereinafter, to thereby produce the heretofore-mentioned relative change in position of the clothes.

The agitator member **30** is fitted over the drive shaft **18** and attached to the inner drive shaft **21** by a hub connector **32**. The agitator **30** is thus driven in an oscillatory manner during the wash cycle. The spinner basket **26** is connected to the outer spin tube **22** which is not rotatable in both directions during the wash cycle, but may be rotated during the spin cycle. The agitator motion is thus independent of the spin motion. The spin tube **22**, the basket hub **24**, the spinner basket **26**, and the gear frame **16**, therefore, move and may rotate as one unit.

To provide, during the wash cycle, that the spinner basket **26** can rotate in only one direction, the basket **26** is coupled to the stationary casing structure **4** by means of a helical coil spring **34** made of steel wire and preferably having a rectangular cross section. The spring **34** is disposed partially over a first hub or collar member **37** integral with the lower end of the gear frame **16** and partially over a second hub member or sleeve **38** pressed onto the lower end of the stationary casing structure **4**, one end of the coil spring being permanently secured to the hub member **37**, in any suitable manner such as by staking or clamping.

The casing structure **4** comprises a base **39** and cover **40**. The base and cover are provided with a sealing ring gasket **41** to prevent leakage of lubricant **42**, shown in FIG. 2, from the casing structure. The lower end of the driving shaft is threaded for receiving a lock nut **43** for retaining the pulley **10**. A component **44** of a seal assembly **45** fitted in the lower end of the base **39** is captivated therein by the pulley **10** and a second seal assembly component **46**, which is supported by the pulley **10**. An annular wall **47** of the component **44** comprises a resilient material, for example, while the mating surfaces of the components **44** and **46** are of solid construction fabricated respectively, of Bakelite and steel.

In order to provide a machine as hereinabove described, that would meet with acceptance by the consumer, it was discovered that conventional lubricants employed in washing machine transmissions were not satisfactory. For example, high viscosity oils serve quite well to dampen the noise generated by the gear train symbolicly indicated at **48** (see FIG. 2), however, they are not compatible (i.e. clutch slippage occurs) with the requirements dictated by the operation of the spring clutch **34**. It was also found that to solve the clutch slippage problem by use of lower viscosity oils was to create the problem of a noisy transmission.

The lubricant **42** constitutes a gelled oil comprising a relatively low viscosity paraffin base oil, for example, Socony Mobil DTE 26, which oil has a viscosity of 307 SUS at 100° F., combined with approximately 3% by weight of lithium-12-hydroxy stearate. The lubricant or gelled oil **42** was prepared by heating the base oil, to which had been added 10% by weight of a thickening agent, for example, lithium-12-hydroxy stearate, to 210° C. for approximately 1 hour, until all the thickening agent was dissolved in the base oil. The resulting solution was then allowed to cool to ambient room temperature, resulting in a gelled wax-like product. The gelled wax-like product was then passed through a high speed Premier colloid mill to mechanically work the component product until a smooth, buttery, grease-like composition was obtained. The grease-like substance was then diluted (extended) with additional quantities of the base oil, to bring the thickening agent content to 3% by weight, resulting in a soup-like mixture which was then reworked in the aforementioned premier colloid mill to a smooth gelled liquid to conclude the process. The viscosity of the final product was measured in accordance with the Brookfield No. 6 spindle test to be on the order of 18,000 c.p.s. at 10 r.p.m.; 10,000 c.p.s. at 20 r.p.m. and 6,000 c.p.s. at 50 r.p.m.

An important characteristic of the lubricant **42**, formulated in accordance with the foregoing process, is high shear stability when exposed to prolonged working. Referring to FIG. 2, it can be seen that using the paraffin base oil enhances shear stability over others employed. By further reference to FIG. 3, it will be seen that the lithium-12-hydroxy stearate thickening agent provides superior shear stability over other agents tried. The shear stability is a significant factor in the present application since in order for the lubricant **42** to continue to dampen noise, its viscosity must remain substantially constant.

OPERATION

In operation, the bulk of the lubricant **42** forms a pool or reservoir **49** (see FIG. 2) which encompasses part of

the gear frame **16** and the spring clutch **34**. Through operation of the transmission, fragments or portion **50** of the gelled oil or lubricant **42** are thrust upon and cling to interior parts of the casing structure **4**, gear train **48** and gear frame **16**. Mechanical working or agitation of the lubricant **42** by the spring clutch **34** results in the lubricant **42** exhibiting characteristics of the lower viscosity parent oil thereby facilitating gripping of the surfaces of the hub member **37** and the sleeve **38**, by the clutch **34**.

As the solid mating surfaces of the seal assembly components **44** and **46** rub during relative rotation thereof, the lubricant **42** creeps therebetween, where it is subjected to very high mechanical shearing which generates very high tempratures. This extremely thin film of gelled oil it is believed heats up to the seal surface temperature well in excess of 200° C. At that temperature, the thickening agent dissolves in the parent oil and the gelled oil **42** "inverts" to a true liquid state. As the hot liquid exudes on the outer side of the seal assembly **45**, as indicated at **51** (FIG. 2), the liquid gelled oil cools below the inversion temperature, the thickening agent precipitates from the solution and reverts back to an unworked, high consistency and low penetration grease equivalent to a NLGI No. 3 grease.

Since numerous changes may be made in the above-described apparatus and different embodiments of the invention may be made without departing from the spirit thereof, it is intended that all matter contained in the foregoin description or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Clothes washing machine apparatus comprising:
- a rotatable clothes receiving tub,
- an agitator disposed within said tub and supported for oscillatory movement,
- a gear train and agitator shaft driven thereby for imparting oscillatory motion to said agitator and a gear frame for operatively supporting said gear train and said shaft,
- a sealed casing structure having said gear train and said frame disposed therein, said frame having secured thereto said rotatable basket, for rotation therewith,
- a power input shaft operatively connected to said gear train,
- said gear frame and said casing structure being provided with hub members disposed internally of said casing structure,

- a spring clutch coupling said tub and said casing structure through engagement of said hub members,
- a lubricant in said casing and contacting said gear train, said spring clutch and said hub members,
- said lubricant comprising a parent oil together with a thickening agent which normally adheres to the casing structure, gear frame and gear train and which under loads, bearing thin film lubricating conditions, yields a film having the same lubricating characteristics as the parent oil, such condition being exhibited by said spring clutch tightening on said hub members.

2. Structure as specified in claim **1** wherein:
- said parent oil is a paraffin base oil.

3. Structure as specified in claim **2** wherein:
- said thickening agent comprises lithium-12-hydroxy stearate.

4. Structure as specified in claim **3** wherein:
- the quantity of said lubricant is equal to substantially less than half the volume of said casing structure.

5. In a clothes washing machine including an agitator and a rotatable spin tub,
- drive means for imparting oscillatory motion to said agitator and effecting rotative forces which act on said spin tub,
- a sealed casing structure housing said drive means,
- means interconnecting said drive means and said spin tub for restricting movement of said spin tub in one direction, said interconnecting means being disposed in said casing structure,
- lubricant in said casing structure adapted to contact said drive and interconnecting means, said lubricant comprising a parent oil together with a thickening agent which normally adheres to the drive and interconnecting means and which under a load, bearing thin film lubricating conditions, yields a lubricant having lubricating characteristics similar to the parent oil, such conditions being exhibited by said interconnecting means.

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WILLIAM I. PRICE, Primary Examiner

U.S. Cl. X.R.

74—467; 192—113