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# Unique Information about Lubricants

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The positive and negative properties/characteristics of liquid and plastic lubricants are presented here in brief. General aim: to show the ways to improve the positive role of lubricants for mobile junctions, namely, for pairs of friction. At the same time, there are two devices which are represented to make the effective control both the quality and viscosity for lubricant as well. And the new very important effect with the organic lubricant was discovered. It is the electro-magnet property which helps to keep organic lubricant in a zone of friction constantly.

*Keywords*: liquid and plastic lubricants, dynamic, devices, effectiveness, control, friction bearing.

## 1. Introduction

It is commonly known the different lubricants (liquid and plastic) play various role when they are applied usually in the mobile junctions of mechanisms or machines. This role can be both positive and negative. In the first case, the all lubricants decrease wear and tear, temperature in zone of friction, noise, forces of movement/rotation and separate the surfaces of the pair of friction. But quite the contrary, we obtain (rather not seldom) the negative processes, namely: the temperature can be too high if there is too much lubricant inside the box or in the roller bearing, or if it is not proper for the certain junctions at all, or if the strains in the roughness increase essentially (especially, if the liquid lubricant was applied when the liquid medium can reach the bottom of the irregularity). There were investigated the factors and the new ways to increase the positive role of lubricant can enhance the reliability in operation for the main parts of technical systems [1-3].

## 2. Aspect 1

Using liquid lubricant, we try to obtain at least thin oil film between of the two surfaces in the area of friction. But inside the friction bearing, the forces or pressure which the liquid oil can create, cause the displacement of the shaft axis to the centre of bearing ring (Fig. 1).

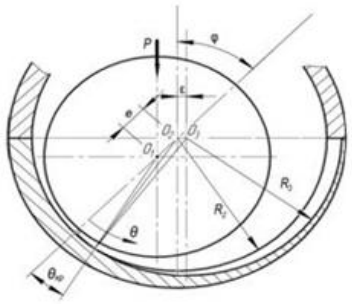


**Figure 1** Displacement/eccentricity ($\varepsilon$) for two axes in the friction bearing, which usually takes place due to oil pressure

Such situation is not quite good: one can get the critical angle of displacement $\theta_{kp}$ when the thin oil film between of the two surfaces disappears. At this moment, practically dry friction can occur and the process of wear and tear will be more than it takes place if the thin oil film is present.
To verify the actual position of the shaft in the friction bearing, a new test bench was made (Fig. 2).

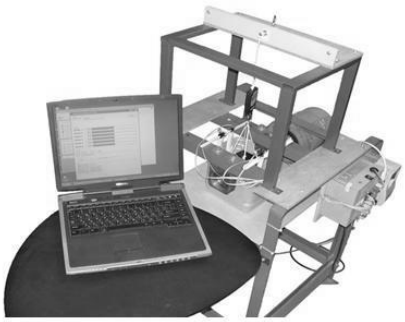

**Figure 2** Test bench to investigate the position of shaft in the friction bearing

This stand has the next main parts: drive, oil pump, sensors, transducers, detector and computer. And indeed we have got the picture which was described above. That is why the general aim is formulated as: how to design the friction bearing and to compel it to move up strictly vertically (practically, without any displacement). We managed to solve this interesting and important task producing several smooth grooves/notches (see Fig. 3).

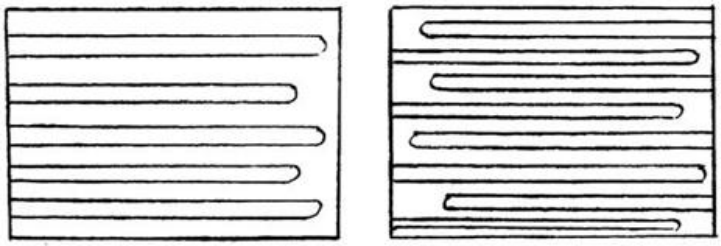

**Figure 3** Grooves/notches made on the surface of ring for slide bearing especially: the left version is for situation if the bearing can rotate only into the counter clockwise, but the left version is for situation if this bearing can rotate both clockwise and counterclockwise

Using this simple method of modernization for the surface of friction bearing, we entirely excluded the above mentioned negative effect of its displacement (Fig. 4).

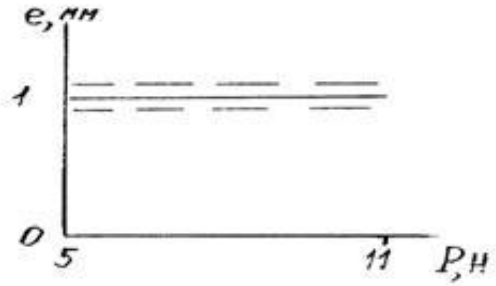


**Figure 4** Maximum displacements with respect to the central position for the pair "shaft-ring" are ±0.12 mm: $P$ – force, $\varepsilon$ – eccentricity (mm); *1* is the zero position (conventionally) between the dotted lines

Consequently, this important task is completely solved.

## 3. Aspect 2

The well-known methods related to the test of adhesion and quality of the plastic lubricant are not quite effective and they cannot give excellent and objective information about important characteristics of this plastic lubricant, especially in the dynamics of work. But we are need to know these properties in detail [1-3]. To obtain this information, we recommend the following device (Fig. 5).
Legend:
*1* – high-speed motor; *2* – velocity sensor; *3* – coupling; *4* – stepped shaft; *5* – electronic weight scale; *6* – foundation; *7* – transparent cup; *8* – cover; *9* – case with a frame.

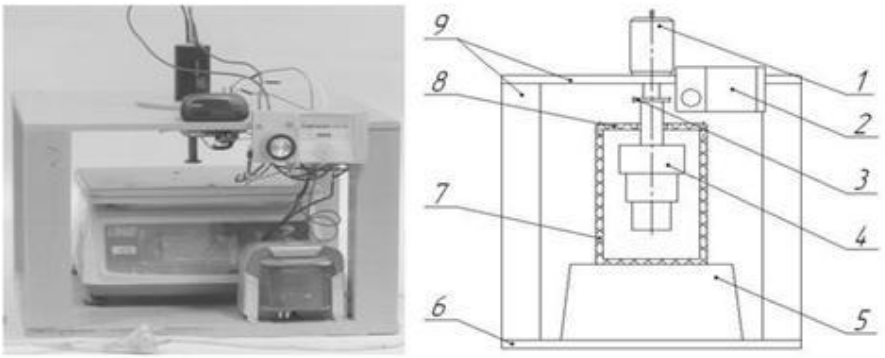


**Figure 5** Multipurpose adhesiometer: outside appearance (on the left) and the layout (on the right)

Changing the velocity of rotation for the stepped shaft, we can see the two important moments, namely: the speed when even the very small piece of lubricant will be visible on the cup, and the speed if all of the plastic lubricant will be on the wall or on the bottom of the glass.
Moreover, we have got the possibility to make experiments both at the high temperature and at the lowered one.

## 4. Aspect 3

On effective and rapid check of adhesion, and quality of the liquid lubricant in dynamics (Fig. 6).
It is the new and patented by author way. The layout of investigation is practically the same as we have just described above (Fig. 5).
Legend:
1 – thermal chamber; 2 – plate for the liquid material; 3 – annular collar of the plate (height is not more 2 mm); 4 – liquid lubricant (thin layer); 5 – engine supports; 6 – engine shaft; 7 – high-velocity motor/engine; 8 – the upper bushing; 9 – coupling; 10 – shaft connected both to the bush and the plate; 11 – cup; 12 – pivot; 13 –

lower bushing; 14 –pivot base; 15 – prop as the supporting wall; 16 – precise weight balance; 17 – common foundation.

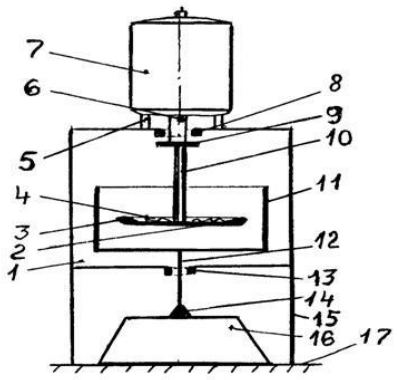


**Figure 6** The layout to control both the adhesion and the quality of the liquid lubricants in dynamics (and the liquids in general)

*Note:* The annular collar of the plate has the smooth slope in the direction to the center of the plate (the angle is less than 15 degrees). During the rotation of the plate with liquid lubricant and with different velocity the lubricant will fly away from the surface of the plate due to centrifugal force. The precise weight balance will constantly register this situation related to the velocity of the plate rotation.

## 5. Aspect 4

About how quickly to remove the products of wear and tear from the liquid lubricant in operation (Fig. 7).

It is very important problem, especially for the engine which is operating with liquid lubricant. This lubricant in the course of time accumulates different particles of wear (materials of pairs of friction "steel-steel", "sealing-steel or sealing-alloy", "plastic-steel", etc. [4, 5].

Moreover, from time to time, in this lubricant, we can find rather small abrasive and contaminating elements. To perform the diagnostics for engine correctly and quickly through the reliable composition of lubricant, we use the next technical novelty, namely, operating principle (Fig. 7).

Moreover, we obtain the possibility to conduct experiments both at the high temperature and at the lowered one.

Legend: *1* – foundation; *2* – cubical tank to collect the basic amount of the heterogeneous elements in lubricant; *3* – guide; *4* – plug; *5* –opening in the plug; *6* –lower hole in conic funnel; *7* – conic funnel; *8* – mixer; *9* – liquid lubricant; *10* – the upper level of lubricant; *11* – fastening assembly; *12* – removable cover ; *13* – fastening for the discharge orifice in the cover; *14* – plug; *15* – hose; *16* – cubical tank; *17* – engine; *18* – engine supports; *19* – platform; *20* – engine output shaft; *21*

–hole in the cover; *22* – "pillar" of contamination (heterogeneous elements in liquid lubricant).

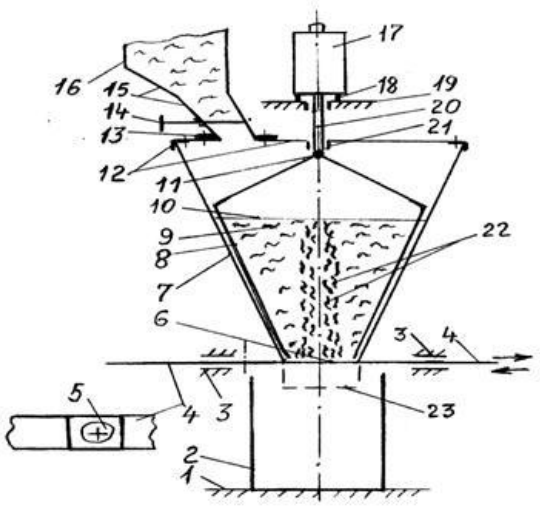


**Figure 7** The layout of the operating principle to remove the products of wear and other small elements

Using the mixer, we collect the maximum amount of contaminants in the middle of our cubical tank. After this short action, opening the lower hole, we collect the main heterogeneous elements to perform chemical and/or another technical analysis. It facilitates us to make the decision about the real amount of liquid lubricant at the moment.

## 6. Aspect 5

About the new organic lubricant

Usually, to produce an organic lubricant, we are cultivating plants or trees with fruits, or gather fruits and vegetables from the wild nature. They must be treated for a long period of time, for many hours or even days to obtain liquid or plastic lubricant with various elasticity, flash point, etc.

But here we paid attention to the hair. As usual, they are oily, and we wash our heads with shampoo or a soap. And moreover, we often cut/clip and shave our faces, for example, beard and moustache. Using this action in dry way with electrical safety razor, we can get many small parts of our hair.

Here it is, the short insight into the hair (Fig. 8).

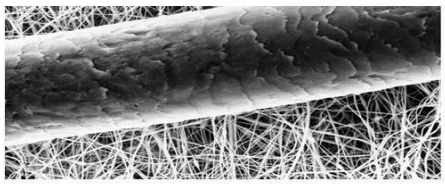

**Figure 8** Human's hair

There are so many chemical elements and compositions in the hair, for example: albumen, lipid film which provides water protection, fat, carbon (≈51%), oxygen (≈21%), nitrogen (≈17%), hydrogen (≈6%), sulphur (≈5%); moreover, there are magnesia, arsenic, chromium and others.

The calculation equations for wear ($\mu m$) with hair as a lubricant are given below (Fig. 9):

$W1_i := -1.071 \cdot 10^{-3} \cdot (x_i - x_0)^2/h^2 + 6.857 \cdot 10^{-3} \cdot (x_i - x_0)/h + 0.029$

$W2_i := -5.238 \cdot 10^{-4} \cdot (x_i - x_0)^2/h^2 + 5.071 \cdot 10^{-3} \cdot (x_i - x_0)/h + 0.020$

$W3_i := -3.810 \cdot 10^{-4} \cdot (x_i - x_0)^2/h^2 + 4.286 \cdot 10^{-3} \cdot (x_i - x_0)/h + 0.017$

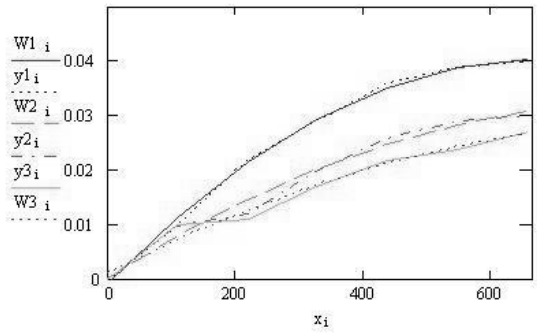


**Figure 9** Experimental and theoretical curves: two below ones refer to the new organic lubricant; the upper one represents absence of lubricant; $x_0$ is the average value of the test time (min); $h$ – step of periodical check for wear development (110 minutes)

Small hair particles, regarding that they are is an organic lubricant, were collected in a small glass cups. There are many small organic elements of this lubricant (powder-like) on the surface of friction after the experiment test. And, suddenly, we revealed that this powder acquired the property similar to electric magnet. This organic lubricant literally adhered to the surface of friction. For the process of wear, it is very positive and important new factor.

**Figure 10** View of the sample (steel washer with the special grooves/notches to catch lubricant actively) – left picture; the test bench – the right picture; the group of samples before testing in the laboratory (below)

In our experience (Fig. 10) we use the electric drill FINCH Industrial Tools FIT$^{TM}$ Serial NO: ID 04 1 0298 with the rotation frequency of 1410 rpm.

The step of observation for wear and tear was $h$=110 min; maximum term of observation was $x$=600 min; for steel samples, the real wear registered in the form $y1_i$, $y2_i$ and $y3_i$; $W1_i$, $W2_i$ and $W3_i$ are the theoretical descriptions in the computer programme MathCad [1, 4-11]; and also ref. to [12, 13, 14].

## 7. Aspect 6

### 7.1. *About cost effectiveness*

So, we really see (Fig. 9) the decrease in the rate of pairs of friction wear if we use this new organic lubricant. This lubricant can be practically produced very easy in any hairdressing salon. According to our estimate, the cost of about 1 kg of such organic lubricant will be not more than 5 roubles. But, if we apply the traditional organic lubricant, the cost will be approximately 1000 roubles. Moreover, the additional effect can be achieved for many steel pairs of friction (or for another materials if they acquire the property like electro-magnet holding this organic lubricant) during the operation. In this case, we must not raise sunflower (for example), fertilize (ground), plough, sow, water, weed, harvest, etc. The costs may be too high in this case. As it was shown above, the term of real operation for the different pairs of friction will be longer as well. Using this new organic lubricant, we additionally enhance the general reliability of mechanisms and pairs of friction in equipment [15-21].

In our view, there is only one essential negative point for this new organic lubricant, namely, it is the high temperature. Unfortunately, any organic lubricant cannot withstand high temperature: the hair burns. But if the temperature is essentially lower than zero (even about -100°C), it will work well in zones of the mobile frictional junctions. And few more words about the shape of plastic or liquid lubricant. It must be like a small ball (hollow or extendible and solid), as a small doughnut, a small macaroni or a roller. Such forms of any lubricant essentially decrease the strain in the upper layer of material (pair of friction) from 30% to 10 times.
Taking into account all important factors, we estimate the average economical effect if this organic lubricant will be applied in practice. The average sum will amount about several millions of roubles. This depends on the amount of pairs of friction and the operation life.

## 8. Conclusion

1. We managed to provide the vertical movement for the friction bearing if the oil film has the attempts to distort the place of the friction bearing location during the operation of the shaft. It protects any zone of friction against the rupture of the oil film. Consequently, the process of wear and tear for pairs of friction will be essentially slower.

2. The applied new organic lubricant is the cheapest among the other organic lubricants in the world. It ensures the decrease in the rate of deterioration potentially for many moving parts of mechanisms, machines and devices.

3. The new and very important effect of the organic lubricant was discovered, that is electro-magnet property which helps to keep organic lubricant in a zone of friction practically constantly during the whole period of operation.

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