STUDY ON THE DEPLOYMENT OF THE FLEXIBLE SYSTEM BELLOWS OF FOOD MACHINERY LUBRICATION

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Abstract

The paper presents a method for implementing the system of food machinery lubrication systems with elastic bellows, seals frontal system that is used in terms of a constructive friction torque locking ring which is provided by the force of an elastic the pressure plus the force due to hydraulic fluid pressure sealed.

Key words: lubrication system, seals, front bellows, friction torque, food machinary

INTRODUCTION

Operation of a front seal in food machinery, is not possible without a constant force to maintain contact between the primary ring and counter ring. (Cristea V. 1973) Clamping force must be greater than the sum of the forces that try to open the seal.(Anton, I, 1979)

Closing forces are:

- Force pressing the bellows (FAS) and hydraulic power (FH) due to fluid pressure sealed (p1). (Hutte, 1995, I Iorga et al, 1972, Mayer,E 1972) Force that tends to open the seal is hydrostatic force (FHS) resulting from the action of hydrostatic pressure (PHS) in the interface.

Fi = Fas + Fh

This force must be taken by force hydrostatic hydrostatic (FHS), the hydrostatic bearing fluid film (FHD) and mechanical lift (FM) which occurs in direct contact between asperities:

Fi = Fas + A(K p +p2) = Fhs +Fhd + Fm

Depending on the rate of compensation, we have:

$K = \frac{A_H}{A}$ [AH – hydraulic load area slip A – area (contact) the sealing rings]. (Chioreanu N, 2006, Georgescu, Al, 1987, Cornea C 1991)

- Seals front cleared that K ≥ 1 (Kmax = 1.2) is used for low pressures (p1 <10 bar)
- Seals frontal offset that K <1 (K = 0.55 ÷ 0.8) was used at high pressures.

The total seal closing force (Zeus, D, 1974, Hritescu C. 1989) cleared the entire system must be done by pressing elastic and elastic force to the offset and hydraulic force acting in parallel. (Bofet Emil, 1973, Dubbel 1998, Panaitescu, V. 1979) The elastic pressing need for seals front cleared even if (FH) is large enough where:

- Decrease fluid pressure sealed
- Fluctuating pressure.

MATERIAL AND METHOD

To achieve the elastic force using a wide range of constructive solutions to the most common are:

- Elastic spring system
- Elastic bellows system
- Elastic system of pressure-sealing "O" rings or profile.

Constructive systems of press-seal are also commonly used because of their dual functions:

- Exercise the closing force of the interface
- Making secondary seal.

The most common are seals or bellows seal that protects components, eliminating friction side seal, radial and axial over games do not require maintenance. (Cunningham, F. 1974, Demian T. 1982, Gelubev, G.A 1976) The temperature limit depends on the base material use, as from this point of view two types of bellows:

1. Plastomers bellows of operating up to 200 º C
2. Metal bellows that can operate up to 600 º C.

Bellows type flexible systems instead require a space assembly axially longer than other types of springs

1. Bellows of plastomers shown in Figure 1 a, b, e.

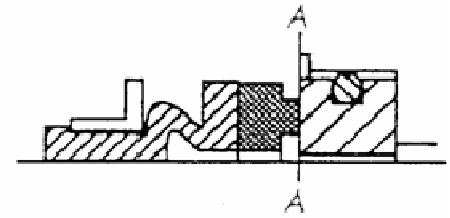

Fig. 1.a

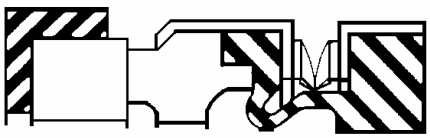

Fig. 1.b

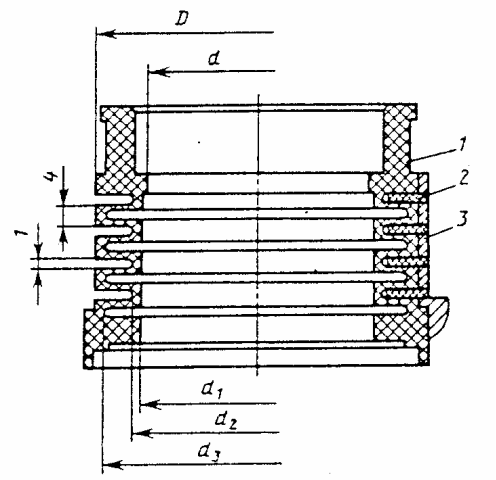

Fig. 1.e

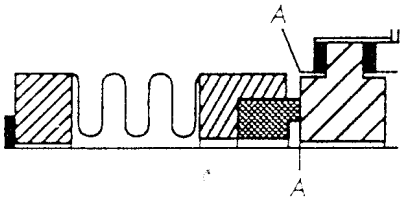

Fig. 1.c

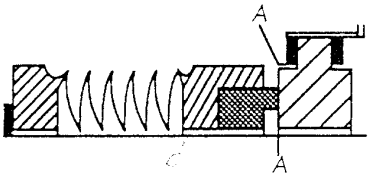

Fig. 1.d

are generally cheap, resistant to corrosion, but can not be used in any chemical environment and are limited within certain limits of temperature (at low temperatures and become brittle when lifting soften). Can have a stretch either alone or in combination with a coil spring construction or corrugated. Use both simple construction (Fig 1.a) and in special construction (Fig. 1.c) with gaps between the wafers filled with elastomeric, and metal armor protected them. (Shigley, J,1992, Demian, Tr,1982) This solution allows the use of high pressures due to bellows metal armor This solution allows the use of high pressures due to bellows and metal armor can exert a greater force due to elastic elastomeric. Also can be used in environments heavily polluted with suspensions that could block the common bellows by deposit in wafers.

2. Corrugated metal bellows construction (Fig. 1. c) or grid (Fig.1. d) are resistant to many environments and is made of corrosion metals (brass, phosphor bronze, Model alloy, aluminum, stainless steel).

Also withstand higher temperatures than plastomers and perform well at low temperatures. Seals wave may have different profiles:

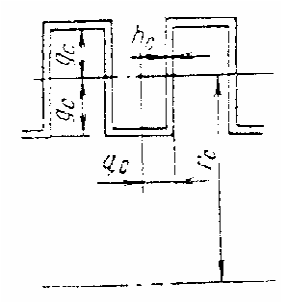

Fig. 2.b

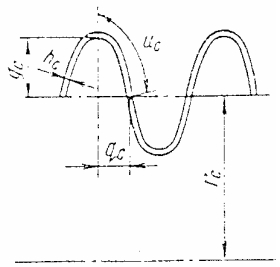

Fig. 2.d

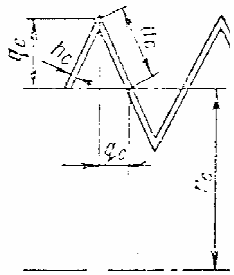

Fig. 2.e

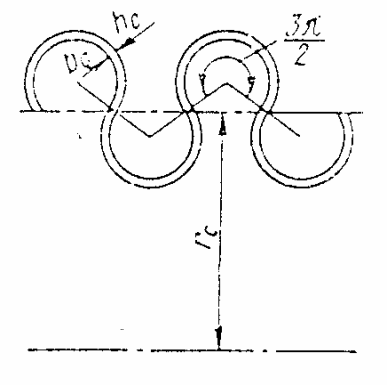

Fig. 2.f

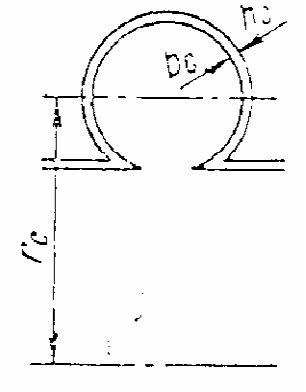

Fig. 2.g

seals welded (or glued) (Figure 2. a, c)

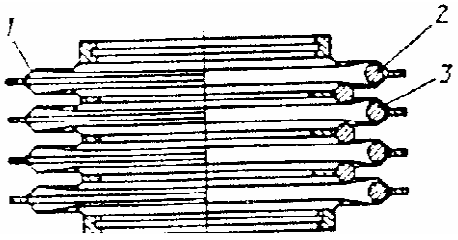

Fig. 2.a

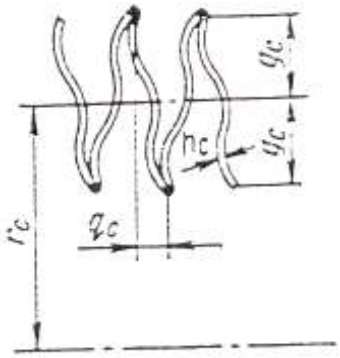

Fig. 2.c

performed better elastic force, and by reinforcing the use increases the pressure.

RESULTS AND DISSCUSIONS

The remaining dimensions in [cm] to obtain the following expressions for the elastic characteristics:

1. triangular bellows (fig.2.e)

$$K_r = 0{,}307 \frac{Er_c h_c^3 q_c}{u_c g_c l} \cdot \frac{1}{R}$$

2. Sinusoidal bellows (fig.2.d)

$$K_r = 0{,}307 \frac{Er_c h_c^3 q_c}{u_c g_c^2 l} \cdot \frac{1}{R} \cdot \frac{q_c + g_c}{q_c + 1{,}6 g_c}$$

3. Bellows with profile „S" (fig.2.f)

$$K_r = 1{,}12 \frac{Er_c h_c^3}{b_c l\left(1-\mu^2\right)} \cdot \frac{1}{R}$$

μ - Poisson coefficient of the material

4. Toroidal bellows (fig.2.g)

$$K_r = \frac{Eh_c}{18{,}65 b_c}$$

5. Rectangular profile (fig.2.g)

$$K_r = 0{,}102 \frac{r_c h_c^3 E q_c}{g_c^3 l} \cdot \frac{1}{R}$$

6. Welded bellows (fig.2.c)

$$K_r = 0{,}785 \frac{Er_c h_c^3 q_c}{g_c l}$$

CONCLUSIONS

Corrugated membranes to achieve bellows assembly can be done by:

- Soft coating for use above 150 º C
- Hard coating for temperatures below 150 º C
- Welding of steel and stainless steel bellows.

Elastic characteristic depends on the profile seals wafers. Using the notation in Figure 2 and noting with:

- E - modulus of elasticity of the material [daN/cm2]
- L - length of the bellows active in relaxed state [cm]
- R - coefficient correction

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