

EXPERIMENTAL RESEARCHES REGARDING THE ACHIEVEMENT OF A PROTECTION VALVE WITH CORRUGATED PIPE FOR GAS FURNACES

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Abstract: In this work the authors present the results of their own researches regarding the achievement of a protection valve with corrugated pipe for gas furnaces. The valve with corrugated pipe was conceived in a way that in case of random disconnection of the gas blowpipe flame it couples out automatically the gas and a new firing could not be attained without human intervention. The valve was conceived for gas blowpipe with low yield usable at the refrigerating systems (type Fram 22) for vehicles.

Keywords: Protection valve, corrugated pipe, gas furnaces, gas blowpipe, refrigerating systems, valve case, restriction spring, corrugated pipe, glass, sonde, silicon oil, bulb.

1. INTRODUCTION

The using of the GPL gas blowpipe with low yield at the refrigerating systems type Fram 22 for vehicles, involves the assessment of the next safety precautions.

- in case of random disconnection of the flame, it is necessary to couple out automatically the gas fuel;
- a new starting of the gas blowpipe must be attained only manually at the human intervention;
- at the tick over of the refrigerating unit operated by the calorstat the gas blowpipe must function with stable look-out flame and with low gas fuel consumption.

For answering these requirements the authors of the hereby article have drawn up, realized practically and studied a protection valve whose closure is commanded by an corrugated (corrugated) pipe.

Besides the valve has been combined with a device of manual firing of the flame proceeded by the human operator.

2. THEORETICAL NOTIONS REGARDING THE CONVERSION OF THE TEMPERATURE VARIATION IN LINEAR VARIABLE MOTION WITH THE AID OF THE CORRUGATED PIPE

In many cases, the sag (f) of the pipe (figure 1) could be expressed approximately this way: spring 5, we are in the situation of a maximum cold and when the cam is in the position of high

$$f = F \cdot \frac{(1 - \mu^2)}{Eh_o} \cdot \frac{n}{\left(A_o + \alpha A_1 + \alpha^2 A_2 + B_o \frac{h_o^2}{R_i^2} \right)} \quad (1)$$

where: F = the axial force;
 n = the number of undulations;
 E = the modulus of elasticity of the material;
 μ = Poisson's constant;
 A_0, A_1, A_2, B_0 = factors which can be determined from the nomograms and they are specific for each type pipe;
 α = the angle of the undulation;
 R_i = the interior radius;
 h_0 = the wall thickness.

If $\alpha = 0$, then the sag (f) can be determined with the relation:

$$f' = F \cdot \frac{(1 - \mu^2)}{E h_0} \cdot \frac{n}{\left(A_0 + B_0 \frac{h_0^2}{R_i^2} \right)} \quad (2)$$

The axial force F depends on the pression p within the pipe and can be determined with the relation:

$$F = p A_{ef} = \pi p R_m^2 \quad (3)$$

where: A_{ef} = the effective surface;
 R_m = the medium radius of the pipe expressed by the relation:

$$R_m = \frac{R_e + R_i}{2} \quad (4)$$

So as the gas fuel supply of the gas blowpipe to be coupled out automatically when the flame stopped for no matter what reasons, a protection valve must be fit in the feed circuit.

The specialty literature advises many procedures for the flame monitoring. Among these, we consider as the most simple the procedure based on the conversion of the temperature variation of the blowpipe flame in the linear motion of the valve core, and on the overcoming of axial forces F_R of the stop spring.

This procedure can be successfully applied when disposing of an operating technology capable of filling the corrugated pipes with a liquid which vaporizes at over 200 °C degrees, but is not flammable at 800 °C degrees.

3. THE EXPERIMENTAL MODEL PROPOSED.

We've projected and realized practically an automatic protection valve for the gas fuel supply of a gas furnace (for the **Fram 22** refrigerator).

In figure 2, it is presented the valve chart and it has the following elements:

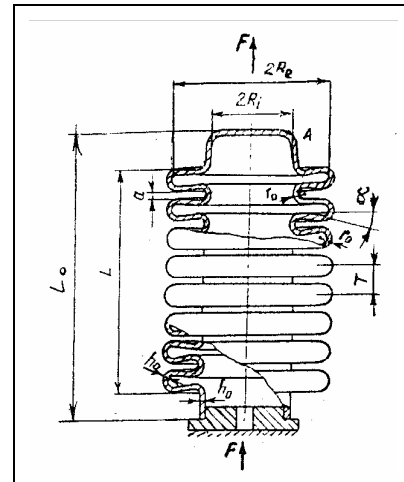


Fig. 1. The corrugated pipe.

1,7 - operating button manual valve; 2 - packing nut; 3 - sealing; 4 - packing ring; 5 - opposing spring button;

6 - packing ring; 8 - valve garniture;
9 - packing nut of seat;
10 - packing ring;
11 - seat of valve;
12 - valve case;
13 - valve stem; flame;
14 - guiding nut;
15 - stop spring of valve
16 - packing nut of the detecting element; 17 - support of the corrugated pipe; 18 - flame detecting element.

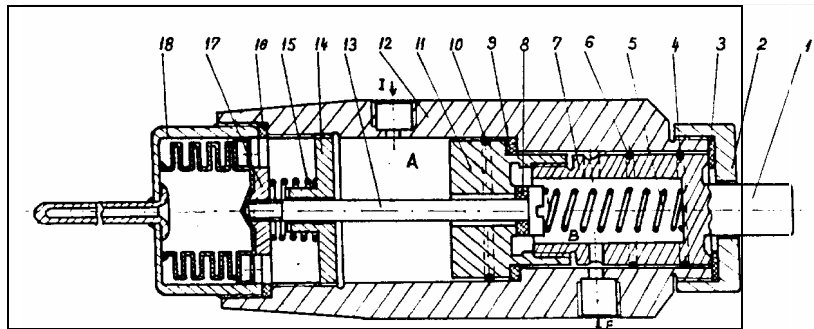


Fig. 2. The valve chart.

We conceived the protection corrugated pipe as a combined pipe which can be switched on/off at the control of the flame monitoring with corrugated pipe, and can be switched on at the human control. The manual switching on of the corrugated pipe was conceived without the activation **"stoppage on the position "on"**. We used this variant, because for operating automatically the control (after the firing) is taken over by the flame monitoring.

We also conceived a flame monitoring with corrugated pipe presented in the figure 3, having the following elements: 1 - restriction spring; 2 - corrugated pipe; 3 - glass; 4 - sonde; 5 - silicon oil; 6 - bulb.

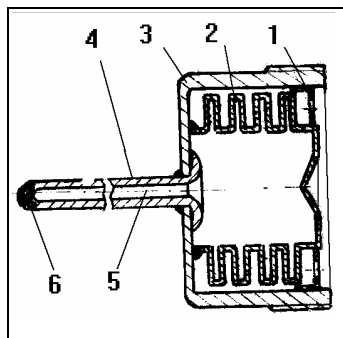


Fig. 3. The bulb.

The flame monitoring sonde was made of copper capillary tube with 1,5mm diameter. The corrugated pipe was made of CuSn6 band, STAS 94/1990 , 0,6mm sickness, on an automatic machine, according to Thomson technology licence owned by the Mechanical Plant "Sadu".

The rigging of the glass 4 with the sonde 4 and the corrugated pipe 2 was attained by hot tinning on a special machine. For restricting the bolt of the corrugated pipe during the performance , an restriction spring 1 was pressed above. The glass 3 was made of brass and it has been provided of an exterior thread for the rigging of the protection valve.

The supervisor has been filled with silicon oil on the installation U.M. Sadu after the interior was previously vacuumed. After the filling and jewel setting of the sound 4, a packing bulb was applied by oxyacetylene seam.

4. THE RESULT OF THE MEASUREMENTS.

Whereas the flame monitoring represents the element which changes the temperature variation into linear movement, we've done two experiences:

- The determination of the corrugated pipe gradient before the filling with silicon oil;
- The determination of the corrugated pipe gradient after the filling.

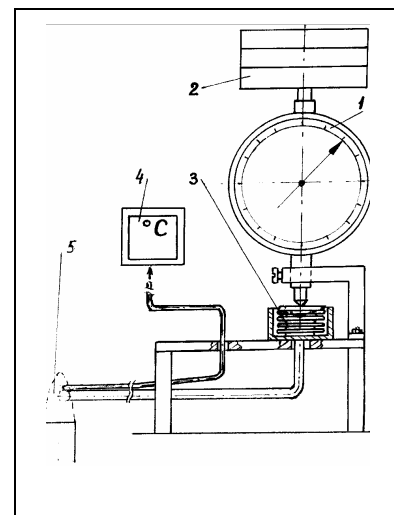


Fig. 4. Testing stand.

For both experiences we used a testing stand (figure 4).

The result of the measurements are presented in figures 5 and 6.

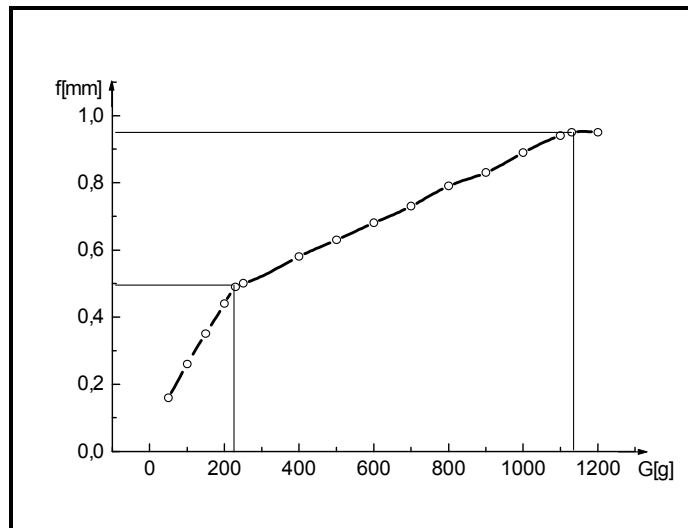


Fig. 5. The result of the measurements.

5. CONCLUSIONS.

After the measurements and the symbolic processing with the aid of the ORIGIN program for PC computers, the following conclusions were formulated:

- 1) - The silicone oil is a liquid which can be successfully used in the process of changing the temperature variation into linear movement with the help of the corrugated pipes;
- 2) - The linear movement of the corrugated pipe begins after the temperature attained 60 C degrees, having a linear variation within the interval (350 C degrees - 750 C degrees);
- 3) - The valve opening has 1mm at 1 Kgf load and it is enough for the gas blowpipe supply;
- 4) - At the disappearing of the flame from the monitoring bulb, the valve is automatically shutting down in 40 seconds;
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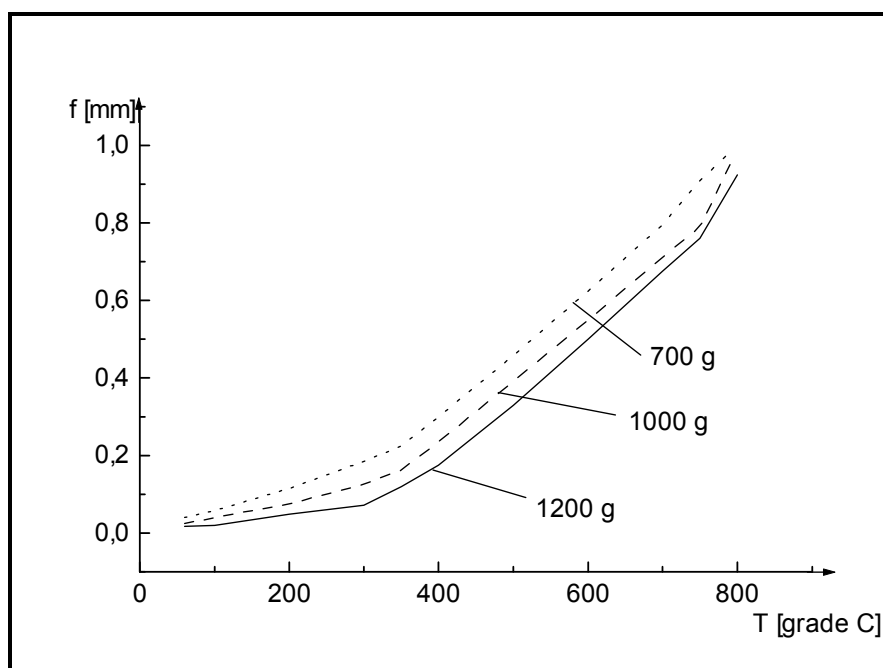


Fig. 6. The result of the measurements.

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