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EXPERIMENTAL RESEARCHES ABOUT ACHIEVEMENT OF A PROTECTION VALVE WITH SILFONIC TUBE, FOR BURNING INSTALLATION WITH GAS

In this work the authors present their research results on the achievement of a valve protection tube silfonic for combustion plants with fuel gas.

The valve with silfonic tube has been designed in such a way as to interrupt the Accidental flame burner gas to stop automatically feed it gas, and a nine ignition can not be achieved except through human intervention. The valve has been designed for burning gas at low speeds suitable facilities for cold type cars FRAM 22.

1. Introduction

Using LPG gas burner at low speeds with refrigeration facilities for cars type FRAM 22, involves following the imposition of safeguards.

-- Accidental interruption flame automatically to stop supplying gas and fuel;

-- Ninth in the service of re-burner can be realized only with manual human action;

-- Crossing the functioning of the cold aggregate to slow motion ordered by thermostat, the burner flame to work with the Observing stable and low gas;

To meet these requirements the authors of this article were designed, developed and studied practically a valve protection which ordered the shutdown is a silfonic tube (undulate).

Also the valve was combined with a manual striking device of flame, acted by human operator.

2. Theoretical notions about conversion of variation in temperature of linear variable displacement, with silfonic tubes

Silfonic tubes (undulate) occurred in the technique of measurement and automation processes, as a result of technical progress achieved in the manufacture of metal tubes with thin walls. These tubes are known as undulate sack. In Figure 1 is presented a section through such a tube and the geometric dimensions to be taken in extremely complex calculation of these sensitive items.

In most cases, the arrow (f) of silfon (Figure 1) may be expressed in an approximate way, as follows:

$$f = F \cdot \frac{(1-m^2)}{Eh_0} \cdot \frac{n}{\left[A_0 + \alpha A_1 + \alpha^2 A_2 + B_0 \frac{h_0^2}{R_i^2}\right]}$$

where: F – axial force

n – number of undulation

E – material elastic module

m – Poisson constant

A_0, A_1, A_2, B_0 – coefficients determined from nomogrames, and is special for every silfon type

α – undulation angle

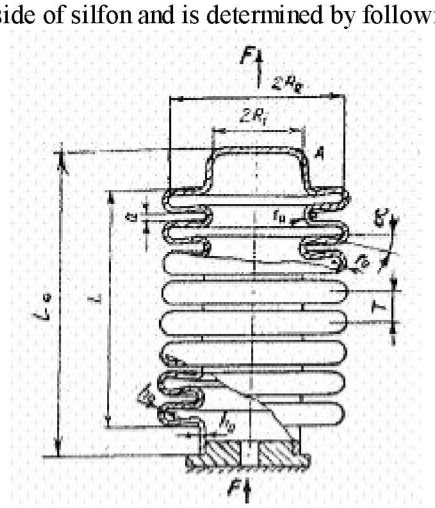
R_i – intern radius

h_0 – wall thickness

In case of α = 0 then arrow *(f)* is determined by relation:

$$f' = F \cdot \frac{(1-m^2)}{Eh_0} \cdot \frac{n}{\left[A_0 + B_0 \frac{h_0^2}{R_i^2}\right]}$$

Axial force F depend on pressure p inside of silfon and is determined by following relation: $F = p$



$$R_m = \frac{R_e + R_i}{2};$$

Because the supply of burner gas fuel can be automatically stopped when the flame for some reason stopped is necessary in power supply circuit to be mounted a protection valve.

The valve must stop automatically feed fuel gas burner and a new filling is permitted only to manual human intervention. Also, after the flame lighting, the valve must to remain on the open position.

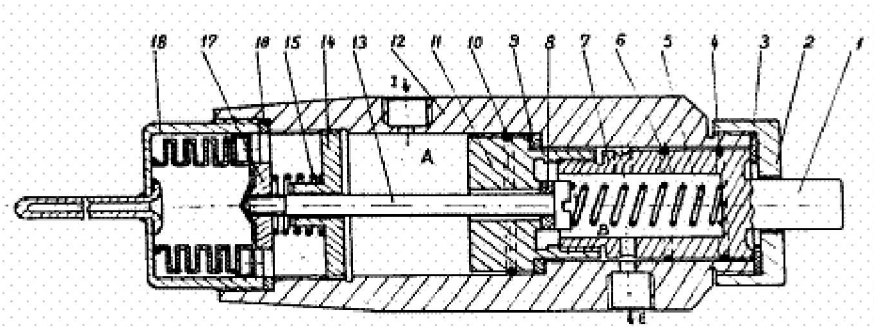
From the point of view constructively, it involves equipping the valve with a supervisor with the flame able to give the order stopping gas when the flame has disappeared and with a valve allowing manual feed gas burner when it wants to relighting the flame.

Literature specialist recommended several procedures for overseeing the flame. Of these, we believe that the most straightforward is that based on conversion of temperature variation burner flame in a linear movement of the valve rod and overcome the axial forces FR of the spring of closing. This technique can be applied successfully when it has a technology for making and loading silfonic tubes with a liquid that is vaporize over 200°C but not flammable at a temperature of 800°C.

3 . Experimental model proposed.

Since Sadu Mechanical Factory has a line of manufacturing technology of silfonic tubes, we have designed and built a virtually automatic protection valve supplying gas a fuel combustion plants for refrigerators FRAM 22.

In figure 2 is presented general model of this valve with it components:



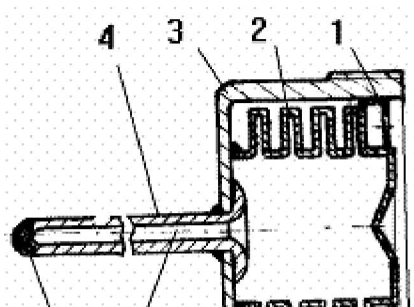
1, 7 – manual action button; 2 – tighten nut; 3 – gland; 4, 6, 10 – tighten ring; 5 – ward spring; 8 – valve garnish; 9 – seat gland; 11 – valve seat; 12 – valve body; 13 – valve rod; 14 – guide nut; 15 – closing valve spring; 16 – gland of flame detector; 17 – silfonic tube support; 18 – flame detector

Fig. 2

We designed the protection valve as a combined valve can be closed / open on supervisor command of the flame with silfonic tube and can be opened manually ordered by the action of operator. Opening manual the valve was designed without the "restraint on the open position". He used this possibility, since to operate automatically command after ignition flame, is taken by the supervisor of flame.

Also we have designed a supervisor with the flame silfonic tube shown in Figure 3 and which party has the following components:

The supervisor probe was made of copper capillarity tube inside diameter of 1.5 mm. Silfonic tube was made of band CuSn 6, STAS 94 / 1990 thickness of 0.6 mm, an automatic machine technology under license by Thomson take by Mechanical Factory Sadu.



1 .- ring limitation; 2 .- silfonic tube; 3 .- glass; 4 .- probe; 5 .- siliconic oil; 6 .- bulb;

Fig. 3.

Assembly glass 3 with probe 4 and silfonic tube 2 was designed by tinning on a special machine. To limit the arrow of silfonic tube during the operation, pushing it over a limitation ring 1.

The glass 3 has been made of brass and was fitted with threaded with assembling outside for the protection valve.

Supervisor itself was filled with siliconic oil on the plant UMSadu after the first was vacuumed. After filling and probe 4 mounting was applied by welding oxyacetylene of a packing bulb.

4. The principle of operation.

Gas LPG fuel type of low pressure enter through the entrance I of the protection valve compartment A. The valve being closed gas stops in the A (Figure 2), but can pass in the B. By pressing a button manual 1, seat 11 mobile gas fuel allows passage through the compartment B, the exit E of the valve and then to the burner where the lights from an appropriate source of heat. After lighting gas, bulbul 6 (Figure 3), it warms facilitating vaporization of siliconic oil from capillary probe. By vaporization, oil pressure increases in silfonic tube producing a trip to axial ring limitation 1. Meanwhile rod of the valve 13 (Figure 2), is the axial displaced. If the button is released manually 1 gland of the valve no longer reach mobile chair and passage of gas between the two compartments is made easy.

5. The results of the measurements

As the flame of supervisor means that converts the temperature variation in linear movement, we conducted two experiments:

-- Determine gradient of silfonic tube before filling with siliconic oil;

-- Determine gradient of silfonic tube after filling;

Both experiments are based on the fact that the silfonic tube behaves like an ordinary spiral resort, with similar mechanical characteristics.

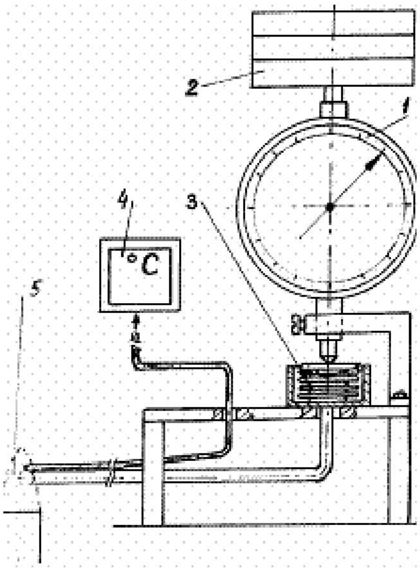


Fig.4

For both experiments we used a stand verification (Figure 4), which consists of:

1 .- comparator (0 - 25 mm)

2 .- standard weights;

3 .- supervisor of flame;

4 .- thermocouple 0 - 1000°C;

5 .- source of heat from 0 to 800°C;

The results of the measurements are presented in tables 1 and 2, and after processing results were obtained curves of figures 5 and 6.

Tabelul 1.

Nr. crt.	G [grame]	f [mm]	Nr. crt.	G [grame]	f [mm]
1	50	0,16	9	600	0,68
2	100	0,26	10	700	0,73
3	150	0,35	11	800	0,79
4	200	0,44	12	900	0,83
5	230	0,49	13	1000	0,89
6	250	0,50	14	1100	0,94
7	400	0,58	15	1130	0,95
8	500	0,63	16	1200	0,95

Tabelul 2.

Nr. crt.	T [o C]	f [mm]	G [grame]	f [mm]	G [grame]	f [mm]	G [grame]
1	60	0,018	1200	0,025	1000	0,040	700
2	100	0,020	1200	0,040	1000	0,058	700
3	200	0,048	1200	0,075	1000	0,115	700
4	300	0,072	1200	0,126	1000	0,185	700
5	350	0,120	1200	0,162	1000	0,225	700
6	400	0,175	1200	0,235	1000	0,300	700
7	500	0,330	1200	0,392	1000	0,550	700
8	600	0,500	1200	0,550	1000	0,625	700
9	700	0,710	1200	0,712	1000	0,795	700
10	750	0,726	1200	0,790	1000	0,910	700
11	800	0,924	1200	0,990	1000	1,000	700

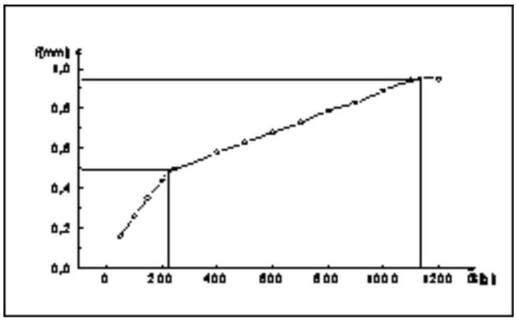


Fig. 5.

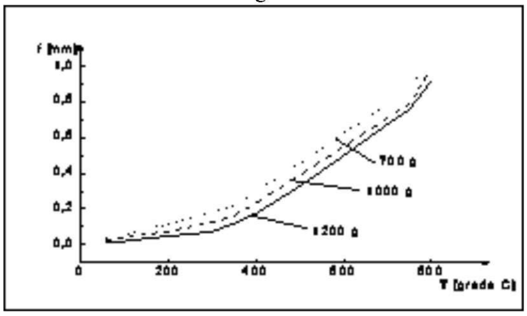


Fig. 6.

6. Conclusions.

After measurements and experime ntal data processing with the ORIGIN software were formulated following conclusions:

1). -- Siliconic oil is a liquid that can be used successfully in the process of conversion of variation in temperature linear movement through silfonic tubes;

2). -- Movement of linear silfonic tube start after the temperature reached 60°C one, with a variation on the linear interval [350°C - 750°C];

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