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NASA TECH BRIEF

Goddard Space Flight Center

Thermally Responsive Mechanical Actuator

The problem:

Most materials expand in heat and contract in cold. This property is very useful in heat control, heat measurement, and mechanical actuation by heat. Devices built for such applications include thermometers, thermostats, safety switches, circuit breakers, and mechanical actuators, to name a few. However, in each device, a different material is actuated by the heat. It would be a major technical improvement to have one material that could be used in most if not all of these devices.

The solution:

Silicone rubber has the highest coefficient of expansion of any known material and seems suitable for most of these devices.

How it's done:

Silicone rubber has the following advantages:

1. It has the highest coefficient of expansion of any known material. The coefficient of expansion ranges from 5.9×10^{-4} to 6.9×10^{-4}/°C.
2. It is flexible enough to be fitted into all kinds of enclosures.
3. Because it is a solid, it does not require seals as in the gas- and liquid-actuated devices.
4. It provides higher work output per given unit of heat than any other material.
5. It is very inexpensive.
6. It can be molded into any shape.
7. It can sustain temperatures up to 600° F.

The illustrations below show some practical applications of silicone rubber. Figure 1 shows the standard glass thermometer using silicone rubber and colored fluid to indicate temperature. A temperature gauge that is activated by expanding or contracting silicone rubber is shown in Figure 2. Finally, two mechanical actuator models using silicone rubber are shown in Figures 3 and 4.

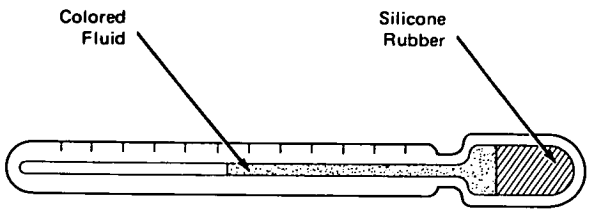

Figure 1. Glass Thermometer

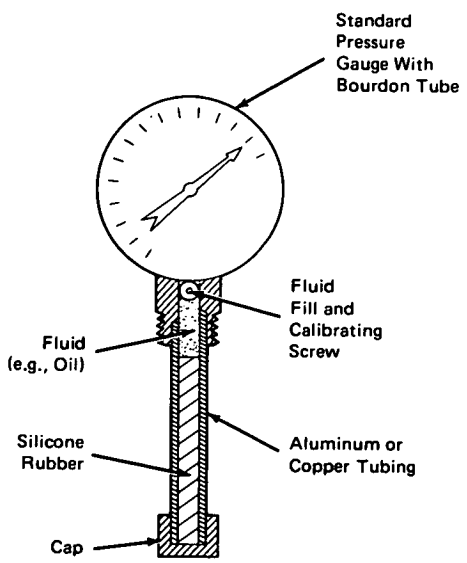

Figure 2. Temperature Gauge

(continued overleaf)

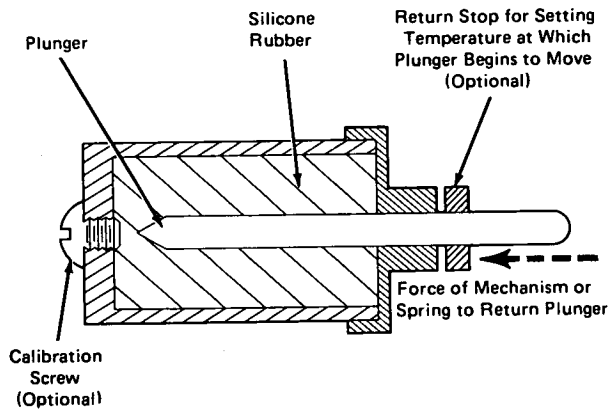

Figure 3. Unsealed Mechanical Actuator

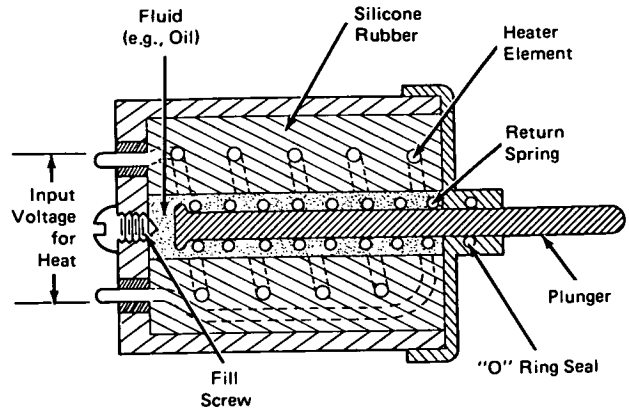

Figure 4. Sealed Mechanical Actuator

Note:

No further documentation is available. Specific questions, however, may be directed to:

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Reference: B73-10208

Patent status:

NASA has decided not to apply for a patent.

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(GSC-11697)