Bimetallic and Pneumatic Control Correlation
by Joel Smith, Spring 2010 – for M E 345

Pictured in Figure 1 is a Honeywell TP-970A pneumatic controlled thermostat. The purpose of this thermostat is to regulate temperature using air pressure from an air compressor to power other mechanical devices (dampers, valves, actuators, etc.). This particular model can be found in several buildings on the Penn State campus. Such thermostats work using basic mechanical parts such as a bimetal, cam, spring, and diaphragm. The basic operation of these controls is that they are supplied a given pressure from an air compressor. The thermostat will take in that air pressure from the air compressor and send out either the same or a different pressure (branch pressure). This pressure then is used to operate the mechanical devices (dampers, valves, actuators, etc.).

How It Works

1. A person turns the thermostat knob to the desired temperature (Figure 1).
2. The knob rests on a cam and that cam will move the bimetal up or down (Figures 1 and 2)
3. Three possible results:
    - The bimetal could be in contact with the top of an air port, thus sealing off the air flow and therefore building the pressure (branch pressure = pressure from compressor)
    - The bimetal could be close to the air port, thus partially stopping the air flow and therefore building a little pressure (0 < branch pressure < pressure from compressor)
    - The bimetal could not be close to the air port, thus not stopping any air flow and not building any pressure (branch pressure = 0)
4. As the temperature in the room changes the bimetal fluctuates up or down as discussed in class (2 metals with different coefficients of thermal expansion). This fluctuation results in the bimetal moving closer or further from the air port thus rendering one of the cases mentioned above in 3 (Figure 2).

Pneumatic controls are gradually being replaced by electronic controls. These electronic controls are similar to the pneumatic controls in a sense. The electronic thermostat has a bimetal that moves and makes contact with another metal which allows current to flow which generates power. This is just like the pneumatic thermostat that as the bimetal moves it allows air pressure to build which generates power.

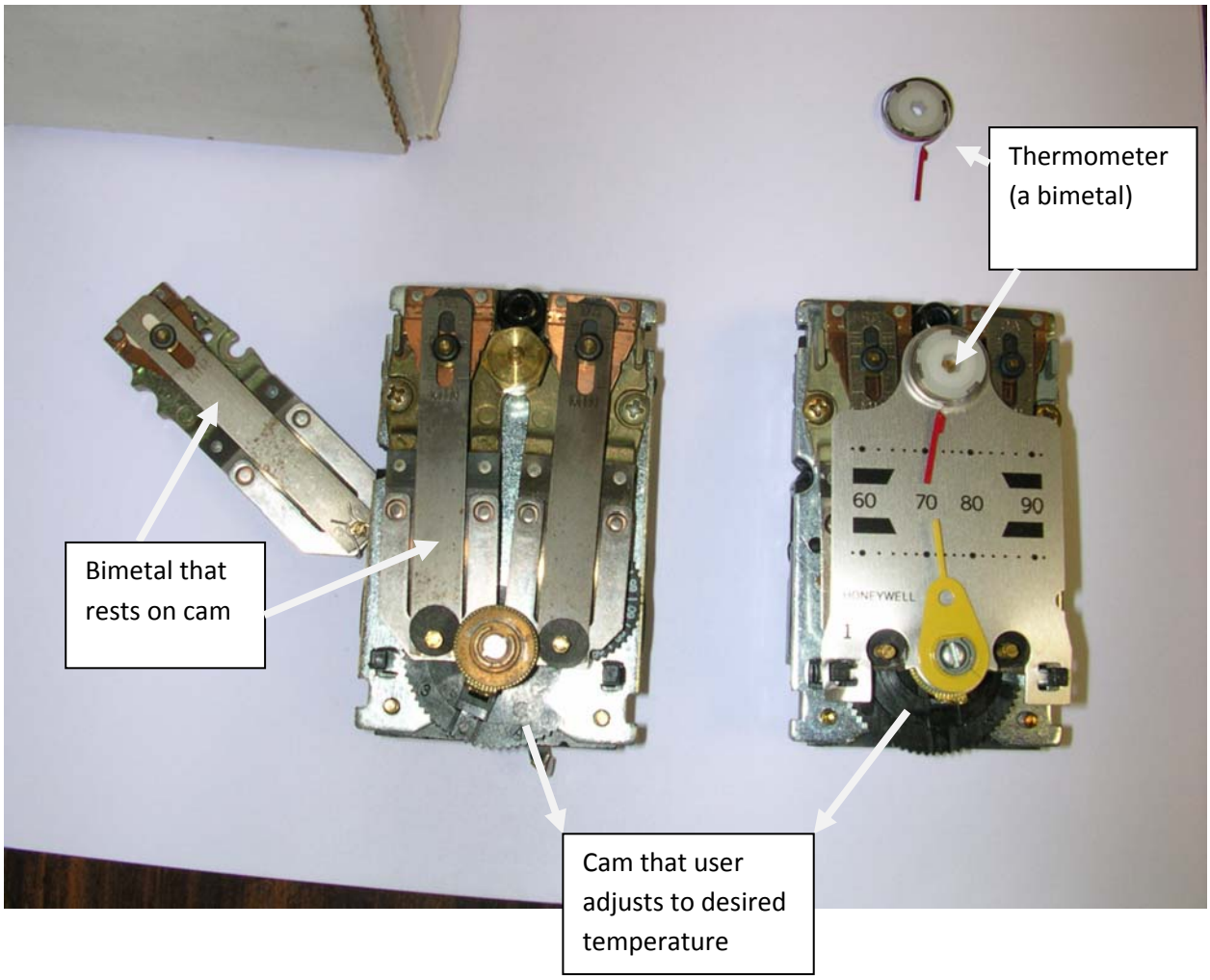
Thermometer
(a bimetal)
Bimetal that
rests on cam
Cam that user
adjusts to desired
temperature
60
70
80
90
HONEYWELL

Figure 1

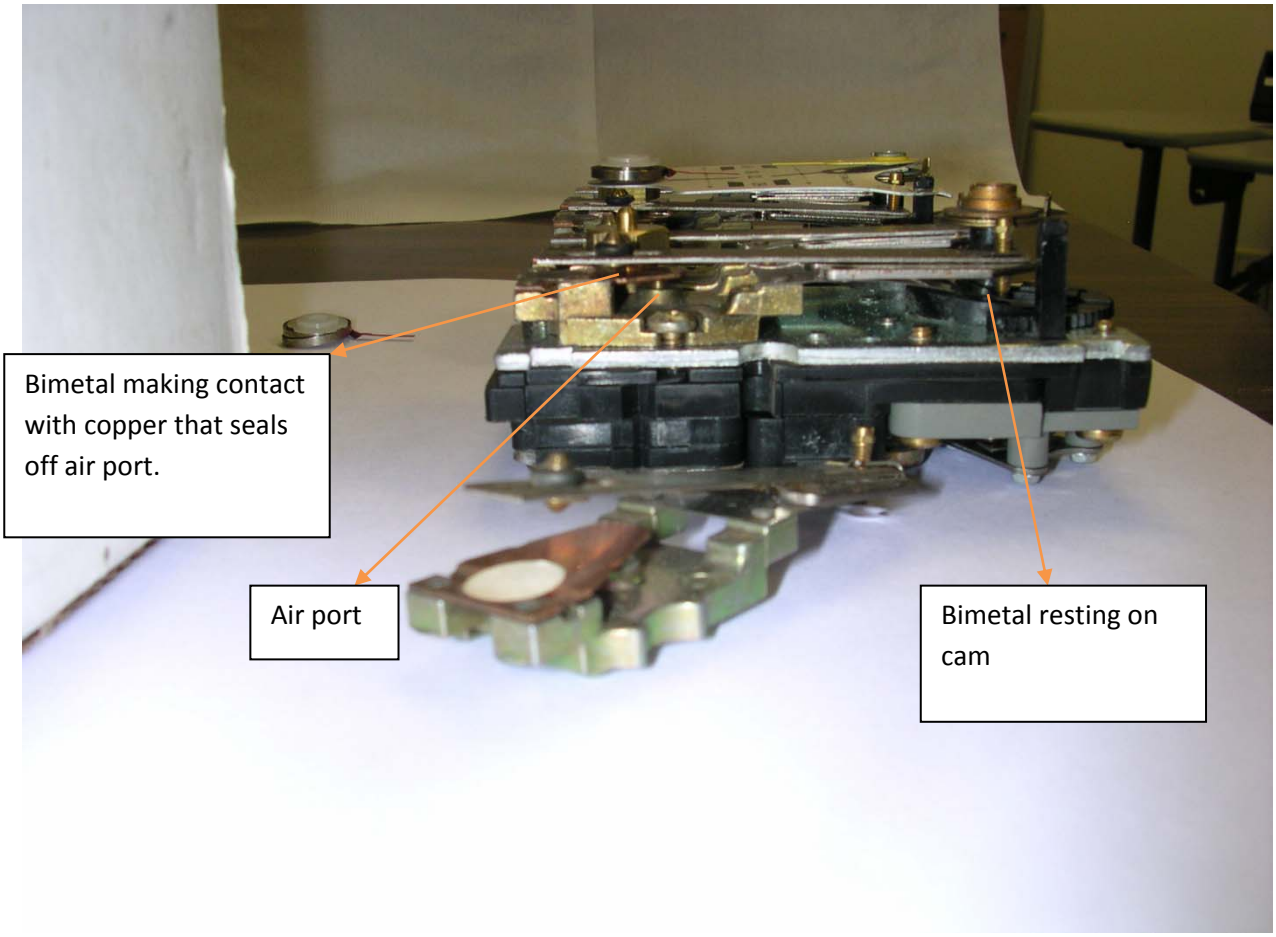
Bimetal making contact with copper that seals off air port.
Air port
Bimetal resting on cam

Figure 2