When buildings are heated from central stations, especially those using steam or vapor, automatic heat control is imperatively necessary, since heat must be available at all times in full power, and it is beyond human ability to manipulate manual controlling apparatus with sufficient nicety to prevent overheating.

When gas or oil are used as fuel, automatic control of combustion is necessary in order that the fuel costs may not be prohibitive. With quickly responsive fuels such as gas or oil, automatic heat control applied to the burners is remarkably effective and its influence is especially noticeable.

With coal as fuel and automatic control of combustion there is so much stored heat in the firebox that necessarily the volume of heat output lags behind the thermostatic influence of a change in dampers. Ashes, clinkers, etc., affect the intensity of the fire, but nevertheless the automatic control is far superior in comfort and economy to manual control.

Service hot water, no matter how it may be heated, constantly fluctuates between a scalding temperature and an unsatisfactory lukewarm condition, unless controlled automatically.

Temperature and humidity, or moisture content, are inseparably associated as factors of comfort and in nearly all industrial applications of heat. Automatic heat control becomes automatic humidity control as soon as the influence of evaporation can be applied. Thus a wet bulb thermometer indicates percentage of moisture, and a moistened thermostat can be made automatically to regulate humidity.

All systems of automatic heat control use thermostats. Thermostats are almost infinite in their variety.

Solids and gases change in volume when influenced by temperature. Electrical conductors change in resistance when influenced by temperature. Thus there is one type of thermostat which consists of an expansible hollow enclosure containing a small amount of volatile fluid having a boiling point below the range of temperature to be controlled. This fluid, vaporizing under the influence of the temperature to which the instrument is exposed, develops a pressure proportional to the temperature change.

There is another type of thermostat which has two pieces of metal of different characteristics so attached to each other that very slight temperature changes will cause the assembly to bend in one way or the other, due to unequal expansion and contraction of the different metals.

Another thermostat consists of a simple plate or tube of some organic composition having an especially high coefficient of expansion.

In some cases the movement of the thermostat is transferred to a liquid in a tube, and as friction is slight under such conditions and as a liquid is nearly incompressible, valves or dampers may be operated.

In other cases the thermostat controls the opening or closing of a small valve, which in turn controls a current of compressed air. This compressed air, by means of pressure diaphragms, operates valves or dampers, controlling the heat. Since there is no particular limit to the number or size or remoteness of the valves and dampers when compressed air is used, this helpful intermediary is commonly employed on all very large installations.

TWO DIVISIONS IN TEMPERATURE CONTROL

There are two grand divisions in modern temperature control apparatus. The simple class is one in which the thermostat and valve are self-contained, without outside power. These devices are generally adapted particularly to individual applications. They control service hot water, and do it perfectly, whether by valves on the heating pipes or by dampers on the heaters, or by valves on the oil or gas supply pipes. They control all kinds of residence heating, usually by a thermostat on some representative room, with dampers on the heater or valves on the main supply from a central station. They control ovens, dryers, vats, etc., in industrial work. When coal-fired heaters are controlled, as for residences, it has been found exceedingly desirable that not only shall there be a thermostat in the heated space, but also that there shall be a thermostat in the heater or pipes, which, when the house is warm and has shut off, will still protect the combustion requirements by maintaining a limited temperature against the next demand. The first thermostat in the house is not far from human, but the combination of the two, you see, becomes almost superhuman.

Automatic control of automobile cooling is one of the recent interesting developments, and is of very great value. It is usually applied by varying the volume of the cooling air.

The other and more elaborate class of temperature control apparatus uses some outside power. This is generally pneumatic, but may be electric or hydraulic, or may be by springs or weights. The thermostat controls the power, which, naturally, is practically unlimited.

By the beneficient application of power, controlled by thermostats, many interesting things can be accomplished. For instance, by means of clocks, the temperature automatically is kept comparatively low at night and is raised for the day. In large buildings where many rooms are to be controlled, the cost for a central pneumatic system is much less than that for so many individual units of the self-contained type. A small automatically governed air compressor is used, and the air piping is usually installed while the building is under construction.

It is possible for large buildings, such as dormitories, having many similar rooms, to install an incomplete or partial system of automatic heat control, using for each general exposure or side of the building a single thermostat and cut-off valve. If consideration is given to this feature when designing the piping, the installation can be very simple and the results will be found decidedly worth while. It is notoriously true that such buildings without automatic control will be too cold on the shady side if the general heating is reduced enough to keep the windows closed on the sunny side, and that open windows will follow the sun around if the general heating is accommodated to the shady side. Need we suggest that open windows and economy are not compatible?

Hot water radiators are rather slow to respond to manipulation of the circulation valve, due to the considerable storage of heat in the water. It used to be a hobby to put certain bedroom hot-water radiators in recesses, with doors in front of them, so that bedrooms could be cooled quickly at night and warmed quickly in the morning. Such an arrangement has many advantages, and will undoubtedly save fuel. Capitalizing