time. It has made possible the drying of lumber in months, where it formerly took years.

In the manufacture of prepared foods automatic heat control has shortened the time and has made the processes exact, saving much spoilage formerly wasted.

The introduction of automatic heat control in manufacturing plants almost always releases labor which would otherwise be kept occupied manipulating valves and dampers.

The installation of automatic heat control is a justifiable investment for many heating systems, inasmuch as it very positively contributes to: (1) conservation of fuel, (2) improvement in health, (3) increase in comfort and efficiency.

Automatic heat control is a desirable addition to or rather a fundamental part of the heating and ventilating apparatus in:

1. All public buildings such as schools, theatres, etc.
2. All residences, particularly those using oil or gas fuel.
3. All offices, especially those having many employees.

Automatic heat control is vitally necessary in order to operate satisfactorily and economically:

1. All manufacturing processes in which heat is employed, and where varying temperatures affect the quality of the manufactured product.
2. All refrigerating systems, especially the ultramodern small automatic unit type.
3. All service hot-water heating systems.

Thermostats

Thermostats are very simple mechanisms. Almost every physical thing expands or changes under the influence of heat and so can be made into a more or less effective thermostat. Liquids can be compounded which will become gases at any reasonable temperature desired. Metals having different rates of expansion can be harnessed together so as to give a greatly increased thermostatic movement. Common air is an excellent thermostatic medium, and is used extensively.

There are two general divisions into which devices for automatic heat control may be grouped, as follows:

1. The simpler class includes the type in which the thermostats and the valves and dampers which they operate are self-contained without any outside power, gaining sufficient energy from the thermostat itself (Fig. 1). This class of apparatus is especially adapted to single installations, as for service hot-water heaters, residence heating, and the like. It is suggested that this kind of thermostat be called the unit type. In present commercial practice most unit type thermostats use the expansive power of a liquid or gas, contained in a hermetically sealed receptacle.

2. The other and more elaborate class of thermostat, Fig. 2, includes the type of thermostat which controls air or liquid or electricity already under pressure, and which by controlling this outside power, operates the dampers or valves against springs or weights and similar opposition which will reverse conditions when the outside power is shut off. There is practically no limit to the power which can be applied in this manner.

It is suggested that this kind of thermostat be called the pilot type. In present commercial practice, pilot type thermostats are used for large buildings, where many thermostats are required, usually with air at about 15 lb. pressure, from an electric or steam compressor.

Compressed air is a very reliable agent, capable of great flexibility and elaboration of control, and is of considerable corollary use for remote operation manually of distant dampers and valves. Pilot type thermostats often are used to operate electric switches, the current then passing to electric motors or to magnets which move the dampers and valves. Electricity is so flexible and adaptable that very complicated and elaborate interlocked functions are possible.

Pilot type thermostats are also used to operate valves on pipes from water supply mains, thus using hydraulic power for moving valves and dampers. Owing to silting up of pipes which have sluggish currents and to corrosion, this method is not always to be advised.

APPLICATIONS OF AUTOMATIC CONTROL

New uses and styles are developed almost daily. Some of the applications will be listed which are believed to be approved methods of installation.

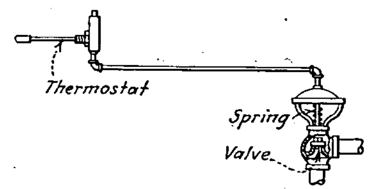

Fig. 1. Example of Unit Type Thermostat

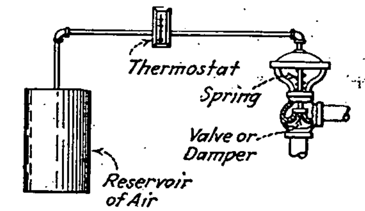

Fig. 2. Example of Thermostat Using Outside Power

Note.—The expansive material in the thermostat acts directly on the diaphragm of the valve, against the spring, which opens the valve when the thermostat contracts.

Tempering Heaters

The tempering heaters, particularly if they are of copper with extended surfaces, and if there is a two-pipe vacuum system of steam circulation having a vacuum pump, should be arranged with a separate outer layer of radiation capable of heating the air from the coldest temperature likely to be encountered to a temperature above freezing. This outer layer should be controlled by a thermostat on the cold side set to shut off steam when the outside temperature gets warmer than around 34 deg., and set to keep steam turned on when the outside temperature becomes cooler than 34 deg. There should be an additional layer of tempering heater, controlled by an additional thermostat in the duct beyond the fan discharge after mixing of the strata of air shall have been accomplished by the fan. This thermostat should be set to control the temperature at the desired degree for cooling the building, such as will give an average temperature at the delivery opening of say 65 deg., or if this causes drafts, at a slightly higher temperature.

If there is no vacuum system of steam circulation, it is decidedly likely that any attempt to control the temperature by opening and closing steam and return valves will result unfavorably, due to freezing of the radiation and sudden temperature fluctuations in the rooms, as tempering heaters are immediately responsive and flash hot or freeze solid with great rapidity. Where no vacuum system is available it will be wiser