to control the tempering heaters by means of dampers, preferably of the interlocked double type operating in a slow or intermediate manner and reducing positively the air volume through the heaters as they increase the air volume through the by-pass around the heaters. Under this condition no diaphragm valves will be placed on the tempering heater supply and return connections.

Air Washers

The air washer should invariably be placed between an outer tempering heater capable of warming the air above a freezing temperature, preferably controlled by an outside thermostat, and an inner tempering heater capable of warming the conditioned air to the desired delivery temperature and controlled by a thermostat in the duct on the discharge side of the fan. It is never advisable to use a by-pass damper around a tempering heater in front of an air washer, since the cold air might cause freezing.

Control of humidity is possible by adjustment of the temperature of the air as it meets the water, and in greater refinement, by control with an additional thermostat, of the water temperature, cooler for lower relative humidity, possibly from a refrigerated supply; and warmer for a higher relative humidity, possibly from a heated supply.

Room Temperatures

The room temperatures are controlled by individual thermostats, operating valves on the radiators, and mixing dampers in the flues, as may be necessary. If a vacuum system of steam circulation is installed, the room thermostats should be intermediate or slow moving, while if steam circulation is by single-pipe or any kind of gravity system, the radiator valves should be operated quickly from full open to full closed. It is important that the mixing dampers in any case shall be moved slowly and held in intermediate positions.

If there is any room which has a separate supply fan and heating equipment, such as an auditorium or gymnasium heated by warm air and without radiation, as is often convenient and desirable, it is advisable to provide against cold drafts by a variation in the above arrangement, as follows:

Suppose that there is a fan drawing through a heater composed of five layers, and delivering air directly to an auditorium, or to a picture theatre. The thermostat in the room ordinarily will strive to keep the room cool. If there are many occupants and many artificial lights, the problem will be to keep cool rather than warm, and the room thermostat, in a temperature above that at which it is set to operate, will ordinarily shut off all heat, while the fan will deliver unheated air. In a room at 80 deg. the admission of air colder than about 70 deg. (depending on the point of entry) will cause discomfort from drafts.

The prevention of this unfortunate situation is achieved by installing two thermostats, one in the room and one in the air duct, the room thermostat serving merely to admit air to the duct thermostat. When the room is cool, both thermostats will be closed and warm air will enter. When the room temperature gets to the critical point of the room thermostat, the room thermostat opens, passing air to the duct thermostat. The duct thermostat may be set to permit this air to pass on by and to function at the heater to reduce the temperature, but will be set so that when the duct temperature lowers to the critical point of the duct thermostat, the latter takes control and prevents the entering air from getting so cool as to cause drafts.

Unit Systems

These individual fan-radiator units are usually equipped with highly efficient radiators in one section, having one supply and one return valve, and depend on nicely adjusted dampers for mixing the heated air with unheated air to gain a desirable admission temperature. In the milder climates, it is necessary to operate steam supply valves with thermostats arranged to close after mixing damper has been completely closed. Some unit heater manufacturers are furnishing two sets of heating coils in the unit heaters so that one coil may be used as a tempering coil. The approved procedure is to use an intermediate or slow acting room thermostat for operating the mixing dampers in the unit. This thermostat may also operate the radiator valves if a vacuum system of steam circulation is provided. If the steam circulation is single-pipe, or any kind of gravity type, the direct radiators should have positive thermostats.

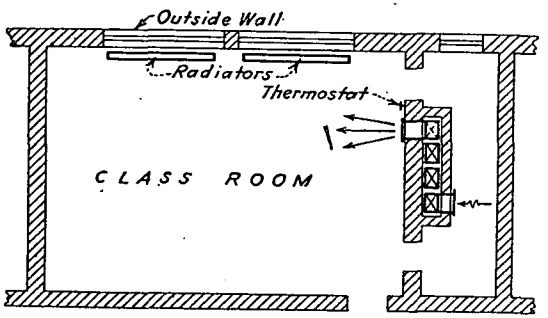

FIG. 3. PLAN OF CLASS ROOM IN AN ELEMENTARY SCHOOL, SHOWING LOCATION OF THERMOSTAT

The fresh air intakes to the units should be closed when the building is unoccupied, and the human operator cannot be trusted, especially in an installation comprising many units, to do this by manual means at each unit. An excellent recourse is to handle these cold-air intake dampers by a compressed air line running from the control point, say in the boiler room, which by manual opening of a valve permits air to pass to all of the units and to open all of the inlet dampers, the arrangement being such that the dampers will always be held shut by springs or weights when no air is permitted to pass or when the air compressor is shut down.

Direct-Indirect Radiators

Direct-indirect radiators are usually housed in, having cold-air inlets at their bases, and give rather a make-shift type of ventilation. It is not practicable usually to install mixing dampers, such as are used with fan-units, in these, and since the heating surface is in a single radiator calculated for the coldest air inlet temperature, regulation is difficult. The best results are obtained, where the use of direct-indirect radiators is necessary, by installing slow acting thermostats on special brackets directly above the radiators where the thermostat will be exposed to the air currents from the outside, and arranging for these to receive air only