

Unit heaters should be carefully air vented and usually a blast type trap of at least 50 per cent excess capacity should be used to take care of the load during the heating-up period. During that period the temperature of the air entering the heaters is low and the heaters therefore condense more steam than they do when the building is up to temperature. Steam pressures below 5 lb. can be used with safety for recirculating heaters when proper provision is made for returning the condensation. If heaters are to take in air that might be at a temperature below freezing, a steam pressure of at least 5 lb. should be maintained on the heater coils.

Stopping the fan motor but with steam on the coils reduces the heat output 70 to 95 per cent, depending upon the design of the heater. Thus room temperatures can be controlled by starting or stopping the fan motor on one or more of a group of units. This can be done manually or by means of a simple thermostat which makes and breaks the circuit either direct to the motor for fractional horsepowers or through an automatic starting switch. Of course the heat output of the heater may also be controlled by the throttle valve to the heater coil. This can be done thermostatically either with a graduated or with an on and off action. In some applications thermostatic controls to both the motor and the steam valve are used in conjunction.

What has been said relates generally to units in which steam or hot water is used as the heating medium. On rare occasions electrical resistances are used as the heating element but are applied only where electric power is abundant and cheap and other forms of fuel scarce and expensive.

DIRECT FIRED UNITS

In places where these heating mediums are not available the direct-fired type of heater is used. Here the heating element is a firebox in which coal, coke, oil or gas is burned directly. This firebox is enclosed in a casing in which fans are mounted so as to draw air over the firebox, and combustion chamber and discharge it directly into the room. This type of heater is also used for temporary heat or where the installation of a steam or hot water plant is for some reason not justified.

AIR CONDITIONING UNITS

A recent development has been the introduction of self-contained unit air conditioning devices. Essentially an outfit of this kind consists of a unit heater with the addition of an air-washer, humidifier or dehumidifier. Several types are on the market and are being used, in certain cases, to render a service similar to that produced by the well known types of central air conditioning systems, which central systems are equipped with supply air ducts for uniform distribution of conditioned air and recirculating ducts for returning the air to the apparatus.

In most lines of manufacture where the product is of such value as to necessitate the use of air conditioning equipment, it may be considered imperative to provide a highly uniform delivery of conditioned air. A few years ago it was considered necessary to install a return duct system similar to the supply ducts, but recent practice has been to eliminate

many of the smaller branch return ducts and pick up the return air in comparatively large volumes at suitably spaced return intakes. A logical development of this trend is to eliminate the delivery ducts, also, by the use of individual air conditioning units.

Good judgment and thorough knowledge of the art are prerequisites for the design of both unit and central types of air conditioning apparatus. For some purposes it will probably be satisfactory to deliver conditioned air from one or more units suitably located within an enclosure.

An air conditioning unit is so designed that it will draw in air from the room or enclosure in which it is placed or it will draw air from the outside, or through a medium of mixing dampers; it will also draw any predetermined mixture of the two. This entering air passes through one or more spray or mist chambers, in which space, moisture is either added to or removed from the air in accordance with the temperature of the air and of the spray water and at the same time the air is washed substantially free of dust and solid matter. The air next travels between the customary labyrinth eliminator plates to lose its entrained water.

A suitably located fan assembly causes the air to flow over a heating element and the conditioned air is delivered to the room. A motor-driven centrifugal pump or other means is used to take water from the tank built into the base of the unit and deliver this water under a suitable pressure to the spray heads, mist nozzles or other atomizing apparatus. In some makes of unit conditioners spray nozzles have been discarded in favor of other means of producing the required water spray or mist for the transfer of heat from air to water or vice versa. Automatic instruments control the condition of the leaving air by regulating the temperature of the spray water and also the amount of steam supplied to the air heater. Such instruments are usually placed in the path of the return air as it enters the unit to be conditioned, as the entering air is a sample of room air. The spray water can be heated by either an ejector or closed type heater, in the usual manner for humidifying purposes.

For dehumidifying work cold water can be supplied under automatic control as needed. It will be found best to employ a separate water cooler located in close proximity to the compressors and condensers, where artificial refrigeration is used, instead of making use of direct expansion coils or brine coils within the air conditioning units.

Unit air conditioning equipment may be of the following types: (1) the air washer type which does not control the moisture content or temperature of, but simply cleans the leaving air, (2) the humidifying type which controls the relative humidity without washing the air or controlling its temperature, (3) the complete air conditioning unit, which washes the air, controls its moisture content and heats or cools the room within which the unit is located.

In addition to the use of air conditioning purely for human comfort, there are many industries where the materials handled are hygroscopic in nature, and where the processes are greatly facilitated by the use of conditioned air. An example is a printing plant where many difficulties such as those from static electricity or from improper register are encountered with the paper as it passes through the presses.

There are certain other industries whose higher existence depend upon