not sufficient in size and importance to be equipped with individual ventilating systems probably do not require any ventilation.

Where the total heat required is in excess of the rated capacity of the unit, the unit must be supplemented by direct radiation. Otherwise, the unit can be used for both heating and ventilating without direct radiation.

No special treatment of vent flues is required by this system, the vitiated air being discharged from the building in the same manner, as all other mechanical systems. It has been found that the best results have been obtained where the cross sectional area of the vent flue does not exceed 20 sq. in. per 100 cu. ft. of air per minute.

Industrial Service

Unit heaters for industrial work consist of a heating element over which air is forced or drawn by means of a power driven fan which also distributes this heated air to the space to be heated. The area that can be served by one unit varies according to the type of unit and the location of the unit within the building.

Industrial units are available in capacities from that of the smallest disc or propellor type fan up to that of gangs of centrifugal fans, and in ranges, expressed in heating output, from perhaps one hundred square feet of radiation up to several thousand square feet of radiation.

They may be placed on the floor, or may be suspended from overhead construction, and may be heated by steam or water or other fluid, or may be direct fired, with coal, oil or gas.

There has been a remarkable recent expansion in the demand and in the production of all sorts of industrial heaters, and their use no longer is confined, by any means, to industrial buildings alone.

The tendency is apparent to return after some digression, toward a location for the units as near the floor as is practicable, especially with suction ducts or high velocity outlets arranged to move the cold heavy stratum of air which is likely otherwise to lie close to floors.

The service of industrial unit heaters is essentially that of heating, and recirculation is usual, with dependence on windows and doors for ventilation. Since the fans can be operated without heating the radiators there is some advantage from them in warm weather.

Due to the very high heat transmission rates from radiators over which air is driven at high speed by fans, industrial unit heaters usually effect material space economies.

CHAPTER XX

MOTIVE POWER FOR FANS

THE selection of motors for heating, ventilating and air conditioning systems is an important consideration for the architect and engineer in producing a plant that is efficient and economical. Points to be discussed briefly are fan characteristics, motor selection, methods of drive and general requirements of control as well as other power sources and sound deadening methods.

FAN MOTIVE POWER

Motive power for fans should be determined in accordance with the Standard Code of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, TRANSACTIONS, Vol. 29, 1923; p. 442.

Fans divide themselves into two general classes; the disc or propellor type, and the centrifugal type.

Disc and Propellor Fans

The disc or propellor type of fan is available for conditions of low air resistance, with very short ducts, or no ducts at all. The low speed of the blades near the hub of such fans, compared with the peripheral speed renders this entire class of fans of low efficiency when overcoming heavy resistance. The air driven by the effective blade areas near the rim can pass back through the less effective blade areas at the hub more easily than it can pass the duct-resistance. The power required for such fans increases with the cube of the speed as the speed is increased, and the static efficiency curve falls rapidly at any given speed when the resistance to air flow is increased.

Disc and propellor fans lend themselves to direct-connected motive power, especially as the speeds may be high enough for economical electric motor speeds.

In specifying direct connected electric motors for these fans it should always be remembered that the motor will be subject to the dust and possible high temperature of the material handled by the fan.

Enclosed and especially cooled electric motors are available for this service, and in many types the fan is suspended on the motor shaft and seems to be incidental to the motor.

Centrifugal Fans

The centrifugal, housed, type of fan is available for conditions of high air resistance, with heaters, ducts, etc., and is used for systems requiring

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