of switch provides protection to the motor beyond the power of fuses to supply. Fuses when used necessarily must be large enough to take care of the inrush current which makes them inadequate for protecting the motor under operating conditions. The thermal overload device allows for this inrush and does not function until an overload has become persistent, the time element depending upon the percentage of overload over the rating of the element.

This type of switch is available for manual operation and also is furnished in the magnetic type for remote operation by push-button, or for operation by other types of pilots such as pressure switches and thermostats.

On the standard squirrel cage motors above 5 hp. a starting compensator usually is employed to keep the inrush current to within the limits specified by the local power companies. Compensators may be obtained in transformer type and primary resistor type, and usually are furnished for manual operation. They can be secured for remote control also, but are necessarily expensive. However, the new type of high reactance, self-starting motors, may usually be thrown across the line up to 30 hp. in size, and still have their inrush current within the limits of the rules of *National Electric Light Association.* With this type of motor a magnetic contactor usually is used. This device may be operated from a remote point by push-button, if desired. These magnetic contactors are furnished usually with thermal overload and no-voltage protection.

For remote operation of motors through magnetic starters, the operating buttons may be located in the engineer's or manager's office, and tell-tale indicating lamps may be wired up with the circuit to indicate whether or not the unit is in operation.

This type of control is very desirable in large buildings where the engineer is to have complete charge of the ventilating system.

Remote or automatic control of the units may be effected also by pneumatic or hydraulic apparatus, or by thermostats or by pressure devices which are provided with electric contacts for starting or stopping the units upon reaching certain conditions.

Variable speed slip ring motors and direct current motors may also be arranged for remote speed control by means of pre-set automatic regulators, where the operating speed of the motor is set by a dial-switch or regulator (which may be near the fan or at a remote point) and the motor is then automatically controlled at this speed merely by operating the remote control push-button for starting or stopping the equipment.

Arrangements may be made for remote control of fan motors, or for automatic control by influence of temperature. Remote control may be by pneumatic or by hydraulic manipulation as well as by electrical means.

In many large ventilating systems which have heating plants in connection, steam engines are used to operate fans. A medium speed steam engine, exhausting at low pressure into the radiators which heat the building or which warm the air, is a very economical source of power, is quiet in operation, and has a wide range of speed variation. The steam economy of such an engine usually is of little importance, since the engine serves as an auxiliary to the pressure-reducing valve interposed in such cases between the boiler and the radiators.

Internal combustion engines and line shafting are often used for fan driving, requiring clutches or shift-belts with loose pulleys in order to secure proper starting and control.

GENERAL SUGGESTIONS

Single inlet, single width fans should be selected wherever possible. If double width, double inlet fans are selected, care must be taken that both inlets have the same free area. If one inlet is obstructed more than the other, the fan will not operate properly, as one half of the wheel will deliver more air than the other half.

Where duct connections are made on double width fans, static pressure on both inlets must be carefully balanced; otherwise, the fans may be over or under capacity. Inlet connections on double width fans necessitate the driving arrangement on the outside with extended shafts and outboard pedestals. It is not considered good practice to drive the belt through duct connections.

In selecting the discharge and rotation of the fan, the design of the duct should be continuous with the fan scroll.

DESIGNATION OF FANS[1]

This method of designation will apply to all centrifugal fans, single or double width, and single or double inlet. Do not use the word "hand," but specify "clockwise" or "counter-clockwise."

Facing the driving side of the fan, blower or blast wheel, if the proper direction of rotation is clockwise, the fan, blower or blast wheel will be designated as *clockwise.* If the proper direction of rotation is counter-clockwise, the designation will be *counter-clockwise.* (The driving side of a single inlet fan is considered to be the side opposite the inlet regardless of the actual location of the drive).

The discharge of a fan will be determined by the direction of the line of air discharge and its relation to the fan shaft, as follows:

Bottom Horizontal: If the line of air discharge is horizontal and below the shaft.

Top Horizontal: If the line of air discharge is horizontal and above the shaft.

Up Blast: If the line of air discharge is vertically up.

Down Blast: If the line of air discharge is vertically down.

All intermediate discharges will be indicated as angular discharge as follows:

Either top or bottom angular up discharge or top or bottom angular down discharge, the smallest angle made by the line of air discharge with the horizontal being specified.

ARRANGEMENT OF DRIVE

For the convenience of fan users, and to prevent misunderstandings which cause delays and losses, the following suggestions are made for such arrangements of drive which are most often used. Reference to the various arrangements will be understood as referring to Fig. 6.

Arr. 1. For Belt Drive.

Single fan. Wheel overhung. Includes housing, wheel, shaft, two bearings, pedestal and pulley.

Arr. 2. For Belt Drive.

Single fan. Pulley overhung. Includes housing, wheel, shaft, two bearings and pulley.

[1]Recommendations adopted by the *National Association of Fan Manufacturers.*