Arr. 3. For Direct Connection.
Single fan. Includes housing, wheel and base. Wheel is overhung on engine or motor shaft.

Arr. 4. For Direct Connection.
Single fan. Includes housing, wheel, shaft, one bearing on drive side of fan, flanged coupling and base.

Arr. 5. For Direct Connection.
Single fan. Includes housing, wheel, shaft, two bearings, flanged coupling and base.

Arr. 6. For Direct Connection.
Single fan. Includes housing, wheel, shaft, two bearings, flexible coupling and base.

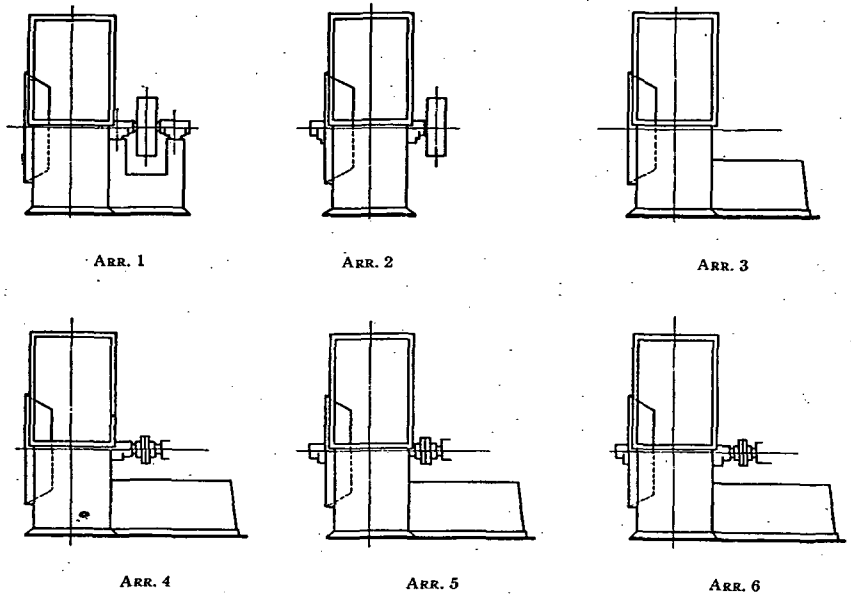

FIG. 6. ARRANGEMENT OF FAN DRIVE

Arrangement 1. Fan is of the overhung wheel type with the two bearings mounted on one side and the driving pulley in between. Arrangement 1 is preferred where the fan exhausts from shafts making the inlet bearing inaccessible. It is also used for high temperatures and other conditions where it would be impossible to locate the bearing in the fan inlet.

Arrangement 2 is furnished with a bearing on each side with the wheel supported in the center. This fan is arranged for driving with belt, which permits the use of high-speed efficient electric motors which can be purchased at a low initial cost. Arrangement 3 can be purchased at a lower initial cost than any other type shown.

Arrangement 3. Fan is used for practically all direct-connected work. The fan motor is mounted directly on the motor shaft, the motor being mounted on a pedestal built integral with the fan housing, both motor bearings being easily accessible.

Arrangements 4, 5 and 6 are used in larger fans where the fan wheel is of such weight as to not permit it being suspended on an extended motor shaft.

CHAPTER 27

AIR DUCTS

Design and Installation of Air Ducts; Friction Losses; Insulation of Ducts.

THE proper functioning of any system requiring the transmission of air or dust is dependent to a large extent on the correct design of the ducts.

FUNDAMENTALS OF DUCT DESIGN

The sizes of ducts and flues for gravity or mechanical circulation of air are based on the losses due to friction, and these losses must be kept within the available pressure difference. This pressure difference in mechanical ventilation is that derived from the fan, while in gravity ventilation the aspirating effect due to the temperature and height of the column of heated air causes the pressure difference.

The general rules to be followed in the design of a duct system are:

1. The air should be conveyed as directly as possible at reasonable velocities to obtain the result desired with greatest economy of power, material, and space.
2. Sharp elbows and bends are to be avoided.
3. All ducts or flues shall have sides as nearly equal in size as possible. (In no case shall the ratio between long and short sides be greater than 10 to 1.)

The ducts for a school, theater or other public building, where freedom from noise and elimination of drafts is essential and where branch ducts serve individual rooms, present more difficult problems in design than are involved in proportioning ducts intended for heating a factory, where a main duct of decreasing dimensions extends lengthwise of the building and gives a uniform distribution of air. For public buildings air velocities must be kept low, the range being from 900 to 1,200 ft. per minute while in industrial buildings velocities may range from 1,500 to 2,000 ft. per minute or even more.

The higher velocities reduce the cost of the ducts but, of course, increase the cost of power for driving the fans.

The standard velocities of air for public buildings are as follows:

1. Through the outside air intakes 1,000 ft. per minute.
2. Through connections to and from heater 1,000 to 1,200 ft. per minute.
3. Through the main discharge duct from 900 to 1,200 ft. per minute.
4. In branch ducts 600 to 1,000 and vertical flues 400 to 800 ft. per minute.
5. In registers or grilles 200 to 400 ft. per minute depending upon the size and location.
6. If diffusers of proper design are used, 25 per cent higher air velocities may be permitted.

It is customary in proportioning ducts for heating and ventilating work to follow either of two methods: