candy in air deprived of its excess vapor and winter time quality is obtained. Many other processes in the candy factory—the chocolate dipping and packing, the starch and storage rooms, gain by the use of cold, dry air.

DEHUMIDIFYING

As with its ally, humidifying, dehumidifying serves a long list of industries. The bakery, for the unvarying temperatures in its dough rooms, the cooling of the loaves, the cooling of mixers, the drying of biscuit with confectionary coatings, the chilling of storage rooms, needs air conditioning to insure mass quality production. The manufacturers of artificial silk and pearls would be at a standstill without dehumidified air, the motion picture film and photographic paper industries would be shut down a third of the year without it. The drying of fine gelatin, the summer growth of mushrooms, the year-round production of yeast, the storage of furs moth-free, the wartime products of time-fuses and airplane parts, the making of rubber gloves and automobile tires, the drying and handling of matches, are a few among the notable dependents of this science. To this list can be added dozens more, each reader being able to recognize some. The test is: when the products or processes due to the weather, on any day or during any season, are not up to standard, the need for air conditioning is established.

The science has been carried in some few cases even beyond the service of specific processes in certain industries. Even Nature has been assisted; witness the infant incubators; note also the methods developed by the specialists for crowding into successive units of time, the sequence of ideal conditions so often interrupted in Nature as to take months and years for completion of the natural processes. Such refining of process has been worked out successfully for such widely separated items as the curing of tobacco and the drying of lumber. The effects of manufactured weather, eliminating the interruptions of Nature, has opened such a broad field that by comparison the one heretofore claimed for this science is almost infinitesimal.

So we have defined the term and have illustrated its meaning as we understand it. If an idea of the immense usefulness of this science to industry has been given, and if an understanding that it can only be scientifically applied by the specialist qualified by study, research and experience, has been obtained, then the object of this article has been fully accomplished.

CHAPTER XXI

DESIGN AND CONSTRUCTION OF AIR DUCTS

THE successful operation of a mechanical or plenum heating installation, an exhaust system or a dust collecting plant is largely dependent upon the correct design of the duct system. Materials, proportions, friction, location and innumerable other items are factors in the correct operation of a duct system.

In the design of ducts and flues for the mechanical circulation of air, or by gravity, losses due to friction are the basis for figuring 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 it is the asperating effect due to the temperature and height of the column of heated air.

When attempting the design of a duct system the general rules to remember 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 piping systems for various operations must be of different design. For instance, the ducts for a school, theatre or other public buildings, where freedom from noise and elimination of drafts is essential and where branch ducts serve individual rooms, is a much different problem in design than that 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, therefore, be kept low between 900 and 1200 ft. per minute while in industrial buildings they can range from 1500 to 2000 ft. per minute or even more with no other disadvantage than expensive operation.

Standard velocities of air in public buildings are as follows:

1. Through the outside air intakes 1,000 ft. per min.
2. Through connections to and from heater 1,000 to 1,200 ft. per min.
3. Through the main discharge duct from 900 to 1,200 ft. per min.
4. In branch ducts 700 to 900 and vertical flues 400 to 600 ft. per min.
5. In registers or grilles 200 to 400 ft. per min. depending upon the size and location.
6. If diffusers of proper design are used, 25 per cent higher air velocities may be permitted.

Material for this section was especially prepared for THE GUIDE by F. R. Still, New York.