amorphous state, cooling in the usual summer weather, absorbs water just like any other material; given enough time, the clear, hard, compact mass forms a solid solution with the absorbed water, and the sugar slowly but surely crystalizes out as it was before the cooking. Cool the same 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.

REFRIGERATION

REFRIGERATION may be accomplished mechanically, as in the case of anhydrous ammonia, sulphur dioxide, carbon dioxide, ethyl chloride, etc., or chemically by the use of aqueous ammonia, known as the absorption system.

In the use of mechanical refrigeration in the United States anhydrous ammonia is the most popular refrigerant. Authorities estimate that anywhere from 95 to 98 per cent is accomplished by this method.

The ammonia in the form of vapor is drawn from the cooling pipes located in the cold storage rooms or brine tank through a pipe line called the suction line by the action of the compressor. It is then converted into a super-heated gas and discharged from the compressor through a line called the pipe line into the ammonia condenser. The gas as it enters the condenser is quite hot and contains heat generated by compression as well as heat taken from the goods in storage. In the condenser the gas is cooled by the use of water and converted into ammonia liquid under pressures which vary according to the temperature of the cooling water. The ammonia liquid is then condensed under the pressure of the condenser and the cooling pipes in the storage rooms or brine tanks as the case may be, where it is expanded into the cooling pipes, reducing the pressure as the volume increases. The liquid ammonia at the reduced pressure boils inside of the cooling pipes at a low temperature and thereby produces the desired cooling effect in the space surrounded by the cooling pipes. As the ammonia boils it is again converted into a vapor and drawn back to the compressor through the suction line. This completes the cycle of operation.

CONDENSERS

Condensers are classified in practically three classes: *atmospheric*, *double pipe*, and *submerged*.

The atmospheric condenser consists of a coil of pipe standing vertically with a water distributing trough over the top pipe, the ammonia is on the inside of the pipe. The water running down over the outside of the condenser, condenses the ammonia on the inside of the pipe. Most atmospheric condensers are constructed of 2-in. pipe. Atmospheric condensers must be placed in open places where the outside air has free access to the same, preferably the roof of a building.

Double pipe condensers consists of two concentric pipes also in the form of a coil, the inner pipe containing the water and the surrounding or outer pipe the ammonia. Most double pipe ammonia condensers consist of 2-in. for the outer pipe and 1¼-in. for the inner pipe, although some condensers have been made of 2½-in. and 1½-in. pipes, and some of 3-in. and 2-in. pipes.

Some of the advantages of the double pipe condenser are that it may be placed near the other apparatus and does not have to be placed out-

Material for this section was prepared especially for THE GUIDE 1923 by Lee Nusbaum, Philadelphia, Pa.