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**Creators:** Jacobson, Eric M.

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# AIR CONDITIONING IN INDUSTRY

By ERIC M. JACOBSON

AIR Conditioning was brought into being at the beginning of this century some thirty-five years ago because of a need in the processing industries. It has more recently come into the limelight in the guise of a new industry due to its spectacular achievement in promoting human comfort. Its public acceptance has been primarily due to its popularization in theatres and railroad cars and from these it has been extended to many other fields where public patronage has been solicited.

There are at present at least three distinct fields in which it finds application. First; the original industrial field where products are primarily concerned; second, the commercial field where it pays its way by increasing patronage; and, third the personal or luxury field where it finds application in homes and private offices.

Air Conditioning was first demanded by industry wherever weather-sensitive (that is hygroscopic) products are manufactured. The Lithographing art had muddled along for years in its fight with the weather. Variations in the humidity interfered with the register and great skill was required to do good work under difficult and variable conditions. In 1902 research was made in ways of maintaining a uniform humidity in a lithographing plant. Largely from this research the present art of Air Conditioning was developed.

Air Conditioning has subsequently become of great economic importance to those industries whose products are affected by weather conditions. For examples, the textile industry including rayon which could not be manufactured without it; in all parts of the tobacco industry such as the manufacture of cigars and cigarettes; in the printing and lithographing industries; in the processing and manufacture of paper and paper products; the manufacture of chocolate and confectionery; in the manufacture of gelatin products such as capsules and photographic films, in fact in a long list of over one hundred industries. In these industries Air Conditioning pays for itself many times over in the improvement of quality and the increase of production.

In order to grasp the possibilities of Air Conditioning let us examine the fundamental principles involved. Air Conditioning in industry usually requires an exceedingly exact control of relative humidity, as this is the prime factor affecting hygroscopic materials. In certain products, however, uniform temperatures, either at a high or a low level may be desirable or necessary. Many products such as cotton and tobacco need high humidities for successful processing. This need was well recognized in an early age by an English manufacturer who added moisture to his spinning and weaving rooms. The

only thought was to add moisture to the air and at first he used steam jets and vapor pots and sprinkled the floor in order to get moisture in the air. Later he improved the process by overhead atomizing sprays which absorbed the heat by evaporation, but the success of such means of humidification relied on minimizing ventilation which was necessary to remove the excess heat generated by the machinery. This made working conditions practically impossible, but in 1906 two systems were devised for the air conditioning of textile mills which would control both the temperature as well as the humidity in an economical and practical manner. One system involved the use of room atomizing sprays with auxiliary mechanical ventilation. The other system controlled both the temperature and the humidity by the introduction of cool saturated air in sufficient quantities to remove the heat generated within the mill itself. This marked the advent of modern air conditioning.

The second system described above was based on the discovery of the fundamental principle that for any given relative humidity, there was a definite temperature difference between the dewpoint and the room temperature . . . that is between the temperature of the saturated air introduced and the temperature of the room. For example if a relative humidity of 70% is to be maintained, then the difference between the dewpoint temperature and the room temperature must be approximately 11%. In other words, enough saturated air must be introduced into the room to be conditioned to cool that room to within 11% of the saturated air. In the winter time both the temperature of the saturated air and the temperature of the room were controlled, but in the summer time only outside air was employed so that the air could be saturated at the lowest practicable temperature without the use of refrigeration.

The first in relation to this process of air conditioning was also to be of great importance to the industry and to the art of air conditioning. That is, when air is passed through a spray of recirculated water and brought substantially to the point of saturation it will always be cooled to the outside wet bulb temperature. The wet bulb temperature being the temperature indicated by a thermometer covered by a wetted wick. This thermometer will always read from ten to thirty degrees lower than the temperature of the outside air depending on the amount of humidity in the atmosphere. The average wet bulb temperature during the hottest months varies from sixty-five to seventy degrees F. in different parts of the United States and there are but few days when this maximum temperature exceeds seventy-five. This will give some idea of the temper-

ature available without the use of refrigeration. For example, the average mill temperature where 70% relative humidity is maintained by the process described would be seventy-six to eighty-one; not an entirely comfortable temperature but a practicable working temperature.

The principle of the humidifier used in cooling and saturating the air is that evaporation is a cooling process in which the sensible heat of the air is converted into latent heat of water vapor. The degree of cooling de-

pending obviously on the temperature and dryness of the outside air entering the humidifier and may be expressed in an exact mathematical formula. Where lower temperatures are required in the room the air is further cooled by the use of refrigeration of the water spray.

Thus by the use of air conditioning equipment the atmosphere in which any industrial process is carried on may be controlled to the desired degree of temperature and humidity.