

REFRIGERATION FOR TOWNS AND CITIES BY STREET MAINS.

The Colorado Automatic Refrigerating Company, of Denver, is, we believe, the first and thus far the only company to successfully introduce a method of supplying refrigeration to families, restaurants, saloons, hotels, meat markets, commission houses, etc., by means of street mains. Established in 1889, at a cost exceeding \$130,000, it is already a demonstrated success. The plant of the company, as shown in our illustration, occupies a room 40 by 180 feet in size. Over two miles of street mains have been laid. Numerous applications for street service, beyond its capacity, have been necessarily declined. An extensive cold storage warehouse, issuing negotiable warehouse receipts, is operated in connection with it. It is the business of this company to furnish thorough refrigeration at lower cost than the same could be obtained, in an inferior and imperfect manner, from the use of ice. The company have secured a franchise from the city to lay mains in its streets and alleys. About one hundred and fifty service connections can be made to the mile, service boxes being provided at the sidewalk, similar to those supplied by water and gas companies.

The street piping is virtually a part and an extension

of piping surface supplied and according to the amount of ammonia allowed to flow through.

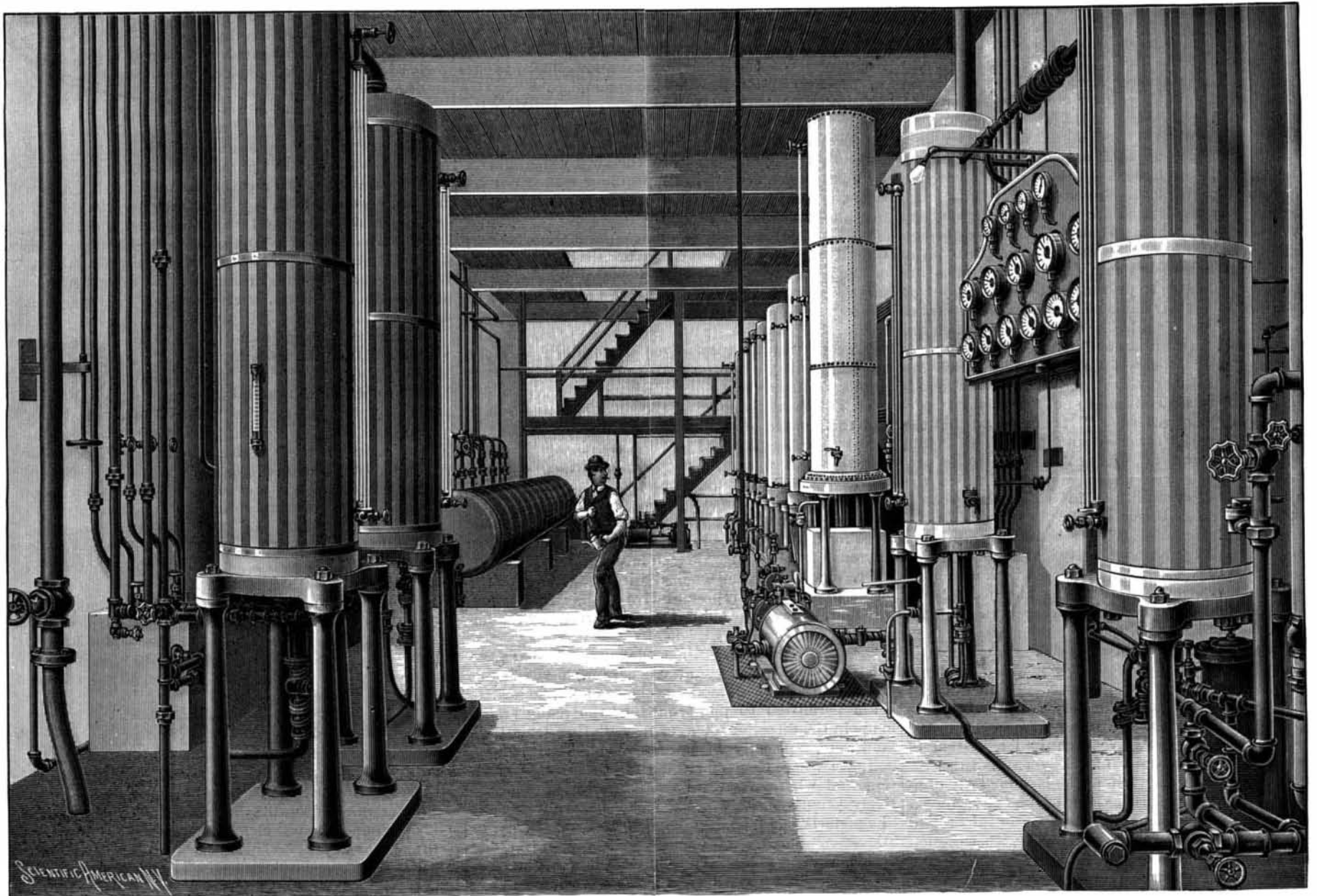
No refrigeration is done in the conduits in transit to the consumer because a pressure is maintained to hold the ammonia in liquid form, therefore no refrigeration is lost. The entire amount is delivered where it is utilized and paid for.

The liquid anhydrous ammonia used is contained in strong reservoirs under a pressure of 150 pounds, and in expanding absorbs heat from the coil and from the air surrounding it and from the material to be refrigerated. The ammonia gas resulting from the expansion of the liquid ammonia is returned to the central station, through another pipe, where it is absorbed by water, which has a great affinity for ammonia. It is then separated from the water by distillation, and cooled and reconverted back into liquid ammonia, being held in that state in the receiver ready again for use. The ammonia is, in this way, carried through pipes at small expense, as the quantity required is small, an inch and a quarter pipe being sufficient for the street main of an entire district. When refrigeration is desired, ammonia is turned on by opening a cock in the supply pipe. This is automatically turned on and off by an electro-magnet connect-

manufacturing artificial ice in closets adjoining the kitchens, freezing ice cream and carafes of table water, and cooling bottles of champagne.

The Denver Club, an extensive institution well known among club men throughout the United States, and located a mile distant from the central station, has six different compartments refrigerated by the company, maintaining six different temperatures. One for fruit at about 45° Fah., one for meats, fish, game at 36° Fah., one for wines and liquors at 40° Fah., and one for freezing carafes of water, ice cream, and wines at about 10° below zero. Fresh meat, poultry, game, fish, and all kinds of delicate food are thus readily preserved for weeks, in the warmest weather, obviating the waste heretofore attendant upon the use of ice in the old-fashioned way, it being possible when necessary to hold refrigerators or cold storage rooms at a permanent temperature of 20° below the Fahrenheit zero. The system is also readily applicable to hospitals, theaters, sick rooms, and wherever it may be desirable to reduce temperature.

The system operated by this company is covered by a combination of twenty to thirty patents, the most important of which applies to the storage of the surplus refrigerant in receivers to be drawn upon as



PLANT OF AUTOMATIC REFRIGERATING COMPANY, DENVER, COL.

of the storage tanks located at the central station, and consists of three lines of extra strong ammonia pipe, laid in cement and connected by special steel fittings. One pipe is called the "liquid line," for the conveyance of anhydrous ammonia under pressure, and is about one and one-quarter inches in diameter. Another, two to three inches in diameter, according to its distance from the central station, is called the "vapor line," or return main, for returning the expanded ammonia in gaseous form after having performed refrigeration. The third pipe, known as the "vacuum main," is about one inch in diameter, and is connected at each customer's service box with both the liquid and vapor lines. Its office is to remove any accumulation of gas from main or branch lines.

A suitable amount of piping, called the "expansion coil," is placed in each refrigerator, or apartment intended to be refrigerated, one end being connected with the "liquid line," the other with the "vapor line." A valve, when opened, allows a trickle of ammonia to enter the expansion coil, and the liquid ammonia, when relieved of pressure, boils or vaporizes at 25 degrees below zero of Fahrenheit, thus cooling the piping and producing an exterior covering of white frost, refrigerating the box or apartment inclosing it to any desired temperature, according to the amount

ed with a thermostat. When the temperature of the box or room falls below a standard, the valve stops the flow. It also opens it when the temperature rises above a standard, obviating the necessity of any attention from the engineer in charge.

Exhaustive experiments are said to have resulted in establishing the fact that one pound of anhydrous liquid ammonia has the same refrigerating power as three pounds of ice. Water and vapor from melting ice saturate with moisture the contents of the most expensive and perfect of modern improved ice refrigerators. The odors of the various foods deposited in them is absorbed by the damp air so that the flavor of each is injured, recognizable as the "ice box taste." The *absolutely dry refrigeration* of this system is one of its most important features.

A walk along the line of the mains now in operation and a glance at the results is interesting. At one place the temperature of a large butter room of a commission house is held by contract at 42° F. Near by is the meat room of a wholesale market with a constant temperature of 36° F. Adjoining, the beer vault of an extensive brewery is properly cooled, while on the principal retail streets are found numerous saloons, restaurants, hotels, and club houses availing themselves of similar facilities in a variety of ways, such as

wanted, obviating the necessity of the continuous operation of the machine used in the manufacture of the anhydrous ammonia.

The machinery which we illustrate, and which was photographed specially for us, is a modified type of the refrigerating apparatus known as an absorption machine, the essential process of which is the separation by heat of the ammonia from its water, the cooling and condensing of the same to liquid anhydrous ammonia, the use of this liquid in street lines, and the absorption of the expanded gas from the return main back again into its water, to be again distilled, reliquefied and sent out, the waste of material in the cycle of operations being very slight. The construction of machinery suitable for pipeline work necessitated a number of costly experiments, as the variations in the rate of the refrigerating load are often sixty-five to seventy per cent above or below a daily rate, and such changes often occur within a very short space of time. Such perfection has been attained in this particular that the machine equalizes the pressure automatically without attention from the engineer and adjusts itself to the irregular use of the liquid. The company claims that its safety devices and its system of operation are such that any serious accident is an impossibility.—*W. Y. Beach.*