

READING DAY 8 November

History of Refrigeration

Refrigeration is a process of removing heat, which means cooling an area or a substance below the environmental temperature. Mechanical refrigeration makes use of (he evaporation of a liquid refrigerant, which goes through a cycle so that it can be reused. The main cycles include vapour-compression, absorption steam-jet or steam-ejector, and airing. The term 'refrigerator' was first introduced by a Maryland farmer Thomas Moore in 1803, but it is in the 20th century that the appliance we know today first appeared.

People used to find various ways to preserve their food before the advent of mechanical refrigeration systems. Some preferred using cooling systems of ice or snow, which meant that diets would have consisted of very little fresh food or fruits and vegetables, but mostly of bread, cheese and salted meals. For milk and cheeses, it was very difficult to keep them fresh, so such foods were usually stored in a cellar or window box. In spite of those measures, they could not survive rapid spoilage. Later on, people discovered that adding such chemical as sodium nitrate or potassium nitrate to water could lead to a lower temperature. In 1550 when this technique was first recorded, people used it to cool wine, as was the term 'to refrigerate'. Cooling drinks grew very popular in Europe by 1600, particularly in Spain, France, and Italy. Instead of cooling water at night, people used a new technique: rotating long-necked bottles of water which held dissolved saltpeter. The solution was intended to create very low temperatures and even to make ice. By the end of the 17th century, iced drink including frozen juices and liquors tad become extremely fashionable in France.

People's demand for ice soon became strong. Consumers' soaring requirement for fresh food, especially for green vegetables, resulted in reform in people's dieting habits between 1830 and the American Civil War, accelerated by a drastic expansion of the urban areas arid the rapid amelioration in an economy of the populace. With the growth of the cities and towns, he distance between the consumer and the source of food was enlarged. In 1799s as a commercial product, ice was first transported out of Canal Street in New York City to Charleston, South Carolina. Unfortunately, this transportation was not successful because when the ship reached the destination, little ice left. Frederick Tudor and Nathaniel Wyeth, two New England' businessmen, grasped the great potential opportunities for ice business and managed to improve the storage method of ice in the process of shipment. The acknowledged 'Ice King' in that time, Tudor concentrated his efforts on bringing he ice to the tropical areas. In order to achieve his goal and guarantee the ice to arrive at the destination safely he tried many insulating materials in an experiment and successfully constructed the ice containers, which reduce the ice loss from 66 per cent to less than 8 per cent at drastically. Wyeth invented an economical and speedy method to cut the ice into uniform blocks, which had a tremendous positive influence on the ice industry. Also, he improved the processing techniques for storing, transporting and distributing ice with less waste.

When people realised that the ice transported from the distance was not as clean as previously thought and gradually caused many health problems, it was more demanding to seek the clean

natural sources of ice. To make it worse, by the 1890s water pollution and sewage dumping made clean ice even more unavailable. The adverse effect first appeared in the blowing industry, and then seriously spread to such sectors as meat packing and dairy industries. As a result, the clean, mechanical refrigeration was considerably in need.

Many inventors with creative ideas took part in the process of inventing refrigeration, and each version was built on the previous discoveries. Dr William Cullen initiated to study the evaporation of liquid under the vacuum conditions in 1720. He soon invented the first man-made refrigerator at the University of Glasgow in 1748 with the employment of ethyl ether boiling into a partial vacuum. American inventor Oliver Evans designed the refrigerator firstly using vapour rather than liquid in 1805. Although his conception was not put into practice in the end the mechanism was adopted by an American physician John Gorrie, who made one cooling machine similar to Evans' in 1842 with the purpose of reducing the temperature of the patient with yellow fever in a Florida hospital. Until 1851, Evans obtained the first patent for mechanical refrigeration in the USA. In 1820, Michael Faraday, a Londoner, first liquefied ammonia to cause cooling. In 1859, Ferdinand Carre from France invented the first version of the ammonia water cooling machine. In 1873, Carl von Linde designed the first practical and portable compressor refrigerator in Munich, and in 1876 he abandoned the methyl ether system and began using ammonia cycle. Linde later created a new method ('Linde technique') for liquefying large amounts of air in 1894. Nearly a decade later, this mechanical refrigerating method was adopted subsequently by the meat packing industry in Chicago.

Since 1840, cars with the refrigerating system had been utilised to deliver and distribute milk and butter. Until 1860, most seafood and dairy products were transported with cold-chain logistics. In 1867, refrigerated, railroad cars are patented to J.B. Sutherland from Detroit, Michigan, who invented insulated cars by installing the ice bunkers at the end of the cars: air came in from the top, passed through the bunkers, circulated through the cars by gravity and controlled by different quantities of hanging flaps which caused different air temperatures. Depending on the cargo (such as meat, fruits etc.) transported by the cars, different car designs came into existence. In 1867, the first refrigerated car to carry fresh fruit was manufactured by Parker Earle of Illinois, who shipped strawberries on the Illinois Central Railroad. Each chest was freighted with 100 pounds of ice and 200 quarts of strawberries. Until 1949, the trucking industry began to be equipped with the refrigeration system with a roof-mounted cooling device, invented by Fred Jones.

From the late 1800s to 1929, the refrigerators employed toxic gases – methyl chloride, ammonia, and sulfur dioxide – as refrigerants. But in the 1920s, a great number of lethal accidents took place due to the leakage of methyl chloride out of refrigerators. Therefore, some American companies started to seek some secure methods of refrigeration. Frigidaire detected a new class of synthetic, refrigerants called halocarbons or CFCs (chlorofluorocarbons) in 1928. This research led to the discovery of chlorofluorocarbons (Freon), which quickly became the prevailing material in compressor refrigerators. Freon was safer for the people in the vicinity, but in 1973 it was discovered to have detrimental effects on the ozone layer. After that, new improvements were made, and Hydrofluorocarbons, with no known harmful effects, was used in the cooling system.

Simultaneously, nowadays, Chlorofluorocarbons (CFS) are no longer used; they are announced illegal in several places, making the refrigeration far safer than before.

READING DAY 8 QUESTIONS NOVEMBER**Questions 1-5**

Look at the following events (Questions 1-5) and the list of dates below.

Match each event with the correct date, A-F.

Write the correct letter, A-F, in boxes 1-5 on your answer sheet.

List of Dates

- A 1550
- B 1799
- C 1803
- D 1840
- E 1949
- F 1973

- 1 Vehicles with refrigerator were used to transport on the road.
- 2 Ice was sold around the United States for the first time.
- 3 Some kind of chemical refrigerant was found harmful to the atmosphere.
- 4 The term 'refrigerator' was firstly introduced.
- 5 Some chemicals were added to refrigerate wine.

Questions 6-10

Look at the following opinions or deeds (Questions 6-10) and the list of people below.

Match each opinion or deed with the correct person, A-G.

Write the correct letter, A-G, in boxes 6-10 on your answer sheet.

List of People

- A Thomas Moore
- B Frederick Tudor
- C Carl Von Linde
- D Nathaniel Wyeth
- E J.B. Sutherland
- F Fred Jones
- G Parker Earle

- 6 patented the idea that refrigerating system can be installed on tramcars
- 7 invented an ice-cutting technical method that could save money and time
- 8 enabled the cold storage technology to be applied in fruit
- 9 invented a cooling device applied into the trucking industry
- 10 created a new technique to liquefy the air

Questions 11-14

Complete each sentence with the correct ending, A-E, below.

Write the correct letter, A-E, in boxes 11-14 on your answer sheet.

11 A healthy dietary change between 1830 and the American Civil War was greatly associated with

12 The development of urbanisation was likely to cause

13 Problems due to water treatment contributed to

14 The risk of the environmental devastation from the refrigeration led to

A new developments, such as the application of Hydrofluorocarbons.

B consumers ' demand for fresh food, especially for vegetables.

C the discovery of chlorofluorocarbons (Freon).

D regional transportation system for refrigeration for a long distance.

E extensive spread of the refrigeration method.