equipment was low—about one-half the cost of mechanical equipment of comparable capacity. And daily costs for nitrogen stood at reasonable levels of $8-$12 per truck.

Economy is important, but dependability is perhaps the greatest virtue of nitrogen refrigeration. This is a particular advantage in piggyback haulage of trailers on railroad cars where breakdown of unattended mechanical equipment can cost thousands.

Space Conditions Simulated

Many other areas of use have been opened. In space, temperatures dip close to the greatest cold obtainable, absolute zero, minus 459.72 degrees Fahrenheit. At this point all molecular motion would cease. What will happen to metals and instruments in space vehicles at such temperatures? In vast test chambers tons of liquid nitrogen are helping provide answers.

Similar test chambers are being used to simulate arctic conditions to test paints, storm windows and such that will have to withstand temperatures 50 degrees below zero Fahrenheit.

"Controlled atmospheres," in which nitrogen replaces oxygen, are opening enticing possibilities. Farmers long ago discovered that stored apples lasted longer when kept in barrels. It remained for chemists to discover why. As apples "breathe" they produce carbon dioxide. As this gas accumulates in barrels it slows oxidation and, therefore, rotting. Might not inert nitrogen do an even better job?

Today the storage life of apples and pears is being greatly extended by piping nitrogen into warehouses. Preliminary evidence indicates that it will be similarly useful in extending freshness of lettuce, beans, celery and other vegetables, as well as flowers.

Food Spoilage Prevented

The hiss that you hear when you open a can of coffee is probably nitrogen. It keeps coffee oils from turning rancid. Used in bottling salad oil, it drives out the oxygen that would lead to spoilage. It also helps preserve peanut butter, mayonnaise, packaged cheese, bacon and a host of other foods.

Liquid nitrogen is opening dazzling vistas in biology. Its super-coldness confers potential immortality on any tissue or microorganism. In normal laboratory methods of culture, bacteria and viruses have an unfortunate tendency to mutate. Thus, a virus may be one thing today, quite another next year. Deep-freezing with nitrogen extends life unchanged indefinitely, thus providing constant reference points.

Storage of frozen blood is another rapidly expanding field. While normal bank blood must be discarded after 21 days, blood frozen by liquid nitrogen appears to keep indefinitely. Programs for large-scale preservation are underway in England, France, Sweden, Italy, elsewhere. New York's Community Blood Council plans to bank rare blood-types for genetic research.

Cryosurgery — surgery utilizing extreme cold—is a glamorous new field. Freezing simplifies removal of cataracts. Liquid nitrogen is offering new hope in one of the most horrid of human maladies, Parkinson's disease, which is marked by tremor, mask-like face, muscle rigidity.

With this disease the source of trouble is a small group of cells in the base of the brain. Might they not be destroyed by extreme cold? Dr. Irving S. Cooper of New York's St. Barnabas Hospital thought so. He sought the help of the Linde Company in designing a small, insulated cannula which could be inserted directly into the brain. Liquid nitrogen circulates inside, produces extreme cold at the silver tip.

Hundreds of patients, so badly incapacitated that they could not walk and could not feed themselves, have been dramatically relieved of tremors and rigidity. Nine out of ten who have received this remarkable treatment have obtained significant relief—enough to encourage more than 100 hospitals scattered around the world to buy the equipment.

Retina Not Scarred

In eye surgery, liquid nitrogen is being used to pin down detached retinas that may cause blindness unless reattached. For years retinas were welded into place with pinpoint shots of electricity, an operation which must be repeated several times during a patient's life, but the scar that formed at the weld spots made successive operations more difficult.

Dr. Harvey Lincoff of New York Hospital-Cornell Medical Center thought a liquid nitrogen probe might produce tiny sealing adhesions that would heal without leaving a scar. His idea worked. A two-to-five second touch with a probe cooled as low as minus 40 degrees Fahrenheit does the fastening job.

"Nitrogen has a fantastic future," says A. L. Matter of Linde. Figures support this statement. A decade ago barely two billion cubic feet of nitrogen were being used a year outside the fertilizer industry. Today the figure is 67 billion cubic feet, and it is expected to rise to 150 billion by 1970. Not bad, everything considered, for a substance that is not supposed to do anything.

This article was prepared for SCIENCE NEWS LETTER in cooperation with the READER'S DIGEST. It will appear shortly in that magazine.

• Science News Letter, 86:91 August 8, 1964

PUBLIC HEALTH

Gases in Demonstrations Hazardous to Health

➤ BRITISH CHEMISTRY teachers are alarmed at an occupational hazard, the effect upon their health of obnoxious gases breathed during chemistry demonstrations. One teacher credited his asthma to allergies incurred through exposure to chlorine, sulfur dioxide, sulfur trioxide, hydrogen sulfide and other gases used in chemistry teaching.

He contends that his chest damage cannot be attributed to smoking because he has not smoked, and industrial fumes are not present in the small town school where he has taught.

Improvement in the arrangements to ventilate the hoods for conducting chemical experiments is being planned by science education authorities.

• Science News Letter, 86:91 August 8, 1964