CHEMISTRY

44 Gases Used in World War; New Ones Promised for Next

Chlorine, Bromine, Arsenic and Ethyl Radicle Figure Prominently in Numerous Lethal Compounds

HERE are the most important known poison gases which have been found effective in warfare. Many of them were developed and used during the World War. Others, in addition, will be used if war now comes to Europe.

1. *Mustard Gas.* Chemically is dichloroethyl sulfide. In pure state almost odorless. In World War smelled like mustard or garlic. Heavy, oily liquid of dark straw color. Evaporates slowly at ordinary temperatures. Thus a persistent type of gas. Frequently diluted with another poison, chloropicrin, to keep it liquid in colder weather. Has delayed action on body. First symptoms itching and blistering. Especially damaging to eye's cornea. In eye, tissue degeneration begins two minutes after exposure to dilute concentrations. If gas is swallowed symptoms of nausea, vomiting and diarrhea develop. Gas very penetrating. Goes through ordinary clothing, rubber and even leather. Is 50 times as toxic as chlorine.

2. *Chlorine Gas.* First gas used in World War. Two and a half times as heavy as air. Clings to ground. Fills shell holes, depressions and dugouts. Greatest action occurs in presence of moisture. Major action is on respiratory tract with symptoms of choking, coughing and suffocation.

3. *Phosgene Gas.* A combination of carbon monoxide and chlorine. Resembles chlorine in action but has a more delayed effect. Is ten times as toxic as chlorine. First symptoms very minor. Its effectiveness mainly due to initial innocuous character. Its menace is revealed only after considerable gassing has occurred.

4. *Lewisite.* Known chemically as chloro-vinyl-dichloro-arsine. Developed secretly during World War by Capt. W. Lee Lewis of U. S. Chemical Warfare Service. War ended just before gas entered combat use. Has all blistering properties of mustard gas but more effective because it has ability to penetrate the skin. Three drops, placed on rat's abdomen, causes death in two to three hours. Is powerful respiratory irritant. Produces violent sneezing. Another variety called beta-beta-prime-chloro-vinyl-dichloro-arsine has less blistering effect but its irritation on respiratory system is much more severe.

5. *Toxic smokes.* Chemically are diphenyl-chloro-arsine and diphenyl-cyano-arsine. Popularly called sneezing gas. Are really finely divided dusts. Can pass through ordinary gas masks unless special filter attachments are provided. Effective in concentrations of one part in 10,000,000, of air. In higher concentrations cause vomiting. Considered as poisonous as phosgene in equal concentrations.

6. *Crying Gas.* Twenty-three different varieties used in World War. All intended to produce temporary disability and confusion. Favorite German lachrymatory gas was xylyl bromide. Among Allies chloropicrin was widely used.

In all some 44 individual gases and mixtures of gases were employed by the combatant nations from 1915 to 1918. Their names follow:

Acrolein; arsenic chloride; benzyl iodide; benzyl chloride; bromoacetone; bromobenzylcyanide; bromomethylethylketone; benzyl bromide; chlorine; chlorosulfonic acid; chloroacetone; chlorobenzene; chloropicrin; cyanogen bromide; dichloromethylether; diphenylchloroarsine; dichloroethylsulfide; ethyldichloroarsine; ethyliodoacetate; hydrocyanic acid; methylchlorosulfonate; monochloromethylchloroformate; phosgene; phenylcarbylamine chloride; trichlormethylchloroformate; stannic chloride; sulfuric anhydride; xylyl bromide.

And mixtures of: bromoacetone and chloroacetone; chlorine and phosgene; chlorine and chloropicrin; chloropicrin and hydrogen sulfide; chloropicrin and stannic chloride; chloropicrin and phosgene; dichloroethyl sulfide and chlorobenzene; ethyl carbazol and diphenylcyanoarsine; ethyldichloroarsine and dichloromethylether; ethyliodoacetate and alcohol; hydrocyanic acid, chloroform and arsenious chloride; hydrocyanic acid, arsenious chloride, stannic chloride and chloroform; phosgene and arsenious chloride; dichloroethyl sulfide and carbon tetrachloride; phosgene and stannic chloride; methyl sulfate and chloromethyl sulfate.

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ENGINEERING

Industrial Research Cuts Costs to Consumer

INDUSTRIAL research does many things but where it comes nearest to most folks is in the improved quality of many products and in lowered costs to the ultimate purchaser.

Back in 1918 we bought what we thought was a pretty good rubber tire for our automobiles whose rate of wear was such that for every mile the car traveled it took 2.15 cents out of our pocket. Today, twenty years later, automobile tire cost per mile of travel is less than a third of a cent.

Intensive research on the ways to produce a longer wearing, more rugged rubber and on ways to fabricate more easily and with greater control over the quality of the output, is the answer.

In comparable fashion is the automobile itself. In 1925 a good car, by the standards of that day, cost $1,000. Twelve years later, in 1937, a better car sold for only $700.

Before the forum of the American Engineering Council, T. A. Boyd of the research division of the General Motors Company cited these examples of what research can do for the consumer.

Reviewing research progress over various lengths of time, Mr. Boyd noted the following lowering of costs:

Research over a period of between 10 and 14 years:

Electric refrigerators dropped in cost from $334 to $169, telephone message for 970 miles decreased from $7.50 to $2.75, rayon yarn from $2 a pound to 50 cents a pound, ammonia from 7.5

cents a pound to 4.5 cents, and methanol from 67.5 cents a gallon to 33 cents.

In the period of research covering 15 to 20 years:

Radio sets from $200 to $50, gasoline from 31.4 cents a gallon to 14.3 cents, camphor (natural) $3.75 a pound to 30 cents (synthetic).

Such a list could go on indefinitely but it would still omit a perhaps even greater aspect of research: the formulation of new industries which never before have existed.

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PHYSICS

Newest Vacuum Pumps Create Low Pressure

THE EMPTIEST man-made space ever attained is now being created by the newest vacuum pumps which use oil molecules to sweep out the air from scientific apparatus.

While it is impossible to produce a perfect vacuum, a vacuum can be created in which it is possible for a molecule to travel nearly 500 feet (15,000 centimeters) before it would encounter another molecule.

Since a molecule is only about .0000001 centimeter in diameter, it means that in travelling 15,000 centimeters the molecule goes over 100,000,000,000 times its own length before encountering a companion. Here, truly, is loneliness.

If the same emptiness were applied to people it would mean that a man 5.2 feet tall would have to travel over 100,000,000 miles before meeting anyone. The loneliness would be much greater than if there was only one man on the earth and another on the sun.

In terms of atmospheric pressures the new oil diffusion pumps, as they are known, can produce pressures of .0000005 millimeter of mercury without the use of cooling traps of liquid air.

Normal atmospheric pressure is 760 millimeters of mercury, which is more than a billion times that attained in the newest oil diffusion pumps.

In operation the new pumps consist of elaborate and beautiful glassware arranged in tubes and columns to make a complete circuit for the oil vapor.

The oil is heated at one point in the circuit and the vapor flows around the loop. As the flow passes a specific point it comes by an opening leading to the chamber to be evacuated. Molecules of air coming out this opening are bumped by the oil molecules and the latter knock the air molecules away from the container being evacuated.

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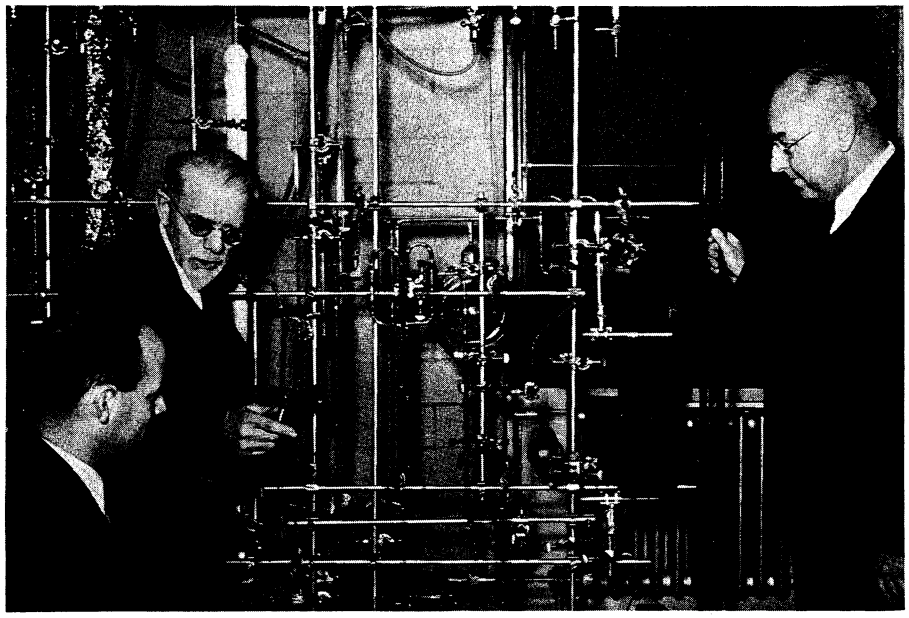

AT DEDICATION

An elaborate set of apparatus in the new chemical research laboratory of Brown University dedicated on December 28. Pres. Henry M. Wriston, right, looks on as Prof. Charles A. Kraus, center, president-elect of the American Chemical Society, discusses the set-up with Prof. John P. Howe.

PUBLIC HEALTH

Men Suffer For Beauty, Too; Permanent Scars Reported

THE PRICE of manly beauty sometimes comes high. Take the matter of dekinking hair on the closely cropped male pate.

From Harlem Hospital, New York, comes the report of two cases of painful burns and probably permanent scarring resulting from such attempts at hair straightening. Dr. Frederic Lewis and John V. Scudi, reporting the cases (*Journal, American Medical Association,* Jan. 7), say that the men who use hair straighteners are principally, but by no means exclusively, Negroes.

Hair straighteners developed for men contain caustics, notably sodium hydroxide, which converts the hair protein to a gel. When not applied with great care, severe burns may result.

One of the men who suffered long for sweet beauty's sake looked, when the doctor first saw him, as if he had second degree lye burns. He had applied the hair straightening cream to his own woolly head, and had let the rinse water trickle down his face. He was three weeks in Harlem Hospital. His scars are probably permanent.

Case No. 2 has a large white expanse on his otherwise chocolate forehead. As Dr. Lewis and Mr. Scudi report the case:

While applying a cream for the purpose of straightening the patient's hair, the barber got to talking of "women people." Original sin haunted that barbershop and for fully five minutes enraptured its proprietor. The client made efforts to tell the barber that something was burning his forehead.

"The sequelae are not accurately remembered by the patient. There were several days of soreness, then crust formation and gradual exfoliation (scaling). The depigmentation (loss of color) proved enduring, but the straightening of the hair, alas, was transient."

Hair straighteners on the market have been found to be within the limit set by the Federal Caustic Poison Act, but there can be no regulation of their manufacture in the home and barbershop, the New York doctors point out.

Much of the peril lies, they believe, with such synthesizing amateurs who would do miracles of straightening.

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