ENGINEERING

Climate a la Carte

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By HARLAND MANCHESTER

➤ MANY PEOPLE THINK of air conditioning merely as an aid to the appreciation of Hedy Lamarr during the dog days. Actually there is hardly a critical operation in the production of vital weapons, explosives, tools, medicines, and foods that is not being done better, faster or cheaper because of machine-made climate.

Without air conditioning, much of the sensational new communications equipment could neither be manufactured nor employed at the front. Electronic tubes, like light bulbs, are highly efficient furnaces, and if the heated atmosphere were not continuously exchanged for artificially cooled air, any room where a large number of these tubes are made, tested or used would quickly become a Turkish bath. These facts were not clearly understood when the electronics industry launched its skyrocketing war program, and in one factory which relied upon natural air, rejection of faulty tubes ran as high as 80%. Now processed air is a must.

On naval vessels some of the newly developed communications equipment is used in sealed chambers thickly walled against gunfire and outside disturbances. Air which is mechanically cooled and filtered makes these rooms endurable. Air conditioning keeps gun crews efficient by pumping out powder fumes and pumping in fresh, cooled air; and down in the magazines it protects stored powder from deterioration.

Vital in South Pacific

The roofs of military radio trucks in the South Pacific are often heated by the sun to 160 degrees or so, and inside there is enough radiation from the tubes to heat a house. No one could exist long, let alone work, in these trucks without the special air conditioning equipment which has been built in.

"Sweatboxes," they used to call the ready rooms on aircraft carriers, where pilots assembled in their heavy flying suits to hear final orders before guiding their planes to the cold upper regions. Now the rooms are mechanically chilled, and a prelude of discomfort is removed from a job which demands the utmost in alertness.

Repairing a bombsight or a radio set on the hot, sandy desert or a fetid Pacific island was once a job to try a mechanic's soul. Now there is a portable air-conditioned repair hut, which telescopes into a package small enough to be shipped by air transport to any remote point, and repairs to delicate instruments are made in half the time with no sweat or dust.

Grounded Planes Cooled

On a tropical front not even the hardiest mechanic can work for more than a few minutes in the stifling cabin of a grounded plane. Now there is in production a mobile cooler and dehumidifier which can be wheeled up beside the plane to deliver cooled air through canvas tubes.

The hottest place in an air field used to be the glass-enclosed control tower, where there is no escape from the sun. This was hell on the personnel, and bad for the weather-recording and radio instruments. Packaged cold came to the rescue.

Operating and X-ray rooms in many base hospitals are now comfort-cooled, thereby reducing the danger of infection from sweat and dust, increasing the efficiency of surgeons, and generally contributing to the remarkably low death rate from wounds. Many wounded men are also kept comfortable on the way to the hospital in air-conditioned Pullman-type ambulances.

Aerial photographic films must be developed and the prints dried and ready for use in a matter of minutes. This would be impossible in hot climates without the Army's new trailer darkrooms in which air conditioning keeps film free from dust, holds emulsions at specified temperatures, and checks perspiration.

During the fighting in Africa, a completely air-conditioned motor caravan, the first of its kind, enabled a flying squadron of engineers and technicians to eat, sleep and do their paper work in cool comfort while the thermometer outside registered about 130 degrees.

Mechanical air-cooling is much the same thing whether it keeps you cool in a theater or keeps the milk cool in your refrigerator, and one of its valuable applications is in the Army's new portable units. By means of these mobile coolers, meats and vegetables frozen in American plants stay frozen all the way to the mess sergeant's storehouse on some obscure island half way around the world.

Self-refrigerating storeroom units are carried in the hold and delivered full of frozen meat or vegetables at advanced bases. Trailers carry 8,000 pounds of frozen beef apiece, which is kept at about 10 degrees. At the front the tractor is unhooked and driven off, and the trailer becomes a stationary cooler with its own power plant. Packaged cold is bringing fresh food to more soldiers than ever before in the history of warfare.

Meanwhile, on the war production front, tailored weather has broken a score of bottlenecks. Temperatures in copper mines run as high as 150 degrees, and once it was standard practice to blow air through the tunnels for three years or so until they were cool enough to work in. Now these sweltering holes are cooled in less than a month.

As factory technology improves, more and more machines are assembled in a given space. Every machine generates heat by friction; the bulbs and tubes which illuminate the plant give off more heat, and every worker constantly gives off as much heat as comes from a 100-watt light bulb. In many of these plants the temperature would be 100 degrees or more if industry had to depend upon natural atmosphere, and the work could not be done.

Fingers Kept Dry

High-precision instruments made for the Navy were being rejected in large numbers despite rigid inspection at the plant. After a few weeks tiny specks of corrosion on their highly polished surfaces made them useless. The "saboteur" was finally identified. If in the process of assembly a damp finger-tip so much as brushed one of the mirrorlike areas, the acid in the perspiration planted the invisible germ of future deterioration. Air conditioning keeps the workers' fingers dry. There is no trouble now.

A blue print six (*Turn to Page 396*)

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feet long, drawn in the cool of the evening, may expand by as much as an inch in the heat of the day, which may easily lead to a serious error in construction. And once there was an annual loss of thousands of man-hours due to the smearing of blueprints by sweating hands. Now all the war plant drafting rooms are supplied with dustless, uniform artificial weather.

One reason for the great improvements made in our warplanes and weapons is the closer fit, or finer tolerances, of the various parts. This has raised problems in mass production. A part made in the cool of the night and assembled in the heat of the day may expand enough to be rejected. Or a part made in St. Louis may not fit a companion part produced in the cooler climate of Springfield, Mass. Air conditioning removes these inequalities, "freezing" dimensions during manufacture. All delicately fitting parts are now made in the same artificially controlled climate, so that no matter when or where a part is made, it fits when it reaches an assembly plant or when it is used to repair a stricken plane in a distant battle zone. Tailored weather now makes it possible to produce all manner of delicate instruments by mass-production methods. It is estimated that production of the famous Norden bombsight would be cut 50% during the summer months without air conditioning.

The highly polished gauge blocks, finely divided calipers, and other super-accurate measuring devices used by every production plant to check the accuracy of tools are themselves prey to contraction and expansion with changes of natural weather. Experts say that if the temperature of the test room varies by as much as one degree they can detect a difference in these "yardsticks." Here again air conditioning prevents error. With test rooms kept constantly at 68 degrees, and relative humidity at 50%, these final arbiters never lie.

Until 1931, all the gases used as refrigerants were toxic, inflammable or uneconomical. The unsafe gases had caused a number of fires and fatal accidents. The answer came in 1931 from the late Thomas Midgley, Jr., famous as the man who discovered that tetraethyl lead would take the knock out of gasoline. Charles F. Kettering phoned Midgley at his Dayton laboratory and told him what was needed. Midgley and his assistants set to work, came up in three days with "dichlorodifluoromethane,"—which goes, mercifully, under the trade name of Freon. At a conclave of chemists Midgley inhaled a lungful of Freon, and then blew out a candle with it, proving dramatically that it was non-toxic and non-inflammable. Soon Drs. M. A. Youker and H. W. Daudt of the DuPont company found a way of making the rare and complex gas cheaply.

Freon, in its various forms, has revolutionized the whole business. It is not only safe, but its superior properties have made it possible to reduce the size and weight of the machinery. For example, the new gas makes possible a supply of fresh, cool air in a submarine. The crews can even smoke.

Air conditioning is slated for a tremendous postwar boom. It is reasonable to expect that within a few years virtually all factories, shops, laboratories, trains, hotels, assembly places, office buildings and new apartment houses will be equipped with controlled weather, with immense dividends in comfort, health and efficiency. And in the future, perhaps the distant future, lies the goal of weather-as-you-like-it in the average home.

This background story on air conditioning will appear in Reader's Digest for January.

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