LOW, Low, Low, and Lower Temperatures

Imagine the coffee you bought in SUB creeping out of your cup. Impossible? For coffee, but not for liquid helium. The "creep" is a dramatic effect of superfluidity, a property helium takes on below two degrees absolute. Superfluid behavior in films of helium only one or two atomic layers thick is being studied in the low temperature lab of the physics department.

A new world opens up for the scientist who studies the effects of extremely low temperatures. "Many phenomena (such as the "creep") that happen at low temperatures are unique to that region", comments Dr. F. D. Manchester.

Dr. Manchester and Dr. S. B. Woods, assisted by five graduate students, are exploring this new world. Their refrigerant and main subject is liquid helium. A gas at room temperature, helium boils at 4.2 degrees Kelvin (-452° F) zero.

PERPETUAL MOTION A POSSIBILITY

Zero on the Kelvin scale is the point where the cold stops even molecular motion—and for the men who work in the low temperature lab it is everyday routine to come within a few tenths of a degree of his point. Huge thermos bottles, ("Dewar vessels") are used to keep the helium at such low temperatures.

Giant electronic brains have been made using another peculiar effect that happens at low temperatures. Normally, if you induce an electric current in a circuit, it will soon weaken due to the resistance. But close to absolute zero, the old dream of perpetual motion comes true! Superconductivity" allows the current to travel around the circuit almost forever.

Alchemists, who searched long for the perpetual motion machine, never found one. But they did not have the apparatus and delicate instruments the modern scientist has.

PECULIARITIES BEING STUDIED

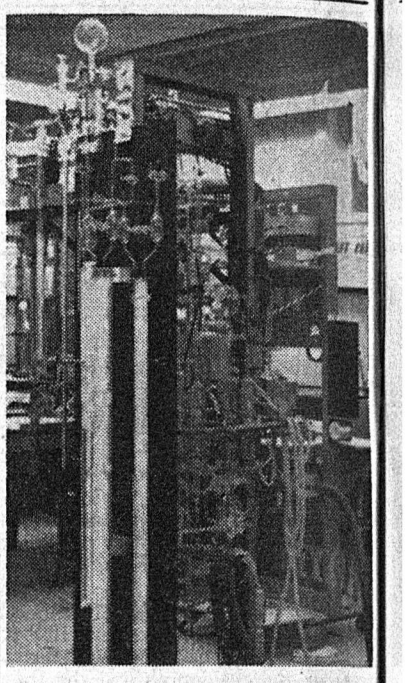
The principle piece of apparatus in which low temperature experiments are done is the cryostat. Because ordinary thermometers would freeze at very low temperatures, the cryostate has electrical instruments to measure the temperature. Vacuum systems are used to provide thermal insulation.

"Second sound", a heat wave found only in helium below two degrees Kelvin, is studied by Mr. A. Hassan, a graduate student. This wave is called "second sound", because its propagation (movement) in liquid is very much like the propagation of sound in air. Mr. Hassan is therefore using methods very much like those used in the old subject of acoustics, explained Dr. Manchester.

Properties of metals are easier to study at low temperatures says Mr. J. Adler, another graduate student, because heat makes the atoms move faster.

Sodium should really be the simplest metal to study, but here research is frustrated by another peculiar low temperature effect. At 36 degrees absolute, there occurs a sudden change in the crystal structure of sodium. This same change, which is called the Martensitic transformation, occurs in steel at very high temperatures. Actually, it is one of the factors that determine the strength of steel.

Lowest temperature used in the lab at the moment is of the order of a few tenths of a degree above absolute zero. But if needed, the experimenters can come within as little as a few thousands of a degree of absolute zero. Such extremely low temperatures are produced with the help of a magnet, and the huge new electromagnet to be installed soon in the low temperature lab will extend this work greatly.



A CRYOSTAT — Shown above, this device is essentially a very low temperature thermometer. It will measure temperatures lower than —450°F.

The Incomparable BB is coming—Oct. 17-24.