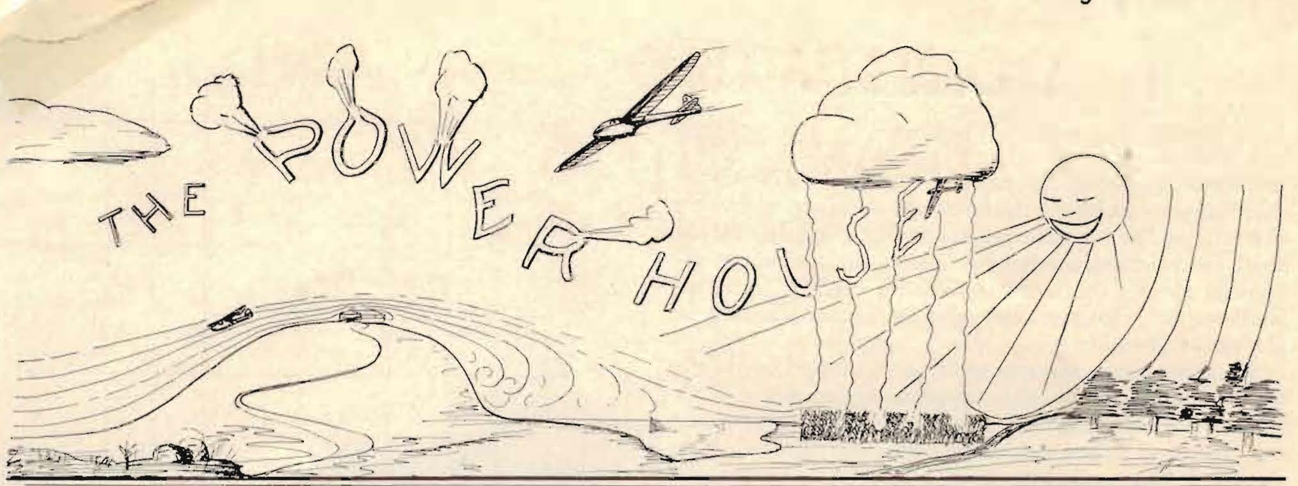

Conducted by Barney Wiggin of the U. S. Weather Bureau

Atmospheric TURBULENCE

This is the second installment of a serial article on atmospheric turbulence written by Mr. L. P. Harrison of the U. S. Weather Bureau

In summing up the foregoing chapters that came out in our last issue, it may readily be seen that the rate with which the temperature changes with height in the lower atmosphere undergoes a diurnal cycle variation. The greatest rate of decrease of temperature with height in the layer of air near the surface will usually be found about the time that the maximum temperature occurs at the surface, i.e. about 2 to 3 p.m., Local Standard time. (See Figures 1 and 2.) On the other hand, the least rate of decrease of temperature with height will be found in this layer about the time of the surface minimum temperature, just before dawn, which is also the time at which investigations are most pronounced.

"Lapse rate" is the term applied to the rate of decrease of temperature with height. When the lapse rate is 0.55° F. per 100 feet in the vertical (1° C. per 100 meters), it is called the "Adiabatic Lapse Rate." An inversion is a negative lapse rate.

Lapse rates equal to, or greater than the adiabatic lapse rate, prevail for a short distance above the surface during the warmer portion of clear, sunny days, when the ground is not saturated with water, nor snow and ice covered. When a parcel of air is given an upward impulse, it will expand as it ascends and cool approximately at the adiabatic rate. Therefore it will remain warmer than the surrounding air in the layer of super-adiabatic lapse rate, and its upward movement will be accelerated.

If two bodies of air are at the same pressure, the warmer of the two will be less dense, that is, lighter. Buoyancy acquired through the addition of heat at the surface, and maintained because of the continued relative warmth of the rising mass relative to the surrounding air, produces accelerated motion until a level is reached where the temperature of the surrounding air is the same, or higher, than that of the rising mass. In the first case the momentum of the rising air may carry it some distance farther with decelerated motion; in the second case where the rising air becomes cooler than its surroundings its greater density soon causes it to sink back to the level where temperature equality prevails.

When the lapse rate equals the adiabatic value which is nearly always the case near the surface when a fresh to strong wind is blowing, a parcel of air is subject to no vertical forces and is said to be in neutral equilibrium because its temperature equals that of the surrounding air. It may ascend or descend at will depending on its initial motion and its own momentum.

Upward currents of air are therefore invariably found

(Continued on page 6)

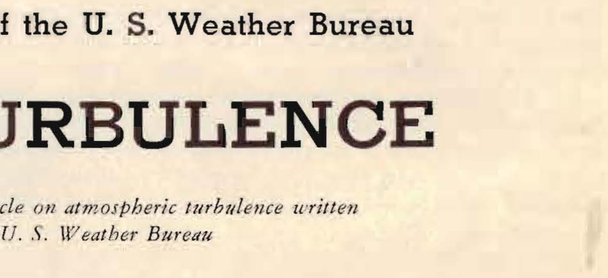

Fig. 1. Thermograph Traces, Ithaca, N. Y., illustrating diurnal temperature range, summer type. (Remember these dates? On June 27, 1939, the first cloud soaring at the National Contests. Parker Leonard rode a towering cumulus to the Silver C level. Bob Stanley continued in the same cloud to the Golden C level, and beyond, doubling the American Altitude record. On July 4th he nearly tripled the old record and set the now standing altitude record for the U. S. The same day Endo Fisher was carried well up into one of these clouds and thrown out of his ship.) BLW.

Fig. 2. Curves showing diurnal temperature variation over land: A, early morning; B, midday; C, evening; broken line is the dry-adiabatic; arrows show direction of eddy flux of heat.