



CAMERA MACHINE GUN

For training aerial gunners is this type of machine gun camera demonstrated at the National Academy of Sciences in Washington. Such cameras are mounted in the combat planes of the Army and Navy during maneuvers and train pilots in aerial attack. As the trigger is pressed the object in the "line of fire" of the dummy gun is photographed. Later the films from the various planes are developed to see who killed whom in the dummy war.

METEOROLOGY

Upper Air Data Will Aid In Forecasting the Weather

The Word "Probably" Will be Seen Less Frequently In Prognostications Because of Air Mass Analysis

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THE WORD "probably" will be seen less frequently in the daily weather forecast when the observations of conditions in the upper air are further extended by the U. S. Weather Bureau.

In its efforts to meet modern demands for specialized weather service, the Weather Bureau has in recent years given more and more attention to what goes on in the air far above the earth's surface. It was recognized by meteorologists many years ago that the weather experienced by man on the ground resulted from nature's processes in the vast upper air as well as from elements observed at the earth's surface.

In fact, the layer of air next to the

ground in which man normally lives and moves is but a very thin portion of the atmosphere above us, thousands of feet in height, most of which in one way or another takes part in the "manufacture" of the weather.

One of the difficult problems of meteorology is to obtain observations of these important conditions in the upper air—the temperature, the humidity or moisture content, the pressure and the winds at significant heights in the atmosphere—and having obtained these data, to analyze them quickly and to determine how the various air masses will interact to change the weather. If we understand these changes we can forecast what the weather will be tomorrow.

How can an observer on the ground

tell what the temperature, humidity and other elements are at several thousand feet altitude?

The upper winds he can determine in clear air by observing a small pilot balloon through a kind of "telescope" called a theodolite. But in general he cannot tell the temperature and humidity accurately unless he goes up in an aircraft with instruments and makes the observations personally, or sends a recording instrument up in some sort of aircraft.

Several Methods

Several methods have been used. Small sounding balloons have been and in some cases still are employed with recording instruments attached. But this method is very slow because the observer must wait until the recording instrument drifts to the ground on its small parachute and is found by some chance passerby and returned by mail—sometimes weeks or months later. In some cases it is never found.

A somewhat faster method is the use of box kites with recording instrument attached. After ascent with the instrument, the kite, or kites in tandem, are hauled down and the instrument record obtained. But this method also is slow and depends upon favorable winds to take the kites even to moderate heights. It is no longer used in this country because of attendant hazards.

Other methods include sending instrument and observer up in an airplane, or occasionally even a free balloon. Upper air observations by airplane are still in use daily at six Weather Bureau stations in the United States, at eight naval stations, and until last July, at seven army stations.

But the newest method of obtaining the temperature and humidity of the air high above the surface is the use of the radio-meteorograph, or the radio-sonde as it is called in this country. This is actually a modern development of the earlier sounding balloon with its recording meteorograph. But with the radio-sonde the instrument transmits by radio signals which indicate the air pressure, temperature and humidity every few hundred feet up to 60 or 70 thousand feet. The observer on the ground receives this information through his special radio recorder as rapidly as the balloon ascends. This method is speedier than others and promises to become the most commonly used. Today there are six Weather Bureau, (Turn to Page 110)

From Page 103

two Army and two Navy radio-sonde stations.

The balloon which carries the instrument is about 3 feet in diameter before inflation and 5 or 6 feet in diameter after inflation. It can lift almost three pounds, but the instrument, including its inexpensive radio transmitter, weighs only about $1\frac{1}{2}$ pounds. The instrument now in use for Weather Bureau observations is that developed by the National Bureau of Standards for use of the Navy Department.

The balloon and the instrument rise at a rate of about 1,300 feet per minute. They ascend for sixty minutes or more to an altitude of about fifteen