METEOROLOGY

# New Radio Balloon Instrument Measures Thickness of Clouds

## Wind Velocities at Upper Levels of the Atmosphere Above Clouds Also Signaled by Light Instrument

INCREASED safety for aviation is seen in the newest development of the National Bureau of Standards. It is a new device which enables scientists on the ground to learn the height of clouds, their thickness and the altitude to which an airplane must climb to come out "on top," as the pilots call it. H. Diamond, W. S. Hinman, Jr., and F. W. Dunmore of the Bureau's Radio Division have cooperated in the development of the instrument at the request of the United States Navy.

Moreover, the device can be used to learn the wind velocities above or within clouds, which conceal the upper sky, as well as to indicate the temperature and humidity of the air for altitudes up to nearly twelve miles.

The new equipment of the Bureau is an improved type of radio meteorograph; a tiny balloon bearing aloft a small radio transmitter which has characteristic signals for temperature, humidity, and altitude. These signals are received and recorded automatically on instruments on the ground.

Previous radio meteorographs have operated the switching mechanisms by clockwork devices or by a small electric motor which needed a battery to run it. The new design operates entirely without external power and uses the power of varying barometric pressure, as the balloon rises, to accomplish the switching.

### Photoelectric Cell

The attachment to the radio balloon device which makes it possible to learn cloud thickness is a small photoelectric cell that records light brightness. As the balloon rises up to the under side of the cloud the photocell gives a reading characteristic of the light brightness found there. When the balloon enters the cloud the light brightness falls sharply and gradually increases until the upper surface of the cloud is reached and the instrument comes out into the brilliant sunshine found there. Since the light brightness for each altitude is transmitted by the balloon and received on the ground the thickness of the cloud can be accurately estimated although the cloud is miles overhead.

Moreover, by using a delicate directional antenna on the ground receiver it is possible to follow the flight of the balloon even though it is hidden by clouds. This angle above the horizon and the line of direction horizontally when coupled with knowledge of the altitude at the instant when the "sight" was taken, make it possible to fix in space the position of the balloon and its radio transmitter. A short time later, when the balloon is higher, this process is repeated and the drift of the balloon due to upper air winds can be calculated easily.

The only way this knowledge can at present be obtained by balloon flights is to make two observations of the balloon from two distinct stations by the use of small telescopes. This method naturally will not work in bad weather when it is impossible for the observer actually to see the balloon. Yet this cloudy, bad weather condition is exactly the one which aviation needs most to surmount.

At present much of the knowledge of upper air weather is achieved by daily airplane flights in many parts of the country specifically for this purpose. These flights are costly, however, and average, it is estimated, about $25 apiece. The National Bureau of Standards believes that with a semi-mass production of the radio meteorographs their cost could be made less than $25.

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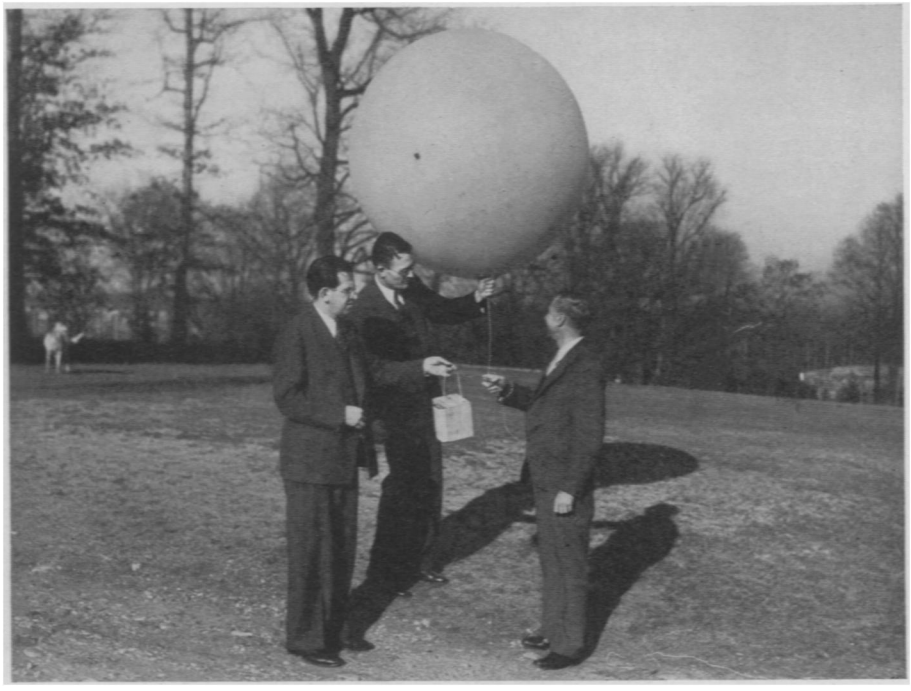
***ROBOT WEATHERMAN***

***It goes aloft to 60,000 feet and radios back to earthbound scientists the vital information on which forecasts for aviation and commerce can be made. Margaret Wendt of the National Bureau of Standards in Washington holds the cover box opened to show the tiny three-tube radio transmitter while below is the barometrically-controlled commutator unit which switches the signals from temperature to humidity data alternately. The entire unit weighs less than two pounds and the meteorograph operates entirely without external power.***



*MEASURES OVERCAST*

*Scientists Harry Diamond, Wilbur S. Hinman, Jr., and Francis W. Dunmore (left to right) of the National Bureau of Standards hold the radio meteorograph ready for launching. The device not only tells upper air temperatures and barometric pressures for altitudes up to nearly 12 miles but also measures the thickness of clouds; knowledge of great aeronautical value. Even though unseen above clouds a directional antenna can spot the position of radio signals from this instrument and by calculation the wind velocities overhead can be obtained.*

RADIO

# Find Why Many Stations Are Received on One Dial Setting

## Mystery of a Year's Standing Now Cleared Up When Poor Contacts in House Lighting Were Found at Fault

THE year-old mystery of multiple station reception on a single dial setting of a radio receiver has at last been solved. It all started when a radio service man was called to a home in a certain part of New York where the complaint was, "When I tune in WEAF I also hear WOR and WJZ."

Spinning the dial to 660 kilocycles for WEAF, the service man found that the complaint was no myth. Truly he was puzzled, for the three New York stations are widely separated, with WOR at 710 kilocycles and WJZ at 760. Careful examination revealed no internal trouble in the receiver. Seemingly no explanation was logical. Yet other complaints in the same neighborhood soon lent additional mystery to the happening.

News of this peculiar phenomenon reached the ears of the R.C.A. License Engineers. Moreover, they had heard similar reports from other cities, especially Cincinnati, where the engineers of the Crosley Radio Corporation had already started an investigation. Scouts were sent out by both of these groups to obtain all pertinent information about the affected neighborhoods. When they compared notes, the plot thickened. It was apparent that all of the affected vicinities were in areas where there were at least two strong station signals. Yet, only certain houses were troubled. Finally, one night, they struck the clew that put them on the right track.

At one home, it was found that this trouble did not occur when the lights were off. It was thus immediately evident that the house wiring must account for the trouble. Examination of the wiring revealed a faulty contact. When this was repaired, there was no more interference.

Further investigation revealed that faulty grounds or contacts on the power lines often caused the trouble, while in other instances, poor contacts within the house wiring, or even the plumbing, were at fault. In every case, however, there was a poor contact between two conductors, which acted as a rectifier.

### Reported to Commission

On the basis of this, the engineers were able to frame a simple explanation, which the Crosley Corporation presented in report form before a recent meeting of the Federal Communications Commission. It was brought out that the conductor making a rectifying contact becomes a small transmitter, sending out spurious frequencies, which bear a definite relationship to the frequencies of the signals it picks up.

For instance, if the frequency of one station absorbed is designated as a, and that of another, b, the transmitting element sends out the frequencies a+b, a—b, 2a, 2b, 2a+b, 2a—b, 2b+a, 2b—a, 3a, and 3b. Some of these are not heard, because they are outside of the broadcast band. Others occur in positions between stations, where they cause no interference. Occasionally, however, one of these spurious frequencies, coincides with that of a local station, making trouble. This is exactly what happened when listeners complained of hearing WOR and WJZ on the WEAF frequency. For, if WJZ, with a frequency of 760 kilocycles, is designated as a, and WOR, with a frequency of 710 is designated as b, then 2b—a is equal to 660, which is exactly the frequency of WEAF.

### Preventives

In order to prevent this happening radio engineers suggest improved grounding of power lines and house wiring; installation of radio frequency chokes and bypasses, to prevent the power lines from picking up the radio-frequency signals; and, in some cases, a relocation of the receiver antennas in order to diminish pick-up from the power lines.

*Science News Letter, February 27, 1937*

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Fossil plants have been called "thermometers of the past," because they show what ancient temperature conditions must have been to enable them to grow.