

RADIO—AERONAUTICS

# Two New Methods of Gaging Altitude of Airplanes

## Frequency Modulation Used in One System for Telling Distance From Ground; Low Frequency Used in Other

**T**WO METHODS of radio distance measurement, enabling pilots of airplanes to tell not only their distance above the ground, but also, in the case of one of the inventions, that from some reference station as well, are included in the patents issued recently by the U. S. Patent Office.

To Dr. Ernst F. W. Alexanderson, General Electric Company engineer, who has made many inventions pertaining to radio and television, was granted patent 2,248,599, which he assigned to his employers.

Frequency modulation, which is making possible static-free broadcasting, is used in this system. However, Dr. Alexanderson describes it as "a new and fundamentally different method" for distance measurement. Very simple apparatus, compared with some of the complicated devices that have been used for a similar purpose, is required.

From the airplane is sent out a high frequency radio signal, which is reflected back from the ground so as to create a series of standing waves below the aircraft. The frequency, or rate of vibration, of the transmitted wave is varied with great rapidity—so fast, in fact, that when the reflected wave has returned to the plane, and is picked up by a receiver, the frequency change has made a complete cycle. The transmitter is then sending out signals of the same frequency as when the wave left—or at least of some definitely related frequency.

The farther away the ground, the longer it takes the reflected wave to return, and the more slowly need the frequency be changed. The receiver picks up both the original wave, which has travelled but a few feet, and the reflected one. If the two frequencies are the same, there is none of the beat frequency between them that would occur if the two were out of step. In use, the control knob of the transmitter is graduated in terms of altitude. It is turned until the beat disappears, and then the height above the ground is indicated.

The other radio distance device won

patent 2,248,215 for Horace T. Budenbom, who assigned his rights to the Bell Telephone Laboratories, of New York City. Instead of using a high frequency, or short wave, he uses a low frequency, with a very long wave. The wave, in fact, is somewhat longer than the distance to be measured. By receiving it with two different receivers, each with its own special aerial, it is possible to determine the distance between the transmitter and the receivers, in terms of the length of the wave. The indications are made on a phase indicator, of which various types can be used. This can be calibrated in terms of one or more of the wavelengths used at the transmitter so as to show directly the actual distance.

In a modification of the device, the airplane sends out a signal from a

transmitter, to a receiver on the ground. This automatically retransmits it, and it is received back at the plane. Then the apparatus tells the time that was taken. In one form of Mr. Budenbom's invention, the altitude as well as the distance from the ground station are given with the same receiver. Since the ground-reflected wave that tells height comes back much sooner than the retransmitted one for distance measurement, it is possible to separate them by electrical filters, so each is indicated on its own dial.

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A 4,000-year-old *spearhead* used in the Stone Age has been found near Kemi, in northern Finland.

The New York Zoo is exhibiting famous breeds of beef dairy *cattle* in a special exhibit beside the world's wild and primitive cattle.

The *Chinese Dragon* is sometimes explained as having the "nine resemblances": deer horns, camel head, devil eyes, snake neck, sea serpent body, carp scales, hawk claws, tiger paws, and ox ears.



### ORDINARY PHOTOGRAPHY

Show this picture and the one on the facing page to a photographer and ask him the difference between them. He will probably tell you that this one was taken with the diaphragm—the adjustable lens opening—opened to the limit. The one on the facing page, he will doubtless tell you, was made with the lens "stopped down," using a very small opening, to focus sharply on the foreground and the distant background in the mirror at the same time. As a matter of fact, both were made at the same lens opening of *F. 2.7*, with a motion picture camera. This picture was taken in the usual manner. The man in the foreground, 8 feet 6 inches away, is sharp, but the men in the distance, at 48 feet, are blurred.



## IR SYSTEM

To take this picture, a new system of lighting control, invented by Dr. Alfred N. Goldsmith, Harry R. Mennefee, William Mayer and Fritz Kastilan, of New York City, was used. Instead of lighting the entire set continuously, first the foreground is illuminated, then the middle distance, and then the background. By means of a series of compensating plates that revolve behind the camera lens, the focus is kept in step with the lighting, so that whichever part is lit is in focus. For each picture of the movie film, the entire set is lighted. The illumination may be divided into four or even more areas if necessary, while in some cases two might suffice. With this system, in the hands of an expert director, it is expected that many dramatic effects can be introduced into the movies.

## CHEMISTRY

## Mystery Explosive Plant May Be Effort To Avoid Bottleneck

### Any Carbon-Containing Compound To Which Extra Atoms Of Nitrogen Can Be Attached May Replace Toluene

THE NAVY'S plans for a \$70,000,000 "mystery" plant for producing a new explosive may represent an effort to get away from a bottleneck in production of TNT in the unprecedented quantities that will be necessary when the great fleets of super-bombers now building are ready to receive their loads of deadly "eggs"—some of them weighing as much as two tons each.

Toluene, or toluol, basis of TNT, is normally produced from a light oil distilled out of coal tar. But a ton of tar will yield only about six pounds of toluene—and when toluene is demanded in thousands of tons, a bottleneck can very easily develop.

Recently several new methods have been announced for the production of toluene, or other substances "just as good" for high-explosive manufacture, out of petroleum and natural gas. It is within the field of legitimate conjecture that the proposed new plant described by Rear Admiral W. H. P. Blandy before the House Naval Committee might be for the production and processing of toluene or its equivalent from such fluid fuels.

The exact nature of the explosive is simply impossible to guess. In any case, such guessing might not be in the best interests of national defense. Any carbon-containing compound to which

extra atoms (usually three) of nitrogen can be attached is capable of becoming a high explosive. Toluene became the favorite about a generation ago because it is a solid at ordinary temperatures, is easy to handle, and yields a stable, "safe" explosive that doesn't go off until it is told to. But with literally thousands of other carbon-containing compounds available, a wholly new, perhaps more desirable explosive could be worked out and kept safely under wraps of military secrecy until ready for large-scale use.

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## MEDICINE

## Epilepsy and Migraine Are Related Diseases

A GREAT many people, even in this day of free popular discussion of medical topics, illnesses and symptoms, have a prejudice against epilepsy which makes them go far to avoid persons suffering from this disorder and even, perhaps, to hesitate about using the word. These same people, however, are likely to have considerable interest in and sympathy for persons with migraine and the word itself has long had an aristocratic sound. It may surprise such people as well as many migraine and epilepsy sufferers themselves to learn that the two ailments are kin—some sort of cousins, according to Dr. William G. Lennox, of Harvard Medical School. He explains the relationship in his book, *Science and Seizures* (Reviewed, *SNL*, this issue), as follows:

"Epilepsy and migraine are both disorders of the nervous system, but epilepsy involves primarily the brain, and migraine the vegetative (or autonomic) nervous system, that part of the nervous system which is not under the conscious control of the individual. Therefore, if the superficial nature of names is remembered, migraine may be spoken of as an epilepsy of the vegetative nervous system or epilepsy may be called a migraine of the brain."

The same person may have both epilepsy and migraine, as did Julius Caesar. In a study of more than 2,000 patients, more than nine out of every 100 had had attacks of both epilepsy and migraine. Neither epilepsy nor migraine occurred so frequently in 1,000 medical students, nurses and other patients selected for comparison as being representative of the general population. Family histories of patients with epilepsy and migraine also