been considerably over 78 mph., and in a few hours was back at her hangar with no injury to personnel.

In May, 1924, the *Shenandoah* flew to Buffalo. On the return flight, thunderstorm conditions were encountered, as forecast, after dark. A large thunderstorm appeared which the ship quickly put in the rear, but two more large storms developed ahead. The ship successfully drove between these two storms and outdistanced them. Next morning she rode over a dense fog until she reached her hangar.

On August 8, 1924, the *Shenandoah* was successfully moored to the *U. S. S. Patoka,* the first time an airship was ever moored to a floating mast. On this day again, thunderstorms were expected, and sharp look-out was kept. Around noon cumulo-nimbus were sighted in the northwest and the clouds took on the aspect of a line squall. The ship immediately left her mast and subsequently encountered some very interesting cloud formations and air conditions in running southward along the Jersey coast to find an opening in the line squall which developed.

A few days later, on August 15, the *Shenandoah* flew several hundred miles to sea toward Bermuda on a scouting problem. On the return voyage a secondary disturbance which had not appeared on previous weather maps was encountered, and the ship's course was altered to avoid the worst of the wind and rain, based upon the information furnished by the meteorological officer aboard after a study of wind circulation and cloud forms.

The real assurance of the airworthiness of the *Shenandoah* was established by her behavior on the recent epochal trans-continental voyage to San Diego and the far Northwest. The choice of favorable weather conditions was made secondary to the desire to maintain schedule, and the ship flew several of the legs of this voyage under very adverse conditions. A meteorological officer was aboard continuously, and the meteorological information furnished was sufficient safeguard against the ship's undertaking the impossible. Her successful flight against fresh and strong head winds for a large part of the voyage and her admirable behavior in heavy storms, among them a snow storm in the mountains and a sandstorm at 7000 feet over the desert leaves no doubt of the fact that airships with proper meteorological advice can weather storms and gales and many times turn to favorable account air conditions which are unfavorable for surface ships.—*F. W. R.*

The Variation of the Wind With Height

By W. J. Humphreys

The speaker called attention first to the mathematical paper by Ekman, published in 1905, dealing with the effect of a steady wind on the movement of water.

This effect is to cause the surface water in mid-ocean to drift at an angle of forty-five degrees to the right (in the northern hemisphere, left in the southern) of the direction of the wind with reference to that drifting surface: and to cause each deeper and feebler layer to bear this same relation to the one next above it. He next showed that if the air were initially at rest and a water or soil surface should be drawn along under it at a fixed speed and direction, that being the equivalent of a wind, the Ekman oceanographic equations could be applied directly to give the relation between surface winds and gradient winds, and also the change in direction and speed of the wind with height.

A non-mathematical proof of the general effects, equally applicable winds and ocean drifts, also was given.

The conclusion thus derived, although in some respects quite surprising, are in close accord with observations.—(*Author's Abstract*).

(This paper will be published in the *Journal of the Franklin Institute*).

Discussion—MR. H. H. CLAYTON said he was greatly impressed with the explanation given of the increase in wind from the surface to about 500 meters and the decrease above that level. Referring particularly to the increase, he had observed this work with kites many years ago and had found that it was decidedly more pronounced at night than during the day.

DR. HUMPHREYS, in reply, stated that the turbulence at night and in the early morning is of the frictional type, whereas that during the day, particularly in the afternoon, is largely thermal, and extends through a greater range of altitude, resulting in a more moderate rate of increase.

MEISINGER MEMORIAL

The latter part of the morning session of January 3rd was devoted to a resumé of Meisinger's contribution to Meteorology; to a consideration of some outstanding aerological problems that are recommended to students who may desire to compete for grants under the Meisinger Aerological Research Fund; and to a report of the purposes and present status of that Fund.

PROF. C. F. MARVIN reviewed briefly the circumstances leading up to Dr. Meisinger's decision to make meteorology his life work. During the war he served in the meteorological unit of the Signal Corps, and for a considerable period was stationed at Fort Omaha, where he qualified as a balloon pilot. He very soon developed a keen interest in the application of meteorology to aeronautics, and there welcomed an opportunity, which came in 1919, to enter the Weather Bureau and pursue special research along this line. Already possessing the requisite practical training and experience for this pursuit, he at once took up advanced work at George Washington University in order that his theoretical equipment, particularly in physics and mathematics, might be equally complete.

Within a few months after his entry into the Weather Bureau he became convinced that the crying need in meteorology, especially in forecasting, is the development of a method for accurately representing pressure distribution at selected levels in the free air. Synoptic charts at these upper levels would not only be of great aid in aviation, but more important still would show the intimate relations which undoubtedly exist between free-air movement and our day to day weather and