

## SEVERAL CLOUD SPOUTS

By EDWARD M. BROOKS (Worcester, Mass.)

Several cloud spouts were recently observed from the open east slope of Mann Hill, Littleton, N. H. (lat.  $44^{\circ} 21' N.$ , long.  $71^{\circ} 44' W.$ , altitude 1,475 feet above sea level). These cloud spouts were interesting because they occurred at an unusual place and times of day; they were moving in uncommon directions; and, even though one looked like a tornado, it caused no apparent damage.

At 7:30 p. m. (E. S. T.) on July 9, 1931, while the air was calm and sultry, a dark cloud approached at a moderate speed from the north-northwest. A quarter of an hour later, a sudden breeze came over the hill from the northwest just after the front of the dense cloud had passed overhead. Suddenly at 7:50 p. m. a cloud like a puff of smoke rose at a rapid rate from a near-by valley in the southeast. But as this arose, more cloud formed below and so on until there was a ragged column of cloud between the ground and the base of the dark cloud above. This column soon became weaker as it moved southeastward. However, there were other patches below the general cloud base and ragged cones hanging half way down to the ground in the immediate vicinity; one of these, about 5 miles north of the main spout, developed into a rough column extending nearly to the ground. Some of these patches and cones converged with it, especially from the southwest, at the rate of about 35 miles per hour. By this time, 7:55 p. m., the mass, which was now a tornado cloud in the form of a dense funnel-shaped cone inside a rough cylinder of thinner cloud, had receded toward the southeast over the slope of a hill (elevation 1,200 feet above sea level). Since the elevation of the cloud base was about 2,000 feet above sea level as indicated by an observation made with a psychrometer immediately afterward, the tornado cloud was about 800 feet in height. By estimation, a certain portion of a cloud required 25 or 30 seconds to ascend from the ground to the cloud base. Hence the rate of ascent was about 30 ft./sec.

When it was at its best, the cloud spout had reached a point  $1\frac{1}{2}$  miles northeast of Wing Road (lat.  $44^{\circ} 19' N.$ , long.  $71^{\circ} 39' W.$ ). At 8:00 p. m. it had passed over the little hill into a swamp on its southeast side. But by this time the cone had broadened, become less dense, and merged with the huge cylinder, thus indicating a decrease in intensity of the whirl. At 8:05 p. m. the lower end of the column had risen from the ground and was half way to the cloud base. As the cloud spout approached Beech Hill a few minutes later, it disappeared. Except for a few scattered trees probably blown over by it, no damage was visible from the highway running northeastward from Wing Road.

During the night the northerly wind continued, but with much reduced velocity, and heavy rain fell, ceasing on the morning of July 10. At 7:45 a. m. the sky was mostly covered with dense strato-cumulus clouds moving

generally from the southwest. Also there was some fog in a few valleys, especially to the southeast, but it was moving slowly from the north or northeast. At 7:55 a. m. there were a few low clouds about 8 miles to the south-southeast of us in front of Mount Garfield. At 8:00 a. m. these clouds were rising into the cloud base and soon a cloud spout had formed. The rate of ascent of cloud projections from the side of the spout was about 25 ft./sec., according to a rough angular measurement by C. F. Brooks. The spout at its best probably extended to the ground, but this is not certain since Mount Agassiz and Cleveland in Bethlehem cut out half the view. It did not last long because its top was moving in the opposite direction from its base, thus causing it to lean at the top toward the northeast and finally to separate. Other cloud spouts kept forming between 8:00 and 8:30 a. m. in various places toward the southeast, but they were weaker than those that preceded.

## A TORNADO CLOUD IN THE FREE AIR

By ALFRED C. HAWKINS

A very unusual tornado cloud was observed by many people at Wilmington, Del., September 4, 1931. It was a fine summer day, with blue sky, and about 0.2 cirrus and 0.4 cumulus, the latter in small detached showers, high but only a few miles broad. Surface wind from the west, about 5 miles per hour, and cumulus in upper part moving very slowly from the west; lower dark, ragged nimbus from the west-southwest.

The largest shower was due east of Wilmington, I should judge 15 or 20 miles east of the Delaware River, over New Jersey. It was building up and backward and did not appear to move. At 5:45 p. m. a narrow white ribbon appeared in the sunlight, joining the upper part of the cumulus with a nimbus layer at the bottom. It looked like the white ribbon of smoke which an airplane laying a smoke screen might make on a long vertical dive. From 5:45 until 6:00 p. m. this tornado spout was visible, retaining the same position, but developing a bend about two-thirds of the way down, and finally fading out at the bottom, developing a thin point which ascended and descended at intervals. A bulge formed in the spout at times and traveled downward toward the bottom. We could see the spout revolving, but it was never wide at the top. At times the bottom of it glowed a beautiful rose color in the sunlight. It never reached anywhere near the ground, but simply joined the two layers of cloud. If the bottom of the cloud at the dew point were about a mile above the earth, then the spout must have been approximately half a mile high. At 6:00 p. m. some dark nimbus clouds came along and obscured the spout, although it could be seen for some time through holes in the nearer clouds.