the storm the next day . . . cedar trees, with trunks 16 inches through [were found] lying on the upper benches of the mountain, that had been torn up by the roots down in the valley and brought up bodily and deposited among the big timber on top of the range. . . . (*Postmaster Okal, Huntsville, Ala.*)

. . . A mule was hurled 100 feet against a tree stump, its body pierced by a 2 by 4 scantling; a horse was carried several hundred feet into a patch of wood where it was found the following morning apparently unhurt; a steel range from the Preston home was found 3 miles away in a wheat-field; harrows, plows and other agricultural implements were scattered over the fields for miles around; a sewing machine was found hanging from a tree limb. . . . (*Occurred in the tornado of April 12, in Union County, N. C., according to Mr. G. S. Lindgren.*)

This list could be continued indefinitely, and it is presumed that each locality visited could yield a number of remarkable "freaks."

The series of articles in the *Review* is concluded by a reprint from the "Physics of the Air,"[2] by Dr. W. J. Humphreys on the "Tornado and its cause," and a bibliography prepared by Professor C. F. Talman, which gives the principal publications containing statistics of tornadoes in the United States.

It is needless to say that the twenty-one or more tornadoes which have been experienced in the United States this spring, have been terribly destructive of life and property. It is estimated that in the tornadoes of March 28 killed 163, injured several hundred and destroyed ten million dollars worth of property. Those of April 20 were even more destructive of life, there being 229 deaths reported and over 700 injured, with a property loss also extending into the millions. This most destructive of storms is so extremely local that even though there may be a wind speed of between two and five hundred miles per hour in the funnel-cloud, this speed falls off so rapidly with distance from the center that the wind may not even be of destructive violence within a few hundred yards. Owing to this extreme localization, the tornado can not be accurately forecast; and if it could, it is so violent that no precautions could be taken except these already observed in localities where it frequently occurs—namely, keeping in readiness the storm-cave.

2 *Journal of the Franklin Institute*, January, 1918, pp. 114–116.

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SPECIAL ARTICLES

THE SOUNDS OF SPLASHES

UNDER the above title an interesting note has just been published by Professor C. V. Raman and Mr. Ashutosh Dey.[1] The authors call attention in a footnote to the fact "that the splash of a liquid drop is practically soundless unless the height of fall exceeds a certain minimum." In connection with this remark it seems perhaps worth while to publish a note on a preliminary study of a similar problem which I made in 1915. I have been intending to return to the work, but have been giving my attention to other matters.

My observations were confined to drops of water falling into water, and were made by ear. They indicate not only a single minimum height of fall within which the drops strike the water silently, but also other greater heights of fall for which the drops enter the water without sound. The boundary between a region in which a drop makes a sound when it strikes and a region in which it does not make a sound when it strikes is very sharp, a fraction of a millimeter difference in the height of fall being sufficient to pass from a drop which falls silently to one which makes a sharp click when it strikes.

In the figure the results of five experiments are shown. The numbers at the left give the distances in centimeters from the orifice from which the drop fell to the surface of the water below. Each vertical line indicates a range throughout which the drops click when they strike the water. The maximum heights of fall tried are indicated by the horizontal dotted lines.

It will be seen that in most cases a drop strikes silently if it falls less than about 5.5 cm., if it falls more than about 7 cm. but less

1 *Phil. Mag.* (6), 39, p. 145, January, 1920.

than 8 cm., or if it falls more than 11 cm. With increasing size of drop all of these distances increase. Thus the lower limit of the range of sounding which is marked *A* on the figure is about 7.0 cm. for a drop which has a mass of 45 mg., but is between 7.7 cm. and 7.8 cm. for a drop which has a mass of 49 mg.

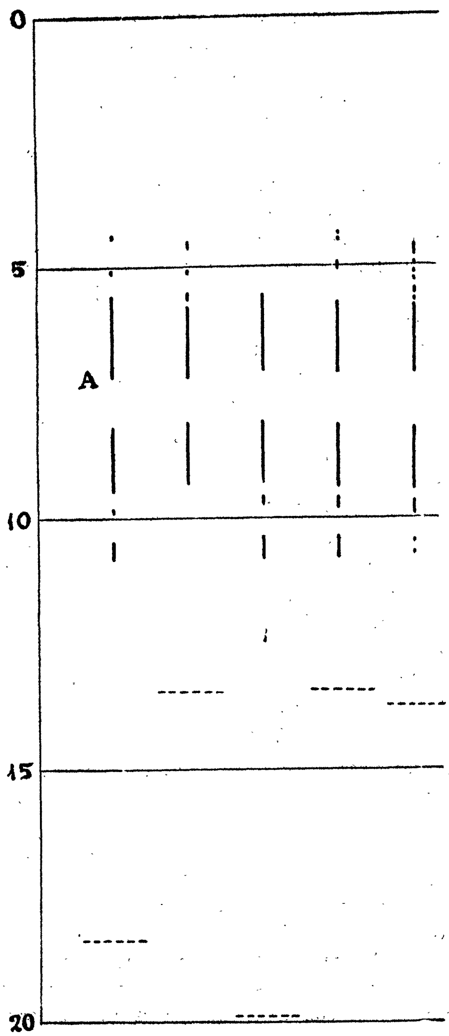

FIG. 1.

The depth of the water into which the drop falls makes no difference so long as this depth exceeds about three centimeters. The horizontal distance from the boundary of the water surface to the point at which the drop strikes makes no difference so long as this distance is more than about a centimeter. The depth of the water surface below the top of the containing vessel appears to be without effect.

Instead of the characteristic sharp click of the drop there was occasionally a softer, duller sound, and when this soft sound occurred the drop often left a bubble at the point where it had struck. In the case of the click no bubble was usually left.

I have no explanation to suggest for this series of sounds. If they depended on the shape of the drop when it struck the water we should not expect an abrupt boundary between the regions of sounding and the regions of silence, and we should expect the series of regions to repeat at distances proportional to the squares of the successive integers.

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THE CRYSTAL STRUCTURE OF ICE

X-RAY photographs of ice were taken to determine its crystal structure following the method used by A. W. Hull.[1] The lines on the film correspond to those of the hexagonal system. They show that ice has a lattice which is built up of two sets of right, triangular prisms interpenetrating one another in the following way. Consider the plane containing the bases of one of the sets of prisms. The molecules lie at the vertices of equilateral triangles of side 4.52 Ångstroms. At a distance of 3.66 Ångstroms above this plane lies the plane containing the bases of the second set of prisms. Here the molecules also lie at the vertices of equilateral triangles equal to those of the first set, but each molecule is situated directly above the center of one of the lower triangles. The other molecules of the crystal will lie directly above the molecules of the two planes just described at intervals of 7.32 Ångstroms. The above values give an axial ratio of 1.62 in good agreement with the crystallographer's value of 1.617.[2] From

1 *Phys. Rev.*, 9, 85, January, 1917.

2 Gmelin Kraut, "Handbuch der Anorganischen Chemie," Heidelberg, Vol. I., 1, p. 107, 1907.