DR. V. H. YOUNG, professor of botany and plant pathology in the University of Idaho, has been appointed to succeed the late Dr. J. A. Elliott as professor of plant pathology in the University of Arkansas and pathologist in the Agricultural Experiment Station.

STEWART A. KOSER, of the U. S. Bureau of Chemistry, has been appointed assistant professor of bacteriology at the University of Illinois.

JOHN L. BUYS, of the University of Akron, has become professor of biology in St. Lawrence University, Canton, N. Y. A. L. Leathers, Ph.B. (Wesleyan '07), Ph.D. (Cornell '16), will teach zoology at Akron.

CARL GEISTER, of the chemistry section of the Iowa Engineering Experiment Station, has been appointed to the fellowship of the Vitrified Tile Floor Association at the Mellon Institute of Industrial Research.

DR. JOHN RONALD CURRIE, professor of preventive medicine, Queens University Faculty of Medicine, Kingston, Ont., has been appointed Henry Mechan professor of public health at the University of Glasgow, Scotland.

## DISCUSSION AND CORRESPONDENCE

### THE UNITY OF ENGLISH WEIGHTS

THERE is but one pound in the English system of weights, and that is the standard pound of 7,000 grains. Every weight known to the English system is a multiple of one or the other of these fundamental and invariable units. The multiples of the pound and of the grain which are used in trade have been fixed entirely by custom or convenience, and not by the prescriptions of arbitrary law. What has been established by custom may, of course, be abandoned by custom. That is the way with free men.

But Professor Alexander McAdie in his letter published in SCIENCE of August 24th, last, states: "7,000 grains make a pound, a certain kind of a pound; 5,760 make another kind of a pound."

The Troy pound (which is Mr. McAdie's another kind of a pound) was abolished as a legal weight in the United Kingdom eighty years ago, and the Troy pound is likewise entirely obsolete in the United States. There is accordingly only one pound weight in the United States and the United Kingdom.

The Troy ounce of 480 grains is now confined to use in the weighing of gold and silver bullion. Statistics of gold and silver production, for example, are given in millions of ounces. The Troy ounce, moreover, has been legally decimalized, both as to submultiples and multiples in the United Kingdom. The British statute on bullion weights provides for the division of the Troy ounce into tenths, hundredths and thousandths, and the Board of Trade standards include these decimal sub-multiples, and also standards for 1, 2, 3, 4, 5, 10, 20, 30, 40, 50, 100, 200, 300, 400 and 500 ounce weights of the Troy or bullion ounce. These decimal sub-multiples and multiples of the Troy ounce are in fact the only Troy weights offered to the trade in England or America. In the Assay Office in New York, gold bullion is weighed in the balance against 500 ounce Troy weights, and the intermediate decimal multiple weights are available when required.

The Troy ounce is obsolete as an apothecary's measure. It is the grain (and there is only one grain in the English system) which is the English unit for medical prescription. The ounce of the apothecaries is not the Troy ounce, but the ounce measure or fluid ounce, which in England is the volume of the standard ounce of water, and in America is the sixteenth part of the pint of the old wine gallon of 231 cubic inches. There is some variation here, the American fluid ounce being the volume of 1.042 ounces of water, whereas the British fluid ounce is the volume of an ounce (one sixteenth of a pound) of water, precisely. We ought to adopt the British fluid ounce in this country. Even now it is customary for apothecaries to regard the fluid ounce as the measure of an ounce of water flat.

Drugs and fine chemicals are fast becoming handled in the trade as "ounce goods," and as such are quoted and sold by the hundred or thousand ounces, the British standard or avoirdupois ounce being indicated, and such drugs, purchased by the avoirdupois ounce, are dispensed on prescription by grains weight, when not sold in solutions measured in fluid ounces. The foregoing is in conformity not only to present practice, but also to the recommendations made by the commissioners for the Restoration of the Standards, in their report to Parliament of December 21, 1841, from which the following paragraphs are quoted:

> 41. That the Troy pound be no longer recognized; that the word pound, or any letters or symbols commonly used to denote the pound, as applied to a weight, be always interpreted to mean the pound of 7,000 grains (formerly called the avoirdupois pound).
>
> 42. That the word ounce be always interpreted to mean 1/16th part of the pound, except it be described as the Troy ounce.
>
> 43. That the use of the Troy ounce and pennyweight be confined to gold, silver and precious stones.
>
> 44. That in contracts applying to any other substance whatever (drugs included) no denomination be recognized lower than the pound except the ounce, the grain and the decimal parts of the pound.

The movement to decimalize the standard ounce, just as the Troy ounce for bullion weights has been

decimalized, ought to be encouraged. Weights of the tenth, hundredth and thousandth part of the standard ounce are now available to the trade, and fine balances with beams graduated to tenths and hundredths of the ounce, are also offered by manufacturers. Package goods for retail trade ought to come in 10, 20, 30, 40, 50 or 100 ounce containers, and liquids should come in containers of the same denominations of fluid ounces, the fluid ounce being newly defined as the volume of the standard ounce of water.

And there is an advantage of far-reaching importance in this project. The inch, equal to 25.4 millimeters, which is the most precise as well as practicable value which can be given the inch, produces 304.8 mm to the foot; or 30.48 mm to the tenth of the foot, the cube of which is 28,316.877072 cubic millimeters, from which it follows that the weight of the cube of the tenth of the foot of water is 28,316.877072 milligrams. But the kilogram, while projected as the weight of the liter of water, has been found to be the weight of 1.000,027 liters of water, which means that the liter of water weighs 1,000,000/1,000,027 kilograms, and that the cc of water weighs 1,000,000/1,000,027 grams. Applying the correction, we find that the cube of the tenth of a foot of water weighs 28,316.112536 milligrams. As the standard ounce is 28,350.2 milligrams in weight, the weight of the cube of the tenth of the foot of water is but 34.1 milligrams less than the weight of the standard ounce. The weight of the grain is 64.8 milligrams, so that by reducing the standard ounce 341/648 or .526 of a grain, or from 437.5 grains to 436.974 grains, we can produce a new ounce which is precisely equal to the weight of the cube of the tenth of the foot of water, and of which 1,000 would equal one cubic foot, just as 1,000 grams equal 1 cubic decimeter of water.

Let us, therefore, have a new American standard ounce, precisely equal in weight to the ounce measure of water, defined as the volume of the cube of the tenth of the foot, and then let the standard American ounce be divided into decimal sub-multiples corresponding to the dimes, cents and mills of the dollar, and be used in decimal multiples for retail trade weights. The change from our present weight standards would only be about one per thousand (or more precisely, 1 per 900), which is well within the tolerances allowed for trade weights. The change would accordingly be entirely negligible in trade and contracts, and would give us a scientific precision in weights, and a correlation of weights and volumes that leaves nothing to be desired.

The so-called long ton in America should be abolished by law, as it has already become obsolete by custom in a large part of the country. The long ton is now unknown in the great coal and metalliferous mining trades of the Rocky Mountain region. The all-important ton-mile of the railroads, in universal use the country over, is based on the standard ton of 2,000 pounds.

The Troy pound may be regarded as obsolete, and the long ton as obsolescent, and accordingly as nonexistent in the United States, except in the historical sense.

SAM'L RUSSELL

WASHINGTON, D. C.

## PECULIAR HAIL

WHILE engaged in field work for the Illinois Geological Survey in the vicinity of Oregon, Illinois, the writer observed a hail storm that had certain peculiar characteristics. The storm occurred about mid-afternoon on August 7, and was observed in Oregon, which is in Rock River Valley, about 100 miles west of Chicago.

The preliminary meteorological conditions were: (1) A gentle two-hours' rain in the early forenoon, followed by clear skies; (2) increasing cloudiness towards noon with heavy storm clouds formed in the northwest, from which a hard rain passed to the south and another to the north and east; (3) increasing sultriness after noon until it became very oppressive prior to the close approach of the storm, and (4) an apparently heavy rain moving from northwest to the north and east, followed by the formation or splitting off of a smaller storm in the northwest, which spread rapidly west and south as it moved southeastward toward Oregon. In the latter storm heavy, dark clouds were moving swiftly, with considerable "boiling" in the southeast portion. High wind and heavy rain appeared to be approaching rapidly, accompanied by some violent lightning and thunder, but less than is common in a typical thunderstorm.

The storm reached Oregon from the northwest as a sudden squall of wind, quickly followed by large raindrops, with a few hail of uncommon size. Leaves began to be abundantly blown and beaten off the trees. The hail increased rapidly in size and quantity so that the lawns were soon covered as though by a layer of coarse quartz gravel. This continued for about three minutes, with considerable wind and rain, then the storm rather rapidly subsided, until the sun was shining about 15 minutes after the first hail fell. In one district only was the wind violent, as evidenced by overturned trees and shattered windows. Outside of this limited area few windows were broken.

Most of the hail was of a size and form not observed hitherto by the writer in his experience with hail storms in the Mississippi Valley and the northern Rocky Mountains. Hail measured immediately at the close of the storm with dimensions of 2″ x 1″ x ¾″ were plentiful, and a few were 2½″ x 2″ x 1¼″. One stone 2″ x 3″ was reported. Hail about one inch