

Now any of the widths may be combined with a great diversity of lengths and these again may be combined with a great diversity of angles. We readily see that in this way we arrive at a vast multitude of slight variations in these instrument forms, any attempt to specify individual instruments without some rules for limiting the number becomes hopeless.

I took up this matter as a subject of study a number of years ago, with the thought that these instrument forms, or a sufficient number of them, could be specified by formulæ, as is done generally with mechanics' tools; as the quarter-inch auger, half-inch chisel, etc. In this study I was at first led into a very complicated system of measurements, which I consider too complex to introduce into school work. But the need of some available system has been so constantly apparent that the subject has not been allowed to rest. Work has been renewed at intervals with each new thought obtained; and finally the idea of a strict limitation of instrument forms in breadths, lengths, and angles of blades has been arrived at. The carpenter will not buy an auger or a chisel that has not been made to a definite formula—a definite measurement. This is true of mechanics' tools generally. They are all made to specified formulæ. It may be said that the mechanic's drills are made to definite formulæ in order that he may fit bolts made to similar definite formulæ, and that the dentist does not do this. True, but the mechanic also uses these formulæ in naming both his drills and his bolts that he may know them. Why should not the dentist have his instruments made to definite formulæ in order that he may know them, and designate the one fitted for a special act in excavating? Why should he have an infinite variety of forms without definiteness? No one dentist uses such a variety. Why should we not agree upon definite angles of the blades of hatchet and hoe excavators, and combine with these angles definite sizes, or widths and lengths of blade? In this way we may gain a sufficient number of forms of cutting instruments and rule out all others. And then the thought has also come to me of arranging these in definite sets in which the formula names shall run on definite gradations for all of the instruments of each set, and in this way so construct them that they will be easily learned and remembered by students.

A strict study of the subject from this standpoint develops the fact that we do not need more than three, or at most four angles. Now with each of these three or four angles we will combine one long blade of definite width, one medium length of definite width, and one short blade of definite width, stipulating that the lengths and widths shall be the same in each angle. This makes a set of hatchets—if three angles be used—of nine instruments, and a set of hoes of nine instruments, or eighteen instruments in all. These we may name the set of ordinaries. (See list of formulæ No. 4.)