more than a screw of great pitch, from ten to one hundred times as great as an ordinary screw of the same diameter. The first part of the calculation requires arithmetic only, but the second a slight knowledge of trigonometry. As can readily be seen from the lower half of Fig. 1, the angle that the spiral makes with the axis of the work, and consequently the angle between the cutter and the work, is the angle whose natural tangent is the ratio of the circumference of the work to the pitch of the spiral. Of course tables are given to cover most of the cases that will arise, but the utility of being able to calculate the proper gears and angle appears when a spiral is to be cut which is not on the tables. Instances like the above of the necessity of arithmetical calculations in the mechanical trades may be multiplied indefinitely, while the inability of the average mechanic to undertake them is clearly shown by

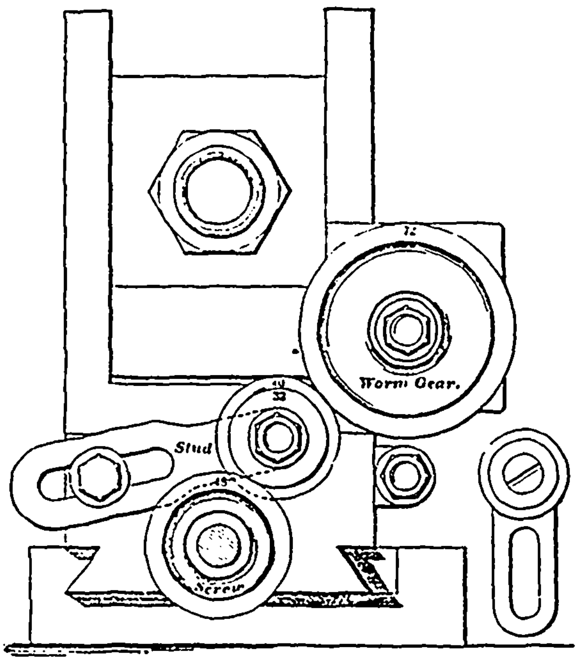

Fig. 2.

the rules, formulae and tables, which are met so frequently. I venture to say, however, that the one branch of mathematics most universally useful in all the mechanical trades is that of geometry. By geometry is not only meant the ordinary Collegiate Institute idea of the term, including practically only Euclid's elements, but also the more modern constructive and descriptive part of the subject, which is usually included in the study of mechanical drawing. Euclid, although useful, and, I think, necessary as a training for mechanics, and also as an aid in many problems likely to arise, is not so generally used practically as descriptive geometry. A knowledge of descriptive geometry and mechanical drawing will prove of very great service in every one of the mechanic arts, and is, in fact, indispensable in most of them. That mechanics should be able to read drawings is absolutely necessary. To be able to reproduce them would indicate the acquisition of a very fair knowledge of geometry, in no other way so easily attained.

To illustrate the importance of geometry in the mechanical trades seems hardly necessary, when you consider that every structure and machine is based on geometrical lines and conforms to geometrical principles. A few examples showing the application of geometry in some mechanical problems will, however, be given. How would the carpenter, if geometry were unknown, determine the forms and sizes of the various parts used in building construction? Or how would the tinsmith construct any vessels for domestic use?

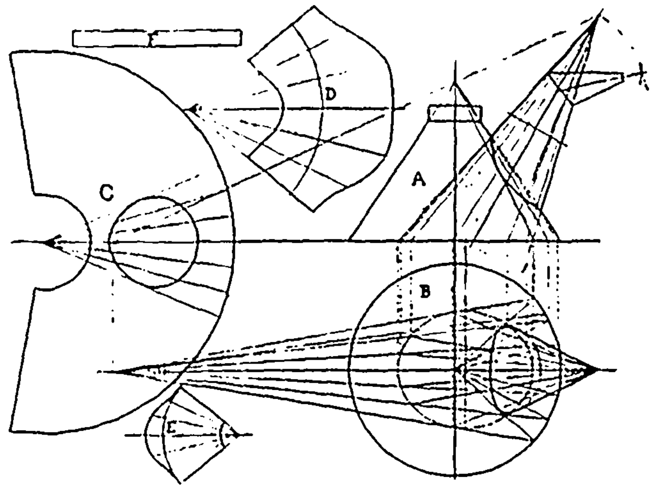

Fig. 3.

Even so simple a utensil as an ordinary tin pail would require some thought, perhaps, from our undergraduates in mathematics, in order to develop the proper form to cut the tin, that when rolled up and joined, it might be the correct shape. Again, let us consider another domestic utensil, a tin teapot. Although the tin is not beneficial to the flavor of the tea made in it, the construction of the pot itself forms a very fine problem. Figure 3, A, shows the general outline of the teapot, which I will grant is not an orthodox shape, but the peculiarities have been exaggerated for the sake of example. B. is the view from above showing the intersection of the body and spout. C. is the developed form of the body of the teapot; D. the form of the lower, E. of the upper part of the spout; F. is the band at the top, while the bottom, of course, will be a circle of the same diameter as B. The development of these forms would I fancy be rather too intricate for most of us. But you may say that tinsmiths cut the tin approximately to shape and then trim it afterwards, or that they have patterns. Well, how close an approximation would your

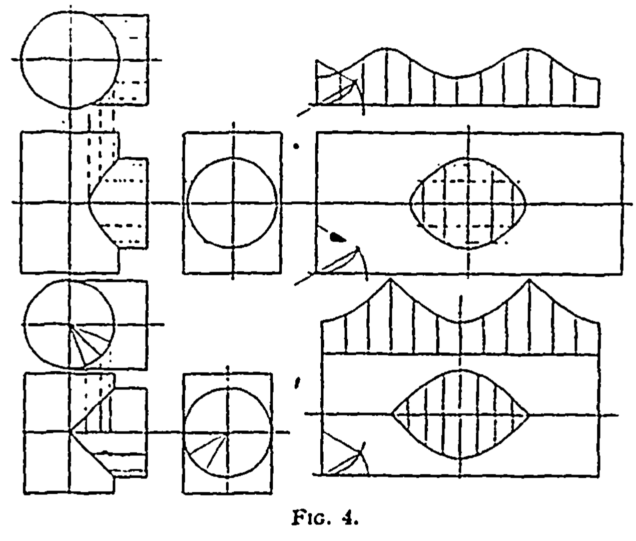

Fig. 4.

first guess of the shape of the spout be? Or how were the patterns obtained? How do boilermakers, in the construction of boilers, determine the forms to be given to the sheets, that, when rolled up, they may ex-