

## MECHANICAL DRAWING.

As to the representation of the three dimensions, without pictorial effects, by plans, elevations, sections, etc., for the guidance of workmen, only a word more need be said. Descriptive geometry, or orthographic projection, forms the basis of this kind of drawing, which begins with the varied representations that may be made of geometrical solids, and then proceeds to practical applications in the different industries of the principles thus demonstrated. The same general principles of representation are involved in drawings for all kinds of constructive purposes, so that when they have been learned for one they have been learned for all, and these principles are derived from geometry. Indeed, *geometry, in some form, should be recognized as the true basis of every variety of drawing, whether industrial or artistic.*

Since drawings of objects to be constructed represent them in parts and without pictorial effects, they consequently make a special demand upon the imagination. Not only the draughtsman who prepares such drawings, but the workman who receives them for his guidance, must make from them, by an effort of the imagination, a vivid mental picture of the object required. Hence, the ability to "see in space," as it is often called, to realize form by an intellectual effort, becomes a matter of decided importance in technical education. And hence the imagination should be well trained both by drawing from the actual solid, and by representing the three dimensions orthographically. For the purposes of instruction in the latter case, flat copies must be the chief reliance; but these need to be supplemented by corresponding solids to assist the first efforts of the callow imagination.

## THE IMAGINATION.

Let it be noted that the sculptor and the painter need the very power which the mechanical draughtsman requires, of realizing form in space by an effort of the imagination. And so instruction good for the latter cannot be, as some so loudly protest, injurious for the former. They have, at least, this most important use of the imagination in common. It is quite as rare a thing to find a mechanical draughtsman with an imagination equal to all the requirements of machine drawing, as to find a sculptor equal to all similar requirements of his art. A good course in orthographic projection would help any artist, while it is an absolute essential of advanced technical education.

There is another mode, a very simple one, which is sometimes employed in certain cases to represent the three dimensions for constructive purposes. This is isometric projection, which combines plan and elevation in one drawing, and affords an interior view when required. A working-drawing and, in a certain sense, a picture at the same time.

## MATERIALS.

Just a word now about the materials employed as vehicles of expression, and to which we are indebted for terms designating different varieties of drawing, as instrumental drawing, point drawing, crayon drawing, stump drawing, charcoal drawing. For the purposes of advanced technical education, the hand ought to be accustomed to the use of different materials. Change of material does not necessarily involve change of work; for whatever materials may be used, the student must work according to certain broad, underlying principles, found, when properly sought, in one or the

other of the great departments of drawing which have been described, and are, in brief, as follows:

## RECAPITULATION.

1. Drawing two dimensions. Freehand and instrumental. For decoration, for designing the forms of many objects, and for mechanical purposes.
  2. Drawing the three dimensions from the solid or round. Effects of *chiaroscuro*. Freehand. For both artists and artisans, but especially for the former.
  3. Drawing the three dimensions, with perspective effects of objects to be constructed. Instrumental. Not to be confounded with drawing from the solid. For both artistic and mechanical purposes, but especially for the latter.
  4. Drawing the three dimensions of objects to be constructed; no *chiaroscuro*, but orthographic representation to a scale. Instrumental. For artisans.
- And so it may very properly be said of drawing, that it rests on a broad basis of definite principles, and that its applications are infinite. It is the universal language of form. The foreigner who understands this language can, upon entering any first-class American workshop, go at once intelligently about his work, while an American ignorant of it would have to be directed at every step. This language, of such vast scope, is not to be learned in a day. No mere trick, no mere device or universal patent recipe can put one in possession of this hundred-handed instrument of art and industry. Therefore beware of drawing-quacks.

## DRAWING IN TECHNICAL SCHOOLS.

If we examine the curriculum of any good school for advanced technical instruction, we find that drawing occupies a large space. This is for the civil engineer, for the architect, for the ship builder, for the machine draughtsman for the designer of manufactures, for the decorator, for the founder, for the miner, for the farmer, for almost every human industry. Some industries require more, others less of drawing; and it goes without saying that each industry must have its special requirements, though there are certain things that belong to them all in common. In the best technical schools there is no haste to reduce the instruction to a rigid specialty in the case of any student. With workmen the case is different.

## VALUE OF BROAD INSTRUCTION.

Experience has shown that he succeeds best in any particular kind of drawing who has been instructed in all kinds. Thus the knowledge of the architect, for example, should not be limited to the requirements of construction: he should know how to decorate; he should be able to give his perspective drawings an agreeable background of sky and earth, with animal and human figures. The designer for pottery or textile fabrics will do his own work better, when his knowledge of the art of design is comprehensive enough to make him intelligent in furniture and the grouping of figures in a picture. But it is not necessary to enlarge on this point.

## PARTS OF DRAWING ADAPTED TO DIFFERENT AGES.

As drawing like everything else, has its elements which can be learned in childhood and early youth, these elements should not cumber the curriculum of the technical or advanced industrial schools, but, like those of arithmetic and grammar, should be made a requisite for admission to the technical schools. Were such the case, *there would be saved certainly one year of the time which the student is now obliged to spend in*