## INTRODUCTORY REMARKS.

ALL work in Linear Perspective requires to be done mechanically, except in the case of curves which cannot be drawn by means of compasses.

The following are the necessary instruments :--

**Pencils**—either H or HH, sharpened to a wedge-shaped point, the flat side of which should rest against the ruler in drawing lines. A piece of fine sand paper is about the best thing for keeping the point of the pencil sharp, and saves the blade of the pocket knife.

Ruler—made of hard wood, at least six inches long, with a straight edge, and divided into inches, and halves, quarters, eighths, and sixteenths of an inch.

Compasses-with steel, pencil, and pen points which fit into a socket in one of the legs. The stationary leg should have a needle point if possible, so that its length may be altered to correspond to whichever one of the mevable points is in use. Tho stationary leg should be a trifle longer than the other leg when the pencil or pen point is in use, and exactly the same length when the steel point is in use. The pencil used in the pencil point should be a little softer than that used with the ruler, as F or . H, and should be sharpened in the same way. In drawing circles its edge should always be perpendicular to the radius. Properly constructed compasses have a hinge joint in each leg, so that when the pencil or pen point is in use, it can be kept perpendicular to the surface of the paper. If this is not attended to in the case of the pen point, the pen will not work properly. The joint of the compasses can be tightened or loosened by means of a little metal key which accompanies them. The joint should not be so loose that the legs will change their relative position when the compasses are being used, nor should it be so tight as to require any exertion to separate the legs. Practice will teach just how tight it should be. The compasses should be held loosely by the joint only, between the thumb and first finger, with the steel or needle point resting on the paper, without any pressure, and the other leg made to revolve around it. The student should practise until he can draw several concentric circles without puncturing the paper with the steel point. It is absolutely necessary that the steel point should be as sharp as it is possible to make it. India ink only should be used in the pens, as other inks corrode and spoil the points. The two steel points are used together when it is necessary to measure or to set off distances very accurately.

A Drawing Pen for "inking in " straight lines. Its points should be exactly the same length and ground to a sharp rounded edge. In use it should be held nearly vertical, with the handle slightly inclined in the direction of the edge of the ruler, and drawn along the paper at a uniform rate of speed without any stoppages. It should be wiped out with a rag or piece of chamois skin every time it is filled, and before being put away.

**Protractor**, made of either metal, horn, ivory or wood ; used for measuring angles. It is not absolutely necessary, but most boxes of mathematical instruments contain a protractor. Its form and instructions for constructing one are given in an exercise on problem xili, in book 2, High School Drawing Course. In using it the centre of the semicircle is placed over the point where the angle is to be constructed, with the diameter coinciding with one line of the angle, and a pencil mark made at the circumference opposite the proper number. A line is then drawn through this point from the centre.

A Set Square, being a triangle of thin wood, will be found useful, though not necessary, for drawing parallel lines and erecting perpendiculars. The ruler is held in position and the set square slid along, with one edge firmly pressed against it. A square about five inches high, having angles of 30°, 60° and 90° will be most convenient.

The importance of being able to change the proportion existing between the object and the drawing of it, will be evident when we consider the limited space our paper offers for a picture of a house, a tree, a street, or even of a room. The method adopted for reducing the size of a drawing is called working to a scale, and may be briefly stated as follows : The unit of measurement of the object being taken, it is divided into a convenient number of equal parts, and one of the divisions is used as the unit of measurement in the drawing. If an object is 12 feet long the unit of measurement is one foot, which is divided into any number of parts, say 12. Then one-twelfth of a foot, or one inch becomes the unit of measurement in the drawing, which will be one-twelfth of the natural size of the object, and therefore one foot long. This scale may be expressed either by the words "scale, 1" to the foot," or by the fraction " $\frac{1}{12}$ ." In a similar way, if one foot is divided into 16 equal parts and Is be used as the unit of measurement in the drawing, the scale will be one of "" to the foot," or "L." It must be remembered that if the scale is expressed by a fraction, it indicates the proportion which every portion of the drawing will bear to the corresponding portion of the object drawn.

The sign 'attached to a figure signifies foot or feet, and the sign ", inch or inches: thus, I'G" reads 1 foot 6 inches, and  $\mathcal{X} I$  "reads 2 foot 6 inches, and  $\mathcal{X} I$ " reads 2 foot 1 inch.

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