the making of a pattern in wood of that part. The knowledge of the process required in the production of this pattern can come only through familiarity with the use and scope of the wood working tools. Pattern making brings into use the principles of the bench and lathe, it brings into practice, care and the observation of minor details.

The next step in the series of operations is the reproduction in iron of the pattern. This is accomplished in the foundry, a link that has not yet been supplied at the University of Oregon. The casting as it comes from the foundry is then taken to the machine shop, where it is put through the various processes to bring it to the exact dimensions of the finished article.

The machine shop teaches exactly how iron of the various kinds may be chipped, filed, turned in the different lathes, or cut down in the planer or shaper.

The construction and working principles of these machines are essential to all engineers and can only be learned by familiarizing one's self with the machine as it works in the shop. Of course, every shop may have machines designed for the same work of different make but the general construction and working principles of all of them are based on the same plan. In their operations in the machine-shop it is often necessary to make a special tool for a certain kind of work; this is accomplished in the forge shop. In the forge shop, too, are produced many of the machine parts that are subjected to greater strains than can be withstood by the cast iron of the foundry, these must be of steel forged to shape. The tempering of cutting tools and cold chisels is an everyday problem to the engineer. This problem is solved scientifically as well as practically in the forge shop. The welding of iron and steel is also learned at the forge.

Shops should contain at least one unit of the more usual classes of tools used in the operations outlined above, any increase being along the lines of special tools for special purposes or of an increased number of tools of one kind to accomodate an increased number of students.

Later developements in connection with shops are courses in shop management, covering systems of machine drive, costs of material, maintenance and wages and their bearing on the total cost of production. These courses are especially desireable for men wishing to become managers of industrial plants or those who may undertake contract work.

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