THE MAKING OF A LEAD PENCIL.

The lead pencil, so generally used to-day, is not, as its name would imply, made from lead, but from graphite. It derives its name from the fact that prior to the time when pencils were made from graphite, metallic lead was employed for the purpose. Graphite was first used in pencils after the discovery in 1565 of the famous Cumberland mine in England. This graphite was of remarkable purity and could be used without further treatment by cutting it into thin slabs and incasing them in wood.

For two centuries England enjoyed practically a monopoly of the lead-pencil industry. In the eighteenth century, however, the lead-pencil industry had found its way into Germany. In 1761 Caspar Faber, in the village of Stein, near the ancient city of Nuremburg, Bavaria, started in a modest way the manufacture of lead pencils, and Nuremburg became and remained the center of the lead-pencil industry for more than a century. For five generations Faber's descendants made lead pencils. Up to the present day they have continued to devote their interest and energy to the development and perfection of pencil making. Eberhard Faber, a great-grandson of Caspar Faber, immigrated to this country, and, in 1849, established himself in New York city. In 1861, when the war tariff first went into effect, he erected his own pencil factory in New York city and thus became the pioneer of the lead-pencil industry in this country. Since then four other firms have established pencil factories here. Wages, as compared to those paid in Germany, were very high, and Eberhard Faber realized the necessity of creating labor-saving machinery to overcome this handicap. Many automatic machines were invented which greatly simplified the methods of pencil making and improved the product. To-day American manufacturers supply nine-tenths of the home demand and have largely entered into the competition of the world's markets.

The principal raw materials that enter into the making of a lead pencil are graphite, clay, cedar and rubber.

Although graphite occurs in comparatively abundant quantities in many localities, it is rarely of sufficient purity to be available for pencil making. Oxides of iron, silicates and other impurities are found in the ore, all of which must be carefully separated to insure a smooth, serviceable material. The graphites found in Eastern Siberia, Mexico, Bohemia, and Ceylon are principally used by manufacturers. The graphite, as it comes from the mines, is broken into small pieces, the impure particles being separated by hand. It is then finely divided in large pulverizers and placed in tubs of water (Fig. 1), so that the lighter particles of graphite float off from the heavier particles of impurities. This separating, in the cheaper grades, is also done by means of centrifugal machines, but the results are not as satisfactory. After separation the graphite is filtered through filter-presses.

The clay, after having been subjected to a similar process, is placed in mixers with the graphite, in proportions dependent upon the grade of hardness that is desired. A greater proportion of clay produces a greater degree of hardness; a lesser proportion increases the softness.

Furthermore, the requisite degree of hardness is obtained by the subsequent operation, viz., the compressing of the lead and shaping it in to form ready to be glued into the wood casings (Fig. 2). A highly compressed lead will produce a pencil of greater wearing qualities, an important feature in a high-grade pencil. Hydraulic presses are used for this purpose; and the mixture of clay and graphite, which is still in a plastic condition and has been formed into loaves, is placed into these presses. The presses are provided with a die conforming to the caliber of the lead desired, through which die the material is forced. The die is usually cut from a sapphire or emerald or other very hard mineral substance, so that it will not wear away too quickly from the friction of the lead. The lead leaves the press in one continuous string which is cut into the lengths required (usually seven inches for the ordinary size of pencil), placed in crucibles, and fired in muffle furnaces. The lead is now ready for use, and receives only a wooden case to convert it into a pencil.

The wood used in pencil making must be close and straight grained, soft so that it can readily be whittled, and capable of taking a good polish. No better wood has been found than the red cedar (*Juniperus virginiana*), a native of the United States, a durable, compact and fragrant wood, to-day almost exclusively used by pencil makers the world over. The best quality is obtained from the Southern States, Florida and Alabama in particular. Eberhard Faber established his first cedar mill in Cedar Keys, Florida, in the early sixties, whence he supplied his own demand and exported considerable quantities to European manufacturers.

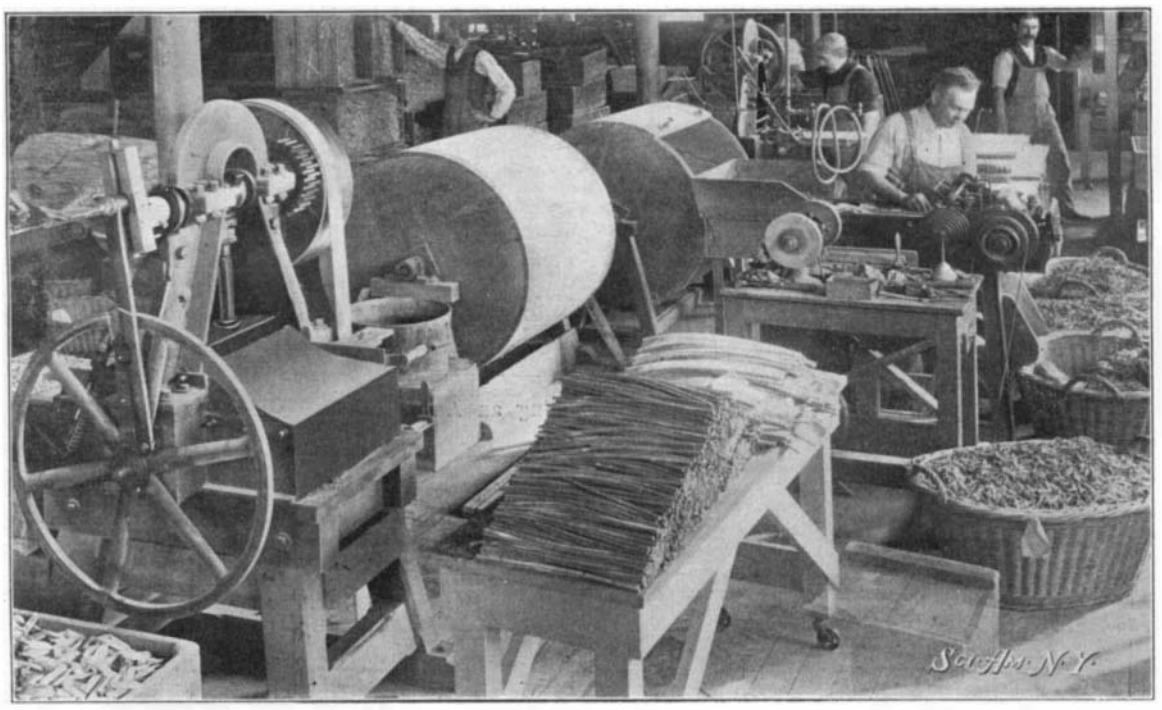

Fig. 9.—Cutting Rubber Bands and Erasers.

The wood is cut into slats about 7 inches long, 2½ inches wide, and ¼ inch thick. It is then thoroughly dried in kilns to separate the excess of moisture and resin and to prevent subsequent warping. After this the slats are passed through automatic grooving machines (Fig. 3) each slat receiving six semi-circular grooves into which the leads are placed, while a second slat with similar grooves is brushed with glue (Fig. 4) and covered over the slat containing the leads. This is passed through a molding-machine which turns out pencils shaped in the form desired, round, hexagon, etc. The pencils are now passed through sanding machines to provide them with a smooth surface.

Fig. 10.—Boxing the Rubber Bands.

After sandpapering, which is a necessary preliminary to the coloring process, when fine finishes are desired, the pencils are varnished by one of several methods. That most commonly employed is the mechanical method by which the pencils are fed from hoppers one at a time through small apertures just large enough to admit the pencil. The varnish is applied to the pencil automatically while passing through and the pencils are then deposited on a long belt or drying pan. They are carried slowly a distance of about twenty feet, the varnish deposited on the pencils meanwhile drying, and are emptied into a receptacle. When sufficient pencils have accumulated, they are taken back to the hopper of the machine and the operation repeated. This is done as often as is necessary to produce the desired finish. The better grades are passed through ten times or more. Another method is that of dipping in pans of varnish, the pencils being suspended by their ends from frames, immersed their entire length and withdrawn very slowly by machine. A smooth enameled effect is the result. The finest grades of pencils are polished by hand (Fig. 5). This work requires considerable deftness; months of practice are necessary to develop a skilled workman. After being varnished, the pencils are passed through machines by which the accumulation of varnish is sand-papered from their ends. The ends are then trimmed by very sharp knives to give them a clean, finished appearance.

Stamping is the next operation (Fig. 6). The gold or silver leaf is cut into narrow strips and laid on the pencil, whereupon the pencil is placed in a stamping press, and the heated steel die brought in contact with the leaf, causing the latter to adhere to the pencil where the letters of the die touch. The surplus leaf is removed, and, after a final cleaning, the pencil is ready to be boxed, unless it is to be further embellished by the addition of a metal tip and rubber, or other attachment.

In this country about nine-tenths of the pencils are provided with rubber erasers. These are either glued into the wood with the lead, or the pencils are provided with small metal ferrules (Fig. 7) threaded on one end, into which the rubber eraser-plugs are inserted. These ferrules are made from sheet brass, which is cupped by means of power presses, drawn through subsequent operations into tubes of 4 or 5 inch lengths, cut to the required size, threaded and nickel-plated. Eberhard Faber has a large number of these presses which are continually operated for this purpose alone. The rubber plugs used in these pencils are but one of many rubber products (erasers, bands, and the like) made in the E. Faber factory in Newark. These articles are all made from pure Para gum, which is thoroughly masticated in huge powerful masticating machines (Fig. 8), then cured, mixed with sulphur and the necessary ingredients to add to its erasive qualities, and vulcanized. The rubber is molded, and in some cases cut, to the required sizes (Figs. 9 and 10).

The Pennsylvania Railroad tunnel under the Hudson River was begun on June 25. The tunnel work is divided into two sections, known as the northern and the eastern sections. The first drill holes for the first shaft were started at noon at the foot of 32d Street and Eleventh Avenue, New York.

In addition to being an ill-smelling, noxious plant, the jimson weed (*Datura stramonium*), also known as stinkweed and stinkroot, has distinctly poisonous properties and should be exterminated wherever growing. It is recommended by the poison plant specialists of the Department of Agriculture to mow the weed while in blossom. The seeds are especially poisonous, and fatal cases are known of children eating them. Poisoning can also be produced by sucking the flower, which is an attractive-looking, very light lavender blossom. Cattle in a few instances have been poisoned by eating the leaves of young plants, where present in grass hay, but these animals either avoid the plant or are very resistant to its poison. Young plants do not contain a large proportion of poison.—G. E. M.

The Russian Department of Agriculture is offering two prizes for the best separators of average dimensions and capable of treating from sixteen to twenty gallons of milk an hour. The competition is open to foreigners, and entries must be made before February 28 (new style), 1904. The prizes will be 1,500 rubles and 500 rubles, or about $825 and $275 respectively.

Fig. 1.—Lead Mills and Mixers.

Fig. 2.—The Lead Presses.

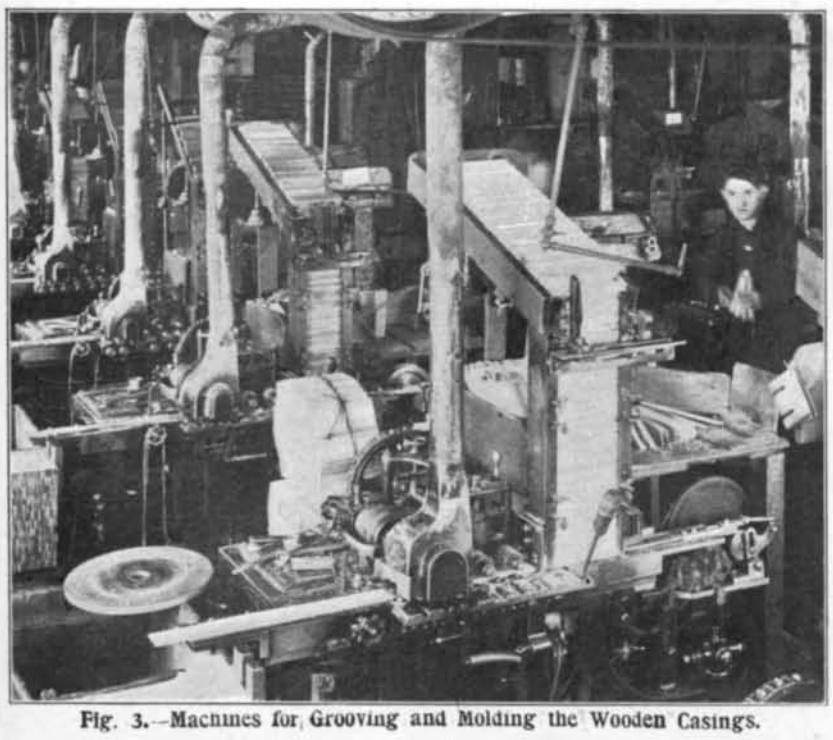

Fig. 3.—Machines for Grooving and Molding the Wooden Casings.

Fig. 4.—Gluing the Leads in Their Casings

Fig. 5. Hand Polishing the Finest Pencils.

Fig 6.—Stamping the Pencils.

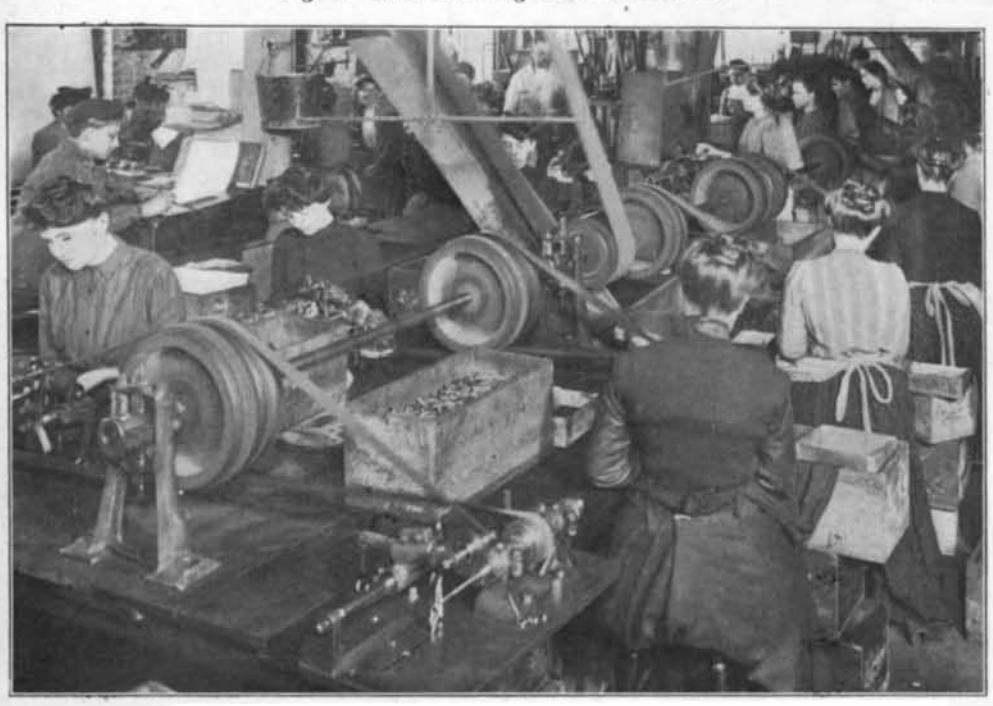

Fig. 7.—Metal Tipping.

Fig. 8.—Rubber Masticators.

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