

upon the metal, the negative must be made accordingly. After having dissolved the unaffected coating the plate may be subjected to the action of acids, etching the plate and leaving the picture in high relief. The metals commonly used for photo-engraving are copper and zinc; zinc being used for line work and copper for half tones.

*Etching.*—In making engravings the metal is first cleaned and then carefully polished. When perfectly smooth it is coated with the sensitive solution. This is merely a solution of albumen—the white of eggs—water and bichromate of ammonium. After coating the plate it is dried and exposed to light under the prepared negative. When the plate has been sufficiently printed it is removed, given a thin uniform coating of transfer ink and then washed in water with a tuft of cotton. This removes all the soluble matter leaving the picture, on the clean zinc surface, in black lines. To further increase the resistivity of the plate to acids it is dusted with dragon's blood, a reddish-brown resin, and then carefully brushed, with a soft brush, free from all surplus powder. This adheres to the ink alone. The plate is next heated until the powder is incorporated with the ink, which is indicated by turning a glossy black. The plate is now ready for etching, but, before placing in the acid bath, the back is coated with asphaltum varnish to protect it. To etch or "bite" the plates dilute nitric acid is used, it being allowed to act from three to five minutes, leaving the picture in slight relief. It is now taken out, washed, dried, repowdered, reburned, and again returned to the acid for its second bite. In all about four bites are given, each succeeding one deeper than the previous bite, which finishes the operation. The plate is taken out, scrubbed with lye to remove the ink and dragon's blood and then turned over to be mounted type-high for the printer's use.

For the production of half tone engravings the *modus operandi* is much the same. A copper plate is coated with the sensitized albumen and exposed under the negative. The etching is done by a strong solution of perchloride of iron, which is allowed to act continuously until the etching is deep enough. In this process inking and powdering are not resorted to, but the compound on the plate is heated until it is dark brown or black; this being sufficient to resist action. If zinc be used in place of copper the etching may be made in a manner exactly like that described for line reproductions.

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