MACHINISTS RECEIPTS.

Belgian Welding Powder.—Iron filings, 1000 parts ; borax, 500 parts ; balsam of copaiba, or other resinous oil, 50 parts ; sal-ammoniac, 75 parts. Mix all well together, heat, and pulverize completely. The surfaces to be welded are powdered with the composition, and then brought to a cherry red heat, at which the powder melts, when the portions to be united are taken from the fire and joined. If the pieces to be welded are too large to be both introduced into the forge, one can be first heated with the welding powder to a cherry red heat, and the other afterwards to a white heat, after which the welding may be effected.

Composition Used in Welding Cast Steel.—Borax, 10 parts ; sal-ammoniac, 1 part ; grind or pound them roughly together ; then fuse them in a metal pot over a clear fire, taking care to continue the heat until all spume has disappeared from the surface. When the liquid appears clear, the composition is ready to be poured out to cool and concrete ; afterwards being ground to a fine powder, it is ready for use. To use this composition, the steel to be welded is raised to a heat which may be expressed by "bright yellow ;" it is then dipped among the welding powder, and again placed in the fire until it attains the same degree of heat as before ; it is then ready to be placed under the hammer.

Tempering Steel Springs.—The steel used should be that called "spring" for large work ; for small work, "double shear." After hardening in the usual way, in water, or, as some prefer, in oil, dry the spring over the fire to get rid of its moisture, then smear it over with tallow or oil, hold it over the flame of the smith's forge, passing it to and fro, so that the whole of it will be equally heated, holding it there until the oil or tallow takes fire. Take the article out of the fire and let it burn a short time, then blow it out. This process may be repeated two or three times if the operator fancies that any portion of the spring has not been reduced to the proper temperature, or rather, raised to it.

Tempering Spiral Springs.—Place a piece of round iron inside the spring, large enough to fill it ; then make the spring and iron red hot, and, when hot place them quickly into cold water, and stir them about till cold ; afterwards rub them with oil or grease, and move them about in a flame till the grease takes fire ; the spring will then be reduced to its proper temper.

To Soften Malleable Iron.—When your furnace is charged with fuel and metal, get the fire up to a dull red heat, then pour fluoric acid all over the coke ; use ½ pt. to 1 pt. or even 1 qt., adding a handful of fluor spar ; it will make the metal much softer.

Chilled Iron.—At Lister's Works, Darlington, England, some articles required turning in the lathe, and cast steel could not be made hard enough to cut them. One man proposed cast metal tools. He was laughed at, of course, but his plan had to be tried. Well, cast metal tools were tried, with points chilled, and they cut when cast steel tools were of no use. The article was turned up with metal tools.

Tempering Liquid for Mill picks.—Rain water, 3 gals. ; spirits of nitre, 3 oz. ; hartshorn, 3 oz. ; white vitriol, 3 oz. ; alum, 3 oz. ; sal-ammoniac, 3 oz. ; salt, 6 oz. ; with 2 handfuls of the parings of horse's hoofs. The steel to be heated to a cherry red. A large jug of this preparation should be kept corked tight, to keep its strength from being lost by evaporation.

To File a Square Hole.—To file a hole square, it is necessary to reverse the work very often ; a square file should first be used and the holes finished with either a diamond-shaped file, or a half round. This leaves the corners square, as they properly should be.

To Temper Small Springs.—*In large quantities*—First, harden them in the usual manner of hardening steel ; then place as many as convenient in a vessel containing oil. Heat the oil containing the springs until it takes fire from the top, then set off the vessel and let it cool. The springs will then be found to possess the required temper.

Black-lead crucibles are made of 2 parts graphite, and 1 of fireclay, mixed with water into a paste, pressed in moulds, and well dried, but not baked hard in the kiln. This compound forms excellent small or portable furnaces.

A good alloy for making working models is 4 parts copper, 1 part tin, and ¼ part zinc. This is easily wrought. Doubling the proportion of zinc increases the hardness.

Tempering Razors, Cutlery, Saws, &c.—Razors and penknives are too frequently hardened without the removal of the scale arising from the forging : *this practice, which is never done with the best works, cannot be to too much deprecated.* The blades are heated in a coke or charcoal fire, and dipped in the water obliquely. In tempering razors, they are laid on their backs upon a clean fire, about half-a-dozen together, and they are removed one at a time, when the edges, which are as yet thick, come down to a pale-straw color. Should the backs accidently get heated beyond the strawcolor, the blades are cooled in water but not otherwise. Penblades are tempered a dozen or two at a time, on a plate of iron or copper, about 12 inches long, 3 or 4 inches wide, and about ¼ of an inch thick. The blades are arranged close together on thin backs and lean at an angle against each other. As they come down to the temper, they are picked out with small pliers and thrown into water if necessary ; other blades are then thrust forward from the cooler parts of the plate to take their place. Axes, adzes, cold chisels, and other edge tools, in which the total bulk is considerable compared with the part to be hardened, are only partially dipped : they are afterwards let down by the heat of the remainder of the tool ; and, when the color indicative of the temper is attained, they are entirely quenched. With the view of removing the loose scales, or the oxydation acquired in the fire, some workmen rub the objects hastily in dry salt before plunging them in the water, in order to give them a cleaner and brighter face.

Oil, or resinous mixtures of oil, tallow, wax, and resin, are used for many thin and elastic articles, such as needles, fish-hooks, steel pens and springs, which require a milder degree of hardness than is given by water. Gun lock-springs are sometimes *fried in oil* for a considerable time over a fire, in an iron tray ; the thick parts are then sure to be sufficiently reduced, and the thin parts do not become the more softened from the continuance of the blazing heat.

Saws and springs are generally hardened in various compositions of oil, suet, wax, &c. The saws are heated in long furnaces, and then immersed horizontally and edgeways into a long trough containing the composition. Part of the composition is wiped off the saws with a piece of leather, when they are removed from the trough, and heated one by one, until the grease inflames. This is called "*blazing off.*" The composition used by a large saw manufacturer is 2 lbs. suet, and ¼ lb. of bees'-wax, to every gallon of whale oil ; these are boiled together, and will serve for thin works and most kinds of steel. The addition of black resin, about 1 lb. to each gallon, makes it serve for thicker pieces, and for those it refused to harden before ; but resin should be added with judgment, or the works will become too hard and brittle.

To Reduce Oxide of Zinc.—The oxide may be put in quantities of 500 or 600 lbs. weight into a large pot over the fire ; pour a sufficient quantity of muriatic acid over the top, to act as a flux, and the action of the fire will melt the dross, when the pure metal will be found at the bottom of the pot.

To Temper Taps or Reamers without springing, select your steel for the job, and forge the tap with a little more than the usual allowance, being careful not to heat to hot nor hammer too cold ; after the tap or reamer is forged, heat it and hold it on one end on the anvil. If a large one, hit it with the sledge ; if a small one, the hammer will do. This will cause the tap to bend slightly. Do not straighten it with the hammer, but on finishing and hardening the tap, it will become straight of its own accord.

SIXTY-FOOT RAILS.

The Edgar Thompson Steel Works have filled an order for 60 foot rails. Several advantages are claimed for rails of this length. They cost no more per pound than 30 foot rails ; and as two crop ends are saved, the cost of production is considerably lessened—no way of using crop ends economically having yet been devised. The cost of laying is lessened ; fewer fish plates, etc., are required ; and as the hammering caused by the rolling stock in passing from rail to rail is lessened by one half, the wear and tear of rails and rolling stock must be greatly diminished. On bridges, also, the strain will be greatly reduced. The practical results of the use of these rails will be awaited with considerable interest.
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