of steel with gold, silver, platinum, and many other metals, in various proportions and combinations, were made, without however producing any very definite results. One of the best was a mixture of 500 parts of steel with one part of silver. While the silver was in this small proportion, it appeared to diffuse itself equally throughout the mass, and the union appeared to be chemical. No remarkable increase of specific gravity accompanied the union ; and the opinion formed at the time, that the steel was improved by the addition, is beginning to be shaken, it is worth mentioning, that if the quantity of silver much exceeded the five-hun­dredth part, the excess was distributed in small distinct fibrous masses, in such a manner as to unfit the steel for most purposes of utility.

Having by any of the means now mentioned manufac­tured a good steel or a good alloy, it is found to have acquired a property on which its great value in the arts entirely depends: we mean the property of becoming very hard when *suddenly* cooled from a high tempera­ture. If heated to whiteness, and then plunged into water, instead of the malleable tenacious substance which had been produced under the welding hammers, it has become nearly as hard as a diamond and as brittle as glass. The sudden cooling from a white heat would, however, be found to have damaged considerably the compactness of the steel; and practically it is known, that the lower the temperature on which the sudden cooling can be made to act with effect, the better will be the quality of the metal. It is also supposed that the lower the temperature nt which the steel is manufac­tured—that is to say, hammered into compactness and malleability—the lower will be the temperature necessary to give it hardness. When all these points have been determined to the greatest exactness, there remains an­other consideration which has been well pointed out by a recent writer on the subject. Since the perfection of every steel instrument depends upon its receiving a hard­ness very exactly proportioned to its intended use, and as the subsequent operations will equally affect every part of the hardened steel, it is most important that the hardening be equal in every part, in order that the hardness of the whole, when reduced, shall be equal. If then the heated steel, at the moment of its plunge into the water, be in some parts coated with an oxyde of iron while in other parts it is clean, the rapidity of the cooling in the various parts will be so different as to affect seriously the uniformity of the result. In this way, among others, we can understand how it happens that one part of a razor or other instrument shall be much harder than another. To avoid this inequality, it has been proposed that the instrument shall be perfectly cleansed upon a stone previously to hardening, and then heated with the utmost care to prevent the formation, or at least the unequal formation, of oxyde upon the surface. Various opinions and practices prevail as to the mode of cooling. Besides water at various temperatures, saline solutions, mercury, and a current of air, have been sug­gested ; but it is doubtful whether any of them is pre­ferable to water at a moderate temperature.

The steel having now been made indefinitely hard, too hard generally for any practical purposes, it requires to be tempered or softened down more or less, according to the nature and uses of the intended instrument. This is done by the application of a moderate heat, varying from 43° to 600° of Fahrenheit; the higher tempe­ratures softening the metal proportionally more than the lower.

Formerly the heat applied in tempering was judged of by the colour assumed by the steel, a portion being always ground clean, to enable the operator to observe exactly when the required shade of colour was obtained. These colours, it may be stated, are produced by the action of the oxygen in the air upon the heated metal; and though their indications are sufficiently accurate for most purposes, it has been found desirable in some cases to substitute a fusible metallic bath, by which a regulated temperature may with certainty be communicated.

The following table, showing the temperatures accord­ing to Fahrenheit, which correspond with various colours, was drawn up by the late Mr Stodart:—

1. Very pale straw yellow, 430°

2. A shade of darker yellow,....· 450

3. Darker straw yellow 470

4. Still darker straw yellow, 490

5. A browner yellow, 500

6 Yellow slightly tinged with purple, 520

7. Light purple, 530

8. Dark purple, 550

9. Deep blue, 570

10. Paler blue 590

11. Still paler blue, 610

12. Still paler blue, with a tinge of green,... 630

When the hardened steel is heated only within the limits here specified, it matters not how it is cooled; the softening or tempering equally takes place, and is proportioned to the temperature. The knowledge of the proper degrees of heat or colour adapted to various instruments, is obtained wholly by experience. The fol­lowing table, extracted from the work before mentioned, is perhaps as accurate as any :—

|  |  |  |
| --- | --- | --- |
| **INSTRUMENTS.**  1. Razors and instruments with a stont back and fine edge, | **COLOURS. TEMPERATURES.** | |
| Straw colour. | 430° to 450° |
| 2. Scalpels and penknives | , Full yellow. | 470° |
| 3. Scissors and small shears, | Brown yellow. | 490’ |
| 4. Pocket and pruning ∣ | First tinge of | 510° |
| knives, J | purple. |
| 5. Watch-springs, ∣  swords, &c. | Purple. | 550° to 560° |

After the operation of tempering, nothing is required but the final grinding, fashioning, and polishing of the article, which it is not here requisite to discuss. (C. K.)

Steel-Yard. See Weighing-Machines.

STEELE, Sir Richard, was born in Dublin about the year 1676. One branch of the family was possessed of a considerable estate in the county of Wexford. His father, a counsellor at law in Dublin, was private secretary to James, Duke of Ormond; but he was of English ex­traction ; and his son, while very young, being carried to London, he put him to school at the Charter-house, whence he was removed to Merton College in Oxford. He left the university without taking any degree, in the full reso­lution to enter into the army. This step was highly dis­pleasing to his friends ; but the ardour of his passion for a military life rendered him deaf to any other proposal. Not being able to procure a better station, he entered as a private gentleman in the horse guards, notwithstanding he thus lust the succession to his Irish estate. However, as he had a flow of good nature, a generous openness and frankness of spirit, and a sparkling vivacity of wit, these qualities rendered him the delight of the soldiery, and procured him an ensign's commission in the guards. In the mean time, as he had made choice of a profession