THE COMMERCIAL VALUATION OF LEAD-TIN AND LEAD-ANTIMONY ALLOYS.[1]

By Joseph W. Richards. Ph.D.

LEAD-TIN alloys are used principally as soft solders, for coating terne plates and making "tin-foil." The amounts used annually for these purposes in this country may easily amount to twenty or thirty thousand tons, valued at some five million dollars. Since lead is worth about five cents a pound, and tin about twenty, the percentage of the latter fixes the value of the alloy; and since dishonest manufacturers are constantly trying to "cut grades" by shaving down the proportion of tin, consumers are constantly on the alert to detect such frauds. A quick, easy method of determining approximately the percentage of tin in such alloys becomes a valuable desideratum in such important industries. Accuracy to one per cent. is amply sufficient for all commercial purposes, because alloys conscientiously made by a careful manufacturer will vary that much from what they are intended to be if made by simply mixing given weights of the two metals.

Lead-antimony alloys, or hard lead, run up to twenty-four per cent. of antimony. Many thousand tons of this is used annually in the type-metal and britannia-ware industries, the proportion of antimony varying usually between five and fifteen per cent.

The commercial testing and valuation of such alloys can be most conveniently and quickly accomplished by determining their specific gravities. Pure lead has a density of 11.33, pure tin 7.43, and antimony 6.65. When tin is added to lead, the density at once falls; not uniformly, however, and the alloy, furthermore, does not have a density such as could be calculated from that of its component metals. It is the same on adding antimony, except that with one per cent. the alloy is *heavier* than lead, with two per cent it is just the density of lead, and above that figure the gravity decreases as with tin. Over twenty-four per cent. of antimony, no homogeneous alloy can be obtained, and this sets a limit to the specific gravity tests; however, twenty

[1] Read before the Lehigh Valley Section, May 3, 1894.

per cent. may be regarded as the maximum ever found in commercial "hard lead."

To inaugurate this scheme of testing, it is necessary to carefully make the whole series of alloys, every one or two per cent. from pure lead to pure tin, and from pure lead up to twenty-four per cent. of antimony. Having determined the specific gravity of these alloys by the time-honored scheme of weighing in air and water, with a good balance, the results are tabulated, and any commercial alloys similarly treated and referred to it are at once identified. This method, however, requires a delicate balance and a careful operator; in fact, rather more skill than an ordinary metal-handler possesses. The apparatus shown in the accompanying cut was devised by Mr. Joseph Richards, of the Delaware Metal Refinery, Philadelphia, to facilitate these tests. The idea is to cast a bullet of fixed size in a brass mould, with each of the standard alloys, and then to weigh the bullets on a delicate scale. The scale shown has agate bearings, and the long beam is graduated every one per cent. from 0–pure lead, to 100–pure tin. On the reverse side, the beam is graduated from two up to twenty-four for the lead-antimony alloys. The marks on the beams have all been fixed by placing on the pan successively bullets of the standard alloys, and marking their weight.

The operation of testing a lead-tin or "hard lead" alloy thus resolves itself into simply melting it in a small iron ladle, pouring the bullet and placing it on the scale; on balancing, the percentage of tin or antimony is read off directly on the beam. The balance is delicate enough to rise or fall with a movement of less than one-half of one per cent., while, with care, duplicate bullets may be cast not varying in weight over one-half per cent. The only precautions to observe are to continue the pouring until the bullet is set, in order to avoid a shrinkage cavity, and not to pour into a hot mould, which would necessarily be larger and cast a heavier bullet. The whole operation of melting, casting, and weighing can be performed easily in three to five minutes, and, if need be, by any workman of ordinary intelligence.

Nearly a score of these outfits have been sold by Mr. Richards during the last six months, and their introduction into the industries using these alloys has displaced the rule-of-thumb practice by accurate calculation, and brought many a dishonest manufacturer to his proper deserts.

PYROXYLIN, ITS MANUFACTURE AND APPLICATIONS.[1]

BY WALTER D. FIELD.

PART III.

(*Continued from p. 498.*)

THE peculiar form in which pyroxylin is deposited from its ether-alcohol solution, first called the attention of experimenters to it as a means for producing improvements in the various industrial arts. Photography was the first of the industrial arts to utilize this peculiar property of soluble nitrocellulose.

Later English experimenters made attempts to use pyroxylin as the base for an imitation bone, ivory or hard rubber. Parks, Spill, Greening, and others labored industriously to find some way or some solvent that would dissolve pyroxylin so they could obtain it in solid blocks suitable for turning and molding.

Four years after Scott Archer used pyroxylin in photography, Parks filed his first patent for the use of a solution of pyroxylin. (Eng. Pat. No. 2359, Oct. 22, 1855.) Then again in May, 1858 (Eng. Pat. No. 1090), John MacIntosh proposed the use of pyroxylin dissolved in a solvent composed "of equal parts of wood spirit and coal naphtha" for use in the insulation of wire. In 1864 Parks (Eng. Pat. No. 2675) proposed the use of pyroxy-

[1] Read before the World's Congress of Chemists, June, 1893.