UNITED STATES PATENT OFFICE.

FRANCIS C. FRARY, OF MINNEAPOLIS, AND STERLING N. TEMPLE, OF ST. PAUL, MINNESOTA; SAID TEMPLE ASSIGNOR OF ONE-SIXTH OF THE WHOLE RIGHT TO SAID FRARY.

HARD LEAD ALLOYS.

1,158,673. Specification of Letters Patent. Patented Nov. 2, 1915.

No Drawing. Application filed August 2, 1915. Serial No. 43,298.

To all whom it may concern:

Be it known that we, FRANCIS C. FRARY and STERLING N. TEMPLE, citizens of the United States, and residents, respectively, of Minneapolis, in the county of Hennepin and State of Minnesota, and St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in the Composition of Hard Lead Alloys, of which the following is a specification.

Our invention has for its object to provide an improved metallic alloy having certain characteristics especially adapting it for use in the casting of type and similar articles in molds, and in the manufacture of bullets and other forms of ammunition.

In the manufacture of type metal, hardness and resistance to compression without cracking are necessary, and furthermore, the metal employed must be of such a character that it will not contract on solidifying, but, on the contrary, will slightly expand and fill the mold in which it is cast. In the manufacture of ammunition, it is very desirable that the alloy be hard and that its specific gravity be as high as possible, so as to thereby concentrate the maximum of kinetic energy in a minimum volume.

Certain of the above-noted desirable characteristics have hitherto been produced by adding a considerable proportion of antimony to lead. The antimony, however, reduces appreciably the specific gravity of the alloy. Furthermore antimony, at the present time, is very expensive as compared to lead, and because of the considerable amount thereof necessarily employed, makes the alloy expensive.

In carrying out our invention, we use metallic strontium, alloyed with a main body of lead. We have found that, weight for weight, the hardening effect of strontium is much greater than that of antimony, and that only a small amount of strontium is necessary to produce a hard alloy of commercial value. We have also found that the alloy containing a small amount of strontium may be improved by the addition of a small amount of copper. This causes the alloy to be tougher and finer grained, and prevents it from having that brittleness which characterizes ordinary antimonial lead, and, to a lesser degree, alloys containing lead and strontium alone.

As examples of alloys made in accordance with our invention, we give the following formulæ:

1. Ninety-seven and two-tenths parts of lead, and two and eight tenths parts of strontium.

2. Ninety-seven and one-fourth parts lead, two and one-half parts strontium, and one-fourth part copper.

3. Ninety-seven and two-tenths parts lead, two parts strontium, and eight-tenths part copper.

The first of the above alloys is harder than commercial antimonial lead, and of a higher specific gravity. The second is of practically the same hardness as commercial antimonial lead, but tougher than it and tougher than the first alloy. The third alloy is a very little softer than commercial hard lead, and very tough indeed. It will be apparent that the properties of the alloys herein described may be varied as desired, within certain limits, by varying their composition.

Commercial lead, as well as pure lead, is, in this specification and in the claims, intended to be included and covered by the term "lead". It is a well known fact that commercial lead usually contains small quantities of copper and of some other materials not removed in the customary process of purification. Frequently the commercial lead will contain as large a proportion of copper as is desired in the alloy, in which case, of course, a further addition of copper would not be necessary.

What we claim is:

1. As a new article of manufacture, a metallic alloy containing lead and strontium.

2. As a new article of manufacture, a metallic alloy containing lead, strontium and copper.

3. As a new article of manufacture, a hard lead alloy having a main body of lead and containing a small amount of strontium.

4. As a new article of manufacture, a hard lead alloy having a main body of lead, and containing small amounts of strontium and copper.

Signed in the city of Minneapolis and State of Minnesota, July, 1915, in the presence of two witnesses.

FRANCIS C. FRARY.
STERLING N. TEMPLE.

Witnesses:
S. A. HANLBERG,
H. J. LOUCKS.