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LEAD MANUFACTURE

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8 Claims. (Cl. 148—6)

This invention relates to the production of a particular form of lead, and to certain uses of lead in this form; one of which uses is for projectiles, particularly small caliber projectiles designed for use in shooting galleries.

The present application is a division of my prior co-pending application Serial No. 616,024, filed June 8, 1932, now Patent No. 2,168,381, dated August 8, 1939.

In one aspect the invention contemplates a projectile or bullet adapted to be completely disintegrated upon impact with a hard impervious surface, such as the steel plates universally used as target backings in shooting galleries.

The lead bullets hitherto used in cartridges designed for rifled firearms, particularly small caliber rifles, have been made by the forming of slugs of solid lead, either by individual molding or by shearing from a wire, and the swaging of such slugs to the desired shape. When such bullets are fired against a steel plate the forward part of the bullet which, upon impact with the target, is traveling with a velocity of the general order of 1,000 feet per second, appears to be quite completely disintegrated. The energy consumed in the disintegration of the forward portion greatly reduces the velocity of the rearward portion, which breaks into comparatively large fragments that may be projected in various directions generally transverse to the surface of the impacted plate with very substantial velocities. Such fragments may again be deflected from the walls or ceiling of the gallery, and, being of irregular shape, their course of flight is very erratic. It has occasionally happened that such fragments were so deflected as to return substantially to the position from which the cartridge was fired, and accidental injury to the shooter and other persons located at the shooting position due to such flying fragments is not unknown.

The present invention is a development of research intended to produce a bullet incapable of projecting any fragments of substantial size from the surface of a hard target. The invention, however, goes substantially beyond the manufacture of bullets, and contemplates a particular and hitherto unknown form of lead, and methods and articles generally comprising the use of lead in this form.

The invention contemplates the division of solid metallic lead into a spongy mass of separated fibres. It has been found that such a separation of lead may be secured by dropping lead in a thin stream into certain fluid solutions. Numerous acid and salt solutions are effective for this purpose, but it is preferred to use a solution having the property of coating the lead fibres in such a way that they do not coalesce into a homogeneous mass under the treatment to which they are subsequently subjected, as hereinafter described. Coatings of two quite different natures have been successfully used. The first is a coating of another metal, such as copper or cadmium, which is secured by using a solution of copper sulphate, copper cyanide, or cadmium cyanide, galvanic action being effective to produce a very thin coating of copper or cadmium on the individual fibres. Similar coatings of any desired metal can readily be secured by making the solution into which the molten lead is dropped an ordinary electroplating bath. The second type of coating comprises a salt, such as lead carbonate, lead borate, lead chloride, lead sulphate, lead sulphide. These coatings respectively are secured by the use of solutions of sodium carbonate, boric acid, dilute hydrochloric acid or ferric chloride, dilute sulphuric acid, and water into which hydrogen sulphide is constantly passed.

One method including the forming of a salt coating is as follows:

A stream of molten lead about ¼'' in diameter is dropped a distance of about 2' into a 4% aqueous solution of anhydrous sodium carbonate, this concentration corresponding to about 10.8% of crystalline sodium carbonate. The concentration of the solution, however, may be varied within wide limits, say 8% to 40% of crystalline sodium carbonate. When dropped into such a solution, or a suitable solution of one of the other substances heretofore mentioned, the lead gathers as a porous, spongy, fibrous mass which is easily disintegrated and is found to consist chiefly of comparatively fine fibres having a dark dull exterior surface which probably contains a substantial amount of lead carbonate, while the interior of each fibre is bright metallic lead. While the reason for this result is not fully understood, it is thought probable that the effect of the impact of hot molten lead with the liquid salt solution is analogous to the well-known result of dropping water onto a metal plate. If the plate is heated above a certain critical temperature, its surface is not wet, the water is broken up into small spherical or spheroidal drops in which it is retained by its own surface tension. The disintegration of the heated lead into fibres may be caused in a

similar manner, and the formation of a coating on the surface of such fibres may assist in preventing their coalescing into a solid mass.

Lead which has been dispersed in the manner heretofore described may be utilized in various ways. By way of illustration, the parent application, above-identified, describes the manufacture from such lead of firearms bullets or projectiles adapted to disintegrate upon impact with a hard target, such as the usual target backing of a shooting gallery. For this purpose the dispersed lead may be fed to an extruding die from which it emerges in the form of a wire consisting of a continuous exterior sheath having a thickness of the order of .001". The continuous sheath appears to be formed by friction of the coated particles against the die. Interiorly the wire consists of a bundle of separate coated particles or fibres. Such wire may be cut into sections of suitable length, which sections are swaged into bullets in the usual manner. Such bullets have been found to substantially completely disintegrate upon impact with a hard target, thus obviating the danger from flying lead fragments of substantial size which attends the use of solid lead bullets at short ranges such as in a shooting gallery.

The invention, however, contemplates not only the production of bullets, but the method of securing fibrous lead and manufactures generally comprising such lead, and the appended claims are to be broadly construed.

What is claimed is:

1. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a salt solution.

2. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a solution of a material containing an inorganic acid radical adapted to form a lead salt, said material being selected from a group consisting of sodium carbonate, boric acid, dilute hydrochloric acid, ferric chloride, dilute sulphuric acid, and hydrogen sulphide water.

3. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a carbonate solution.

4. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a solution of sodium carbonate.

5. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a solution having a concentration from 8% to 40% of crystalline sodium carbonate.

6. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a solution having a concentration of approximately 10% of crystalline sodium carbonate.

7. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a solution adapted to disperse the lead and coat the individual particles thereof by galvanic action.

8. The method of producing granulated or fibrous lead which comprises dropping a continuous stream of molten lead into a quiescent fluid medium having the capacity to disperse the continuous stream of lead into relatively fine particles.

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