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PROCESS OF MAKING SHOT

No Drawing. Application filed August 4, 1927. Serial No. 210,717.

This invention relates to projectiles, and more particularly to shot adapted for use in shot guns.

A shot shell is provided with a propellant charge and a shot charge separated by wadding. When such a shell is fired, there is a sudden force applied to the shot charge to project the same from the gun, and in view of the fact that these shot are of a soft metal, such as lead, these shot will become deformed before striking the target. This deformity contributes to cause the various shot to travel at unequal velocities towards the target, resulting in "stringing of shot"; that is, the distribution of the shot along the line of flight; this stringing may in actual practice be many feet and to such an extent as to greatly affect the accuracy on hitting a target moving across the line of flight of the shot charge. Moreover, this deformity contributes to cause an unequal distribution of the shot laterally of the line of flight and even cause undue scattering so that the pattern of the charge is disadvantageously affected. Moreover, the shoft shot in passing through the barrel of the shotgun not only causes fouling thereof but also deformity of the shot.

Ordinary shot are made from alloy of lead, antimony and arsenic. The function of the arsenic is primarily to affect the fluidity and surface tension of the molten metal which causes the drops to assume truly spherical shape as they fall in the shot tower; however, the arsenic has a decided hardening effect on the shot itself. The function of the antimony is to harden the lead, the greater the percentage of the antimony the greater the hardness of the resultant alloy; however, when the antimony is increased above a certain limit the shot becomes two brittle for practical use.

One of the objects of this invention, therefore, is to provide shot which is so formed and treated as to prevent deformity when fired from a shot gun while its brittleness is kept within limits to enable its practical employment.

One of the features of this invention resides in the fact that the shot is subjected to treatment which will harden it above the original hardness of the alloy of which the shot is composed. In accordance with a practical embodiment of this invention, a lead antimony arsenic alloy shot is subjected to a treatment comprising heating the lead alloy shot to a temperature near its eutectic point, quenching the same and permitting the same to age.

While the above heat treatment will produce a shot whose hardness is greater than the original hardness of the alloy of which the shot is composed, unless the treatment is carefully performed there is danger of the shot becoming deformed due to the temperature of the treatment being so close to the melting point of the alloy. Since the slightest deflection of the shot will affect the pattern, the treatment unless carried out with care is liable to fail in producing a desired shot. Another feature of this invention, therefore, resides in the fact that previous to hardening, the lead alloy shot is plated with another metal having a greater stability and a higher melting point. In accordance with a practical embodiment of this invention, the lead alloy shot is plated with copper to such a thickness as to hold the shot in shape during the subsequent heat treatment and the plated shot is then heated to a temperature near the eutectic point of the alloy, and the same quenched and then permitted to age.

Further objects and features will appear from the detail description in which will be disclosed several embodiments of this invention; it will, however, be understood that this invention is susceptible to various embodiments.

In accordance with this invention the core may be of the usual lead alloy shot formed in the usual manner as in a shot tower. Where plating, however, is resorted to the use of graphite is reduced as much as possible. As an example, a lead alloy of the composition:

Lead	98.41
Antimony	1.38
Arsenic	0.21

is heated to from five to ten degrees centigrade below the eutectic temperature (247° C.); the shot is then quenched in water and allowed to age for a period of at least two weeks. As a result of such treatment it has been found that a number 6 shot having the above composition and having an original hardness of 50.1%, measured by the drop test reduction method, heated to 243° C., quenched in water and aged for two weeks, has its hardness increased to 35% reduction. This hardness is approximately the same from that obtained from a shot having the following composition:

Lead	94.45
Antimony	4.75
Arsenic	0.80

The brittleness of the shot will, however, be considerably less. As another example, a No. 6 chill shot having a composition as follows:

Lead	95.05
Antimony	4.30
Arsenic	0.61

and having an original hardness of 39.2% reduction, when given the treatment as described above, resulting in a shot having a hardness of 25% reduction. It will, therefore, be seen that the hardness of shot gun shot can be considerably increased without increasing the brittleness of an alloy of a given composition.

As stated above, on account of the necessity of carrying the heat treatment to near the melting point, or deforming point of the lead alloy shot, the treatment is a rather sensitive one. In accordance with another embodiment of this invention, therefore, the shot are plated before being subjected to the hardening heat treatment. This plating can be performed in any desired manner. In order, however, to attain a cohering and dense coating of copper, the plating procedure is carried out as described in an application of Alfons G. Schuricht, Serial No. 209,195, filed of even date herewith. In accordance with that treatment, the shot after being thoroughly cleaned in soda ash solution and rinsed with water, are plated in an alkaline electrolyte consisting specifically of cuprous cyanide and sodium cyanide. In this way a cohering and dense plating is secured and if the plating operation is performed in a tumbling barrel, the plating itself will be condensed and burnished. As described in the application referred to, the plating may be preliminarily in an alkaline electrolyte so as to secure a flash or film of copper, and this plating is then built up in an acid electrolyte such as copper sulphate, which may be more expeditiously and conveniently performed.

The plating is carried on until an envelope is secured of sufficient stability as to retain the shot in spherical form and this depends upon the size of the shot. For a No. 6 lead alloy shot the coating need not be in excess of .0002 inch. This coating is sufficient to prevent the shot from becoming deformed during the hardening treatment. This hardening treatment may be carried on as before, namely, heating the plated lead alloy shot to about 243° C., quenching in water and then allowing the same to age for a period of at least two weeks. It is found that the copper plated hardened shot is retained in its true spherical shape while the hardness is increased, not only by the hardening of the core itself, but also by the hardening of the entire shot, due to the application of the plating. In this way it is only necessary to deposit a comparatively thin plating on the shot while still retaining the advantages.

It will, therefore, be seen that the invention accomplishes its objects. A shot is provided which is of sufficient stability as to prevent deformity thereof when fired from a shot gun; accordingly, not only will stringing of the shot be decreased, but the pattern will be improved. Where the shot is plated as well as hardened, not only is its stability high but the plating being non-fouling, fouling of the shot gun barrel will be prevented.

While the invention is applicable to shot for shot shells, it will be understood, that as to some of its features the invention is applicable to other forms and types of projectiles, such as bullets for small calibre rifles (.22 calibre) and balls for use in shot shells. In case of rifle bullets, not only will the bullet as a whole be hardened, but the driving band will be given increased stability. This driving band can be rolled or swaged as described in application of S. F. Briggs, Serial No. 144,585, filed October 28, 1926, in order to not only additionally condense but also size and conform the driving band to the rifle.

It will, furthermore, be understood that certain features, operations and sub-combinations are of utility and may be employed without reference to other features, operations and sub-combinations; that is contemplated by and is within the scope of the appended claims. It is, furthermore obvious that various changes may be made in details of construction and operation within the scope of the appended claims without departing from the spirit of this invention. It is, therefore, to be understood that this invention is not to be limited to the specific details and operations described.

Having thus described the invention what is claimed is:

1. In the art of making shot, the process comprising, plating lead alloy shot and hardening the plated shot.

2. In the art of making shot, the process

comprising, plating lead alloy shot with a metal having a higher melting point, heating the plated shot to a temperature near the eutectic point of the alloy, quenching the same and permitting the same to age.

3. In the art of making shot, the process comprising, plating lead alloy shot with copper and hardening the plated shot.

4. In the art of making shot, the process comprising, plating lead alloy shot with copper, heating the plated shot to a temperature near the eutectic point of the alloy, quenching the same and permitting the same to age.

5. In the art of making shot, the process comprising, plating lead alloy shot with copper successively in alkaline and acid electrolytes, heating the plated shot to a temperature near the eutectic point of the alloy, quenching the same and permitting the same to age.

In testimony whereof I hereby affix my signature this 29th day of July, 1927.

ALFONS G. SCHURICHT.

In testimony whereof I hereby affix my signature this 29th day of July, 1927.

GEORGE T. WRIGHT.