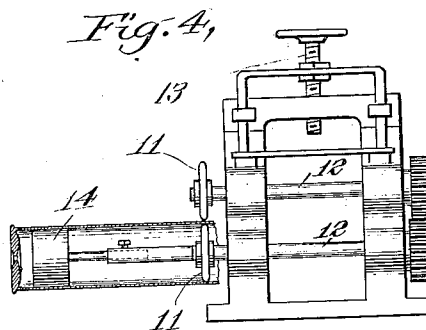
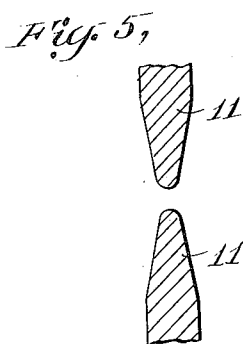
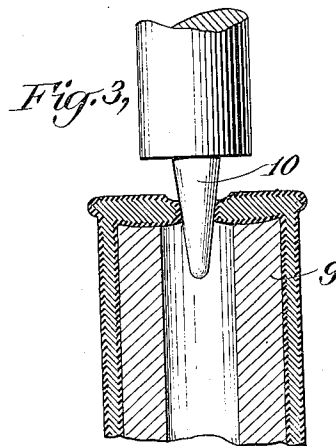
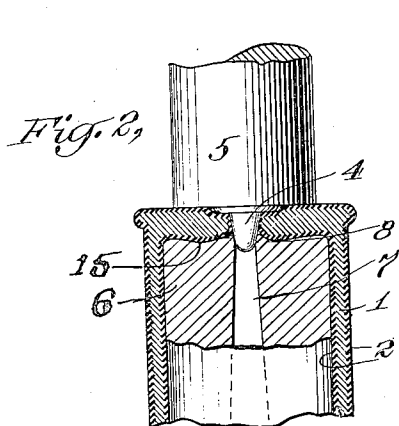
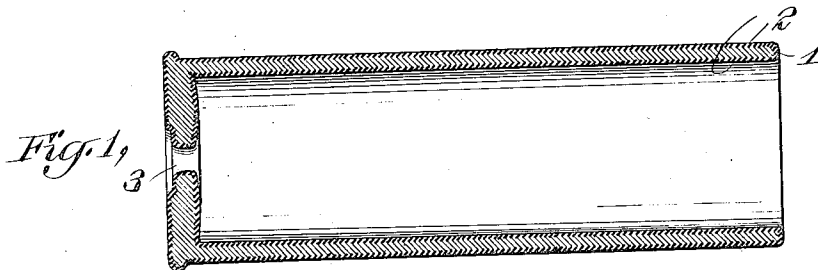


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HOLLOW COMPOUND METAL ARTICLE.
APPLICATION FILED DEC. 26, 1905.

1,063,574.

Patented June 3, 1913.



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HOLLOW COMPOUND-METAL ARTICLE.

1,063,574.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOHN FERREOL MONNOT, a citizen of the United States, residing in the city, county, and State of New York, have invented a certain new and useful Hollow Compound-Metal Article; and I hereby declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to hollow compound metal articles and consists in hollow compound metal articles, and more particularly in cartridge shells and like articles, composed of a base or body of a ferrous metal covered and protected by a filmlike layer of hard, planished, dense, impervious unlike or non-ferrous metal, weld-united thereto and relying thereupon for support; all as more fully hereinafter set forth and as claimed.

Modern smokeless powders generally comprise or consist of nitro products which though usually sufficiently stable *per se*, nevertheless are apt to undergo progressive decomposition or alteration in the presence of relatively minute amounts of many impurities. Such an alteration takes place after a time in smokeless powders loaded in the ordinary brass shells, the metal probably oxidizing and the oxids formed reciprocally influencing the nitro compounds, and the charged cartridge becomes unreliable. It is therefore customary not to load such shells until immediately before probable use and to unload unused cartridges more than a few months old. Unloading and reloading are difficult, dangerous and expensive operations and the inconvenience of waiting for an emergency before beginning to load the number of cartridges required to supply an army is obvious. Furthermore in the operation of modern automatic fire-arms having delicate and complicated working parts it is necessary that a shell shall be stiff and possessed of considerable mechanical strength to resist stresses and deformation while it must also have a true surface and perfect shape to avoid jamming in the gun. The ordinary brass shell though expensive and, as stated, not free from a deteriorative action on nitro powders, in a measure complies with these requirements as regards strength and surface, but its use is restricted

to arms of comparatively small caliber since a prohibitive thickness of wall, both in point of cost and of weight, would be required to give a shell of sufficient strength for large guns. Copper though substantially free from deteriorative action on nitro powders has not sufficient mechanical strength for use in automatic rifles and machine guns. Steel is strong enough, but its surface, even when polished has too great a frictional coefficient for practical use and of course it cannot be kept from rusting while it soon ruins powders.

It is the object of the present invention to provide a cartridge shell obviating the stated objections and attaining a number of new advantages. To this end, such shells are made by a suitable treatment of compound metals resulting from a process for which I have received Letters Patent No. 851,684, April 30, 1907 and No. 853,716, May 14, 1907. Briefly stated, the process therein described and claimed rests upon the fact which I have discovered that while steels and similar ferrous metals have no great affinity for the chemically unlike non-ferrous ductile metals of high melting point, such as silver, copper and the various cupriferous alloys like brass and bronze, gold, aluminum, etc., and will not readily unite therewith to form good unions at the common casting temperatures of such non-ferrous metals, yet if the temperature at the abutting faces of a body of steel and a body of such unlike, non-ferrous metal be momentarily preserved at a point a number of hundred degrees above the melting point of such non-ferrous metal this lack of affinity disappears and good weld-like unions may be readily secured, such unions resisting dissolution by changes of temperature or by mechanical stresses. A copper clad steel billet so produced may be heated red hot and suddenly quenched without dissolution of the union, and the coating cannot be split off by a cold chisel or like cutting tool, the tool refusing to follow the line of union and diverging into the softer metal. The coating may be of one metal, or of two, as when a steel billet is first filmed with a coating of copper applied in the described manner at the extremely high temperature used and then a coating of brass or bronze applied to the filmed surface at

ordinary casting temperature. Brass and bronze as containing low-melting, readily oxidizable metals like tin and zinc, do not readily withstand the application of temperatures much above their melting points and therefore in coating steel billets it is generally preferable to form such a preliminary film coating of a metal like copper which will tolerate the temperature necessary to produce what I have called the supermolten condition; a condition necessary to secure the union with steel. To this coppered surface, brass and bronze can be readily applied at ordinary casting temperatures, copper being like in nature to both alloys.

Clad steel billets produced in the described manner can be as readily worked, and in the same manner as, simple steel billets. For such working it is of course necessary to employ as a coating metal a metal which, like those previously enumerated, has a melting point above ordinary steel working temperatures; say above 900° F. or 500° C. I have discovered that by applying a suitable thickness of one of these metals to a ferrous metal base in the described manner and then coextending the jointed metals to the thickness necessary for a cartridge shell by ordinary metal working methods, I can produce a shell or other hollow article which while substantially all steel and possessing the stiffness, strength and resistance to deformation of steel, will nevertheless have a filmlike, wholly impervious, dense and hard coating of the other metal, hermetically sealing in the surface to which it is applied and indissoluble therefrom by heat changes or mechanical forces. With a copper-clad shell of this character, the copper is altogether too thin to allow any substantial yielding to automatic loading and unloading mechanism in the gun while at the same time the underlying, highly frictional surface of the steel cannot contact with such mechanism or with the steel surface of the gun bore. In the coextension of the two metals, the copper is given a dense, compacted and planished surface, extremely well adapted for smooth working in the gun, while, as stated, its thickness is wholly insufficient to permit any yielding to clutching mechanism or any indentation which would mar the perfection of the surface. The copper is, as a matter of fact, of a tenuity so great that it must wholly rely for support on the steel to which it is welded.

So far as the mechanical action in the gun is concerned, brass-clad steel shells work similarly to the copper-clad, but they are not so well adapted for containing nitro powders when the brass coating is interior as well as exterior. Copper is found in practice to exert very little action on nitro

powders and it is therefore better adapted for the interior coating. Other cupriforous alloys than brass (zinc-copper) may however be used for interior coatings; such as bronze, aluminum bronze, and the like.

In producing shells and similar hollow articles under the present invention, I customarily employ from 3 to 5 per cent. of the coating metal in making the original clad billets and the same proportions between the joined metals will be found to exist after coextension and working to form the shells, such joined metals working like one metal. Less or greater proportions of the coating metal may be employed but those indicated are satisfactory in practice.

To avoid exposure of the underlying ferrous metal in cutting large sheets to make blanks for shells and in cutting necessary orifices in such shells or hollow articles, I resort to an artifice. I have found that in cutting and punching if tools have a rounded or obtunding edge in lieu of the customary sharp edge, the softer coating metal will yield and flow to some extent before the severance of the stiffer steel and will cover the edges of the latter metal, sealing it in.

In the accompanying illustration, Figure 1 shows a central longitudinal section of such cartridge shell. Fig. 2 illustrates the formation of the cap hole in the head of such shell, and the drawing of the coating metal over the edges formed by punching the cap hole, the figure showing the end of the shell in section, and showing the male die in elevation and the female die in longitudinal section. Fig. 3 illustrates the compacting of the coating metal at the cap hole, showing the shell in section, together with its support, and showing the spinning or crimping tool in elevation. Fig. 4 shows an end view of a machine for cutting the ends of cartridge shells and similar tubular objects, and for drawing the coating metal over the cut edges; and Fig. 5 is a detail sectional view showing, greatly exaggerated, the theoretical form and relative position, of the edges of the cutters. Fig. 6 is a detail perspective elevation and cross-section of a grooved spinning disk for uniting layers of coating metals over cut edges, in perfecting the union and covering effected by the stated obtunding tools.

In the said drawings, 1 designates the core or base metal and 2, 2, the layers of coating metal. These layers are not necessarily of the same coating metal; a cartridge shell, for example, may be coated on the inside with one metal, preferably copper or a resistant copper alloy for shells to be used with nitro powders, and on the outside with another metal. I have not attempted to indicate any particular form or construction of cartridge shell, except the construction

of said shell of compound metal, and it will be understood that the particular form of shell illustrated is not material.

3 designates the cap hole. As will be seen, the layers of coating metal are drawn together and substantially united at this cap hole, so that oxidation or other chemical attack on the base metal 1 at this point is prevented. Similarly, the layers of coating metal are drawn together and substantially united at the end of the shell. I have found that the coatings may be so drawn together merely by using a somewhat dull cutting or punching tool or tools, followed, if necessary, by rubbing, spinning or otherwise working together the meeting portions of the two coatings until the same are substantially united and a joint impervious to moisture and to oxygen and other chemically-active gases and vapors is formed. Figs. 2 and 3 illustrate how such a joint may be formed at a punched hole, and Fig. 4 illustrates how such a joint may be formed at a cut edge. Referring first to Fig. 2, it will be seen that the punch 4 of the male die 5 is somewhat blunt or dull, and is tapered, and that the female die 6 has a bore 7 for the reception of this punch 4, and has surrounding this bore an annular outwardly-tapering edge 8. I find that in practice two such dies not merely punch out a clean hole in the end of the shell, but draw the coating metal over the edge of the core, as illustrated with some exaggeration, in Fig. 2, so that the coatings meet, or substantially so. For many purposes, it is sufficient to leave the punched hole in this condition; but if greater finish and a better joint is desired, the edge may be finished by means such as illustrated in Fig. 3, comprising a hollow support 9 for the shell and a taper smoothing-tool 10, either said shell or said tool 10 being revolved, the one with respect to the other, while the tool presses against the edge of the hole; the effect of such action being to compact the coating metal by spinning or equivalent action; it being possible to so unite the two coating layers in this way that they become substantially one.

For cutting the shell to length and covering over the cut edge I may employ means such as illustrated in Fig. 4, comprising somewhat dull rotary cutters 11, 11, mounted on shafts 12, 12, and arranged to be rotated by suitable gearing, as shown, the upper cutter, with its shaft and bearings, being adjustable up and down by means of a screw 13 or equivalent means. To support the shell while it is being cut, I may provide one of the shafts 12 with an extension having an adjustable mandrel 14 on which the shell fits snugly. Fig. 5 shows considerably enlarged and exaggerated, the form of the two cutters 11, the same having approximately V-shaped peripheries, the

extreme edges of which are blunt and rounded as shown. After a shell has been cut off by these rotary cutters, the substantially abutting portions of the two coating layers may be compacted and substantially united by a suitable spinning tool, which may for example be a grooved disk, such as is shown in Fig. 6.

I have not illustrated the dies for drawing the cartridge shell from the sheet to final form, but it will be understood that dies such as are ordinarily used for the purpose may be employed. But whereas in the drawing of brass cartridge shells, annealing and pickling are necessary after practically every step of the drawing, when using the compound metals above referred to only one or two annealings at the most are usually required. It will be seen, therefore, that for this reason alone the cost of forming the cartridge shells is greatly reduced.

At present cartridge shells are usually formed of brass notwithstanding the serious objection that there is some slight chemical action by the brass on many if not all of the explosives now commonly employed in cartridges, which results in gradual deterioration of cartridges, necessitating reloading at intervals. Copper is much superior to brass as a material for cartridge shells, in so far as its chemical properties are concerned, but the weakness of copper as compared with brass, has prevented its extensive use as a material for cartridge shells. But the compound metal herein described, comprising an iron or steel core and a coating of copper, has even greater strength than brass, while having all of the properties of copper desirable in cartridge shells.

The steel core being covered by copper or the like metal, cannot give sparks in violent handling of the cartridges or in loading the same with steel tools, copper being a non-sparking metal. At the same time, the cartridge shell being substantially all steel, has the same rate of expansion and contraction substantially as a steel shell and it does not jam or stick in the gun or in ejector mechanism when such gun or mechanism, both of which are customarily made of steel, becomes heated in firing, in the way in which an all-brass or all-copper shell is apt to stick and jam in an overheated steel gun.

The coatings of the compound metals herein referred to, are materially different from electrically deposited coatings. As is well known, in electrically deposited coatings, the metal is thrown down in crystalline form with dividing lines and interstices between the crystals, so that oxidizing or corrosive liquids, vapor and gases penetrate the coating and attack the metal; neither is the adhesion of electrically deposited coating good, such coatings being merely adherent to the base, and not coherent thereto, and

for this reason and also because of lack of cohesion in the coating itself, it is impracticable to roll or draw electro-plated metals without destroying the continuity of the coating. But the coatings of the compound metals, such as produced, for example, by the processes described in my Patents Nos. 851,684, dated April 30, 1907, and 853,716, dated May 14, 1907, are absolutely coherent to the base, are dense, hard and absolutely impervious to gases and liquids, and remain impervious, even when drawn to extreme thinness. A cartridge shell formed of such metal is therefore a materially different article from a shell coated by electro-plating, dipping or similar processes. In a steel-copper shell, the article mechanically is substantially steel, but the steel is hermetically sealed in by a surface-giving, impervious film of copper.

It will be noted that in the die 6 of Fig. 2, there is a slight annular depression at 15 between the cutting edge 8 and the outside of the die. This depression is to allow space for the flow of the metal.

I do not in this application claim the method of drawing the coating metal over edges of compound metal objects nor the specific apparatus for performing the cutting, as while these are of my invention, they are covered by another application filed March 2, 1906, Serial No. 303,916.

By the term compound metal as herein used I do not intend to restrict myself to material coated on both sides with the same coating metal. Obviously the coating on one side may be of one material and that on the opposite side may be of another material, and the term compound metal as herein employed, is used as a generic term to designate material comprising a base of one metal and a coating or coatings therefor of one or more metals welded to said base.

What I claim is:—

1. As an article of manufacture, a hollow metal object having a wall composed of a thickness of compound metal comprising a ferrous metal body and an impervious, planished film-like coating of an unlike, high-melting non-ferrous metal weld-united thereto, said coating being drawn over and covering the edges of the ferrous metal body.

2. As an article of manufacture, a hollow metal object having a wall composed of a thickness of compound metal comprising a ferrous metal body and an impervious, planished film-like coating of a cupriferous metal weld-united thereto, said coating being drawn over and covering the edges of the ferrous metal body.

3. As an article of manufacture, a hollow metal object having a wall composed of a

thickness of compound metal comprising a ferrous metal body and an impervious, planished film-like coating of copper weld-united thereto, said coating being drawn over and covering the edges of the ferrous metal body.

4. As an article of manufacture, a cartridge shell composed of a compound metal having a body of ferrous metal provided with an impervious, planished film-like coating of an unlike, high-melting non-ferrous metal weld-united thereto, said coating being drawn over and covering the edges of the ferrous metal body.

5. As an article of manufacture, a cartridge shell composed of a compound metal having a body of ferrous metal provided with an impervious, planished film-like coating of a cupriferous metal weld-united thereto, said coating being drawn over and covering the edges of the ferrous metal body.

6. As an article of manufacture, a cartridge shell composed of a compound metal having a body of ferrous metal provided with an impervious, planished film-like coating of copper weld-united thereto, said coating being drawn over and covering the edges of the ferrous metal body.

7. As an article of manufacture, a cartridge shell composed of a compound metal having a body of ferrous metal provided with an impervious, planished, film-like coating of a high-melting unlike-non-ferrous metal weld-united thereto, said shell having a cap hole and having the coating metal drawn over and covering the edges of the ferrous metal at said cap hole and at the end of the shell.

8. As an article of manufacture, a cartridge shell composed of a compound metal having a body of ferrous metal provided with a film-like, impervious, planished coating of a cupriferous metal weld-united thereto, said shell having a cap hole and having the coating metal drawn over and covering the edges of the ferrous metal at said cap hole and at the end of the shell.

9. As an article of manufacture, a cartridge shell composed of a compound metal having a body of ferrous metal provided with an impervious, planished, film-like coating of copper weld-united thereto, said shell having a cap hole and having the coating metal drawn over and covering the edges of the ferrous metal at said cap hole and at the end of the shell.

In testimony whereof I affix my signature, in the presence of two witnesses.

JOHN FERREOL MONNOT.

Witnesses:

JNO. B. HANNUM, Jr.,

W. J. SCHAFER.