T. A. KEARNEY.

PROCESS FOR BANDING PROJECTILES.

APPLICATION FILED DEC. 9, 1907.

930,863. Patented Aug. 10, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

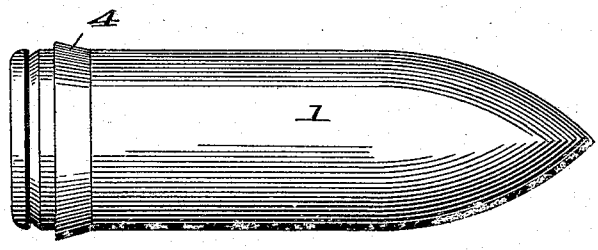


Fig. 3.

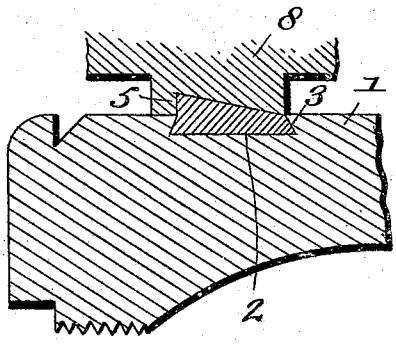


Fig. 2.

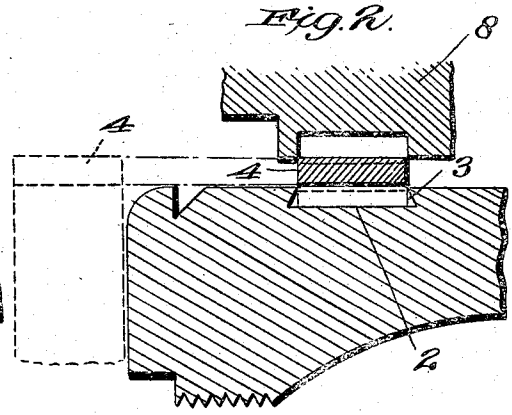


Fig. 4.

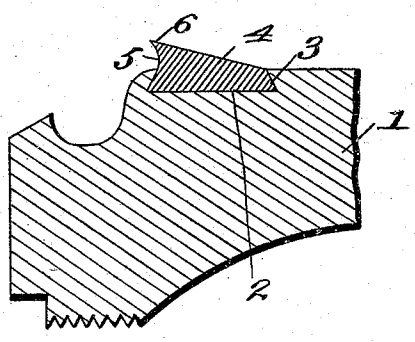
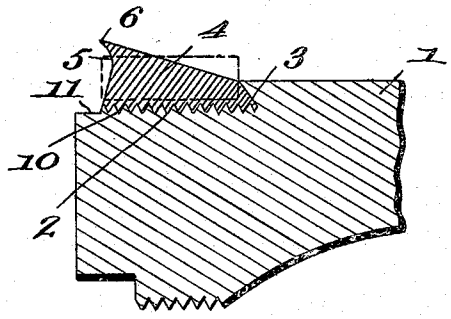


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 6.

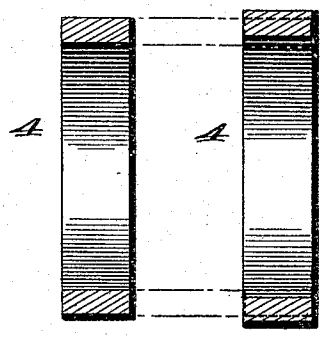


Fig. 7.

Fig. 8.

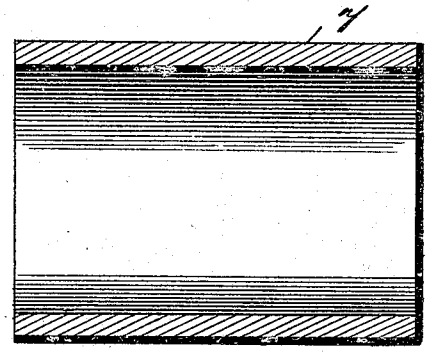
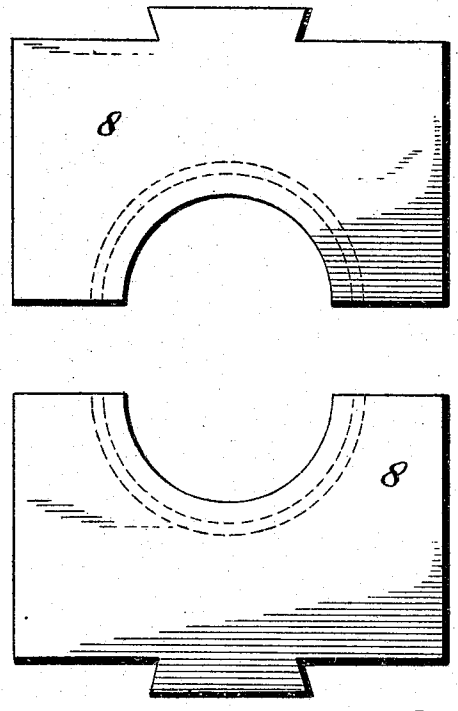


Fig. 9.



Witnesses

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UNITED STATES PATENT OFFICE.

THOMAS ALBERT KEARNEY, OF THE UNITED STATES NAVY.

PROCESS FOR BANDING PROJECTILES.

No. 930,863. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed December 9, 1907. Serial No. 405,772.

To all whom it may concern:

Be it known that I, THOMAS ALBERT KEARNEY, a lieutenant in the United States Navy, and a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Processes for Banding Projectiles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a process of applying bands to shell or other projectiles, and the object of this invention is to provide such shell or projectiles with a band which will be certain in operation, efficient in action and at a cost considerably less than that of applying the bands now in common use.

With this object in view my invention consists in a shell provided with a seamless band swaged into position, and also in the process of applying such bands, more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification, and in which like numerals refer to like parts in all views:—Figure 1 represents a shell or projectile with my band applied thereto, Fig. 2, a sectional view of a part of the rear portion of a shell showing the steps taken in carrying out my process, Fig. 3, a like view showing the final steps taken in my process, Fig. 4, a fragmentary sectional view of the rear portion of the shell with my finished band in place, Fig. 5, a like view showing a modified means of attaching my band to the projectile, Fig. 6, a sectional view of my band before it is expanded by heat, Fig. 7, a like view showing my band after it is expanded by heat, Fig. 8, a sectional view of the cylinder from which my band is cut, and Fig. 9, a plan view of the dies used for swaging my band in place.

Referring to the drawings, 1 represents the body of a shell or other projectile, and 2 the groove in the rear portion of the same, adapted to receive the bands which are now commonly used on such projectiles. These grooves 2 are provided with the undercut portions 3, as shown, into which the metal of the band 4 may be forced. The bands 4 may be given any suitable or desired shape, but I prefer to make them thicker at the rear portion than at the front, and to provide them with the flared out rear grooves 5, terminating into the thin lip 6, as shown in the drawings.

Heretofore, in securing bands to projectiles, it has been customary to employ various methods, among them that of forming the band out of a split ring, and then securing the same upon the projectile by means of screw threads and a swaging operation. It has also been customary to screw the bands upon the rear of the projectile, the screw threads being in such a direction that the rotation of the shell in the gun will tend to tighten the band in its seat. The various methods that have been heretofore proposed are more or less satisfactory, when low velocities are employed, and when only moderately high powder pressures are used; but when the modern high velocities are employed, giving rise to high powder pressures, all the methods that have been heretofore used are, more, or less, unsatisfactory. This is probably due to the fact that the bands become loosened, owing to their expansion by heat, and to the severe racking strains to which they are subjected, and this loosening of the said bands causes the projectile to be unsteady in flight. It is also well-known that the modern smokeless powder exerts a severe corroding action upon the bore of the gun, thereby producing numerous roughnesses, or inequalities, in the surface of the bore, and it is possible that these inequalities aggravate, or increase, the racking strains to which the band is subjected. Whatever the real facts may be, it is certain that the present methods of banding shell and other projectiles, are so unsatisfactory that they cause the modern projectiles to be unsteady in flight. By my method I overcome all of these objections in a very simple and satisfactory manner.

In carrying out my process I select an alloy which is sufficiently soft as to not materially injure the lands of the rifling, to admit of a thorough and easy swaging into place, and yet is sufficiently tenacious to hold up under the most severe strains to which it may be subjected. Such an alloy is found in copper 97½ per cent., nickel 2½ per cent., and aluminum 3 oz. to each hundred-weight of the combined copper and nickel. This alloy is cast in cylinders, 7, in a metal chill, with an elastic sand core; and with an inter-

nal diameter considerably less than the external diameter of the projectile to be banded. Bands are cut from this cylinder and are machined to the proper dimensions. The interior diameter of the finished band, being for the 12″ shell about 3/16 of an inch less than the external diameter of the rear portion of the shell over which the said band is to be slipped. Such a band is shown in Fig. 6, and when it is heated to a cherry red heat, it will expand sufficiently to admit of the same being slipped over the rear portion of the shell, as shown in Fig. 2. When in this position, overlying the groove 2, a light blow with a hand-hammer, or mallet, seats it in the groove, temporarily, and keeps it in place until it is adjusted in the lower die 8. The upper die is brought to position and the band is then swaged into place; the metal of the band being forced to flow into the undercut portions 3, of the groove 2, and into the curved portion of the die, if desired, forming the lip 6. If, however, it is not desired to form this lip by the same operation that swages the metal into the portions 3 of the groove 2, the said lip may, of course, be formed by a separate operation.

Should any irregularities appear, or the band fail to fully fill the groove, or score 2, a thin strip of brass, say about $\frac{1}{8}$ of an inch thick and one inch wide and of a proper curvature, may be placed over the spot where the irregularities occur and will, when struck by the die, cause the metal to flow in the desired direction.

The above operations are all done while the metal of the band is still hot, and the heat due to the swaging action is added thereto; and, of course, when the said metal cools, the contraction of copper being great, initial strains are set up in the said band, and thereby the same is caused to hug the projectile so closely and to be so firmly seated in the groove, that no amount of racking strains to which it may be subjected in use, will dislodge or distort the same. My process in this very particular must be carefully distinguished from all other processes for securing bands to projectiles, because in none of the former processes, so far as I am aware, are these initial strains present. The fact is, that no matter how firmly the former bands may be secured upon their projectiles, when their entire body portions are raised a certain number of degrees in temperature, by the powder gases, they probably become loosened and the exceedingly objectionable results above enumerated follow. Whatever the real facts may be, actual trial at the Government proving grounds have shown that projectiles banded by my process give results that are very much superior to those banded by any other process that has been heretofore tried.

In Fig. 5, I have shown a modified means of securing the band 4, to the base of the projectile. In this figure, the base of the projectile is provided with the screw threads 10, in the bottom of the groove 2, and the rear wall of the groove is cut away at 11. The band 4, is not provided with screw threads, but is made smaller on its interior diameter when cold than the diameter of the bottom of the groove 2. It is then expanded by heat, slipped over the threads 10, as shown in dotted lines in Fig. 5, and finally swaged in place as shown in full lines in said figure; in which position, the undercut 3, of the groove, is filled with metal as well as the spaces between the screw threads 10. The above steps of my process having been taken while the band is hot, as above set forth, initial strains are set up in the metal of the band when it cools, which cause the band to tightly hug the projectile and which probably prevent the band from becoming loose, when again heated by the powder gases upon firing.

Of course, the screw threads 10, are, or may be, in such a direction as will tend to cause the band to tighten on firing, and, of course, the band 2 may be made of any shape desired.

I am well aware that bands or rings of various kinds have, heretofore, been shrunk on shafting and other pieces of machinery; but said bands have not been thereafter simultaneously subjected to a heating action and to the severe racking strains to which a sabot band is subjected, when fired from a modern high power gun. I am, also, aware, of the fact that sabot bands for projectiles have heretofore been swaged, onto projectiles, when cold. But such bands, in order to get them over the base of the projectile, must be made larger than the same; and therefore a much greater amount of metal must be displaced in the swaging process than in my process; and as the operation is done in the cold, it is not possible to get the metal of the band into as intimate a contact with the metal of the projectile as in my process. This is probably one of the principal causes of the failure of such bands in high power guns. Then, again, such bands when swaged in the cold, can not exert any initial tension on the bottom of the groove, and when heated up by the powder gases, probably, expand and loosen up; thereby greatly aggravating the objections that already exist. Whatever the real facts may be, however, my band has proved eminently superior, under Government tests, to all the bands heretofore tried. But, of course, I do not limit myself to any theories or exact reasons for the superiority of my band, since the same can not be ascertained with certainty under the present state of our knowledge.

What I claim is:—

The process of placing bands upon projectiles, provided with grooves to receive the

same, which consists in selecting a suitable band whose interior diameter is less than the exterior diameter of the projectile over which it is to be slipped, then expanding said band by heat until its said diameter is greater than the diameter of the projectile, then slipping said band over the said projectile, while still hot, and finally swaging it in place in the groove on said projectile, substantially as described.

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

THOMAS ALBERT KEARNEY.

Witnesses:

R. M. PARKER,

A. W. NEALE, Jr.