H. REILLY.

Projectile for Rifled Guns.

No. 214,843. Patented April 29, 1879.

Fig. 12.

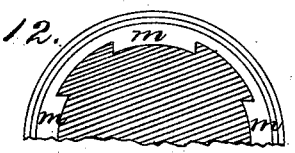

Fig. 11.

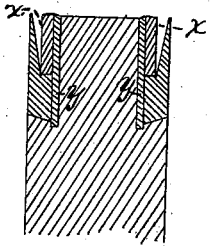

Fig. 1.

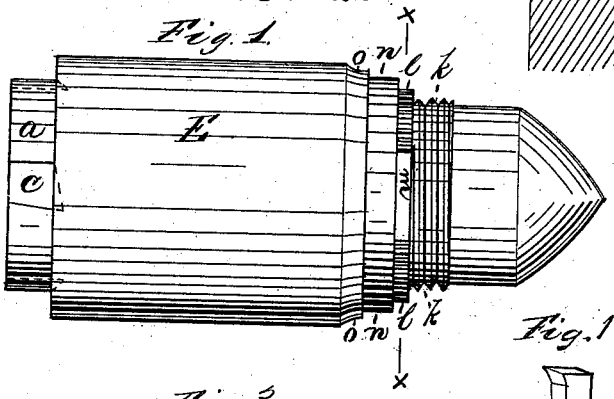

Fig. 2.

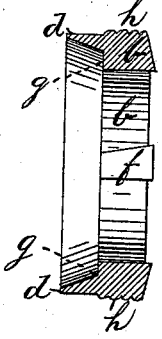

Fig. 10.

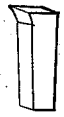

Fig. 3.

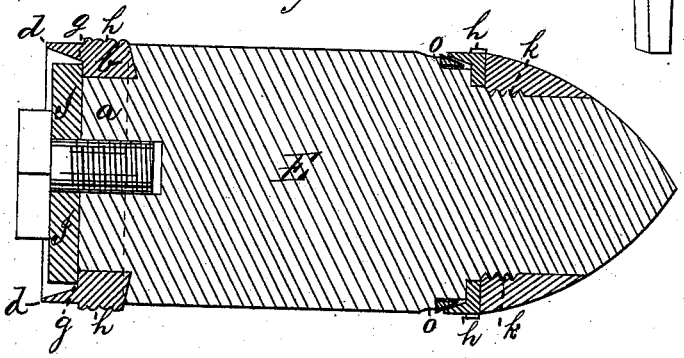

Fig. 4.

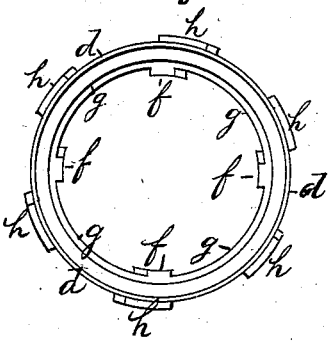

Fig. 5.

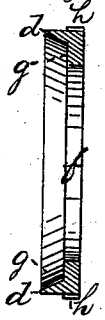

Fig. 6.

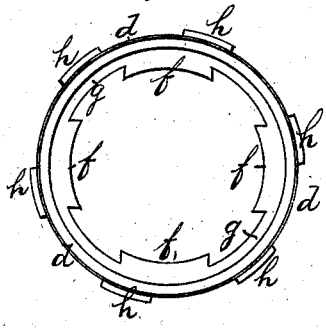

Fig. 7.

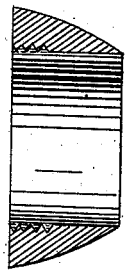

Fig. 8.

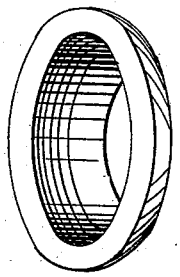

Fig. 9.

Witnesses.

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HUGH REILLY, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN PROJECTILES FOR RIFLED GUNS.

Specification forming part of Letters Patent No. **214,843**, dated April 29, 1879; application filed October 18, 1878.

To all whom it may concern:

Be it known that I, HUGH REILLY, of Brooklyn, State of New York, have invented new and useful Improvements in Projectiles for Ordnance, of which the following is a full, clear, and exact description.

The first of my improvements relates to the form of the sabot at the base or rear end of the projectile, and in the method of attaching the same and effecting its expansion; and my second improvement relates to the form of the sabot at the forward end of the projectile, and in the method of attaching it to the projectile and effecting its expansion.

Reference is had to the accompanying drawings, in which like letters indicate like parts.

Prior to my inventions various devices have been used for centering the shot in the bore of the gun, and also for attaching the sabots both at the rear and at the forward ends of the shot in a manner that should be effective and at the same time less expensive than by the old methods of casting or screwing them on; but they have been partially, if not entirely, unsuccessful.

My improvements seek to obviate the defects of previous devices, and are as follows: I first cast or otherwise form the body of my shot hollow or not, as desired, in the form shown in Fig. 1. The rear projection from the body of the shot (shown at Figs. 1 and 3) is of cylindrical form and concentric with the axial line of the shot, and it extends backward from the body of the shot, or, in other words, is as long as the sabot-ring or that portion of the rear sabot which fits around this projection shall be thick. This portion of the rear sabot is shown at *b*, Figs. 2 and 3.

In the periphery or sides of this projection I cast or otherwise form one or more, preferably four or five, cavities, (one is seen at *c*, Fig. 1,) which cavities extend the whole length of this projection, and their bottoms are equidistant from the axial line of the shot. They are dovetail in form, having the broad end toward the front end of the shot, and both sides may be made flaring. I prefer, however, to make the side which is opposite to that toward which the sabot would be twisted by the action of the rifling of the piece when the discharge takes place straight—that is, parallel with the axial line of the shot—and not dovetailed. This straight side of the cavities I will call the "back side."

The side of these cavities against which the sabot will be twisted I usually form on direct radial lines from the axis of the shot; but they may be cut under, so as to confine the sabot-ring and prevent its expansion; or, if desired, it may be cut on a bevel in the opposite direction, to facilitate the expansion of the sabot-ring.

The confining and expansion of the ring of the sabot by the different angles at which this side of the cavities is cut is somewhat the same in principle as the effect of the different angles of the front face of the sabot-ring, as hereinafter stated.

I sometimes, to secure the sabot more firmly and to more effectually prevent its twisting, extend these dovetail cavities into the body of the shot proper, cutting into it at the shoulder at the base of the projection *a*. I then, to form the rear sabot, cast or otherwise form a ring of brass or other suitable metal of the form shown in cross-section in Fig. 2, and in plan view from the rear in Fig. 4. This ring is provided with a backwardly-extending expansible rim or lip, (shown at *d*, Figs. 2, 3, and 4,) cast in one piece with it.

The sabot-ring proper, *b b*, should have its outer periphery about the same diameter as the diameter of the body of the shot E, and the hole through it should be just large enough to allow it to fit snugly around the projection *a* from the rear of the shot. Thus the thickness of the sabot-ring proper, from the periphery in toward the center, will be the width of the shoulder formed by the difference in diameter of the body of the shot E and the projection *a;* and the length of this sabot-ring, not including the expansible rim or lip extending backward from its rear portion, should be about, but not less than, the length of the projection *a*. On the inner face of this sabot-ring I cast, or otherwise form, a number of projections, *ffff*, Figs. 2 and 4, which extend inwardly toward the center of the ring a distance exactly equal to the depth of the cavities *c* formed in the projection *a*, and, in some instances, as above mentioned, extending into the body of the shot; and they must be in all

respects exactly the shape and correspondingly located as those cavities; but they must not be of the size of those cavities, but so much smaller that the broadest end of the projections *f f f f* can pass in at the narrower or rear end of the cavities *c c* in the projection *a a*. This is necessary in order that the sabot may be placed on the shot, as hereinafter described.

The backwardly-extending rim or lip *d d* tapers on its inner face from its junction with the body of the sabot-ring to its rear edge, where it is comparatively thin. This is in order to facilitate its expansion; and where it joins the body of the sabot-ring proper it must not be quite so thick as the ring is at that point, but so much thinner that a narrow shoulder will be formed by the back face of the sabot-ring within the expansible rim shown at *g g*, Figs. 2, 3, and 4. The outer periphery of this expansible rim *d d* is flush with the external periphery of the sabot-ring.

On the outer periphery of the sabot-ring I form a number of projections or studs, preferably six or more, depending upon the size of the shot and the rifling of the piece in which it is to be used, which studs I usually place distant from one another and make in height and width a little less in each dimension than the distance apart, depth and width of the rifling of the piece; but I sometimes prefer to make these studs not more than half so wide as the grooves of the rifling, in order that the shot may be more readily introduced into the muzzle of the piece; and in order that the studs may more easily accommodate themselves to the rifling of the piece if the sabot-ring should expand under the explosion, I sometimes groove these studs circumferentially by one or more deep serrations. These studs are seen at *h h*, Figs. 2, 3, and 4.

I prefer to bevel the front face of the sabot-ring inwardly and forwardly, and make the shoulder at the rear of the shot conform to this bevel, since by this means the front portion of the sabot-ring will be bound in the angle of the shoulder by the forward thrust of the explosion, and will not expand much, if at all, allowing the rim *d d*, and perhaps the rear portion of the sabot-ring alone, to expand; but the shoulder may be square, or beveled the other way, if preferred, to cause a greater degree of expansion throughout the entire length of the sabot-ring. This feature, however, is described in my patent of July 6, 1875, and is not new now.

Having described this rear sabot, I will explain its adjustment. The sabot is passed on over the rear projection, *a*, the projections from the sabot-ring (marked *f f f f*) passing into the cavities *c* in the projection *a*. When the sabot is in position the shoulder *g g* on the sabot-ring will be flush with the end of the projection *a;* but, because the projections *f f f f* are not so wide, circumferentially, as the cavities *c*, of course the sabot can be turned to some extent on the projection *a*. To make it immovable, I rotate it as far as it will go in the direction in which the impingement of the rifling on the studs would twist it at the time of the discharge, and then I drive tightly in behind each of the projections *f f f f*, and in the holes between them and the back side of the cavities *c*, a metallic key, and I force these keys so firmly home that the sabot cannot stir in its seat. I usually make these keys, in the form shown in Fig. 10, with the head *i*, to enable them to be more easily withdrawn by suitable tools, when desired. The metal of the projection *a* is cut away somewhat to accommodate these heads. I then, to further prevent the sabot from being torn or blown off, place a metallic plate (shown at J, Fig. 3) over the entire end of the projection *a*, and also over the joint between the sabot-ring and the said projection, the edge of the plate resting on the shoulder *g g* of the sabot-ring, and I fasten it firmly in place by a screw-bolt, threaded into the core-hole of the shot, if it be a hollow one; if not, by one or more bolts passing through it into the body of the projection *a;* and I prevent the gases of the explosion from getting under the plate and blowing it off by any known gas-check placed between the under side of the plate, near its edge, and the shoulder *g g* on the sabot-ring.

The device described by me in my patent of July 6, 1875, is a very good one for this purpose. As an equivalent for this plate, I sometimes prefer to fasten the sabot in its place by the following means: I extend the projection *a* beyond the shoulder *g* of the sabot, and I place over it a strong ring of any suitable metal. This ring is made so thick that it will rest firmly upon and almost, if not entirely, cover the shoulder *g*, or at all events rest on the shoulder sufficiently to cover the seam or joint between the projection *a* and the sabot-ring.

This ring may be fastened on the extended projection by the same means as the sabot itself is fastened, and the same cavities which receive the dovetail projections from the sabot being extended through this additional projection will receive the dovetail projections on the attaching-ring, and thus one key will secure both the sabot and the attaching-ring; but when this attaching-ring is used in order to prevent the gases from getting under it and blowing it off, the end of the projection should have a slight shoulder cut in it at its rearward edge all around, and a flange should be formed on the rear edge of the ring just large enough to fit into and tightly fill the said shoulder. This shoulder may have a gas-check applied to it; or the metal of the projection may be beaten down over the flange of the ring. Of course the keys pass through this flange. This ring is shown in Fig. 11 at *x*, and the key at *y*.

By the means above set forth the shot can be used many times; for, the ring or plate being taken off, the keys extracted, and then the

sabot itself being turned back as far as it will go, can be readily pulled backward and away from the shot.

The front sabot is made and attached as follows: The front end of the shot is cast or otherwise formed as shown in Fig. 1. Threads are then cut on the portion of the shot shown at *k k*, Figs. 1 and 3. Behind these threads there is a square enlargement cast on the shot circumferentially; and in this enlargement, which is marked *l l*, Fig. 1, are cut dovetail cavities, one or more, but preferably four or five, to give the front sabot a firm hold on the shot. These cavities are equal in length (the length being considered as in the length of the shot) to the length of the enlargement *l l*, and are in depth, from the periphery of the enlargement *l l* in toward the axis of the shot, from one-half to the entire depth of the enlargement; but they may be less than one-half the depth of the enlargement. One of these cavities is shown at *m*, Fig. 1. The broad end of these cavities is nearest the axis of the shot, and the open small end is in the periphery of the enlargement *l l*, as shown at *m m m*, Fig. 12, which is half a transverse section of the shot through the enlargement *l l* on the line *x x* of Fig. 1. Both ends of these cavities *m* should preferably be made slanting or dovetail in form; but this is not essential. They may be made square; but if square they will not so effectively hold the ring in position.

Immediately in the rear of this first enlargement, *l l*, another is thrown out on the body of the shot circumferentially, which is unbroken. The periphery of this second enlargement, *n n*, is not quite so great in diameter as the diameter of the straight portion of the body of the shot; and from the periphery of this second enlargement, *n n*, the body of the shot is formed on a bevel, as at *o o*, Figs. 1 and 3, until the bevel runs out into the largest diameter of the shot seen at E, Figs. 1 and 3.

I now, to form the front sabot, cast or otherwise form a ring of suitable metal, preferably brass, substantially like the one on the rear of the shot; but it may be much lighter in all its parts. This ring is shown in plan, and looked at from the rear in Fig. 6. It has, in common with the rear sabot, first the sabot-ring proper, which ring should be as thick as the enlargement *l l* is long; second, the inwardly-extending projections *f f f f*, to fill the cavities in the enlargement *l l*, although they dovetail at right angles to the corresponding projections of the rear sabot-ring; third, the backwardly-extending expansible rim *d d*, Fig. 5, cast in one piece with the ring proper, narrower at its rear edge than at its junction with the ring proper, and having its outer periphery flush with the outer periphery of the ring proper; fourth, the shoulder *g g*, corresponding to the shoulder *g g* of the rear sabot; and, fifth, on the outside of the ring proper the projections or studs *h h*, to fit into the rifling of the piece.

It will be particularly noticed that the inwardly-extending projections from the inner surface of this front sabot-ring are to be exactly the shape and size of the cavities *m* in the enlargement *l l*, since this front sabot does not require any keys to fasten it on.

Also, it will be particularly noticed that the projections or studs *h h* on the outer periphery of the front sabot-ring should be so located relative to the like projections or studs on the rear sabot-ring as that they will properly fit into the rifling of the piece in which the shot is to be used; and to effect this they must be set a little to one side of the corresponding studs on the rear sabot, a distance equivalent to the twist of the rifling. This front sabot being placed on the shot, the inwardly-extending projections *f f f f* from its ring entering into the dovetail cavities *m* of the enlargement *l l*, there is then screwed firmly up against it a nut or cap, (shown in section at Fig. 7, and also at Figs. 8 and 3,) which cap may be made of any suitable metal, and in most cases of the same metal as the body of the shot is. The thread is cut in its inside and at its rearward end, although it may be cut the entire length of the cap, and is made to coincide in all respects with the thread on the body of the shot shown at *k k*, Figs. 1 and 3, into which it meshes. This thread should be so cut that the effect of the inertia of this cap when the shot is rotated by the rifling shall be to turn the cap more firmly onto the body of the shot. This cap, when in position, covers the front face of the enlargement *l l* and the forward face of the ring of the front sabot, and is so shaped on its exterior as to fill out the proper outline of the shot with the metal of the cap. A cross-section of the complete shot with all the devices in position is seen in Fig. 3.

I do not confine myself to the use of my improved method of attaching the sabots to sabots with the studs upon them, for the dovetail projections can be also used to attach sabots with plain peripheries.

The advantages of my improvements are, first, these sabots, both front and rear, are attached without the expensive thread-cutting usually employed in double-lip ring-sabots, while they secure all the benefits of such sabots; second, both of the sabots can be easily removed and the shot used repeatedly, which, in target-practice especially, effects a great saving in expense; third, by the use of studs in the rings of the sabots the shot will be accurately centered in the bore of the gun, and by them the shot will be given the twist of the rifling; fourth, by the use of the bolt which is tapped into the core-hole of the shot the attaching and gas-sealing plate is attached, thus plugging the shot and attaching the rear sabot at one and the same cost. This plate, however, is not new with me now, except in combination with the peculiar devices described, it having been fully set forth in my patent of July 6, 1875.

It will be noticed that both of my sabots are single-lip sabots. By that I mean they have, be-

sides the sabot-ring proper, but one backwardly-extending rim or lip, and not two, as in the case of some older forms of sabot, in which older forms one ring attached the sabot to the shot by threads, or in some other manner, and the other and outside ring expanded into the rifling.

It is obvious that the positions of the cavities and dovetail projections on the sabots and in the shot may be reversed, the projections being formed on the shot, and the cavities in the sabot-rings.

The operations of my improvements are as follows: After the explosive has been put into the piece the shot is placed in the muzzle, the studs being introduced into the rifling, and the shot is then forced to the breech, as usual. The studs impinging on the bottom of the grooves of the riflingsupport the shot, and center it both in front and at the rear; and they locate the shot exactly in the center of the bore of the gun, except the little play that must be left to enable the shot to be forced by the usual means into the breech of the piece. The shot, of course, turns on its axis by the operation of the studs while it is being forced into the breech. The charge being then exploded, the force of the gases of combustion causes the backwardly-extending rim of the rear sabot to expand radially and take into the rifling, thus preventing the escape of much of the force of the charge, and also assisting the studs to rotate the shot. A portion of the gases of combustion, however, escape over the rim of the rear sabot, and rushes forward between the sides of the shot and the sides of the bore of the gun, and, catching under the backwardly-extending rim of the front sabot, bends it forward and radially outward, and thus this rim also takes, to some extent, the rifling, and, further, prevents the escape of the force of the charge.

Sometimes, to more effectually expand the rim of the front sabot, I place a ring of iron or other metal not easily compressed or bent, made of the shape seen in Fig. 9 in cross-section, loosely on over the periphery of the enlargement *n n* before the front sabot is placed on the shot. This ring is placed with its square side (marked *p p*) facing the rear, and it is made of such size relative to the inside diameter of the rim of the front sabot that, as it is forced forward by the gases striking its square end, it shall impinge upon the inner surface of the rim and force it outward. Thus the shot is compelled to receive the rotation of the rifling by four means—first, the studs of the rear sabot; second, the studs of the front sabot; third, the taking of the rim of the rear sabot in the rifling; and, fourth, the taking of the rim of the front sabot in the rifling. Moreover, the shot being almost exactly centered, the rotation of the shot while in the air will be almost, if not exactly, on the exact axis of the shot, and its flight much more strong and accurate than when the shot is centered only at the rear or in front, or not at all.

I claim as my invention—

1. The combination, substantially as described, of a shot having a backwardly-extending projection, a ring-sabot having dovetail-like projections extending inwardly, and an expansible rim, fastening-keys, and an attaching-plate, substantially as described, and for the purposes set forth.

2. The combination, substantially as described, of a shot formed in front as set forth, a ring-sabot having inwardly-extending dovetail-like projections, and an attaching-cap, substantially as described, and for the purposes set forth.

3. The combination of a shot, a ring-sabot having dovetail-like projections extending inwardly, and fastening-keys, substantially as specified and set forth.

4. The combination, in a shot, of an attached ring-sabot and movable wedging-ring, substantially as specified and set forth.

5. The combination of a shot and a front ring-sabot, having dovetails fitting into recesses in the shot, and an attaching-cap, substantially as specified and set forth.

6. The combination of a shot, a rear ring-sabot, having dovetail-like projections extending inwardly, fitting into recesses in the shot, and fastening-keys, and a front ring-sabot, having dovetails fitting into recesses in the shot, and an attaching-cap, substantially as specified and set forth.

7. The combination of a shot, a rear ring-sabot, having dovetailed-like projections extending inwardly, fitting into recesses in the shot, fastening-keys, and an attaching-plate, and a front ring-sabot, having dovetails fitting into recesses in the shot, and an attaching-cap, substantially as specified and set forth.

8. The combination, substantially as described, of a shot having a rearwardly-extending projection, a rear sabot provided with studs and dovetail projections, an attaching-plate, fastening-keys, a front sabot having studs and dovetail projections, with or without an expanding-ring, and an attaching-cap, substantially as and for the purposes set forth.

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