No. 772,346. PATENTED OCT. 18, 1904.

A. H. EMERY.

EXPLOSIVE SHELL FOR RIFLED GUNS.

APPLICATION FILED JULY 12, 1901. RENEWED MAR. 12, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

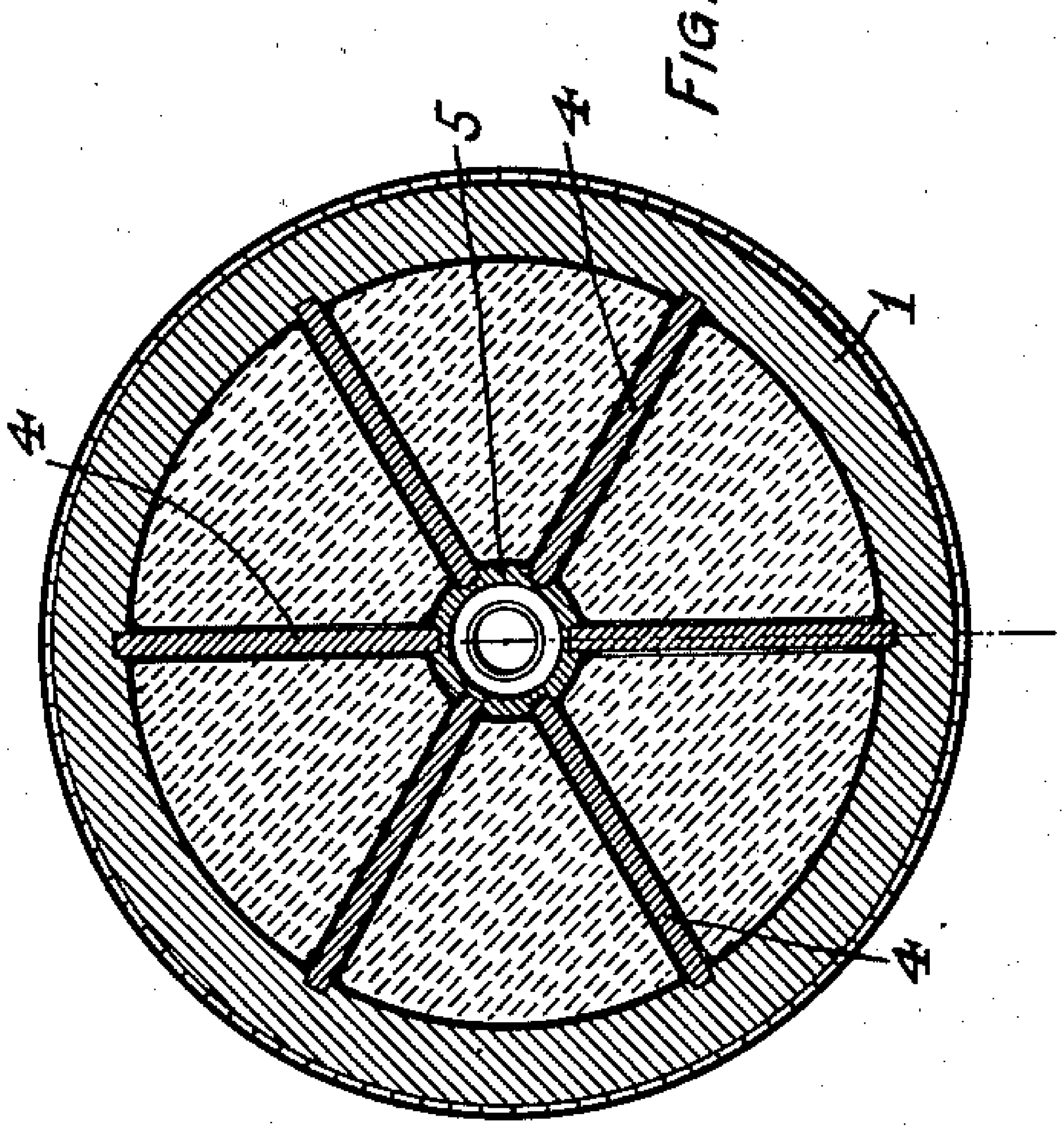

FIG. 2.

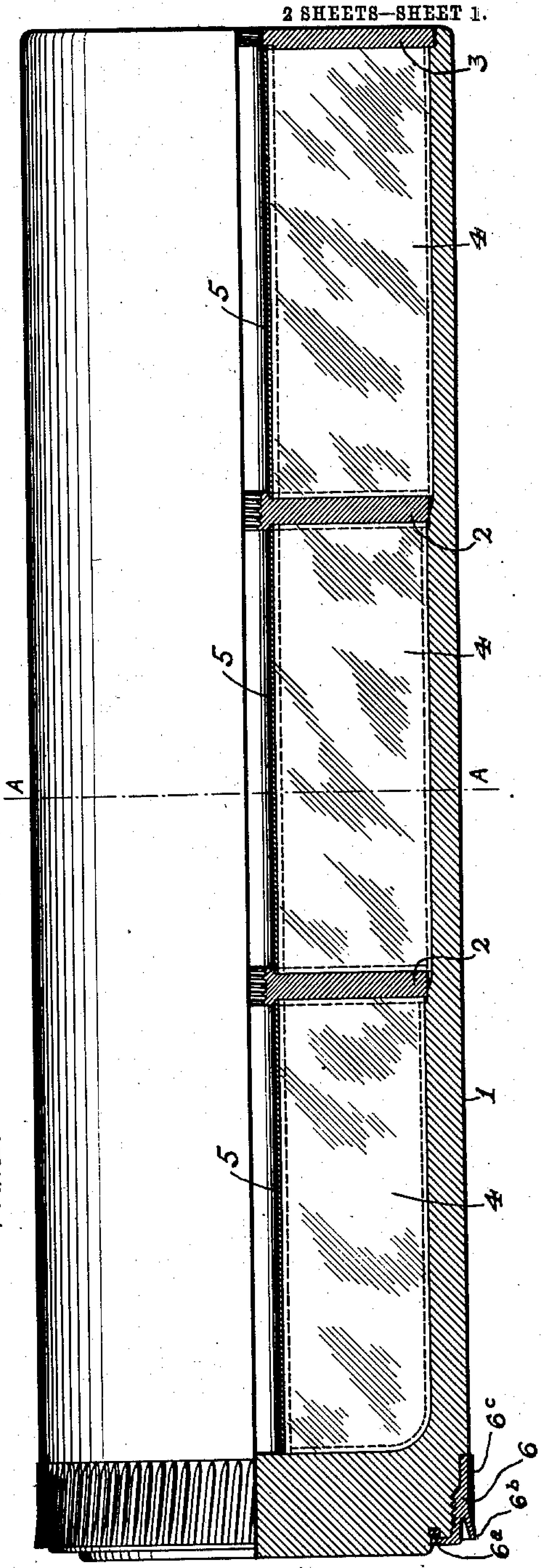

FIG. 1.

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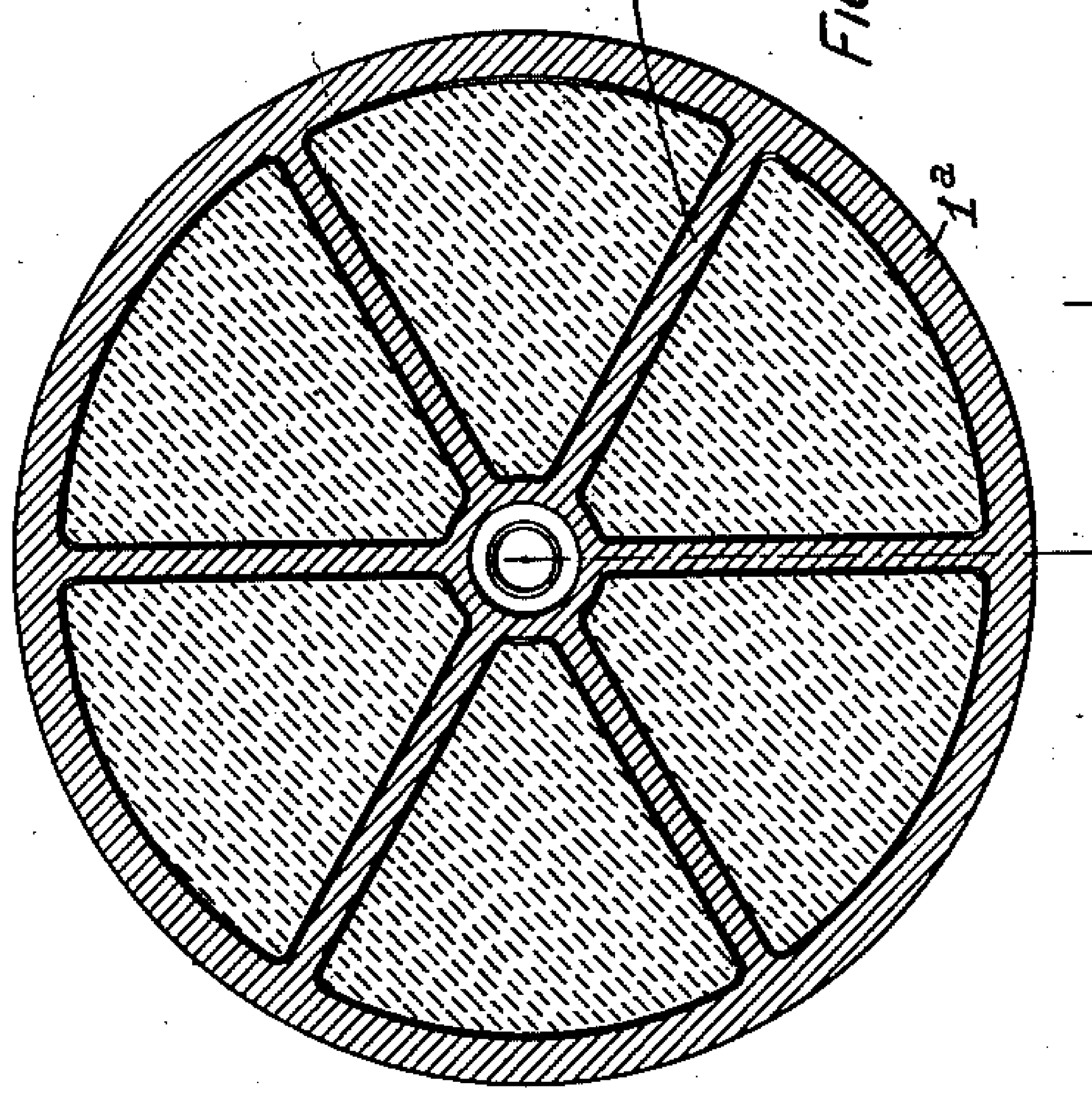

FIG. 5.

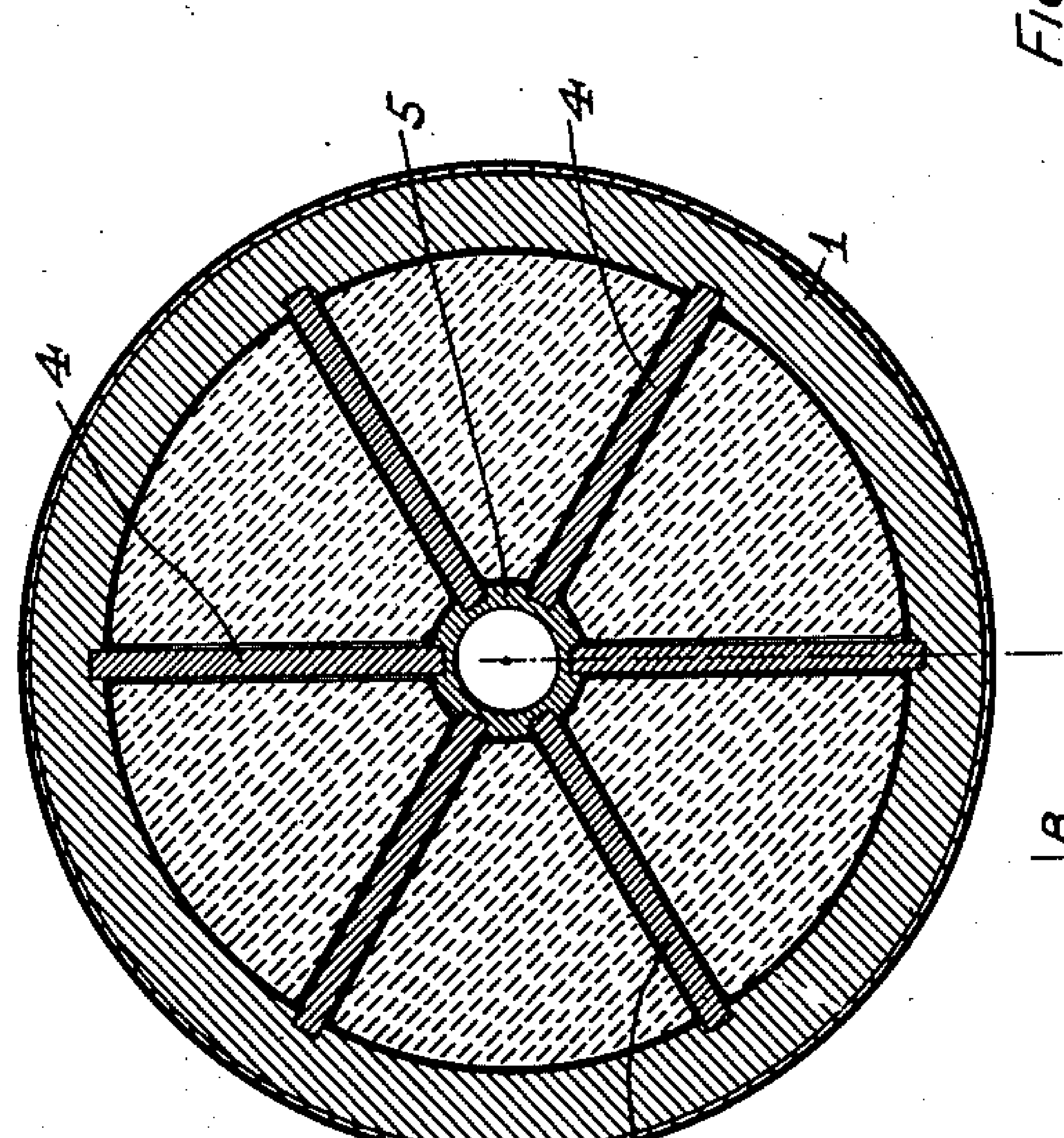

FIG. 4.

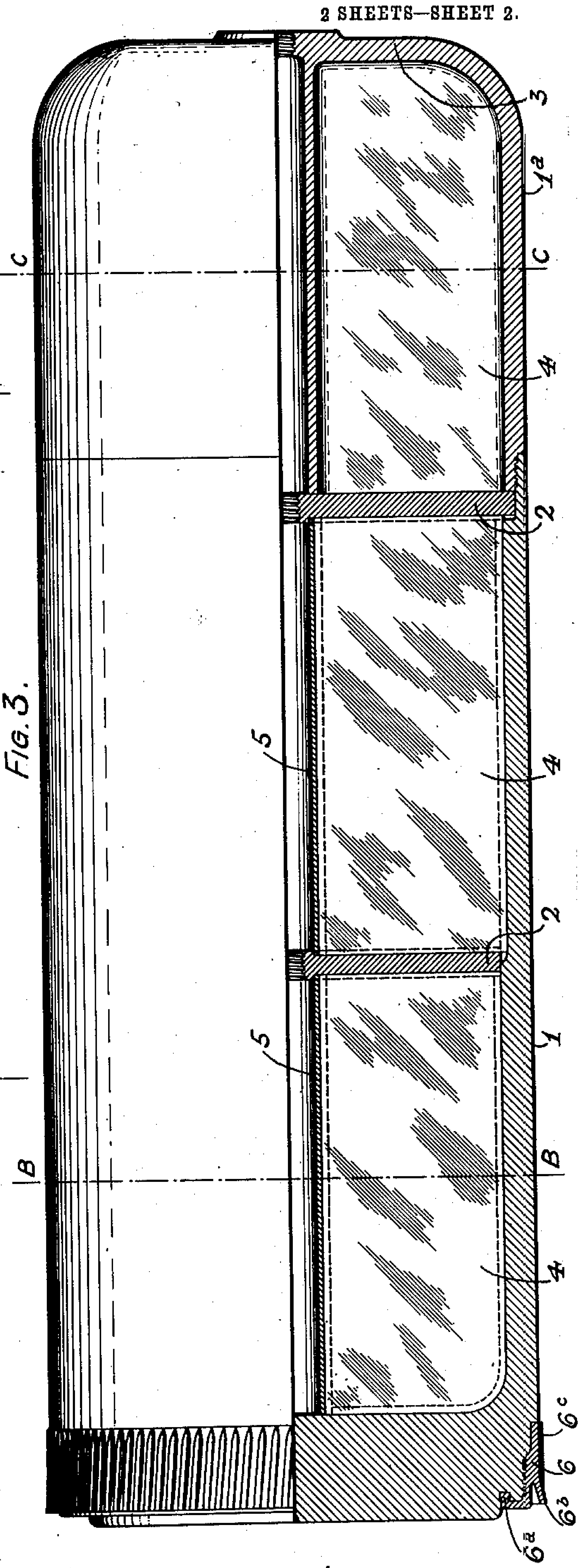

FIG. 3.

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No. 772,346. Patented October 18, 1904.

UNITED STATES PATENT OFFICE.

ALBERT H. EMERY, OF STAMFORD, CONNECTICUT.

EXPLOSIVE SHELL FOR RIFLED GUNS.

SPECIFICATION forming part of Letters Patent No. 772,346, dated October 18, 1904.

Application filed July 12, 1901. Renewed March 12, 1904. Serial No. 197,892. (No model.)

To all whom it may concern:

Be it known that I, ALBERT H. EMERY, a citizen of the United States, and a resident of Stamford, in the county of Fairfield, in the State of Connecticut, have invented certain new and useful Improvements in Explosive Shells for Rifled Guns, of which the following is a specification.

This invention is illustrated in the drawings by five figures, in which—

Figure 1 shows a side elevation, partly in section, of a projectile suitable for large guns. Fig. 2 is a section of the same on line A A, Fig. 1. Fig. 3 is a longitudinal elevation, partly in section, of a slightly-modified form of this projectile. Figs. 4 and 5 are sections of the same on lines B B and C C, Fig. 3.

In making shells for high explosives it has generally been the custom to make them long, with elongated pointed fronts especially adapted to pass easily through the air, and in many cases of forms and constructions intended to be suitable for penetration of highly-resisting targets. This is very objectionable for all cases except those in which the construction and use of the projectile is such that it may pass through the target before exploding, which has rarely been attained when strong thick targets were used. The explosive in these shells has sometimes been divided into several parts by transverse partitions. If the projectile is to do its business upon the target by exploding when impact occurs, it should not be made with an elongated pointed front as heretofore, as such construction holds a very large portion of all the explosive in the shell much farther from the target when the point of the projectile reaches it than is necessary or desirable. As a matter of fact, when the projectile touches the target and explodes the explosive should all be as near to the target as is practicable to have it, for which reason I make the front of the projectile nearly or quite flat and put a very large chamber for explosive in the front end. The walls of the chamber must have sufficient strength to withstand the highest strain brought upon them in projecting the shell from the gun and for this reason should grow thicker as we proceed from the front to the rear, where there must be a thick base sufficiently strong to withstand the shock of firing the projectile from the gun. By making the projectile in this form I bring the whole mass of explosive as near to the very front end of the projectile as is practicable with the dimensions of the charge to be fired and so dispose it as to be as near to the target as possible at time of exploding. The very large charge of explosive exploding closely in contact with the plate of the target receives a very high order of explosion, owing to the weight and resistance of the plate against which it is fired, and this explosion is greatly increased by the strong walls and their contained charges of explosive closely following the front charge, and the whole explosion of the entire charge of the shell is greatly increased in intensity by the weight and position of the thick base of the projectile which is near to and rapidly approaching the target at the time of explosion, when the front of the projectile touches it. The effect on the target due to this base is greatly changed by its being so near from what it would be in another projectile of equal diameter containing equal quantity of explosive had the projectile a long point, as heretofore constructed. So each of the charges into which the whole charge is divided will have much greater effect in my projectile than in those heretofore used, because when detonated it is much closer to the target to be destroyed and the intensity of the explosion of each division of the charge tends in much greater degree to increase the explosive effect of each other division of the charge.

In Fig. 1, 1 represents the base and body of the shell, the walls of which are drawn of uniform thickness for each chamber, but with successively thinner walls as we pass from the base to the front, the offset at each reduction in thickness forming a ledge on which rest diaphragms 2 to support the different charges into which the explosive charge should be divided, if at all sensitive, sufficiently to prevent the explosion of any part of the charge from igniting by the pressure due to its own weight and the impact in firing. In Fig. 3, 2 also represents the transverse diaphragms, as in Fig. 1.

The shells shown in Figs. 1 and 3 are each divided transversely into three parts by the diaphragms 2. The number of the diaphragms 2 should be increased, if necessary, to the extent above indicated, but with the precautionary provisions which I take, as hereinafter explained. Two or three of these transverse diaphragms will usually be sufficient, unless it be in cases where the projectile is unduly long or the powder-pressures extremely high.

In Fig. 3 a portion 1^a of the body of the shell instead of being drawn in one piece with the base and walls of the main shell is drawn or cast or cast and drawn in one piece with a front 3 and after charging screwed to the main body of the projectile, while in Fig. 1 the front 3 is made in a separate piece screwed into the side wall of the projectile.

The base and side walls of the projectile shown in Fig. 1 are best drawn from forged metal, preferably steel, as described in my application of July 12, 1901, Serial No. 68,003, except that I have here added the ledges necessary to support the transverse diaphragms. The base and main walls of the projectile in Fig. 3 are constructed in the same way. The base and walls of this projectile, as shown in either figure, could be cast; but when made by forging and drawing, as explained, they are much stronger and of more uniform density than if cast only, and, besides, when forged and drawn of steel I oil-temper them, which still further strengthens them, and this greater strength of the walls aids in insuring the detonation of the charge to be contained in the shell.

To avoid firing the explosive in the act of firing the shell, it is essential that the walls should be smooth, which is insured by making the projectile in the method described, and even if they are smooth the friction between the explosive and shell, due to the rapidly-rotating shell and the more slowly rotating explosive contained therein, has often caused explosion at the muzzle of the gun or after the projectile has gone several hundred feet. This frictional heat is entirely avoided by dividing the charge longitudinally into a suitable number of sections by diaphragms 4. These diaphragms are made in one with the shell, as shown in the front chamber in Figs. 3 and 5, or they are made separate and placed in the shell, as shown in Figs. 1, 2, 3, and 4, where they are all so placed except those referred to in the front chamber in Fig. 3. These diaphragms are best made of thin rolled sheet-steel, cut to the proper size and tempered and placed in grooves to secure them in place and to cause them to rotate with the shell when fired. These diaphragms not only oblige the charge to rotate with the shell, but they enable us by their support to use comparatively thin transverse diaphragms 2. The thickness required for the longitudinal diaphragms 4 will vary with their number and positions in the shell. Those in the lower chamber should be thicker than those in the chambers above, as the lower diaphragms 4 must support not only in firing the pressure from the explosive in the chamber above it, but must help support the pressure from all the explosive and longitudinal diaphragms above it. The thickness of these longitudinal diaphragms may properly decrease as we go toward the front of the projectile. Of course the thinner these are, while retaining the required strength for the position in which they are to be placed, the better they will be, as they give less weight to the projectile and leave more room for the explosive.

Between the transverse diaphragms 2 are central columns 5, which help support the transverse diaphragms 2, and when grooved, as shown, help fix in place the longitudinal diaphragms 4. They are best made of drawn tubing, when, owing to the holes through the diaphragms 2, they form a continuous chamber leading from the front to the rear of the projectile, readily divisible, if desired, in which detonating charges may be placed to explode simultaneously all the explosive contained in the shell. These charges are left out in the figures shown. The shell may be exploded directly by impact if charged with an explosive which is sure to fire by the concussion produced in hitting the target; otherwise the central column should be charged with a detonating explosive to ignite the main charge when the projectile hits the target.

The main charge is here shown divided into smaller charges both transversely and longitudinally, as explained. Each of these small charges may be placed directly in the chamber it is to occupy at time of firing at any time after making the projectile; but I prefer in most cases to inclose each divisional charge of the explosive in small thin packing-chambers which closely fit the walls of the division in which it is to be placed. These little packing-chambers may well be made of thin sheet metal, lined with paraffin or other suitable material, and after closely filling with the explosive they should be suitably sealed, ready to be placed in the shell at any desired time. By using this method the shell may be charged or uncharged at any time.

In studying this projectile, constructed as described, it will readily be seen that for a projectile of any given diameter, length, and weight a very much larger charge of explosive can be carried than when the projectile has a long heavy front, as heretofore used, and not only is the explosive brought nearer to the target than in the other shells, but the walls may be thinner and still have sufficient strength, owing to the small quantity of metal in the front of the projectile instead of the large quantity used in the points heretofore made, while conversely I have a large quantity of explosive brought close to the target before explosion, where it becomes so very effective, as explained. The front 3 of these projectiles is made very thin; but in cases where it is to strike the water before reaching its target this front should be thick enough to withstand the impact of the water and allow the shell to ricochet and go on to the target before exploding. The proportions shown in the drawings are probably sufficient for this.

It will be noticed that the projectile when made as described of suitable material is not only capable of withstanding large strains in firing from the gun, but contains a very large volume of explosive for a projectile of such weight and length, and so is for this and the other reasons mentioned vastly more effective proportional to its caliber and weight than are any heretofore made.

In using this projectile it is especially desirable that no gases pass by it in firing from the gun and that it is perfectly rifled, so as to keep point on in firing, that its front end may strike the target first, as desired. For this purpose I use a packing-ring 6 of suitable material, usually bronze, securely screwed to the base of the projectile, with a forwardly-projecting lip 6^a at its base. This lip projects into a recess in the base, and after the packing-ring has been screwed tightly to place heavy hydraulic pressure shortens and expands the lip 6^a, causing it to fit tightly the groove in which it is contained. This prevents gases from passing under this ring to blow it off at the muzzle of the gun. The gases not passing under the ring their high pressure at time of firing press the ring tightly against the projectile and cause this pressure to help the screw-threads of the ring, securing it sufficiently to cause the projectile to rotate with it, according to the twist of the gun-rifling.

To prevent erosion of the gun and possible premature explosion of the shell from the action of the gases passing around it at time of firing, a thin lip 6^b is provided at the base of the rifling-ring with a diameter somewhat larger than the bore at the bottom of the grooves of the uneroded gun, this lip entirely shutting off the passage of the gases. In front of this lip the rifling-ring has a series of lands or projections 6^c, which project into and fill and fit the grooves of the gun at time of firing, causing the projectile to rotate with the rifling of the gun. The form of this projectile makes it particularly desirable that this action should be certain.

In inserting this projectile into the gun it is desirable that the lands 6^c of the packing-ring should enter the grooves of the gun at time of loading, and to make this entrance easy the fronts of these lands are made pointed, as shown in Figs. 1 and 3.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. A shell constructed with one or more chambers for high explosive, with a flattened front end constructed and arranged to permit a relatively large section of the explosive to be brought very close to the target against which the shell is fired, before the shell is exploded.

2. A shell constructed with one or more chambers for high explosive and having a thin flattened front wall constructed and arranged to permit a relatively large section of the explosive to be brought very close to the target, before the shell is exploded.

3. An explosive shell having transverse diaphragms dividing the explosive charge into columns sufficiently short to avoid explosion of the shell in the gun in firing, and having radial partitions to divide the charge longitudinally and force it to revolve with the shell; said radial partitions being separable from the shell and recessed into the wall of the shell.

4. An explosive shell constructed with a central column and separable radial partitions recessed into the central column and into the wall of the shell dividing the charge of explosive longitudinally, and forcing it to rotate with the shell in firing.

5. An explosive shell constructed with transverse diaphragms dividing the explosive charge into columns sufficiently short to prevent explosion in the shell in firing, and with separable radial partitions to divide the charge longitudinally and force it to rotate with the shell, recessed into the transverse diaphragms and into the wall of the shell.

6. An explosive shell constructed with transverse diaphragms dividing the charge into columns sufficiently short to prevent explosion of the shell in the gun in firing, with a central column and separable radial partitions recessed into the central column and into the wall of the shell.

7. An explosive shell constructed with a central tubular column to contain an igniting charge, and with separable radial partitions recessed into said central tubular column and into the inner wall of the shell, and dividing the explosive charge longitudinally.

8. An explosive shell constructed with transverse diaphragms dividing the explosive charge into short sections; central columns between the transverse diaphragms; and with separable radial partitions recessed into the inner wall of the shell dividing the explosive longitudinally, and forcing the partitions to rotate with the shell in firing.

The foregoing specification signed this 3d day of July, 1901.

ALBERT H. EMERY.

In presence of—

NATH. R. HART,

JOHN E. KEELER.