

(No Model.)

A. S. LYMAN.

CARTRIDGE.

No. 321,042.

Patented June 30, 1885.

Fig. 1,

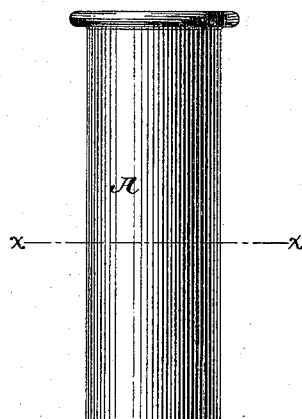


Fig. 2,

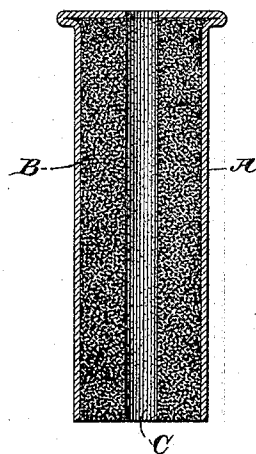
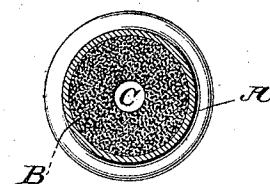


Fig. 3,



Witnesses:

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CARTRIDGE.

SPECIFICATION forming part of Letters Patent No. 321,042, dated June 30, 1885.

Application filed September 8, 1884. (No model.)

To all whom it may concern:

Be it known that I, AZEL S. LYMAN, of New York, in the county and State of New York, have invented certain new and useful Improvements in Cartridges, of which the following is a full, clear, and exact description, and which will enable those skilled in the art to which this invention belongs to make and use the same.

The invention relates to the art of firing projectiles from guns by the use of cartridges made of explosive material, which is consumed behind the projectiles; and it consists, primarily, in arranging the explosive material of the cartridges so that the force generated at the moment of ignition will be comparatively small, but will increase continuously until the entire charge is consumed, the effect being to start the projectile gently and to communicate to it a gradually-increasing motion throughout the entire bore of the gun, and thus relieve the walls of the gun from the dangerous strain that is necessarily exerted upon them when the fire surface or area of the explosive is greatest at or near the moment of ignition. The powder or other explosive is to be packed in a solid mass within a case or shell that protects its outer cylindrical surface from the action of fire, so that when the ignition of the powder first takes place the fire-surface will be comparatively small, but will continually enlarge as the combustion proceeds, thereby increasing correspondingly the volume and heat of the gases generated.

One mode of constructing a cartridge embodying the invention is shown in the accompanying drawings, where Figure 1 is a side view of such a cartridge, Fig. 2 being a longitudinal central section thereof, and Fig. 3 a cross-section on plane *xx* of the first figure.

In these views, A represents the shell or case of the cartridge, which is of any desired length and size. B is the powder, which is packed in the shell so as to form a solid mass or cake, and this cake of powder is centrally pierced by a hole, C, which also passes through the head of the shell.

In firing this charge a primer of any suitable construction may be used, such primer being inserted in the hole in the head of the shell;

but it is only necessary that the primer be of such construction and so located as at the time of the explosion to throw a stream of fire down through the perforation in the powder. This will ignite the powder along the internal walls of the perforation, and, as this perforation is comparatively small, the volume of gases generated at first will be correspondingly small; but as the combustion proceeds the fire-surface will continually increase until substantially the entire mass of the powder is consumed. The effect produced by burning the powder in this way is that the initial pressure upon the projectile placed in front of the charge is relatively low, and by reason thereof the projectile is started from its place of rest with comparatively little strain upon the walls of the gun. As the projectile gains velocity the fire-surface at the same time rapidly increases in extent, with a corresponding increase in the volume and temperature of the gases produced.

By properly proportioning the size and shape of the powder-cake relatively to the projectile to be used and to the length of the barrel through which it is to be driven, the force exerted upon the projectile by the powder may be regulated practically at will, and so as to do the most effective work in any given case. It can be regulated (and this it is believed will be found a desirable condition in use) so that the initial pressure exerted upon the projectile will be maintained substantially uniform during the entire progress of the projectile through the bore of the gun, this being effected by properly proportioning the rate of increase of the fire-surface to the increase in the velocity of the projectile. Instead of thus maintaining a practically constant pressure upon the projectile after its start and during the time of the burning of the powder, such pressure, if it should be desired, might be constantly increased; and this, obviously, could be accomplished by so regulating the shape and size of the cartridge relatively to the projectile and to the bore of the gun that the rate of increase of the fire-surface as the burning proceeds would be in excess of the rate of increase in the velocity of the projectile.

A cartridge made according to the principles above indicated may of course be used for firing either bullets or shot. In the latter case the shot may be properly massed directly in front of the forward end of the powder-cake and inclosed in an extension of the shell or case. So, also, a bullet or single ball might be arranged within a forward extension of the metallic shell; but the particular mode of arranging either a bullet or a charge of shot in combination with a cartridge of the character above described constitutes no part of the present invention, and therefore, so far as concerns this invention, may be done in various ways.

It will be seen that with a cartridge constructed in the manner shown in the drawings, if the forward end of the powder be protected from contact with the fire at the first moment of ignition by the rear end of the shot, only such end, as well as the walls of the perforation through the cartridge, will burn as the combustion proceeds; but as the area of the forward end of the cake is very small relatively to that of the walls of the perforation, the burning at this end does not practically interfere with the action of the cartridge, as above explained. It is believed, however, to be important that the rear end of the powder-cake should be protected (as by the presence of the head of the shell, as shown in the drawings) from the action of the fire, for if the rear end of the powder-cake were to become ignited at the outset there would be danger that the gases generated thereby might force the mass of powder or portions thereof from its seat in the shell, which would interfere with the intended mode of operation of the cartridge.

Ordinarily, with a cartridge such as is shown in the drawings, the primer used would be applied to the rear end; but it is manifest that a cartridge constructed on the principle hereinbefore described might be ignited from the front end of the perforation in the powder-cake by the use at that point of any suitable material or apparatus therefor, in which case the igniting flame would be thrown rearwardly along the perforation. Whether the fulminate used for igniting the powder be placed at the rear end of the perforation or at the forward end, it is important that the perforation be left free and unobstructed, so that the fire from the fulminate or other priming may be flashed instantaneously through the whole length of the aperture, and thus put the entire surface of the walls of the aperture in ignition at once.

I have spoken of the powder-cake as being "solid," and by this I mean compact and hard, particularly as contradistinguished from the incompact character of cakes or pellets of powder that are made up of compressed granular powder, which cakes or pellets, though in a solid form, are granular in their structure

and burn in all directions through their mass after the manner of loose granular powder. With a cake of powder suitable to carrying out the invention, the burning is always on the surface of the cake and the fire does not penetrate to any appreciable extent into its mass.

The cartridge here shown is intended more particularly for small-arms, as for large guns it is believed a cartridge having a multiplicity of holes will be found more efficient. This modification in the application of my invention forms the subject of another pending application for patent filed by me January 26, 1885, No. 153,959, (Case A,) and is not therefore claimed here. So, too, I do not claim the use of a cartridge constructed as here shown, as this is the subject of a pending application filed by me December 29, 1884, and numbered 151,421, (Case C.) Nor do I here claim the improvement in the art of firing projectiles which depends upon a continual increase of the fire-surface of the charge during its combustion, as this forms the subject of a pending application (Case D) filed by me April 20, 1885, and numbered 162,758.

I am aware that heretofore it has been proposed (as in the United States Patent of H. S. Lucas, No. 58,656) to make water-proof cartridges for blasting purposes by wrapping or packing the explosive material in an envelope or case, and providing devices for firing the mass at the center; and in one form of construction proposed by Lucas the fire was to be communicated to the center of the mass by means of a fuse reaching to the center and inserted in a longitudinal perforation extending through or partly through the mass. As distinguished from the Lucas cartridge, my cartridge has a free unobstructed perforation extending through it from end to end, so that by the use of properly-placed fulminate or other priming material the fire will be flashed instantaneously through the whole length of the aperture, and thus all parts of its walls will be ignited at once.

What is claimed as new is—

1. A cartridge formed of powder or other explosive material compacted into a cake within a cylindrical shell or case, and pierced longitudinally by a free unobstructed perforation, substantially as and for the purpose set forth.

2. A cartridge formed of explosive material placed within a cylindrical shell or case, and provided with a free unobstructed perforation extending through it longitudinally from end to end, and protected by such shell from the action of fire upon its outer cylindrical surface and at its rear end, substantially as and for the purpose set forth.

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Witnesses:

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