(No Model.)

W. LORENZ.

METHOD OF MAKING CARTRIDGE SHELLS.

No. 346,759. Patented Aug. 3, 1886.

Fig. 1.

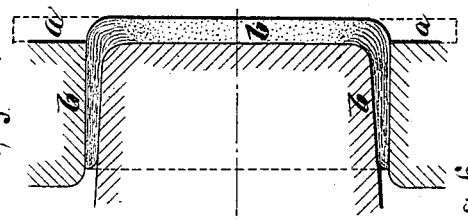


Fig. 2.

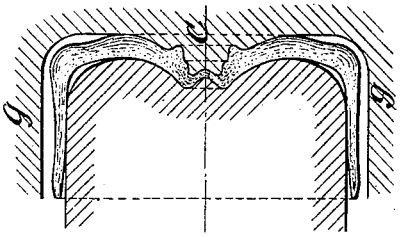


Fig. 3.

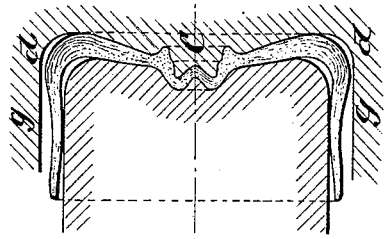


Fig. 4.

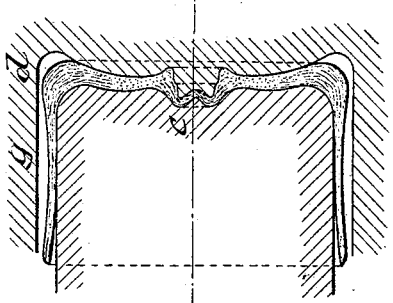


Fig. 5.

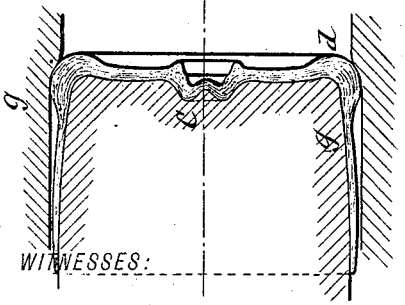


Fig. 6.

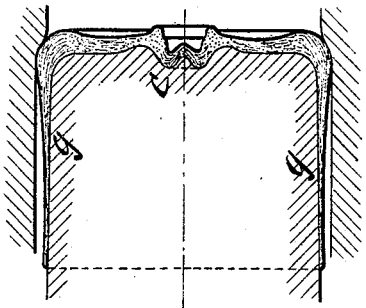


Fig. 7.

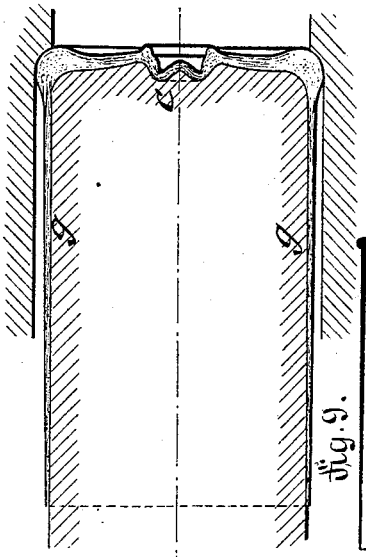


Fig. 9.

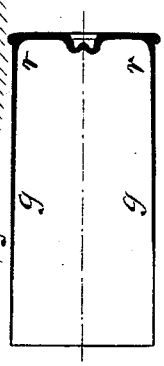
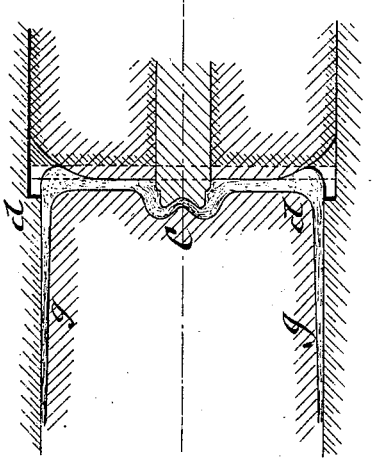


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILHELM LORENZ, OF CARLSRUHE, BADEN, GERMANY.

METHOD OF MAKING CARTRIDGE-SHELLS.

SPECIFICATION forming part of Letters Patent No. 346,759, dated August 3, 1886.

Application filed January 17, 1885. Serial No. 153,136. (No model.) Patented in Germany May 6, 1884, No. 30,275; in France June 20, 1884, No. 162,862; in England July 28, 1884, No. 10,683; in Belgium August 14, 1884, No. 66,030; in Sweden September 29, 1884; in Italy, September 30, 1884, No. 17,250 and No. 189; in Austria-Hungary October 31, 1884, No. 31,515 and No. 50,680; in Spain November 5, 1884, No. 63, and in Norway December 5, 1884.

To all whom it may concern:

Be it known that I, WILHELM LORENZ, of Carlsruhe, in the Grand Duchy of Baden and Empire of Germany, have invented certain new and useful improvements in the manufacture of large-sized cartridge-shells for ordnance and other hollow sheet-metal bodies, (for which Letters Patent have been granted to me in the following countries: Germany, dated May 6, 1884, No. 30,275; France, dated June 20, 1884, No. 162,862; England, dated July 28, 1884, No. 10,683; Belgium, dated August 14, 1884, No. 66,030; Sweden, dated September 29, 1884; Italy, dated September 30, 1884, R. G. Vol. XVIII, No. 17,250, and R. A. Vol. XXXIV, No. 189; Austria-Hungary, dated October 31, 1884, Tom. 34, fol. 2,120, No. 31,515, and Tom. XVIII, fol. 2,108, No. 50,680; Spain, dated November 5, 1884, fol. 428, No. 63, and Norway, December 5, 1884,) of which the following is a specification.

The employment of metallic cartridge-shells for field-pieces and guns of larger caliber offers a number of essential advantages in the construction as well as in the manipulation of the same, as compared to the packing heretofore in use, which consisted of a bag of textile fabric. Metallic shells, for instance, furnish a tight and reliable packing between the barrel and breech-block. They prevent injury to the inner surface of the barrel, and dispense with separate packings—such as sabots, disks, &c. With cartridges having metallic shells it is possible to use percussion-primers, whereby the friction priming with its touch-hole screw and packing, &c., is obviated. The metallic shells also prevent the settling of the products of combustion in the barrel, while by the employment of suitable wads for closing the metallic shells at their mouths, the cartridge-chamber as well as the inner rifled surface of the barrels are cleaned, and the long wiper for cleaning the gun-barrels done away with.

The most essential conditions which are necessary for the proper introduction of metallic cartridge-shells for heavy guns are, first, that the shells, notwithstanding their size, have to be made of very thin sheet metal and as light as possible, so that the weight exerted on the trunnions is but little increased. A second condition is that the shells, notwithstanding their reduced thickness, have to be tough and of great strength and resistibility, so that they can be used several times for avoiding too great expense, especially in practice firing. The manufacture of such thin shells possessing the required degree of resistibility could not be properly accomplished by the method heretofore in use for making cartridge-shells of smaller sizes, as the degree of lightness and strength required for resisting the force of the explosion could not be obtained thereby. It is therefore necessary to provide an entirely new method which differs from the one heretofore in use for producing cartridge-shells for larger sizes of projectiles for artillery purposes.

The method heretofore in use for making shells for smaller cartridges consists, first, in the use of sheet-metal disks or blanks of a thickness which is in a certain fixed proportion to the thickness of the bottom of the shell to be formed, but which thickness turns out in most cases to be greater in the finished shells; secondly, by pressing and drawing the blank from a larger diameter to a smaller diameter, and shaping the bottom from the exterior circumference and side wall toward the center; thirdly, by forming the side wall of the shell only from that part of the blank that forms the side wall of the cup obtained by the first pressing. It is a characteristic feature of this method of making cartridge-shells that in the first stages of their production, not only the thickness of the metal in the bottom is retained, but that the same is increased by the inward crowding of the stock in obtaining the required dimension of the rim, the proper thickness of the bottom, and the proper shape of the priming-cup. It follows, therefore, that for shells with thick bottoms thick blanks, and for shells with thin bottoms thin blanks, have to be used, and that in the manufacture of cartridge-shells with thin bottoms from thin blanks, owing to the easy working up of the material, but little power is required. It follows, further, that the shell is drawn out over and over again

at the point of connection of the bottom with the side wall, while the main part of the bottom remains intact, by which the strength of the material is most injuriously affected at the point where it should be strongest, so that frequently transverse breaks are formed, which render the shell unfit for use. It is not possible to avoid this defect by increasing the thickness of the shell at the point referred to by giving it a larger cross-section, and decreasing gradually its thickness from the bottom to the side wall, because, even if the breaks do not penetrate at first through the entire thickness of the side wall, they gradually increase in depth in firing until they pass through the wall of the shell. It is therefore clear that by using the method heretofore referred to for making shells for cartridges for guns of heavy size—such as field-pieces or other heavy guns—the thickness of the sheet metal has to be so selected that the priming-cup and rim can be formed from the same, that further the bottom retains the thickness of the blank-disk, and that the bent-up side wall of the cup formed from the blank has to form the side wall of the shell. These conditions require that the bottom of the shell would have to be very thick, and that, consequently, the weight of the shell would be considerably increased. This additional weight forms a serious objection, as it would eventually preclude the use of metallic shells for heavy projectiles, owing to the increased weight and the increased strain on the carriage.

My improved method of making cartridge-shells for projectiles of large sizes avoids the above-mentioned objections, and the invention consists of a method of making metallic shells of large size in which all the stock that is not required in the bottom for the formation of the priming-cup and the rim is first forced by pressure from the bottom toward its circumference, and then drawn from the circumference into the side wall of the shell. It is therefore possible to make shells with thin bottoms from thick blanks or disks by gradually crowding the metal in a series of concentric rings or radially from the center toward the periphery, whereby the strength of the shells at the point of connection of the bottom with the cylindrical side wall is increased.

In the accompanying drawings, Figures 1 to 8 show the different stages through which the blank has to pass in forming a shell, together with the dies for bending, drawing, pressing, and forming the rim of the blank. Fig. 9 is a vertical longitudinal section of a finished shell.

Similar letters of reference indicate corresponding parts.

In carrying out my invention a thick blank, *a*, of disk shape (shown in dotted lines in Fig. 1) is first bent into cup shape in the usual manner. The blank-cup *b* is then exposed to pressure, so as to form the priming-cup *c* from the stock at the central part of the bottom, while the stock immediately around the priming-cup is forced in outward direction, as shown in Fig. 2. In the following stages of the pressing operation (shown in Figs. 3 and 4) the stock is crowded from the center toward the circumference, whereby the diameter of the bottom is enlarged, the thickness of the same diminished, and a thick annular portion, *d*, formed at the circumference. From the annular portion *d* the stock is conveyed by drawing, as shown in Fig. 5, into the cylindrical side wall, *g*, of the shell, which drawing is continued, so that the shell is gradually lengthened, as shown in Figs. 6 and 7.

It appears clearly from the Figs. 1 to 7, that the thickness of the bottom decreases successively, and that the stock is gradually crowded from the center toward the periphery of the bottom, and from the same in a continuous fiber into the side wall of the shell, while sufficient quantity of stock is retained for forming the rim *r* of the shell, as shown in Fig. 9.

The final formation of the rim *r* takes place in an analogous manner by crowding the stock from the center toward the circumference. This is accomplished by pressing the bottom first into proper shape from the inside by means of a straight and smooth die, as shown in Fig. 8, so that the next following pressure on the outside by the die which forms the rim (also shown in Fig. 8) cannot force the stock back toward the center. As the bottom is compressed by the first pressure, the stock in the annular portion *d*, being of softer metal, can only flow in outward direction. Without this preparatory pressing the stock would be distributed over the bottom, and thereby an increase in the thickness of the same obtained, which is the very object to be prevented.

It is obvious that by crowding the stock from the center of the bottom toward the circumference by means of one or more successive pressings, the grain-like structure of the metal is gradually changed to a fibrous structure that extends radially from the center to the circumference, and which extends by the successive pressing and drawing into the rim and from the same into the side wall of the shell, as indicated in Figs. 1 to 8, in which the continuity of the fibre is clearly indicated. It is also obvious that by thus imparting a fibrous structure to the metal no part of the shell is injuriously affected, so that, consequently, no weak spots are formed near the rims or cross-breaks, owing to the longitudinal direction of the fibers.

My improved method of making larger sizes of shells has the advantage that blanks of any desired thickness may be used, as said thickness is reduced in the course of manufacture to the required thickness of the bottom, and the superfluous stock crowded into the side wall of the shell, in which it is drawn out to the required thickness, and finally cut off to the required length. All that is necessary in selecting the thickness of the blanks is to have proper regard for the thickness of metal required for the priming-cup, and for the de-

sired weight of the finished shell. It follows, therefore, that the dimensions of the blanks can be determined accurately and with a view to the most economical distribution of the stock. The improved method requires, however, in contradistinction to the method heretofore in use for making shells from thin sheet metal, powerful pressures, so as to produce the thin bottoms from the blanks of greater thickness.

In the same manner as cartridge-shells other hollow sheet-metal bodies can be made according to the method described, either with central depressions in the nature of the priming-cups, or with ring-shaped depressions, or with solid projecting rims, or with hollow rims. My method is therefore adapted to make all kinds of seamless cylindrical bodies from any suitable metal, such as cans, boxes, vessels, and other articles.

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

1. The method herein described of making large sized cartridge-shells and other hollow sheet-metal bodies, which consists in crowding the stock by successive pressings from the center of the bottom of the blank toward the circumference, and then drawing the same gradually into the side wall of the shell or other body, substantially as set forth.

2. The method herein described of making large-sized cartridge-shells and other hollow sheet-metal bodies, which consists in reducing the thickness of the disk-shaped blank by crowding the stock from the center of the blank toward the circumference by successive pressings, then drawing gradually the stock from the circumference into the side wall of the shell or other body, shaping the bottom and increasing the strength by inside pressure, and finally forming the rim at the periphery of the body, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

WILHELM LORENZ.

Witnesses:
FRIEDRICH LORCH,
ADOLF LEHNE.