J. D. PEDERSEN.

CARTRIDGE.

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1,081,983.

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Fig. 1.

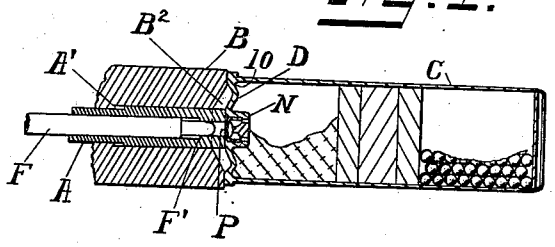


Fig. 3.

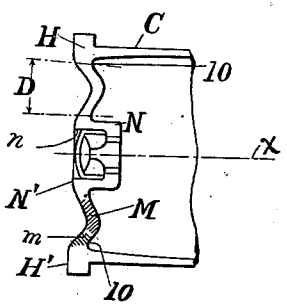


Fig. 2.

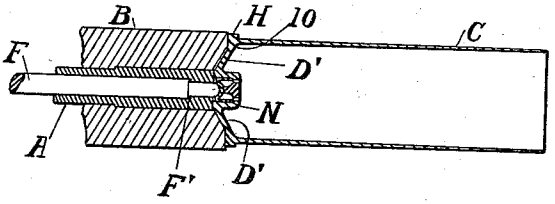


Fig. 4.

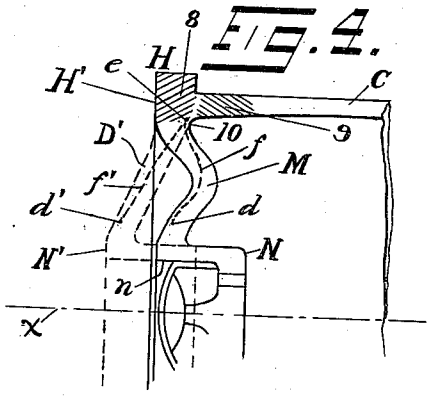
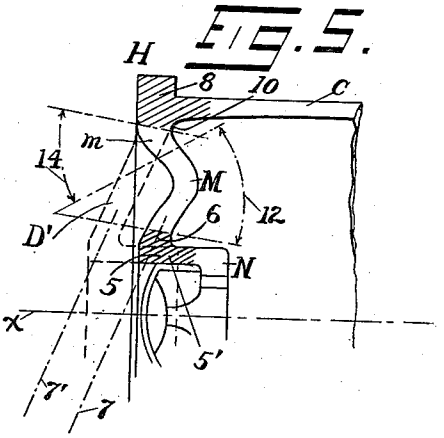


Fig. 5.



Witnesses:

Chas. E. Whiteman,

H. D. Penney

Inventor:

John D. Pedersen,

By F. H. Richards,

Attorney.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN D. PEDERSEN, OF JACKSON, WYOMING.

CARTRIDGE.

1,081,983. Specification of Letters Patent. Patented Dec. 23, 1913.

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To all whom it may concern:

Be it known that I, JOHN D. PEDERSEN, a citizen of the United States, residing in Jackson, in the county of Uinta and State of Wyoming, have invented certain new and useful Improvements in Cartridges, of which the following is a specification.

In my present improvements a principal object is to effect the completion of the head of the cartridge shell for enabling this head to sustain the maximum gas-pressure, by utilizing or employing the gas-pressure itself to form or finish the head into its final shape, and to do this subsequently to the firing of the primer and by the force of that pressure during the early stages of its increasing force; and to accomplish this result without any mobility as between the tube of the shell or any part thereof and the extractor-rim, and without any surplus of metal therein or the employment of any additional parts in the cartridge.

A further object is to accomplish those results in such a manner,—while avoiding any extension of the metal in any part of the shell such as would tend either to elongate or to weaken the tube or the extractor-rim, or to weaken or modify the connection, whether integral or otherwise, between the forward and thinner part of the tube and said extractor-rim,—that during such re-formation and completion of the preliminarily-formed head of the shell, the central primer-carrying member thereof may be effectively employed as an operative means for actuating a resisting member or power-transmitter in the gun mechanism.

In the accompanying drawing forming a part of this specification, and in which similar characters refer to like parts in all the views,—Figure 1 is a longitudinal section of a cartridge having its shell made in accordance with my present improvements, and showing the head of the shell in operative relation with those parts of a cartridge-operated gun mechanism, which come directly into engagement with this kind of a cartridge when in position ready for firing. Fig. 2 is a view similar to Fig. 1 but showing the reformable part of the cartridge head re-formed into its final or completed shape or construction; this view also and further illustrates the manner in which a gun mechanism of the character referred to may be actuated from and during the re-formation of the cartridge head, as hereinafter further described. Fig. 3 is a similar sectional view, on a larger scale, for illustrating the arrangement in the head of the shell of the several structural or mechanical components which are comprised therein. Fig. 4 is an enlarged sectional view of the head portion of the cartridge, showing by solid lines the preliminary form illustrated in Fig. 1, and showing by dotted lines the completed formation illustrated in Fig. 2. Fig. 5 is a view corresponding to Fig. 4, for further illustrating the mechanics of the component members during the period of their operative co-action.

In Figs. 1 and 2 the forward portion B of a breech-block is shown, together with the forward end A of a lock-operating actuator adapted to be forcibly driven rearwardly within the breech-block by the operation of the head of the cartridge when the charge is fired. For permitting this operation to properly take place, the breech-block B is shown with the forward end having a chamber or space B^2. The space B^2 is shown in Fig. 1 as an open space, while in Fig. 2 said space is occupied by the head portion of the cartridge which is shown in this view in its re-formed or completed formation. In Fig. 1 the actuator A is shown with its forward end in alinement with the forward end of the breech-block, and so it will not interfere with the proper placing of the cartridges in a firearm arranged for automatic operation by power derived from the firing of the cartridges. A firearm of this type and illustrating such an automatic operation will form the subject matter of a separate application concurrently pending herewith.

In Fig. 1 the firing-pin F is shown drawn back ready for being thrown forward to fire the cap or primer P here shown in proper position for this purpose. In Fig. 2 said firing-pin F is shown carried forward and the cap or primer P is shown indented by the blow of the firing-pin. On the working stroke of the actuator A (toward the left hand in Figs. 1 and 2), this power-transmitting member engages with some suitable shoulder, as A′, whereby the said stroke may be limited. Similarly the forward stroke of the firing-pin may be suitably limited by a shoulder at F′. For the purpose of illustrating my present improvements I have shown these applied to the shell of a cartridge of the type suitable for shot-

guns, but it will be understood that my improvements are applicable to cartridges of various sizes and proportions. In Fig. 1 the cartridge shell, C, is indicated as being loaded or charged with powder, wads, and shot, such for instance, as commonly used in a sporting gun. In Fig. 2 the shell C is shown as being in the condition which results from the firing of the charge.

In cartridges of the usual type the base or head has a substantially flat outer surface which, if subjected to re-formation for the purpose herein set forth, would of necessity have to be stretched and subjected to such strain as would often damage the shell, either by enlarging the diameter of the primer chamber or weakening the metal of the disk portion between said chamber and the extractor-rim, and especially by tending to weaken the connection between those several members so that a gas leak might result between the walls of the primer chamber and such disk portion, or between the disk portion and the outer shell. These disadvantages and unfavorable features are avoided in my present improvements, while securing the advantage of utilizing a movement rearwardly of the extractor-rim, of the middle portion of the head as an actuator device, by means of the preliminary formation of the head of the shell followed by the completion of this formation by the firing of the charge. And in order to accomplish these important results and avoid the injuries and disadvantages above mentioned, I have devised a mode of construction for said preliminarily shaped head of the shell whereby the several structural components thereof have an operative co-action in a particular manner which will now be further described in connection, principally, with the enlarged and partially diagrammatic views in Figs. 3, 4, and 5.

In order that the cartridge may not be prevented from operating properly in the firearm, the rearward face of the central member, N, thereof is shown located substantially in the plane of the rearward face H′ of the extractor-rim, 8, while the surplus of metal between said rim 8 and the member N is carried forwardly in its preliminary formation about as here shown. This provides for using the cartridge in such manner, in a firearm suitably organized therefor, that the extreme forward surface of the breech-block B and of the forward end of the block-actuator A (within which the firing pin will usually be located) may be in one corresponding transverse plane; and, by reason of these arrangements in the firearm and in the cartridge, the cartridge will load properly into the gun mechanism when the cartridge is given the usual transverse movement into position forward of the breech-block, and whether or not the firing-pin may be, at that time, in its retracted position.

In my improved gun-operating metallic cartridge, the re-formable portion of the metal is located in an annular zone or space, the outer diameter of which is less or not greater than the inner diameter of the tube C, and is so located rearward of this tube that the outer bending joint at *m* is not joined directly to any part of the tube through which passes the stress of the extractor action. The shell, therefore, when prepared for the firing of the charge, comprises two annular, concentric joints, as *m* and 6, which are located one outside of the other in substantially the same transverse plane, and of which the outer said joint is a bending-joint and connects with the inner side of the extractor-rim 8, while the inner said joint is non-bending and connects with the combined primer-chamber and piston-member N. Thus the medial and preliminarily-shaped zone, M, consisting of the metal between said outer or bending-joint *m* and the inner or nonbending joint 6, constitutes a re-formable diaphragm, D, Figs. 1 and 3, located and operative for permitting the rearward working stroke of the piston member N without affecting the extractor-rim or the connection between this rim and the tube, and without requiring any additional part or member to be provided in the cartridge. In the said medial zone, in the preliminary formation thereof, the metal is forwardly arched toward and against the gas-pressure and on the inner edge is supported by its connection with the non-reforming joint or arch-base portion 5, while on its outer edge the metal of said medial zone is supported by its integral connection with the re-formable joint and arch-abutment, *m*, which is itself subjected to re-formation concurrently with the medial zone and by an action wherein the neutral line, *f*, Fig. 4, becomes located in one part thereof and during such action, at or near the inner surface of that re-formable joint portion of the head-disk. Thus the diaphragm D, is here illustrated as comprising the arched web M and the re-formable annular part *m*.

The member N, or lock-actuator, being integrally connected to the inner edge of the preliminarily-shaped and re-formable annular disk D, and the metal in this disk being of such character and quantity as required for completing the cartridge-head when they shall have been shaped into the conical form illustrated in Figs. 2, 4, and 5, it follows that while the member N is being carried backwardly from its position in Figs. 1 and 3, to its position in Fig. 2, and shown by dotted lines in Figs. 4 and 5, the adjoining and connected disk-metal will gradually during such movement pass

through successive stages of re-formation, until finally this metal becomes properly and nearly evenly distributed and molded into the completed conically-formed disk portion D′, Figs. 2 and 4, in position and in condition for subsequently sustaining the maximum gas-pressure without leakage. The forward curvature or disposition of said disk-metal in the said preliminarily-shaped form thereof, provides for an adequate quantity of metal, including some excess or surplus, being included in the re-formable disk portion D of the head, as compared with the quantity normally required in the head of a cartridge-shell when this has the normal form of a flat disk.

The axially-concentric and hollow cylindrical ring-member N being of relatively small diameter and located with its axis coincident or nearly so, with the cartridge axis x, and having a substantial length longitudinally of the axis x, is highly resistant to the gas-pressure in a diametrical direction and capable of resisting destructive deformation, while it operates after the manner of a direct-acting actuator or piston-like member adapted for driving rearwardly the lock-actuating power-transmitter of a gun mechanism. The inner space n of the piston member N, serves as a chamber for receiving the usual or some suitable primer as P, for firing the cartridge, while the outer annular bearing face, at N′, of this member N is adapted for bearing directly against the resisting actuator A.

The rearward movement of the member N being a resisted one, the gas-pressure on the web M reaches a considerable amount and thus produces a high radially compressive action in the web M during this stroke, and thereby the outer joint m is put under an intense compression in an outward direction against and within the lock-portion H, before the bending action has more than begun; this results in forming one part of the neutral line f at or near the inner surface of the member m, about as indicated in Fig. 4. Since the web M has the metal adapted and disposed therein (as to thickness and form), for being re-formed under the resisted pressure, and with its neutral line so located in the re-forming zone that the re-formation is a compressive-action, this action operates to suppress the breaking action which would otherwise normally occur at the inside surface of the said outer bending-joint or zone m of said head disk D.

The medial zone M of the head is re-formable on the outward (rearward) movement thereof, preferably into a conically-shaped form substantially in the manner illustrated in the drawing. In practice I make the radial length of the re-formable annular portion, M, fully as long or slightly longer than the conical radius, e to d', and thereby secure the required compressive action diametrically of the head during the re-formation of the disk-portion D thereof. The proper performance of these operations in the construction herein set forth, is secured by first making the web of the cartridge head of a thickness insufficient to itself sustain the gas-pressures which are to be employed, but sufficient, when preliminarily-shaped into the curved zone M, to resist the early stage of the increasing gas-pressure and to thus assist in carrying backward the member N against a resisting gun-mechanism actuator such, for instance, as the actuator A. Also, in this connection, I prefer to make the curvature of the zone M much larger than the curvature of the outer connecting zone m, substantially as illustrated, for the purpose of more fully and definitely controlling the mobility of the metal in the head-disk D, during the re-formation thereof.

The recession of the central part of the head of the cartridge gives or produces a small but, as I deem it, a very useful increase of interior space at or immediately following the firing of the primer or cap, with the result, as I apprehend, of tending to reduce or delay at that instant the amount of the rise of gas-pressure, and thus favor that proper re-formation of the preliminarily-shaped medial-zone M of the head, and also favor the inauguration of the backward stroke of a lock-actuator, (in a firearm suitable for using such cartridge), somewhat in advance of the forward movement of the projectile.

The inner portion 6 of the head-disk D by reason of its relation to the inclined line 7, (Fig. 5) serves as a means tending during the back-stroke of the member N, to draw backwardly the inner edge 6 of the re-formable web M, and to do this without deforming the angle-section inner resistance-ring composed of the two elements, the forward part 5 of the member N and the inner portion or ring of metal 6, which constitutes, also, a joint or connection between such ring 5 and the re-formable web M. This joint portion 6 is a relatively static member which, by reason of the other structural features and the mechanical operations described, is not subjected to any material degree of de-formation or re-formation during such operations.

Except for the rearward movement of the member N during the re-forming of the specially constructed annular web or zone M, and the flattening of this annular member by reason of the forward preliminary curvature thereof, the surplus of metal therein would tend too forcibly to expand the member H, and would tend to render the shell-extracting operation unreliable; but when these two operations, the back-

ward or working stroke of the member N, and the re-forming of the said zone under the increasing gas-pressure,—are concurrent, any such injurious effects are avoided. The rearward end of the tube 9 and the extractor-rim 8 being formed integrally together thereby constitute the compressive-hoop H, while the central member N, having the non-reforming joint-portion 6, integrally connects with a re-formable diaphragm which thus integrally connects the said central-member with the inner side of said hoop H. The said diaphragm comprises the inwardly-arched zone M and the outwardly-curved re-formable joint-portion *m*, which are adapted for re-formation under a resisted gas-pressure by compressive action upon a neutral line located in one part thereof at or near to the inner side of said outer-re-formable joint member and located in another part thereof at or near to the outer side of said inner non-re-formable joint member.

The metal of the head of the cartridge is suitably located and disposed in the preliminarily formed head by forming the middle zone thereof into an inwardly extending or curved portion, as M, the proper quantity of metal, and preferably some excess or surplus of metal needed for making the rearwardly projecting conical form, D′ (Figs. 2 and 4), may be provided without in any material way interfering with other features or portions of the cartridge shell. By making the distance via the line *f* from the point *e* to the point *d* nearly equal to (or even slightly greater than) the direct distance *e* to *d′*, Fig. 4, the re-forming of the medial zone M will evidently take place while the metal in said zone is subjected to a radially compressive action, and thereby the metal will be normally re-shaped, subject to the restraining action of the part H, without any material degree of extension or tearing action, thus avoiding the formation on the inner surface at any point of such cracks or fissures as might permit the escape of gas during or directly following such re-formation. In this diagrammatic view, the lines *f* and *f′* may be said to approximately represent the location of the so-called "neutral line" at successive times during the process of re-formation of the metal of the diaphragm. On firing the charge and under the increasing gas-pressure the inwardly-curved or arched zone M is gradually deformed and is also then driven backwardly until it becomes re-formed into the conically-shaped disk or zone D′ (see Figs. 2, 4, and 5), adapted for holding the gas-pressure continuously until this pressure is exhausted.

The outer, and static, annular ring H, consisting of the extractor flange 8 and the part 9 of the tube C (Fig. 4) form an angular section of relatively high stability, as indicated by the differently shaded portions of Fig. 4. The inner annular ring consists of the angular section formed of the part 5 of the member N and the part 6 at the inner edge of the web M; this part 6 is set in the direction of line 7 and parallel to the line 7′, which represents the position assumed by the line 7 on the rearward stroke of the member N. The angle 14 indicates that part, *m*, of the diaphragm D which forms the outer bending-joint that integrally connects with the outer static ring H, and that also similarly connects with the re-formable web M. The relative extent of this web is approximately indicated by the angle 12. Owing to the narrowness radially of the head of the zone occupied by the moldable-joint, or bending-joint, *m*, as compared with the thickness of this member lengthwise of the shell, the metal in this zone would normally be about self sustaining as against the gas-pressure, but in connection with the integrally attached medial web M of greater curvature in the plane of the cartridge axis, the metal in said outer joint-zone *m* is subjected to the outward pressure due to the crushing in, or flattening, of the member M considered as a deformable arch, so that as a result of these complex actions both said zones, M and *m*, are subjected concurrently to the required re-formation.

By reason of the resistance afforded at the instant of firing, by the actuator, as A, Fig. 1, of a suitable gun-mechanism, and by reason of the manner in which the inner edge of the diaphragm D is carried rearwardly with the member N, it appears that the outer bending-joint *m* will, at the beginning of such movement be subjected to a relatively earlier and greater amount of re-formative action as compared with the metal near the inner joint 6, so that the substantial completion of that re-forming action may be said to take place first at the inner edge of the extractor-rim and thence to proceed inwardly toward the center of the head, until finally completed at or near the inner joint 6, concurrently with the member N completing its working stroke. Thus it appears that the described peculiar compressive and resisted re-forming action is normally progressive, both as to diametrical location and in point of time, beginning at or near to the extractor-rim and terminating near to the piston-member N.

The web M is shown set with its inner edge in substantially fixed connected-relation to the rearward end of the piston member N, and, together with the outer, or bending joint *m*, forming the ogee or double-bend zone D, Fig. 3. The quantity of metal comprised in the said re-formable double-zone *m* and M, is made of such character,

thickness and shape that when subjected to the re-forming process or action, (during the initial stage of the burning of the powder) this metal moves in and upon itself, while under diametrical compression, and moves in substantial accordance with a neutral line, as *f*, which by its location indicates the absence of over-tensioning of any of the metal on the inner surface of the said web. Except for this restriction of the flowage under that peculiar re-forming action, and obtained by the said construction followed by the resisted movement of the member N and the gas-pressure over the whole interior surface of the web M, it is evident there would normally be on the inner surface, at the point or circumferential line 10, an excessive stretching or tensioning of the metal thereby, tending to form cracks or fissures, and to create weakness in the head which might result in fracture and thus develop hazardous conditions when, an instant later, the gas-pressure increases to its maximum.

On account of the high pressure now common with the use of high-power explosives, the metal of the re-formable zones of the head-disk D is required to be of a thickness which would ordinarily render the proper re-formation of the same difficult or impracticable while using the cartridge head as a power transmission device for the purposes herein set forth, if the organization of the several components of the head was not such as to effectively control the distribution of the stresses which occur during that period, and which if not more largely compressive than tensional would tend to impair the success of the reformation to such an extent or in so frequent instances as to prevent the commercial utilization of this simple, economical, and effective means for operating the mechanism of the gun.

Having thus described my invention, I claim:—

1. In the shell for a gun-operating cartridge, the combination, with the tube and the extractor-rim formed integrally together whereby to constitute a compressive hoop as against a re-formable web in the medial zone of the cartridge-head, of the central primer-carrying piston-member, and a re-formable web integrally connecting the rearward end of such piston-member and the inner side of such compressive-hoop, and preliminarily-shaped, substantially as set forth, for re-formation by compressive mobility of the metal under an increasing gas-pressure and against the resisted rearward stroke of the piston-member, into a conically shaped web free of over-tensioned metal and thereby adapted for holding the maximum gas-pressure.

2. In the shell for a gun-operating cartridge, the combination, with the tube and extractor-rim, of the hollow cylindrical primer-carrying lock-actuator piston-member, and a re-formable web having an ogee construction, substantially as set forth, and integrally connecting the rearward end of such piston-member and the inner side of the extractor-rim, and adapted for re-formation by compressive mobility of the metal under an increasing and resisted gas-pressure into a conically shaped web free of over-tensioned metal and thereby adapted for holding the maximum gas-pressure, substantially as described.

3. In the shell for a gun-operating cartridge, the combination, with the tube and the extractor-rim formed integrally together whereby to constitute the compressive-hoop H, of the central member N having the non-reforming joint-portion 6 for integral connection with a re-formable diaphragm, and the reformable diaphragm integrally connecting the said central-member by its said joint-portion with the inner side of said hoop H, said diaphragm comprising the inwardly-arched zone M and the outwardly-curved re-formable zone and joint-portion *m*, these two re-formable zones being made of metal proportioned for re-formation under a resisted gas-pressure by compressive action upon a neutral line located one part thereof near to the inner side of said outer re-formable joint member and located in another part thereof near to the outer side of said inner non-re-formable joint member, substantially as set forth.

4. In the shell for a gun-operating cartridge, the combination, with the tube and the extractor-rim formed integrally together whereby to constitute a compressive hoop as against a re-formable web in the medial zone of the cartridge-head, of the central primer-carrier lock-actuator member, and a re-formable head-disk comprising the medial web integrally connecting with the rearward end of said actuator-member and forwardly arched against the gas-pressure, and an outwardly curved joint-member compressively reformable concurrently with the medial-web and integrally-connecting the outer part of this web with the inner side of the said compressive-hoop, the said head-disk being proportioned and preliminarily-shaped, substantially as set forth, for re-formation by compressive mobility of the metal under an increasing gas-pressure and against the resisted rearward stroke of the lock-actuator member.

5. In the shell for a gun-operating cartridge, the combination, with the tube and the extractor-rim formed integrally together whereby to constitute a compressive hoop as against a re-formable web in the medial zone of the cartridge-head, of the central primer-carrying lock-actuator member, a re-formable web integrally connecting with the rear-

ward end of such piston-member and having a connection with the inner side of such compressive-hoop, and preliminarily-shaped, substantially as set forth, for re-formation by compressive mobility of the metal under an increasing gas-pressure and against the resisted rearward stroke of the piston-member, and two concentric annular bearing faces, H′ and N′, the outer bearing-face being located and adapted for supporting the cartridge head on a tubular breech-block, and the inner bearing face being located and adapted for operating on a tubular lock-actuator within such block, and a reformable head-disk intermediate to and connecting said outer and inner bearing-faces and having an ogee sectional form comprising the said medial web arched inwardly for resisting the gas-pressure and operative for applying this pressure to the lock-actuator of a gun-mechanism through said inner bearing-face.

6. In the shell for a gun-operating cartridge, the combination, with the tube and the extractor-rim formed integrally together whereby to constitute a compressive-hoop, and with the central member N having the non-reforming joint-portion 6 for integral connection with a re-formable diaphragm which integrally connects with the said central-member by its said joint-portion, and directly connects with the inner side of said compressive-hoop; said diaphragm comprising the inwardly-arched zone M of relatively large curvature and the outwardly-curved re-formable zone and joint-portion *m* of relatively small curvature, these two re-formable zones being made of metal adapted and proportioned for re-formation under an increasing gas-pressure by compressive action operating diametrically of the diaphragm and during the rearward resisted movement of said member N, substantially as set forth.

JOHN D. PEDERSEN.

Witnesses:
JOHNSON MORGAN,
JOHN E. BRENNAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."