

[54] CARTRIDGE FOR SHOTGUN

3,786,753 1/1974 Eckstein et al. 102/42 C

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[51] Int. Cl. **F42c 7/08**

[58] Field of Search 102/42 C, 95

[56] **References Cited**

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[57] **ABSTRACT**

The thickness of the sidewall forming a cylinder is formed at the inside of the cylinder as to be thicker toward the bottom of a container in a manner that the inside configuration of the container is made in tapered shape, and a bottom and skirt are provided on the container. A slit is longitudinally formed in the sidewall of the cylinder and another slit is cut partially around the periphery of the wall of the cylinder adjacent the upper surface of the bottom. Iron shots are filled in the cylindrical container thus formed so as to fabricate a cartridge for a shotgun. The cartridge thus fabricated hardly wears the barrel of the gun, causes less flare of the choke of a shotgun, and provides killing and wounding power equivalent to lead shot.

10 Claims, 5 Drawing Figures

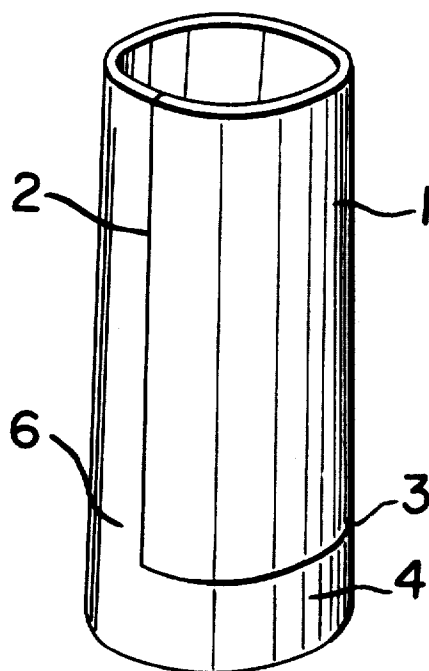


FIG. 1

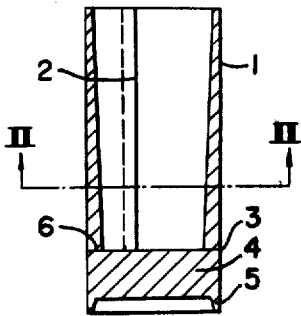


FIG. 2

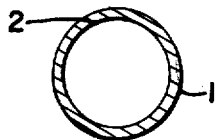


FIG. 5

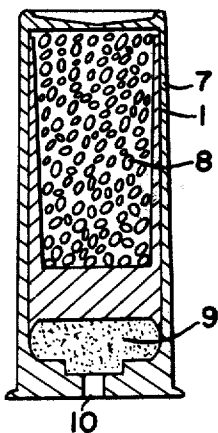


FIG. 3

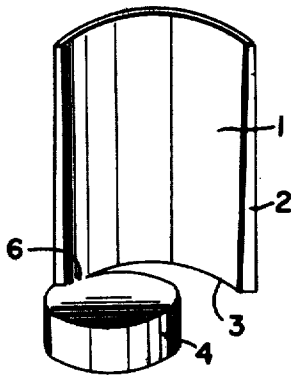
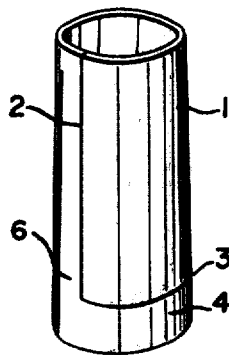


FIG. 4



CARTRIDGE FOR SHOTGUN

FIELD OF THE INVENTION

This invention relates to a cartridge for a shotgun, which cartridge uses iron shot.

DESCRIPTION OF THE PRIOR ART

There have been variously proposed systems which use iron shot for shotgun cartridges, and some of them have been tried, but none of them have been totally successful.

If iron shots are used for shotgun cartridges instead of conventional lead shots, the environmental pollution by lead and various harmful influences caused thereby, as described hereinafter, are prevented and the cost of the cartridge is reduced by utilizing iron which is less expensive than lead.

If a number of lead shots are spattered over a hunting ground in the neighborhood of a ground of fountain head, these lead shots become dissolved in rivers and underground water with the result that it is not possible to obtain good drinking water.

The lead shots spattered over not only the ground of the fountain head but other various places are often retained in the bodies of fish and birds and animals, which are often consumed by humans, with the result that the lead can be injurious to health.

It is desired to eliminate use of toxic lead shots, but there have not yet been discovered nontoxic shots equivalent to lead shots, such as having a heavy specific weight while causing no damage to the gun.

However, since the aforementioned environmental pollution cannot be allowed, the animal preserve districts are gradually increased. The expansion of the preserve districts introduces abnormal breeding of detrimental birds and beasts so that they damage forests, crops and cattle. The expansion of the preserve districts also limits sports and hunting and also introduces chain insolvency of traders, businessmen and makers concerned with fur and its taxidermist.

While the use of iron shots is being studied with the object to lighten evils caused by prohibition of hunting, there has appeared in some localities a law to allow hunting in case iron shots are used. However, iron shots must overcome its own problems to be used practically, which problems are (1) how to make iron shots, (2) how to protect the gun barrel, and (3) how to control the external ballistic characteristics.

Heretofore, there has been tried removing as much carbon and silicon as possible from iron, fabricating shots from the soft iron thus obtained of low hardness, and filling the shots in the cartridge.

According to this conventional method, even if the cost of the iron itself is less expensive such as one-third the cost of lead, the soft iron shots thus formed require high expenses due to the steps required to form the shots, with the result that the cost becomes higher than that of lead shots.

If the cartridge using the above soft iron shots is shot by a shotgun, the barrel of the shotgun is not only worn over 10,000 times as fast when compared with the case where the lead shots are used, but the choke (portion of small diameter near the muzzle of the shotgun) for the shotgun is flared. As a result, the barrel of the shotgun loses its function before the shotgun is shot 100 times so that it must be replaced with a new barrel with

the result that the trail for putting the soft iron shots into a practical use failed.

Another main reason that the iron shots are not put into a practical use is that they cannot obtain the equal killing and wounding power in the same shooting range to that of lead shots.

In order to reduce the increase of air resistance of iron shots caused by iron having smaller specific weight than that of lead when iron shots are used, the diameter of iron shots are made larger than that of the lead shots so that the weight of iron shots per projected area is made equal to that of lead shots.

According to this method, larger diameter of shots are required, and, therefore, if the same amount (number and weight) of iron shots as that of lead shots are filled in a cartridge, the capacity of the cartridge must be enlarged, which is an obvious disadvantage. Therefore, such difficulty is avoided in case of the soft iron shots by reducing the entire shot amount, but if the shot amount is reduced, the dispersive density of the shots is correspondingly decreased so that the probability of the shots hitting the target becomes less, and even if the probability of the shots hitting the target is the same, the number of total weight of the shots hitting the target becomes less so that the target is difficult to damage with the result that if the target is bird or beast, it is not instantaneously killed nor wounded.

SUMMARY OF THE INVENTION

The present invention contemplates to provide a cartridge for a shotgun which uses iron shot instead of lead shot so as to eliminate the aforementioned disadvantages. The present invention is based on the following views:

1. As a result of search and study of iron shot which damage the barrel of the shotgun, it is found that the protection of the barrel of the shotgun and preservation of performance of the shots are simultaneously solved by the shape and property of the shot container.

2. The following facts are investigated in the phenomenon that the shot is urged by the combustion gas pressure when the shot is discharged by the shotgun.

The shot is cylindrical as a whole, but the cylinder accepts pressure so as to be compressed as a whole with the result that it tends to expand circumferentially in the amount compressed. The wear of the barrel of the shotgun is affected by the force tending to expand circumferentially, by the hardness and by the surface state of the shots.

The force for axially compressing the cylinder of shot is at a maximum at the bottom surface which accepts the gas pressure, but the shot disposed at the crimped portion of the shotgun does not accept such compression force but accepts only the force of the product of acceleration of the respective shots and self weight.

3. The compression force of the shot axially of the cylinder is determined by the product of the number of shots and the acceleration caused by the gas pressure. In other words, the compression force is proportional to the height of the cylinder of the shot, and accordingly the compression force corresponding to the height is applied to the cylinder of the shot.

On the other hand, since the iron shot is regarded as substantially rigid, the nearer the position of the circumferential force is to the lowermost of the cylinder of the shot or the nearer it is to the surface which accepts the gas pressure, the higher the axial compression

force is increased, and accordingly the circumferential force becomes stronger. That is, the strongest circumferential force is acted at the lowermost portion of the cylinder of the shot so as to largely damage the barrel of the shotgun.

Since the specific weight of the iron shot is small so that though the capacity of the entire shot is large, the inner diameter of the cartridge case is limited, so that the length of the cylinder of the shot is required to be longer. This length of the cylinder of the shot affects the damage of the shotgun as aforementioned.

It is an object of the present invention to provide a cartridge of a shotgun which adopts iron shot having equivalent wear resistance of the barrel of the shotgun and killing and wounding effect to those of lead shot.

It is another object of the present invention to provide a cartridge of a shotgun which is not damaging to the environment and which is less expensive.

The scope of the present invention resides in a cartridge of a shotgun which comprises a cylindrical container, the thickness of which is so formed at the inside thereof as to be thicker toward the bottom thereof in a manner that the inside configuration of the container is made in tapered shape and having a bottom and a skirt formed thereat, a slit longitudinally formed at the wall thereof for dividing the wall forming the cylinder and another slit cut on the peripheral wall of the cylinder in contact with the upper surface of the bottom partly retained at the portion contacting with the bottom of the container of the previous slit, and iron shot filled in the cylindrical container.

The quality of the material of the shot container of the cartridge according to the present invention must be so hard as not to easily pass the hard iron shot even when the iron shots are strongly urged so as to reach the inner wall of the barrel of the shotgun and is also sufficiently durable for the shock force caused when the shot is discharged from the shotgun.

The shot container of the cartridge of the present invention is made of the same quality of material at the portion contacting with propellant as that of the other portion thereof in consideration with the simplification of the formation of the cartridge of the shotgun. Therefore, it is desired to adopt the quality of material which is not deteriorated by the components of the propellant even after long preservation.

The quality of material of the shot container having the aforementioned characteristics preferably includes, for example, a nonpolar linear high polymer such as polypropylene, polyethylene, etc., a polymer of isotactic structure and high density in the case of polypropylene, and a polymer of structure without side chains and of high density in the case of polyethylene. The molecular weight of these polymers are preferably as large as possible in the formable range, and are preferably at least over 150,000. In order to improve the shock resistance of the mixture obtained by mixing polypropylene, polyethylene, etc., a small amount of polybutadiene is added to polymer composition used as the material of the shot container.

Optimum taper and thickness of the wall of the container of the cartridge depends upon the hardness, grain size, filling amount, quality of material of the shot container and working process of the iron shots, but the taper of the container is preferably 2/100 to 30/100. The iron shot used in the cartridge of the present invention includes soft iron, cast iron, steel, stainless steel,

etc. having iron as the main component, and are of substantially spherical shape, and vary from 2 to 18.3 mm. in diameter.

This shot is produced by various processes for casting molten metal obtained by melting iron material by an electric furnace or cupola into spherical shape, or for forming spherical shape by centrifugal force or aggregating force, or for fabricating iron plate to form spherical shape, and these spherical shots are quenched so as to improve their properties upon requirement.

The iron shot of the present invention is also applied to steel shots for grinding or polishing, ball bearing spheres, balls for pachinko game in Japan, and are particularly applied preferably to the steel shots for polishing in view of its hardness.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and features of the present invention will become more apparent from the following detailed description of an embodiment thereof, when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a longitudinal sectional view of the shot container according to the present invention;

FIG. 2 is a sectional view of the container taken along the line II—II in FIG. 1;

FIG. 3 is a perspective view of the shot container showing the body of the container expanded around the slit;

FIG. 4 is a perspective view of the assembling of the shot container of the present invention for explanatory purposes; and

FIG. 5 is a longitudinal sectional view of the shot container filled with iron shot according to the present invention.

DETAILED DESCRIPTION

Referring now to the drawings, numeral 1 indicates the body of a shot container which is tapered on the inside surface in a manner that the thickness of the side wall of the body is tapered largely toward the bottom 4 thereof. A slit 2 longitudinally divides the body 1 of the shot container, and a further slit 3 divides the body of the shot container circumferentially adjacent the upper surface of the bottom 4, which slit 3 extends from the lower end of the slit 2. Numeral 6 indicates a connecting portion for connecting the body 1 of the shot container to the bottom 4, and 5 is an annular skirt on the container for preventing combustion gas of the propellant from leaking therepast when the cartridge is inserted into a shotgun and is fired. Numeral 7 indicates a cartridge casing, 8 is the iron shot, 9 is a propellant, and 10 is a percussion cap.

The shot container of this invention is different in the following points when compared with a conventional cap for lead shot.

The conventional shot cap is manufactured for the purpose of improving the pattern of the shots, and most of the shot caps are fabricated from polyethylene having low molecular weight and a high melt index so as to be easily formable, and are of thin cylindrical shape with a slit formed longitudinally along the cylindrical portion. This slit opens in flared shape when the shot cap is discharged from the shotgun, so as to separate the shot from the shot cap by means of air resistance. The shot caps form a shot chamber on the cushion portion called wad. When the iron shots are of this type,

the shotgun loses its function after being fired about 100 times.

Since the shot container of the present invention is oppositely tapered toward the advancing direction of the shot by itself and accordingly is gradually opened toward the advancing direction of the shots, the shots accept air resistance immediately after discharge from the shotgun so that the shots are separated from the shot container.

Another feature of the shot container of the present invention resides in the slits 2 and 3 formed in the shot container for further assisting in separating the shots from the shot container under any condition so that the container holds the shots sufficiently until the shots are shot from the muzzle of the shotgun. These slits 2 and 3 of the shot container of the invention are different from the slit formed in a conventional shot cap which opens the wall of the shot cap in a flared shape outside and are provided with a compressed coil spring for opening the cap.

These slits 2 and 3 of the shot container enable the sidewall to extend and contract circumferentially.

Since the shot container extends circumferentially to adhere onto the inner wall of the barrel of the shotgun even when the clearance between the inner diameter of the barrel of the shotgun and the outer diameter of the shot container is large, caused by the fact that the outer diameter of the shot container is formed smaller in consideration with the filling property of the shot container, the shot container is not damaged due to unreasonable flaring force in the circumferential direction of the shot container.

Since the circumferential force is released from the shot container when the shot container is discharged from the end of the barrel of the shotgun, the shot container can easily open with the tapered wall 1 thereof. This point is greatly different from the conventional shot cap which requires several or four to eight slits for opening in a flared shape.

The shot container of the present invention not only uses in a manner to hold all the functions such as shot container, wad, combustion gas sealing in one unit as shown in FIG. 1, but separates the bottom 4 from the tapered cylindrical portion 1 so as to be used in combination with the conventional wad and the tapered cylindrical portion 1.

One example of the shot container used for the shotgun of the present invention will now be described.

The specifications of the cartridge for iron shots using the shot container of the present invention are as follows: However, the numerals in () of paragraph 2, entitled "shooting performance" is the result of the case where the conventional lead shots are inserted into the cartridge, and the result obtained corresponding to the shooting performance of the case of iron shots.

1. Specifications

1.1	Shot container	
	Dimension of tapered cylinder:	
	Length:	40.5mm
	Outer diameter:	19.9mm
	Inner diameter (upper end):	17.9mm
	Inner diameter (lower end):	16.0mm
	Slit: 25° with respect to the tangential line of inner diameter 16.0mm.	
	Quality of material: High density macromolecular polyethylene and polypropylene blend	

-Continued

1.2	Iron shots	
	Steel shots of 6 to 8 meshes of grain size were used for iron shots (HS-240).	
	Number of shots per gram:	15
	Vickers' hardness:	456
	Shot amount:	32 g.
1.3	Propellant	
	Smokeless powder (made by Nippon Yushi Co.,	
	trade name of SS-20):	1.6 g.
1.4	Percussion cap	
	Percussion cap:(made by Nippon Yushi Co., new SS)	
2.	Shooting performance	
2.1	Shot velocity	
	Muzzle velocity: $V_{7.5} = 330$ m/sec. (315-345)	
	Velocity $V_{30} = 260$ m/sec. (230-270)	
2.2	Barrel pressure	
	$P_m = 640$ kg/cm ² (550-800)	
2.3	Pattern	
	40 yards 30 inches circle inside (using 30 inches full choke shotgun)	
	73% (68-76)	
2.4	Wear of barrel of shotgun	
	Not recognized after shot 3,000 times.	
2.5	Deformation of choke	
	No deformation observed.	
2.6	Clay breakage	
	Trap shooting preferable (good)	
3.	Used shotgun and number of shooting	
	KFC elevational duplex OT 30"	6000
	full choke shotgun	
	Remington 1100 skeet shotgun:	3000
	Remington 1100 full choke shotgun:	3000

As clearly seen from the above examples, according to the present invention, there is no noticeable wear of shotgun, the shot effect of the iron shots of the present invention correspond to those of lead shots, there is no appreciable environmental pollution, and the cartridge is less expensively supplied with the iron shots.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A cartridge for a shotgun shell, comprising a one-piece cylindrical shot container having an annular sidewall which is open at one end and defines therein a shot compartment which is of converging tapered configuration as it extends inwardly from said one end, said shot container also having a base fixedly connected to the other end of said sidewall for closing said compartment, said sidewall being tapered in the longitudinal direction thereof so that the thickness thereof increases as it extends longitudinally from the one end to the other end thereof, said sidewall having a first slit formed therein and extending longitudinally thereof, said first slit extending from the one end of said sidewall to a location disposed adjacent to other end thereof, the sidewall also having a second slit formed therein and extending circumferentially thereof, said second slit communicating with said first slit at said location and being positioned at the other end of said sidewall whereby said second slit is disposed directly adjacent the inside surface of said base, said second slit extending peripherally of said sidewall throughout substantially the complete periphery thereof except for a small connecting portion which fixedly connects said sidewall to said base, and the shot compartment as defined within said container being filled with iron shot.

2. A cartridge as set forth in claim 1, wherein the taper of said shot container is 2/100 to 30/100, and wherein said first slit is straight and extends substantially parallel to the longitudinal axis of said sidewall.

3. A cartridge as set forth in claim 2, wherein the iron shot is made of iron material selected from the group of soft iron, cast iron, steel and stainless steel, and the diameter thereof is 2 to 18.3mm, and such iron shots are filled in the shot container.

4. A cartridge as set forth in claim 1, wherein the iron shot is made of iron material selected from the group of soft iron, cast iron, steel and stainless steel, and the diameter of the iron shot is 2 to 18.3mm.

5. A cartridge as set forth in claim 4, wherein steel shots for grinding or polishing, ball bearings or Pack-inko balls are used for iron shots.

6. A cartridge as set forth in claim 1, wherein said second slit has one end thereof terminating at said first

slit, said second slit extending circumferentially around said sidewall so that the other end thereof is spaced a small angular distance from said first slit and is separated therefrom by said connecting portion.

7. A cartridge as set forth in claim 1, wherein the shot container is made of nonpolar linear high polymer having over 150,000 molecular weight.

8. A cartridge as set forth in claim 7, wherein polypropylene having isotactic structure is used for the nonpolar linear high polymer.

9. A cartridge as set forth in claim 7, wherein nonpolar linear high polymer is made of polyethylene without side chain.

10. A cartridge as set forth in claim 7, wherein the shot container is made of a polymer made by adding polybutadiene to a mixture of polypropylene and polyethylene.

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