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(56) Documents Cited
GB 2131925 A GB 2052693 A GB 1141534 A
US 4005660 A

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(54) Projectile for an air,gas or spring gun

(57) In order to produce a one-piece projectile (e.g. a pellet) which can be made of a metal other than lead or lead alloy, the seal at the rear of the projectile, between the projectile and the barrel bore of the gun, is achieved by providing slits (10) in an annular lip (7). During firing, the air that is propelling the projectile deforms the flaps (9) of the annular lip (7) radially outwards to seal against the barrel bore. The flaps (9) also deform inwards if there is a choke at the muzzle of the barrel bore.

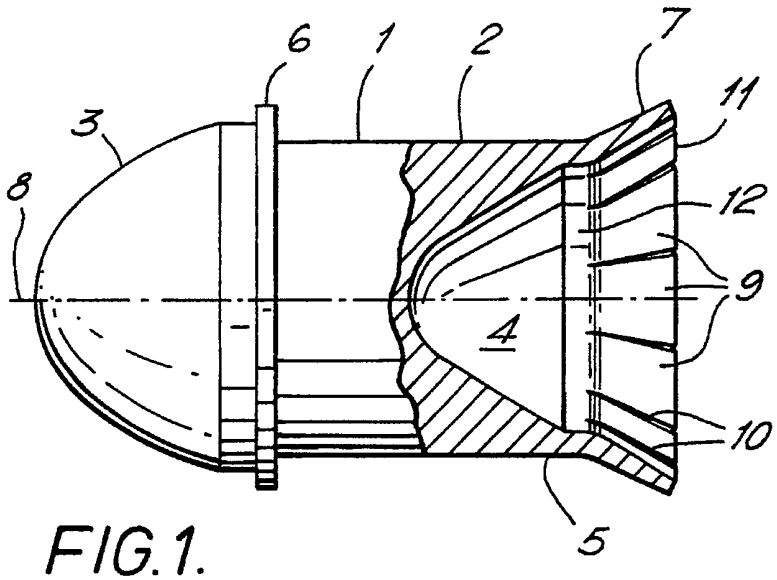

FIG.1.

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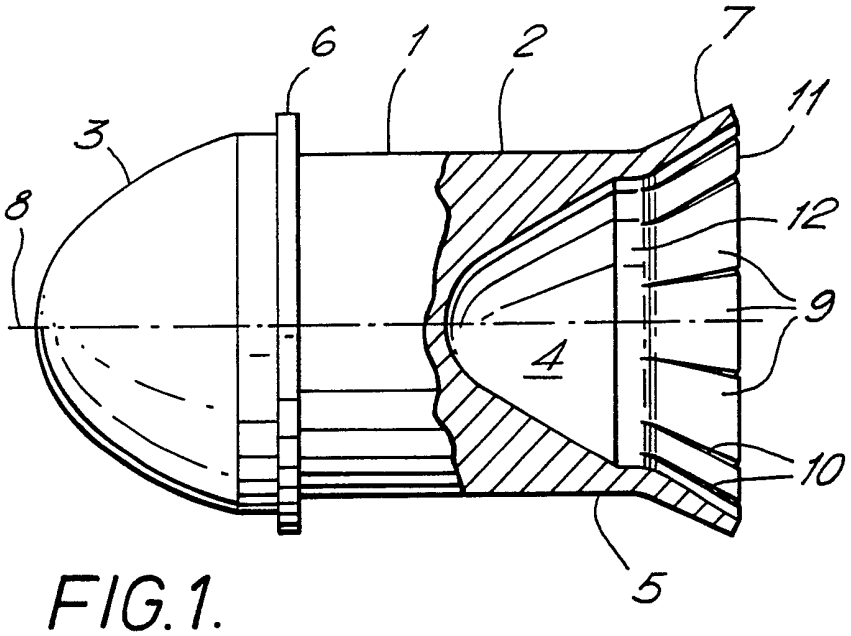

FIG.1.

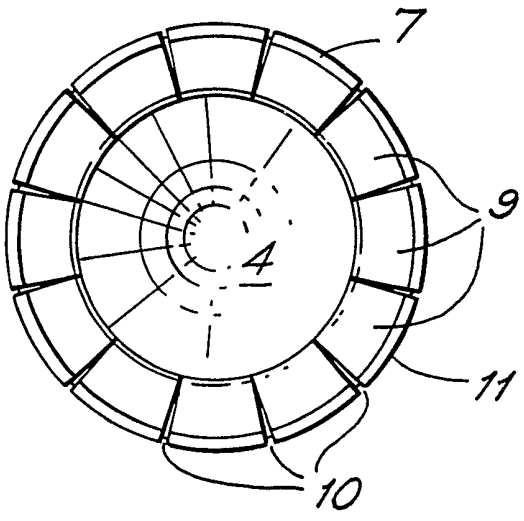

FIG.2.

PROJECTILE FOR AN AIR, GAS OR SPRING GUN

The present invention relates to a projectile (e.g. a pellet) for an air, gas or spring gun.

The conventional pellet for an air gun is made entirely of lead or lead alloy. It has a head portion which guides the pellet and a tail portion which is expanded by the air pressure to seal against the bore of the barrel of the gun. Lead is very soft and ductile and the low pressure produced in an air gun is sufficient to expand the tail portion to seal it against the barrel bore and to propel the pellet along the barrel with only a small loss of energy because of friction between the pellet and the barrel bore.

Because of the toxicity of lead, it is now appreciated that it would be desirable to use a pellet which is substantially lead-free. I have previously manufactured and sold a lead-free pellet comprising a zinc head portion and a plastics tail portion. The plastics tail portion provides a seal against the barrel bore at the rear of the pellet and also ensures that the frictional losses are as low as possible as the pellet proceeds along the barrel bore. The reader is referred to GB-B-2,023,779 and my pending U.K. patent application No. 9216961.4.

Although my two-part pellets made of zinc and plastics are an improvement on the conventional lead pellet, their two-part construction makes them more expensive to produce.

GB-A-2,131,925 discloses a two-part pellet with integral plastics head and tail portions and a metal weight buried inside the head portion. The plastics tail portion has four circumferentially spaced slits which produce four flaps that project straight backwards. In use, the compressed air of the air gun deforms the flaps radially outwards to form a seal against the barrel bore. The two-part construction increases manufacturing costs and the presence of plastics material which rubs against the barrel bore means that the rifling of the bore

will accumulate wisps of plastics material, particularly if the bore is choked.

People have attempted to produce a lead-free pellet in which the head and tail portions are both made of metal. However, because zinc, zinc alloy and copper are harder than lead, it has proved impossible to obtain a satisfactory seal at the rear of the pellet without producing a design that suffers from an excessive frictional resistance as it passes along the barrel bore, especially in a choked bore gun.

Apart from the above designs of pellet, it is also known to produce a two-part dart for an air gun (see GB-A-2,099,962). This dart has a steel tip and a plastics tail which has fins and flaps.

According to a first aspect of the present invention, there is provided a projectile for an air, gas or spring gun, the projectile being elongate along a central axis and comprising a metal body and a metal annular lip which is integral with the body and projects backwards and has a plurality of circumferentially spaced slits which permit radial deformation of the annular lip.

The annular lip may project straight backwards (e.g. for use in a high powered gun) and be flared radially outwards and backwards only in use. Preferably, however, the annular lip is manufactured with this type of flare.

The radial deformation of the annular lip may be inwards and/or outwards, depending on the characteristics of the gun barrel. For example, if the barrel is over-size relative to the projectile, the deformation caused by the propulsive gas will be outwards. If the barrel is under-size, the act of inserting the projectile into the barrel will cause the annular lip to deform inwards. If the barrel bore is choked at its muzzle, the annular lip will be deformed inwards as the projectile enters the choke. The ability of the projectile to conform to the barrel bore, by

virtue of the slits in the annular lip, means that the metal of the body and annular lip does not cause the projectile to suffer the unacceptable frictional losses of the one-piece, lead-free metal pellets of the prior art.

If the body and annular lip are made out of a metal which is harder than lead or lead alloy, but soft enough not to score the barrel bore, the slits ensure that the comparatively low pressure in an air gun is still sufficient to be able to deform the annular lip to form a seal between the rear of the projectile and the barrel bore of the air gun. This seal is achieved without the initial or expanded diameter of the annular lip being such as to generate excessive friction between the metal of the projectile and the barrel bore.

Because the annular lip is integral with the body, the two components do not part company when the projectile hits a target. Because the design of the projectile makes it possible to use a metal other than lead or lead alloy, the projectile may be made out of zinc, zinc alloy, copper, tin, bismuth or brass, or any metal which is soft enough not to score the gun barrel bore. These materials do not shatter when the projectile hits a metal target. This makes recycling of the metal easier.

Preferably, the body has a rearwardly opening hollow defined by a tubular wall having a rear end which is integral with the base of the annular lip and which has substantially the same inner and outer diameters as the base of the annular lip. The hollow inside the body enables the propulsive air in an air gun to push radially outwards on the part of the body adjacent to the annular lip, or enables inward deflection when the bore reduces in diameter at a choke. This construction assists the deformation required of the annular lip to produce a seal between the rear of the projectile and the barrel bore.

Usually, the projectile will further comprise a metal front maximum diameter portion which is integral with a front part of

the body and is axially spaced apart from and is in front of the annular lip, which is integral with a rear part of the body, thereby to function as a rear or tail lip. The front maximum diameter portion guides the projectile along the barrel. If the front maximum diameter portion seals against the barrel bore, the annular lip at the rear does not need to form a seal and may just be used to mechanically project into the rifling of the barrel bore to impart spin to the projectile.

Preferably, each slit is substantially parallel to or substantially intersects the central axis. Thus, the slit does not extend around the central axis in a helical direction and it is therefore easier to deform the annular lip.

According to a second aspect of the present invention, there is provided a projectile for an air, gas or spring gun, the projectile being elongate along a central axis and comprising a metal body and a metal annular lip which is integral with the body and is provided by a plurality of circumferentially spaced, rearwardly projecting flaps which are radially deformable.

The projectile will usually be a pellet, but it may instead be an alternative projectile such as a bullet.

Because the body, the annular lip and, if present, the front maximum diameter portion are integral and made of metal, the projectile has the advantage of having a lower production cost than a projectile which is assembled from separate components. This advantage of a low manufacturing cost is achieved whilst still, by virtue of the slits/flaps, enabling the projectile to be made of substantially lead-free metal so as to avoid the environmental problems associated with lead.

A non-limiting embodiment of the present invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a side view of a pellet in accordance with the present invention, the side view being partially in cross-section; and

Figure 2 is a rear view of the pellet of Figure 1.

The pellet is made entirely of substantially lead-free material such as zinc, zinc alloy or copper. The pellet has an integral construction. Thus, it is a one-piece pellet.

The pellet comprises a body 1 which has a tail portion 2 and a head portion 3. The tail portion 2 contains a rearwardly opening hollow 4 which is defined by a tubular wall 5.

In addition to the body 1, the pellet also comprises a front maximum diameter portion 6 and a rear maximum diameter portion 7 which are spaced apart along a central axis 8. The front maximum diameter portion 6 is integral with the head portion 3 and is in the form of an annular flange which has front and rear surfaces which are perpendicular to the central axis 8.

The rear maximum diameter portion 7 is integral with the tail portion 2 and is in the form of an annular lip which is flared radially outwards and backwards. The annular lip 7 is split into 12 flaps 9 by 12 longitudinal slits 10. Each slit 10 extends from the free edge 11 of the annular lip 7 to the base area 12 of the annular lip. In Figure 2, the width of the slits 10 has been exaggerated for the sake of clarity. As may be seen from Figure 1, the inner and outer diameters of the base area 12 are the same as the inner and outer diameters of the rear end of the tubular wall 5. This ensures a smooth continuation from the body 1 to the annular lip 7.

Although the embodiment in Figures 1 and 2 has 12 flaps, the number may be adjusted to produce a particular desired characteristic for a pellet. Typically, the number of flaps may range from 4 to 20, or be limited to narrower ranges such as 6 to 18, 8 to 16, or 10 to 14. Even with up to 20 slits 10, only an

insignificant amount of the propulsive air of the air gun escapes through the slits when the pellet is being fired.

The pellet is capable of being used in both a rifled barrel and a smooth barrel. In the case of a smooth barrel, the annular lip 7 serves merely to seal the rear of the pellet against the barrel bore. In the case of a rifled barrel, the annular lip 7 serves the two purposes of forming a seal and engaging with the rifling to impart spin to the pellet.

Typical bore diameters for a nominal unchoked 5.5mm bore of a rifled barrel are: an inner bore diameter of 5.47mm and an outer bore diameter of 5.59mm. For the pellet illustrated in Figures 1 and 2, the diameter of the front maximum diameter portion 6 may range from 5.46 to 5.49mm. The pre-firing diameter of the annular lip 7 may be 5.7mm. Thus, the front maximum diameter portion 6 may also engage the rifling to a small extent, in addition to serving its main purpose of guiding the pellet down the barrel bore. When inserted into the barrel, the flaps 9 of the annular lip 7 are initially compressed radially inwards. When the air gun is fired, the pellet proceeds along the barrel and the air pressure acting on the inner surface of the tubular wall 5 and on the inner surface of the flaps 9 causes the flaps to be deformed radially outwards to seal against the inner bore diameter of the barrel and to project slightly into the rifling in order to impart spin to the pellet.

If the bore was choked, the flaps would deform radially inwards upon reaching the choke.

It is the provision of the slits 10 in the annular lip 7 to form the flaps 9 that enables the seal to be formed at the rear of the pellet whilst still enabling manufacture of the pellet out of substantially lead-free metal.

The pellet may be manufactured in a one-stage operation in which the final flared form of the annular lip 7, together with its slits 10, is produced at the same time as the rest of the

pellet is being formed. For example, the pellet is cast between two dies, but this method leaves a split line and, when wear of the dies takes place, this will lead to flash on the split line on the pellet.

A better method is to swage or cast in a single non-reentrant die. Then a second operation is performed of flaring outwards the flaps. For example at the end of the first stage, the annular lip 7 does not contain any slits. A splitting/flaring tool is inserted into the hollow 4 in order to flare outwardly the annular lip 7 and in order to slit the annular lip to produce the flaps 9.

CLAIMS

1. A projectile for an air, gas or spring gun, the projectile being elongate along a central axis and comprising a metal body and a metal annular lip which is integral with the body and projects backwards and has a plurality of circumferentially spaced slits which permit radial deformation of the annular lip.

2. A projectile according to claim 1, wherein the annular lip forms a rear maximum diameter portion and is flared radially outwards and backwards.

3. A projectile according to claim 1 or 2, wherein the annular lip extends from the rear peripheral edge of the body.

4. A projectile according to claim 3, wherein the body has a rearwardly opening hollow defined by a tubular wall having a rear end which is integral with the base of the annular lip and which has substantially the same inner and outer diameters as the base of the annular lip.

5. A projectile according to any of claims 1 to 4, wherein each slit extends from the free edge of the annular lip to the base of the annular lip.

6. A projectile according to any of claims 1 to 5, wherein each slit is substantially parallel to or substantially intersects the central axis.

7. A projectile for an air, gas or spring gun, the projectile being elongate along a central axis and comprising a metal body and a metal annular lip which is integral with the body and is

provided by a plurality of circumferentially spaced, rearwardly projecting flaps which are radially deformable.

8. A projectile according to claim 7, wherein the annular lip forms a rear maximum diameter portion and is flared radially outwards and backwards.

9. A projectile according to claim 7 or 8, wherein the flaps extend from the rear peripheral edge of the body.

10. A projectile according to any of claims 7 to 9, wherein the bases of the flaps are substantially contiguous.

11. A projectile according to any of claims 7 to 10, wherein the body has a rearwardly opening hollow defined by a tubular wall having a rear end which is integral with the bases of the flaps and which has substantially the same inner and outer diameters as the bases of the flaps.

12. A projectile according to claim 4 or 11, wherein the surface of the hollow within the tubular wall has a smoothly curved profile in cross-section.

13. A projectile according to any of claims 1 to 12, further comprising a metal front maximum diameter portion which is integral with the body.

14. A projectile according to claim 13, wherein the front maximum diameter portion comprises an annular flange which has front and rear surfaces which are substantially perpendicular to the central axis.

15. A projectile according to any of claims 1 to 14, wherein the metal is substantially lead-free metal.

16. A projectile according to claim 15, wherein the substantially lead-free metal is zinc, zinc alloy, copper, tin, bismuth or brass.

17. A projectile according to any of claims 1 to 16, wherein the projectile is a pellet.

18. A pellet for an air, gas or spring gun, substantially as herein described with reference to, or with reference to and as illustrated in, the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

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Application number

GB 9312795.9

Relevant Technical fields

(i) UK Cl (Edition L) F3A

(ii) Int Cl (Edition 5) F42B

Search Examiner

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Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search

28 JULY 1993

Documents considered relevant following a search in respect of claims 1 TO 18

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2131925 A (J H THOMAS)	
A	GB 2052693 A (H E EARL)	
A	GB 1141534 (FORSVARETS)	
A	US 4005660 (J FRANCIS)	

Category	Identity of document and relevant passages 12.	Relevant to claim(s)

Categories of documents

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