

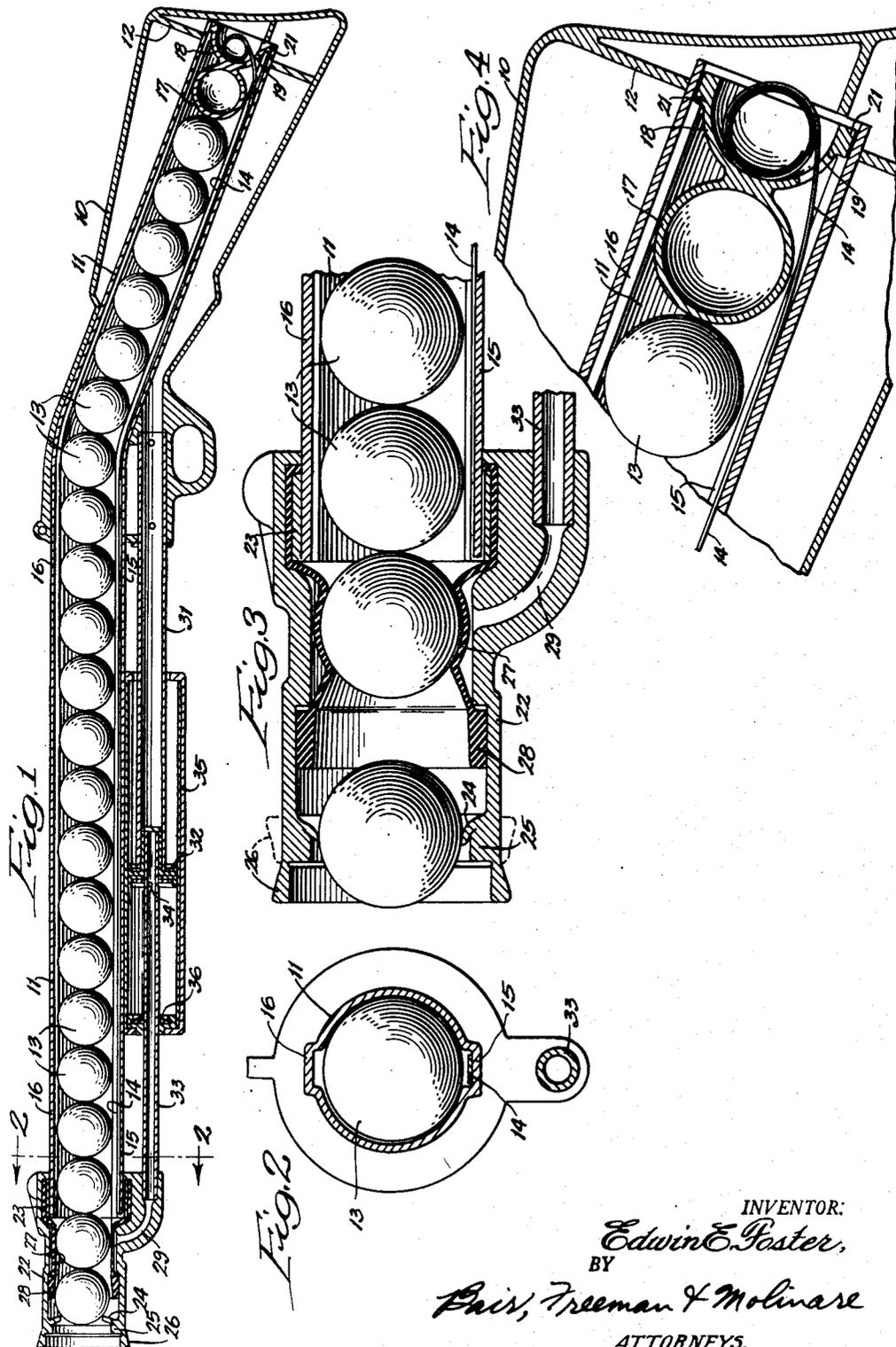
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REPEATING AIR GUN

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REPEATING AIR GUN

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This invention relates to repeating air guns and more particularly to toy guns of the type which shoot light projectiles such as hollow plastic balls similar to ping-pong balls.

Repeating air guns have heretofore been proposed in which light spherical projectiles are discharged by air pressure past a resistance to shoot the projectile out and simultaneously to produce a popping sound. It is desirable that such guns be able to shoot a large number of projectiles in succession and that only one projectile be discharged at each operation of the gun. It is furthermore desirable that the air space behind the outermost projectile be made as small as possible to reduce the size of the pump required and to make operation of the gun easier.

It is one of the objects of the present invention to provide a repeating air gun which achieves these several desirable results.

Another object is to provide a repeating air gun in which a second projectile immediately behind the outermost projectile is gripped and sealed to form an end closure for the air space which receives the air for discharging the outermost projectile.

According to one feature the second projectile is gripped and sealed by an inflatable sleeve inflated by operation of the pump which also produces the discharging pressure.

Still another object is to provide a repeating air gun having a firing chamber which is attached to the gun barrel to receive and successively discharge a series of projectiles in the barrel.

According to one feature the firing chamber is a completely self-contained unit adapted to be attached to the barrel to project therefrom and connected to the pump to receive air therefrom for discharging the projectiles.

A further object is to provide a repeating air gun in which the projectiles in the barrel are urged into the firing chamber with a substantially constant force regardless of the number of projectiles in the barrel.

According to one feature of the gun a strip spring is employed which extends along the barrel and rolls up into a follower member which is held against turning in the barrel to prevent tangling or twisting of the spring.

In the preferred construction the barrel is provided with a longitudinally extending groove in which the spring lies and which also receives a guiding projection on the follower.

The above and other objects and features of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing, in which:

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Figure 1 is a longitudinal central section through a repeating air gun embodying the invention.

Figure 2 is a transverse section on the line 2—2 of Figure 1.

Figure 3 is an enlarged partial section showing the firing chamber construction, and

Figure 4 is a partial enlarged section of the stock end of the gun.

The gun as shown includes a stock portion 10 which may be formed in any desired manner as by molding complementary halves from plastic or like material. The stock portion receives the rearward end of an elongated continuous barrel 11 which may be formed of metal or of plastic as desired and which is bent between its ends to follow the general angle of a conventional gun. As shown, the barrel extends completely to the butt end of the stock and may be locked by a cross-web 12 near the butt of the stock. The barrel projects forward from the stock and at its forward end carries a firing chamber mechanism to discharge projectiles successively from the barrel.

As shown, the barrel is adapted to hold a series of projectiles 13 which may be relatively light and thin plastic balls, such as conventional ping-pong balls. The projectiles are forced into the barrel until the barrel is substantially filled as indicated in Figure 1 and are fed progressively into the firing chamber to be discharged therefrom. For this purpose the barrel contains an elongated flexible strip spring 14 of the type more particularly described and claimed in my copending application, Serial Number 254,100, filed October 31, 1951. The spring 14 may be in the form of an elongated steel strip anchored to the outer end of the barrel by being folded thereover, as shown in Figure 3, and fitting into a longitudinally extending groove 15 in the barrel. Preferably the barrel is formed with a pair of diametrically opposite grooves 15 and 16, one of which receives the spring 14 and both of which function as guides as explained more fully hereinafter. The spring 14 is biased so that it tends to roll relatively tightly upon itself, as shown in Figures 1 and 4. Therefore the spring will exert a substantial constant pressure on a series of projectiles to urge them toward the firing chamber regardless of how many projectiles are in the barrel.

The spring engages a follower having a spherical forward end 17 of substantially the same size and shape as the projectiles 13 to engage the innermost projectile and urge the projectiles through the barrel. A substantially semi-cylindrical hollow portion 18 is attached to the fol-

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lower portion 17 and is formed with an opening 19 therein through which the spring 14 can extend. The portion 18 provides a partially cylindrical cavity of a size to receive the rolled up spring 14 so that the spring will be guided thereby and held against accidental tangling while being permitted to roll up freely without binding or friction. To prevent twisting of the spring the guide portion 18 of the follower is formed with lugs 21 which fit into the grooves 15 and 16 as shown. Thus turning of the follower in the barrel is limited so that the spring is held straight and in proper functioning condition at all times.

The firing chamber at the forward end of the barrel provides a restriction to seal against the outermost projectile and also provides gripping and sealing means to grip a second projectile in the series. As shown, the firing chamber is molded in one piece of an elastic material such as rubber, a well plasticized resin, or the like. The firing chamber includes a tubular body 22 formed at its inner end to fit over the end of the barrel and preferably to engage over a strap 23 on the end of the barrel which provides an enlarged abutment to hold the firing chamber more securely in place. The firing chamber provides a passage which is substantially a continuation of the barrel through which the projectiles can pass successively. Near its outer end the firing chamber is formed with an integral annular lip 24 extending inward therefrom and angling axially toward the inner end of the barrel. An annular shoulder 25 lies beyond the lip and is adapted to engage and support the lip during discharge of a projectile as shown in Figure 3. The firing chamber body terminates in a slightly flared axial flange 26 beyond the shoulder 25 which can be folded as indicated in dotted lines in Figure 3 to increase the resistance to discharge of projectiles when desired, thereby to increase the distance through which the projectiles will be shot and the noise accompanying their discharge.

With the annular lip 24 and shoulder 25 as shown projectiles can easily be forced into the barrel past the lip 24 since it affords relatively low resistance to deflection in the inward direction. However, when a projectile is being forced out as shown in Figure 3, the lip will fold over the shoulder 25 and an expansion of the end of the body will be required to permit the projectile to pass. Therefore a relatively high resistance to discharge will be provided so that the projectiles will be shot the desired distance and will produce the desired noise as they are shot.

In order to hold projectiles behind the outermost one which is to be discharged from reverse movement in the barrel a gripping and sealing means is provided in the firing chamber. As shown this means comprises an elastic inflatable sleeve 27 fitting into the discharge chamber body and preferably rigidly secured thereto at the inner end by fitting over the strap 23 and beneath the body. At its forward end the sleeve 27 is detached from the body but preferably terminates in a relatively heavier reinforced ring 28 integral with the sleeve and formed of the same resilient material such as rubber. Between the ends of the sleeve the body is formed with an air inlet passage 29 to receive air for discharging the projectiles.

When no air pressure is present the sleeve 27 will occupy the position shown in Figure 1 so that the spring 14 can advance the series of projectiles through the barrel until the outermost projectile strikes the discharge lip 24. The

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strength of the spring 14 is so adjusted that it will not advance the projectile further so that the gun will remain in the condition shown in Figure 1 until operating air pressure is supplied to the firing chamber. As soon as air is supplied through the passage 29 the sleeve 27 will be inflated as shown in Figure 3 to grip and to seal against the second projectile in the series. As the pressure continues to increase air will force its way past the reinforcing ring 28 on the sleeve 27 and into the space between the outermost projectile and the second projectile which is gripped by the sleeve. It will be observed that the reinforcing ring 28 provides a resistance to flow of air therepast so that it is insured that the sleeve 27 is expanded into gripping and sealing engagement with the second projectile before any air enters the actual firing chamber.

Air flowing past the ring 28 will enter the firing chamber between the outermost projectile and second projectile and will force the outermost projectile forward as shown in Figure 3. As the pressure becomes sufficient to expand the restricted end of the firing chamber, the outermost projectile will be discharged therefrom with a relatively loud popping noise. As soon as this projectile is discharged the pressure is dissipated and the parts return to the position shown in Figure 1, ready for a repeat operation.

Air for operation is furnished by a hand pump mounted beneath the barrel for manual single stroke operation. As shown, the pump comprises a piston tube 31 rigidly secured at one end to the stock and at its forward end carrying a piston provided with a cup leather packing 32 as shown. A discharge tube 33 fits into the piston tube and has its inner end sealed against flow of air through the piston tube while its outer end connects with the passage 29 in the firing chamber. The tube 33 is provided with at least one port 34 forwardly of the piston 32 through which air can flow into the tube.

The pump is completed by a cylinder 35 slidably mounted over the piston and sealed against the discharge tube 33 by an annular packing 36. At its rear end the cylinder fits loosely over the guide tube 31 so that air can enter freely between them.

When the cylinder 35 is moved forwardly, air will be drawn in through the rear end of the cylinder around the tube 31 and will pass freely past the cup leather packing 32 into the space ahead of the piston. When the cylinder is pulled backward the cup leather packing will seal and the air in front of the piston will be forced through the tube 33 and into the firing chamber to cause discharge of the single projectile therefrom as described above. Each time the cylinder 35 is reciprocated, a projectile will be discharged until all of the projectiles in the barrel have been discharged therefrom. It will be noted that in discharging the last projectile the spherical portion 17 of the follower will fit into the sleeve 27 and will function as the second projectile in the firing operation described above.

While one embodiment of the invention has been shown and described in detail, it will be understood that this is illustrative only and is not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. A repeating air gun comprising a barrel to hold a plurality of projectiles, a firing chamber at one end of the barrel including an annular

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resilient restriction through which the projectiles must pass and which seals against the outermost projectile, an annular inflatable sleeve in the firing chamber rearwardly of the restriction, a pump, a connection from the pump to the inflatable sleeve to inflate the sleeve into gripping and sealing engagement with a projectile inward of the restriction, and means forming a connection from the pump into the space between the last named projectile and the outermost projectile.

2. A repeating air gun comprising a barrel to hold a plurality of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction through which the projectiles must pass and which seals against the outermost projectile, an annular inflatable sleeve in the firing chamber rearwardly of the restriction, a pump, a connection from the pump to the inflatable sleeve to inflate the sleeve into gripping and sealing engagement with a projectile inward of the restriction, and means forming a restricted connection from the inflatable sleeve to the space between the last named projectile and the outermost projectile.

3. A repeating air gun comprising a barrel to hold a plurality of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction through which the projectiles must pass and which seals against the outermost projectile, an annular inflatable sleeve in the firing chamber rearwardly of the restriction, a pump, a connection from the pump to the inflatable sleeve to inflate the sleeve into gripping and sealing engagement with a projectile inward of the restriction, the forward end of the inflatable sleeve being yieldable in response to pressure to pass air under pressure from the sleeve to the space between the last named projectile and the outermost projectile.

4. In a repeating air gun, a firing chamber comprising a tubular body of a size to pass circular section projectiles, a resilient restriction adjacent to the outer end of the body through which the projectiles pass and which seals against the outermost projectile, an annular resilient sleeve in the body, an air passage in the body opening into the space between the body and the sleeve to press the sleeve into gripping and sealing contact with a projectile in the body, and means defining a restricted air passage from said space to the space in the body between the last named projectile and the outermost projectile.

5. In a repeating air gun, a firing chamber comprising a tubular body of a size to pass circular section projectiles, a resilient restriction adjacent to the outer end of the body through which the projectiles pass and which seals against the outermost projectile, an annular resilient sleeve in the body, an air passage in the body opening into the space between the body and the sleeve to press the sleeve into gripping and sealing contact with a projectile in the body, the forward end of the sleeve being detached from the body to pass air from said space to the space in the body forward of the projectile gripped by the sleeve.

6. In a repeating air gun, a firing chamber comprising a tubular body of resilient material adapted to pass projectiles, a resilient annular lip at the outer end of the body to seal against a projectile and to resist outward passage thereof, an elastic sleeve in the body inward of the lip,

an air passage in the body opening into the space between the body and the sleeve to press the sleeve into gripping and sealing engagement with a second projectile in the body, and means forming a restricted passage from said space to the space outward of the second projectile.

7. In a repeating air gun, a firing chamber comprising a tubular body of resilient material adapted to pass projectiles, a resilient annular lip at the outer end of the body to seal against a projectile and to resist outward passage thereof, an elastic sleeve in the body inward of the lip, an air passage in the body opening into the space between the body and the sleeve to press the sleeve into gripping and sealing engagement with a second projectile in the body, the outward end of the sleeve being detached from the body for flow of air therepast into the space outward of the sleeve.

8. A repeating air gun comprising an elongated rigid barrel adapted to hold a series of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction to engage and seal against the outermost projectile of the series, a pump connected to the firing chamber to pump air into it, an inflatable sleeve in the firing chamber inward of the restriction communicating with the pump to be inflated thereby into gripping and sealing engagement with a second projectile in the series, means to establish restricted communication from the pump to the space between the second projectile and the outermost projectile, and feed means connected to the barrel to urge the projectiles of the series outward toward the firing chamber.

9. A repeating air gun comprising an elongated rigid barrel adapted to hold a series of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction to engage and seal against the outermost projectile of the series, a pump connected to the firing chamber to pump air into it, an inflatable sleeve in the firing chamber inward of the restriction communicating with the pump to be inflated thereby into gripping and sealing engagement with a second projectile in the series, means to establish restricted communication from the pump to the space between the second projectile and the outermost projectile, an elongated strip spring in the barrel secured thereto adjacent to the firing chamber and biased to roll upon itself, a follower slidable in the barrel to urge the projectiles therethrough and having a cavity therein to receive the spring as it rolls up, and interengaging guide parts on the follower and the barrel to hold the follower against rotation in the barrel.

10. A repeating air gun comprising an elongated rigid barrel adapted to hold a series of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction to engage and seal against the outermost projectile of the series, a pump connected to the firing chamber to pump air into it, means in the firing chamber controlled by operation of the pump to grip and seal against a second projectile in the series, a follower slidable in the barrel to urge the projectiles therein toward the firing chamber, an elongated strip spring in the barrel secured adjacent to the firing chamber and biased to roll upon itself, the follower having an opening therein through which the spring extends and a cavity to receive the spring as it rolls up, and cooperating guide parts on the follower and barrel to limit turning of the follower in the barrel.

11. A repeating air gun comprising an elongated rigid barrel adapted to hold a series of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction to engage and seal against the outermost projectile of the series, a pump connected to the firing chamber to pump air into it, means in the firing chamber controlled by operation of the pump to grip and seal against a second projectile in the series, a follower slidable in the barrel to urge the projectiles therein toward the firing chamber, an elongated strip spring in the barrel secured adjacent to the firing chamber and biased to roll upon itself, the follower having an opening therein through which the spring extends and a cavity to receive the spring as it rolls up, the barrel having a longitudinal groove therein in which the spring lies, and a projection on the follower fitting into the groove to limit turning of the follower in the barrel.

12. A repeating air gun comprising an elongated barrel to receive a series of projectiles, a firing chamber at one end of the barrel to receive and discharge the projectiles successively, a follower slidable in the barrel to urge the projectiles therein toward the firing chamber, an elongated strip spring in the barrel secured thereto adjacent to the firing chamber and biased to roll upon itself, the follower having a cavity therein to receive the spring as it rolls up, and interengaging guide parts on the follower and barrel to limit turning of the follower in the barrel.

13. A repeating air gun comprising an elongated barrel to receive a series of projectiles, a firing chamber at one end of the barrel to receive and discharge the projectiles successively, a follower slidable in the barrel to urge the projectiles therein toward the firing chamber, an elongated strip spring in the barrel secured thereto adjacent to the firing chamber and biased to roll upon itself, the follower having a cavity therein to receive the spring as it rolls up, the barrel having a longitudinal groove therein in which the spring lies, and a projection on the follower fitting into the groove to limit turning of the follower in the barrel.

14. An air gun comprising a barrel, a stock secured to one end of the barrel, means secured to the barrel to supply air under pressure to the barrel, a resilient construction at the muzzle end of the barrel to form an air tight contact with the projectiles but to yield when air in the barrel is placed under pressure by said means, and means in the barrel extending along the interior thereof to contact and urge the last projectiles in the barrel toward the muzzle end of the barrel, said last-mentioned means being in the form of a spring ribbon secured at one end to the muzzle end of the gun and extending along the inside surface of the barrel and which tends to coil at the other end of the barrel to urge the projectiles in the barrel toward the muzzle end thereof with a substantially uniform force regardless of the number of projectiles in the barrel.

15. The construction of claim 14 in which the barrel is formed on one side with a longitudinally extending groove and said spring ribbon lies in the groove.

16. A repeating air gun comprising a barrel to hold a plurality of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction through which the projectiles must pass and which seals against the outermost projectile, a pump connected to the

firing chamber to pump air into it rearwardly of the outermost projectile, and gripping means mounted in the firing chamber for radial movement therein into and out of the path of a projectile passing through the firing chamber, said gripping means normally lying out of said path and being movable into said path to hold a projectile in the firing chamber against rearward movement in response to operation of the pump.

17. A repeating air gun comprising a barrel to hold a plurality of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction through which the projectiles must pass and which seals against the outermost projectile, a pump connected to the firing chamber to pump air into it, and gripping means mounted in the firing chamber for radial movement therein into and out of the path of a projectile passing through the firing chamber, said means normally lying out of said path and communicating with the pump to be forced into said path to hold a projectile in the firing chamber against rearward movement by air pressure from the pump.

18. A repeating air gun comprising a barrel to hold a plurality of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction through which the projectiles must pass and which seals against the outermost projectile, pressure operated means in the firing chamber movable radially inward therein in response to air pressure to grip and seal against a second projectile inward of the outermost projectile, a pump, a substantially unrestricted connection from the pump to the pressure operated means to move it radially inward in the firing chamber, and a restricted connection from the pump to the space in the firing chamber between the outermost and second projectiles to supply fluid from the pump to the firing chamber at a slower rate than to the pressure operated means thereby to insure that the pressure operated means grips the second projectile before the firing chamber is subjected to pressure.

19. A repeating air gun comprising an elongated rigid barrel adapted to hold a series of projectiles, a firing chamber at one end of the barrel including an annular resilient restriction to engage and seal against the outermost projectile of the series, a pump connected to the firing chamber to pump air into it, means mounted for radial movement in the firing chamber normally lying out of the path of a projectile passing through the firing chamber and movable in response to operation of the pump radially inward of the firing chamber to grip a second projectile in the series and hold it against inward longitudinal movement in the firing chamber and barrel, and feed means connected to the barrel to urge the projectiles of the series outward toward the firing chamber.

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