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TOY VORTEX GUN

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This invention relates to toy guns and more particularly to toy vortex guns adapted to discharge a mass of air.

Generally, it is an object of this invention to provide a novel and improved toy gun of the above description capable of discharging a mass of air at a relatively high velocity, simple in construction and inexpensive to manufacture, yet capable of withstanding the hard and abusive use to which toy guns usually are subjected.

Conventionally, vortex guns comprise a barrel portion have a diaphragm disposed therein adapted to be moved forwardly at a relatively fast rate within the barrel portion so as to discharge a mass of air. In present constructions, the diaphragm is usually tensioned at some point during its operation such as immediately prior to the release of the diaphragm or at some point during the forward motion of the diaphragm. The repeated stresses applied to the diaphragm have resulted either in the use of a diaphragm so heavy and unwieldy that little effective air discharge can be achieved or, if a relatively light diaphragm is employed, failure of the diaphragm after only short periods of use.

The toy vortex gun of this invention comprises a barrel portion having a relatively large, voluminous diaphragm disposed transversely across the interior of the barrel portion and adapted, during a firing stroke, to move from a retracted position rearwardly in the barrel to a protracted position forwardly within the barrel thereby to produce a discharge of air. In both the retracted and protracted positions, the diaphragm remains in a relaxed, untensioned state. Mechanism is included for moving a central portion of the diaphragm rearwardly towards the retracted position to cock the gun. A resilient drive mechanism interposed between the rear end of the barrel and the central portion of the diaphragm provides the motive force for moving the diaphragm sharply forwardly towards its protracted position within the barrel. Means are included positively limiting movement of the diaphragm between these two positions to insure a prolonged life for the diaphragm. The invention contemplates a novel means for mounting the diaphragm within the interior of the barrel of particular utility with the diaphragm construction herein used. Further, a novel trigger mechanism is included for releasably holding the diaphragm in a cocked position rearwardly in the barrel. The trigger mechanism is adapted to automatically latch on to and restrain structure associated with the resilient drive mechanism, thereby releasably holding the diaphragm member in a cocked position, and includes structure limiting rearward movement of the diaphragm member.

More specifically, therefore, it is an object of this invention to provide a toy vortex gun having a movable diaphragm for producing a discharge of a mass of air wherein movement of the diaphragm is confined by limit means to movement between a retracted and protracted position, the diaphragm in each of these positions remaining in an untensioned and relaxed state.

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It is another object of the invention to provide a novel means for mounting the diaphragm of the gun within the barrel of the gun.

5 Still another object is to provide a novel trigger mechanism releasably holding the diaphragm member in a cocked position.

A related object of the invention is to provide such a trigger mechanism which includes structure serving to limit rearward movement of the diaphragm.

10 These and other objects and advantages are attained by the present invention described hereinbelow in conjunction with the accompanying drawings wherein:

Fig. 1 is a side view of a toy vortex gun embodying this invention with one side of the gun removed to show the interior of the gun;

15 Fig. 2 is a cross-sectional view of the gun along the line 2—2 in Fig. 1 showing in more detail the trigger mechanism in the gun; and

20 Fig. 3 is a section view along the line 3—3 of Fig. 2 further illustrating the trigger mechanism.

Referring to the drawings, the toy vortex gun of this invention comprises generally a hollow barrel portion 10 having intermediate its ends a depending handle portion or grip 11. For economical manufacture, the barrel portion may conveniently be prepared from molded plastic. In the embodiment illustrated, the barrel is assembled from two shell portions 12 and 13 which are secured together at their peripheral edges in a suitable manner as by an adhesive to form a joint 14.

30 Barrel portion 10 has at its forward or muzzled end an air discharge opening 16. Discharge opening 16 is somewhat smaller than the inner diameter of the barrel rearwardly of the discharge opening, the sides of barrel 10 converging together at the forward end of the barrel. In this way, air discharges ejected from the gun tend to be ejected as a concentrated mass which increases the range of the gun.

Rearwardly of discharge opening 16 and intermediate the ends of the barrel portion is a diaphragm member 17. Diaphragm member 17 is affixed circumferentially to the interior of barrel portion 10 and transversely across the interior of the barrel portion. The diaphragm may be made of any suitable flexible material, such as rubber or plastic, capable of withstanding the continued flexures which are imparted to the diaphragm. The diaphragm is fairly voluminous as illustrated in Fig. 1. Mechanism is provided as described hereinbelow limiting movement of the diaphragm so that the diaphragm, during operation of the gun, is maintained in a relaxed and untensioned state. Since the diaphragm is never tensioned, it may be constructed of a light, pliable material without severely limiting the life of the diaphragm. The voluminous nature of the diaphragm accommodates relatively large longitudinal movement of the diaphragm within the interior of the barrel without tensioning of the diaphragm and the entrapment of large masses of air for ejection through discharge opening 16.

The diaphragm member is affixed to the interior of the barrel portion in a novel manner enabling the diaphragm to be mounted readily in the gun and without forming undesirable folds in the diaphragm which would hinder the operation of the diaphragm. The mounting means employed has been found to provide completely satisfactory support for the base of the diaphragm particularly since the diaphragm is never subjected to tension during operation of the gun.

70 Referring to Fig. 1, diaphragm member 17 has formed about its outer peripheral edge a continuous bead 21. Projecting inwardly from the interior of barrel portion 10 are a pair of annular flanges 22 and 23 defining between the flanges a groove 24. The diaphragm is mount-

ed within the barrel by clamping portions of the diaphragm member located centrally of continuous bead 21 against the interior of the barrel with a clamping ring 26. Bead 21 wedges against flange 23 and the rear face of ring 26 so that the diaphragm is held firmly within the barrel. In the embodiment illustrated, the diaphragm member is first positioned about clamping ring 26 prior to the assembly of barrel shells 12 and 13.

Provided at the center of diaphragm member 17 is a cutout portion which enables the diaphragm member to be positioned over a button 27 extending through the diaphragm member. The button and diaphragm member are secured together in a suitable manner as by an adhesive. Button 27 serves as a propelling means adapted to shift the central portion of the diaphragm rearwardly within the barrel when pulled rearwardly within the gun. Movement of button 27 forwardly serves to propel the diaphragm member forwardly with the ejection of air from the discharge opening.

Rearwardly of diaphragm member 17 and extending transversely across the interior of barrel portion 10 is a trigger mechanism indicated generally at 31. The trigger mechanism includes a cover member 32 presenting longitudinally along each lateral edge a clamping flange 33 and 34, respectively, a slidable latch member 36, and a positioning member 37. As can best be seen in Figs. 2 and 3, positioning member 37 has an anchoring portion 38 adapted to be press fitted within clamping flanges 33 and 34 of the cover member and tube section 39 normal to the anchoring portion and projecting rearwardly thereof. Cover member 32 has a slot 41 extending longitudinally thereof and accommodating a limited amount of sliding movement of latch member 36.

Trigger mechanism 31 is positioned within the interior of the barrel by a pair of shoulders 42 and 43 projecting inwardly from opposite sides of barrel portion 10. A recess 44 provided in a rear wall 46 of the barrel snugly receives a flanged end 47 of tube section 39.

A compression spring 51 interposed between the upper end of slot 41 and a seating notch 52 formed in latch member 36 urges the latch member downwardly within the trigger mechanism. The latch member is slidable between an upper and a lower limit position determined by a projection 53 of the cover member striking the lower and upper end, respectively, of a guide slot 54.

The latch member and the cover member are each provided with apertures 56 and 57, respectively. When the latch member occupies its lower limit position, illustrated in Fig. 2, aperture 56 is out of registry with aperture 57. Movement of the latch member upwardly to its upper limit position moves the apertures in registry and serves to trigger the gun as described hereinbelow.

Extending axially along the interior of the gun barrel, through apertures 56 and 57 and an accommodating bore provided in tube section 39, is a rod 61. Mounted on the rear end of the rod is a cocking handle 62 which enables the rod to be drawn rearwardly when cocking the gun. Encircling rod 61 intermediate button 27 and the rear end of tube section 39 is a compression spring 63. The rear end of the compression spring is seated on a shoulder 64 within the interior of tube section 39. Compression spring 63 provides a resilient drive mechanism for projecting the center portion of the diaphragm and button 27 forwardly within barrel portion 11.

At the forward end of rod 61 is a nut 66 and a small cushioning spring 67. The rear end of the cushioning spring is seated on the forward end of button 27. Movement of nut 66 rearwardly by withdrawing rod 61 rearwardly within the gun barrel urges spring 67 and button 27 to a retracted position within the gun barrel.

As can best be seen in Fig. 1, the end of tube section 39 adjacent cover member 32 contains an enlarged bore 68, the shoulder or abutment defined by the inner end of the bore providing a seat or stop for button 27 in its retracted position limiting rearward movement of the

button. The dimensions of the diaphragm and the spacing of seat 68 rearwardly from the diaphragm are such that when button 27 is moved into seat 68, the diaphragm remains untensioned and in a relaxed condition. Seat 68 defines the rear limit or retracted position of button 27 and the center portion of the diaphragm member. Movement of the button and diaphragm forwardly within the barrel is limited by handle 62 striking a washer 77 seated in the rear wall of the barrel. This limits forward movement of rod 61 and nut 66, nut 66 and cushioning spring 67 functioning as a second stop defining the protracted position of the parts.

Encircling button 27 is an annular groove 69. The rear end of the button is also rounded as may be seen in Fig. 1. When the button is retracted into the trigger mechanism, latch member 36 rides up over the rear end of the button permitting the button to move rearwardly through aperture 56. Further retraction of the button brings groove 69 in alignment with the latch member, enabling the latch member to move downwardly under the urging of compression spring 63. In this manner, the latch member engages annular groove or catch 69 carried by button 27, releasably holding the button in a cocked condition.

A trigger 71 pivotally mounted as at 72 has one of its ends abutting the lower edge of latch member 36 and carries at its other end a clasp portion 73 adapted to be engaged by a finger. The trigger extends outwardly from the interior of the body of the gun through a slot 74.

A number of ports 76 are provided for the barrel portion rearwardly of diaphragm member 17. These ports enable air to rush into the barrel rearwardly of the diaphragm member when the diaphragm is moved forwardly to its protracted position under the urging of compression spring 61.

To summarize, diaphragm member 17 is at all times maintained in a relaxed, untensioned state by reason of the limit means comprised of seat 68 and nut 66 confining movement of the diaphragm member. The diaphragm is affixed circumferentially to the interior of the barrel portion by a novel clamping structure, comprised of ring 26, flanges 22, 23, and bead 21, which enables the gun to be assembled with a minimum of effort yet which affords the necessary support required by the diaphragm. The novel trigger mechanism of this invention enables the gun to be cocked automatically upon moving button 27 rearwardly in the gun. Cocking of the gun occurs when groove or catch 69 is brought into alignment with latch member 36. The trigger mechanism is constructed to also provide the limit means limiting rearward movement of button 27 within the gun.

The entire mechanism is economically produced and easily assembled. The only function of the diaphragm member is to entrap a mass of air and move it forwardly in the gun so that the diaphragm member may be made of a relatively light, pliable material without limiting the life of the gun. Elongated compression spring 61, extending rearwardly of the barrel, generates the force required to move button 27 and the diaphragm member forward sharply within barrel portion 10.

It is claimed and desired to secure by Letters Patent:

1. A toy air gun for ejecting a mass of air comprising a hollow barrel portion having an air discharge opening at the forward end thereof, a diaphragm member attached circumferentially to the interior of said barrel portion rearwardly of said discharge opening, propelling means secured to a central portion of said diaphragm member and movable with the central portion of said diaphragm member rearwardly of said opening to a retracted position and forwardly toward said opening to a protracted position, a releasably actuated resilient drive mechanism projecting rearwardly of said propelling means urging said propelling means from said retracted toward said protracted position, and limit means confining move-

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ment of said propelling means between said retracted and protracted positions, said limit means including stops defining said retracted and protracted positions, said stops spacing the central portion of said diaphragm member in said retracted and protracted positions rearwardly and forwardly, respectively, of the edge of said diaphragm member a distance less than the distance between the central portion and the edge of said diaphragm member when the diaphragm member is under tension, whereby said diaphragm member is maintained in a relaxed, un-

10 tensioned state in moving within the confines of said limit means.

2. A toy air gun for ejecting a mass of air comprising a hollow barrel portion having an air discharge opening at the forward end thereof, a diaphragm member extending transversely across the interior of said barrel portion rearwardly of said discharge opening, means securing said diaphragm member circumferentially about the interior of said barrel portion comprising a clamping ring thrusting the peripheral edge of said diaphragm member against the interior of said barrel portion and flange means carried by said barrel portion holding said clamping ring, a releasably actuated resilient drive mechanism urging a central portion of said diaphragm member from a retracted position located rearwardly in said barrel portion to a protracted position located forwardly in said barrel portion, and limit means confining movement of the central portion of said diaphragm member between said retracted and protracted positions, said limit means including stops defining said retracted and protracted positions, said stops spacing the central portion of said diaphragm member in said retracted and protracted positions rearwardly and forwardly, respectively, of said clamping ring a distance less than the distance between the central portion and said ring when the diaphragm member is under tension, whereby said diaphragm member is maintained in a relaxed, untensioned state in moving within the confines of said limit means.

3. A toy air gun for ejecting a mass of air comprising a hollow barrel portion having an air discharge opening at the forward end thereof, a diaphragm member having a continuous bead portion presented about its peripheral edge extending transversely across the interior of said barrel portion rearwardly of said discharge opening, means securing said diaphragm member circumferentially about the interior of said barrel portion comprising a clamping ring thrusting portions of said diaphragm member centrally of said bead portion against the interior of said barrel portion and flange means carried by said barrel portion holding said clamping ring, a releasably actuated resilient drive mechanism urging a central portion of said diaphragm member from a retracted position located rearwardly in said barrel portion to a protracted position located forwardly in said barrel portion, and limit means confining movement of the central portion of said diaphragm member between said retracted and protracted positions, said limit means including stops defining said retracted and protracted positions, said stops spacing the central portion of said diaphragm member in said retracted and protracted positions rearwardly and forwardly, respectively, of said clamping ring a distance less than the distance between the central portion and said ring when the diaphragm member is under tension, whereby said diaphragm member is maintained in a relaxed, untensioned state in moving within the confines of said limit means.

4. A toy air gun for ejecting a mass of air comprising a hollow barrel portion having an air discharge opening at the forward end thereof, a diaphragm member having a continuous bead portion presented about its peripheral edge extending transversely across the interior of said barrel portion rearwardly of said discharge opening, means securing said diaphragm member circumferentially about the interior of said barrel portion comprising a clamping ring thrusting portions of said dia-

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phragm member centrally of said bead portion against the interior of said barrel portion and flange means carried by said barrel portion holding said clamping ring, propelling means secured to a central portion of said diaphragm member and movable with the central portion of said diaphragm member rearwardly of said opening to a retracted position and forwardly toward said opening to a protracted position, a releasably actuated resilient drive mechanism projecting rearwardly of said propelling means urging said propelling means from said retracted toward said protracted position, and limit means confining movement of said propelling means between said retracted and protracted positions, said limit means including stops defining said retracted and protracted positions, said stops spacing the central portion of said diaphragm member in said retracted and protracted positions rearwardly and forwardly, respectively, of said clamping ring a distance less than the distance between the central portion and said ring when the diaphragm member is under tension, whereby said diaphragm member is maintained in a relaxed, untensioned state in moving within the confines of said limit means.

5. A toy air gun for ejecting a mass of air comprising a hollow barrel portion having an air discharge opening at the forward end thereof, a diaphragm member attached circumferentially to the interior of said barrel portion rearwardly of said discharge opening, a trigger mechanism secured to said barrel portion rearwardly of said diaphragm member, propelling means secured to a central portion of said diaphragm member and movable with the central portion of said diaphragm member rearwardly of said opening to a retracted position and forwardly toward said opening to a protracted position, said propelling means having catch means co-operating with said trigger mechanism whereby said propelling means is releasably held in a cocked position upon movement of the propelling means toward said retracted position, a resilient drive mechanism urging said propelling means from said retracted to said protracted position, and limit means confining movement of said propelling means between said retracted and protracted positions, said limit means including stops defining said retracted and protracted positions, said stops spacing the central portion of said diaphragm member in said retracted and protracted positions rearwardly and forwardly, respectively, of the edge of said diaphragm member a distance less than the distance between the central portion and the edge of said diaphragm member when the diaphragm member is under tension, whereby said diaphragm member is maintained in a relaxed, untensioned state in moving within the confines of said limit means.

6. The toy gun of claim 5 wherein said trigger mechanism comprises a positioning member fixed to said barrel portion and containing an aperture adapted to snugly receive said propelling means, and a co-operating latch member slidably mounted adjacent said positioning member, said latch member containing an aperture movable into registry with the aperture of said fixed positioning member thereby to release said propelling means.

7. The toy gun of claim 6 wherein one of the stops of said limit means confining movement of said propelling means comprises an abutment portion carried by said positioning member operable to limit rearward movement of said propelling means.

8. A toy air gun for ejecting a mass of air comprising a hollow barrel portion having an air discharge opening at the forward end thereof, a diaphragm member attached circumferentially to the interior of said barrel portion rearwardly of said discharge opening, a central portion of said diaphragm member being movable from a retracted position located rearwardly in said barrel portion and a protracted position located forwardly in said barrel portion, a trigger mechanism secured to said barrel portion rearwardly of said diaphragm member, a compression spring interposed between the central por-

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tion of said diaphragm member and the rear end of said barrel portion urging the central portion of said diaphragm member from said retracted toward said protracted position, means for withdrawing the central portion of said diaphragm to its retracted position, said last mentioned means having catch means co-operating with said trigger mechanism whereby the central portion of said diaphragm member is releasably held in a cocked position upon movement of the central portion towards its retracted position, and limit means confining movement of the central portion of said diaphragm member between said retracted and protracted positions, said limit means including stops defining said retracted and protracted positions, said stops spacing the central portion of said diaphragm member in said retracted and protracted positions rearwardly and forwardly, respectively, of the edge of said diaphragm member a distance less than the distance between the central portion and the edge of said diaphragm member when the diaphragm member is under tension, whereby said diaphragm member is maintained

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in a relaxed, untensioned state in moving within the confines of said limit means.

9. The toy gun of claim 8 wherein said trigger mechanism comprises a positioning member fixed to said barrel portion and containing an aperture adapted to snugly receive the means for withdrawing the central portion of the diaphragm member, and a co-operating latch member slidably mounted adjacent said positioning member, said latch member containing an aperture movable into registry with the aperture of said fixed positioning member thereby to release said diaphragm member.

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