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AIR GUN

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Fig. 1.

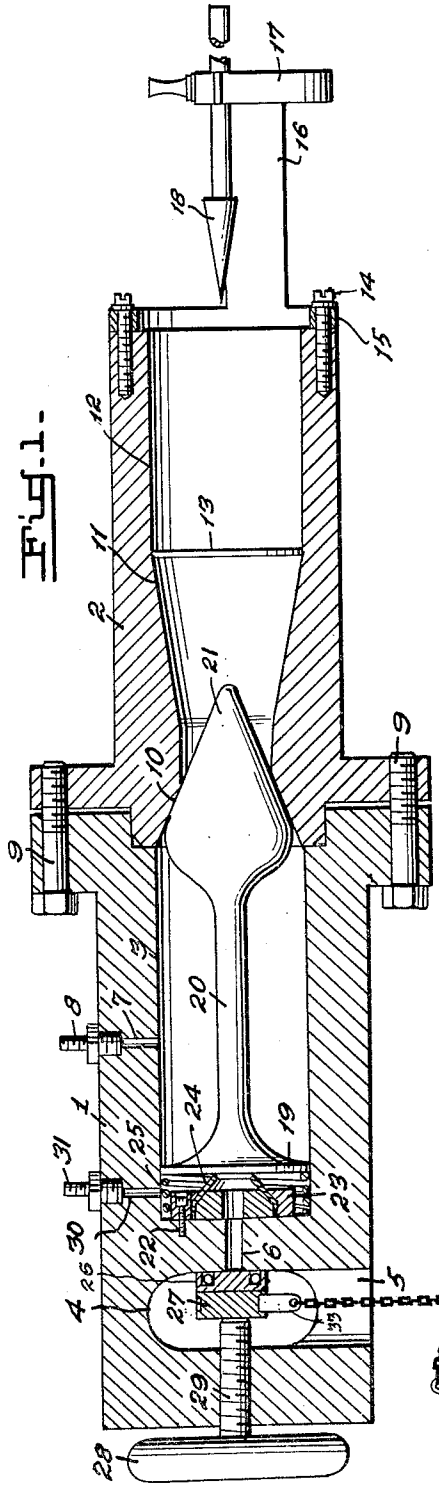
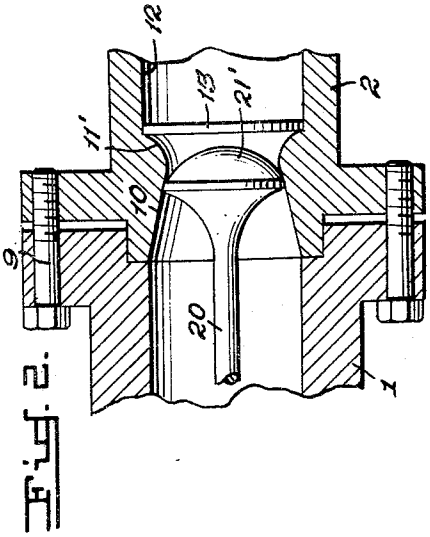
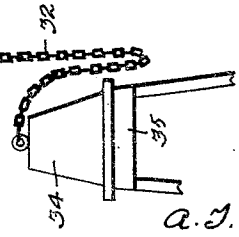


Fig. 2.





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AIR GUN

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This invention relates to an air gun and more particularly to an air gun for projecting a metal disk at high speed into contact with a target.

In order to properly design a fuze for anti-aircraft missile and to be able to accurately predict its performance it becomes necessary to simulate the effect of high velocity impact of the fuze ogive with a thin aluminum target. Investigation relvealed that no satisfactory equipment was available for this purpose. As a result the air gun of this invention was developed.

In the air gun of this invention the ogive is held stationary and the target disk is propelled at high velocity against the ogive. The test results obtained are identical to those that would be obtained if the ogive were projected, but the power requirement to project the disk is substantially less.

The invention comprises essentially a cylinder having a nozzle intermediate its ends. A piston slidable in the cylinder and having an integral valve member cooperable with the nozzle and means to release trapped fluid from behind the piston to allow the valve to open and high pressure fluid to be released to project a disk against the target.

It is an object of this invention to provide an air gun which will project a thin disk at a high velocity.

It is another object of this invention to provide an air gun having a quick opening valve to reduce throttling effect of the valve.

Yet another object is to provide an air gun having means to support a disk and ogive and being operable to project the disk against the ogive to high velocity.

These and other objects will become more apparent when reference is had to the following detailed description and drawing in which:

FIGURE 1 is an axial sectional view of a preferred form of air gun in accordance with this invention, and

FIGURE 2 is a broken away sectional view of a modified form of valve.

With reference to the drawing and particularly to FIGURE 1 the air gun is shown as having the cylindrical body made up of the two parts 1 and 2 secured together by the bolts 9. The body part 1 is provided with the axial bore 3 and the hollowed out portion 4. The hollowed out portion 4 is open to atmosphere by means of the lateral channel 5 and communicates with the bore 3 by means of axial passage 6. The body part 1 is further provided with the radial passage 7 by means of which gas under pressure may be supplied and the plug or valve 8 closing the outer end thereof.

The body part 2 is provided with a central passageway comprising the inwardly tapering section 10 which constitutes a valve seat, the outwardly tapering section 11 and the uniform diameter section 12. The juncture of the sections 11 and 12 forms a seat for the reception of the target disk 13 which is of a diameter substantially equal to the diameter of the section 12. Secured to the end of body part 2 by means of bolts 14 is the support ring 15 which carries the arm 16 and bracket 17. The bracket 17 is adapted to have clamped therein the ogive 18 which stimulates the ogive of a missile.

Slidably mounted within the bore 3 is the piston 19 which has integrally connected thereto the stem 20 and valve head 21. It will be noted in FIGURE 1 that the

valve head is conically shaped and has a smaller outside diameter than the piston 19. In the closed position shown the valve head 21 prevents fluid flow between the body parts 1 and 2. Secured to the body part 1 within the bore 3 by means of bolts 22 is the ring 23 which carries the stop member 24 to limit movement of the piston 19 to the left. The coil spring 25 reacts between the body part 1 and piston 19 to urge the piston to the right.

Received within the recess 4 of the body part 1 is the sealing disk 26 which is adapted to seal the passage 6. Back up disk 27 is disposed adjacent the disk 26 and these disks are forced into sealing engagement with the body part 1 by means of the hand wheel 28 and screw 29. Fluid pressure may be applied to the left side of piston 19 through the passage 30 which is provided with the plug or valve 31.

The embodiment shown in FIGURE 2 illustrates a modified form of valve head. In this form the valve head 21 assumes the shape of a poppet valve with a dome shaped forward end. The expanding portion of the passage 11 is curved rather than gradually tapered as in FIGURE 1. This embodiment permits the body part 2 to be shorter in overall length, but does not produce as desirable a fluid flow pattern.

Operation

To operate the test gun of this invention the hand wheel 28 is rotated so as to force the disks 26, 27 into engagement with the body part 1 to seal the passage 6. This forms a sealed chamber on the left hand side of piston 19. Gas under pressure is now supplied to the left hand side of piston 19 through passage 30 and the passage then closed. This pressure in addition to the bias of the spring 25 moves the piston 19 and valve head 21 to the right so that the valve head is pressed against the seat 10. Gas under pressure is now applied to the bore 3 to the right of piston 19 through the channel 7 which is then closed. The pressures on the left side and right side of piston 19 are regulated to be of equal value. Slight leakage at the piston-cylinder engagement surface will maintain this equality. At the valve head end 21 of stem 20 a large differential pressure forces the valve head to the right in FIGURE 1 thereby forcing the valve head against the seat 10. When it is desired to project disk 13 into contact with the ogive 18, the back up disk 27 is suddenly removed. For this purpose a chain 32 is attached at one end to a metallic strap 33 around the periphery of the disk 27 and the other end of the chain is secured to a weight 34 normally resting upon a bench 35. When it is desired to project the disk 13 into contact with the ogive 18, the weight 34 is suddenly pushed off the bench 35, thereby pulling disk 27 from between the screw 29 and the sealing disk 26. This sudden removal of the backup disk 27 through channel 5 will permit sealing disk 26 to be forced aside by passage of gas through passage 6. This falling weight method is one way of suddenly sliding disk 27 out of position. It will be understood without further illustration, that a lever striking disk 27, as by impact, may also be used to displace disk 27 suddenly. This permits the gas on the left side of piston 19 to immediately escape through the passage 6. Due to the differential area of the piston 19 and valve head 21 the gas pressure operating on the right side of piston 19 moves the piston and valve head to the left thus moving the valve head away from the seat. This permits a high velocity stream of gas to escape from the bore 3 into the tapered passage 11 and impel the disk 13 at high velocity toward the ogive 18. The velocity at which the disk is ejected is dependent upon the pressure of the fluid in the bore 3. It has been found that a pressure of 2000 pounds per square inch in the gun shown closely approximates the disk velocity desired. However, it is

obvious that other pressures may be used to provide different velocities.

It will be apparent that the embodiments shown are only exemplary and that various modifications in construction and arrangement can be made without departing from the scope of the invention as defined in the appended claims.

We claim:

1. An air gun for projecting a disk into engagement with a target having a pointed end comprising a first cylindrical body having an axial bore therein and a passage providing communication between the end of said bore and the exterior of said casing, a second cylindrical body attached to said first cylindrical body, said second body being formed to provide a tapered valve seat aligned with the bore of said first body, said second body being further provided with expanding and uniform diameter passages aligned with said valve seat, said second body forming at the juncture of said expanding and uniform diameter passages a seat for the disk to be projected, a bracket connected to the end of said second body adapted to adjustably support said target with the point thereof facing inwardly of said second body, a piston slidable in the bore of said first body member, a valve head of smaller diameter than said piston rigidly attached to said piston and engageable with said valve seat, means to introduce pressure fluid on opposite sides of said piston and a manually controlled disk adapted to open said passage to release the pressure fluid on the side of said piston remote from said valve head to open the valve and project the disk against the target to be punctured thereby.

2. An air gun as defined in claim 1 further provided with a coil spring reacting between said first cylindrical body and said piston on the side remote from said valve head.

3. An air gun as defined in claim 2 further provided with a stop member connected to said first cylindrical body and positioned within said coil spring adapted to limit movement of said piston.

4. An air gun for projecting a disk into engagement with a target comprising a first cylindrical body having an axial bore therein and an air passage providing communication between the end of said bore and the exterior of said first body, said first body provided at the opposite end to said passage with an offset portion larger than said bore, a second cylindrical body having an axial bore in the barrel at the discharge end and of the same diameter as the axial bore of said first body, the axial bore of the second body tapered interiorly from the center towards the other end and then flared as a venturi to form a valve seat, the flared end of said second body fitting into the offset portion of said first body and securely fastened thereto, a seat for the disk to be projected placed in the bore of the second body at the junction of the tapered portion and the bore of the barrel, a bracket connected to the open end of the barrel of said second body adapted to carry a target shaped like a projectile, a piston stem having a piston on one end slidable in the bore of said first body, a pointed wedge shaped valve head of smaller diameter than said piston on the other end of the piston stem, said valve head engaging the valve seat of said second body, a port in said first body in front of the piston for admission of air under pressure to maintain said valve head closed and means for closing said port when the desired pressure is attained, a second port in said first body behind the piston and means for closing said second port when the pressure behind the piston equals the pressure in front of the piston, a coiled spring between the end of said first body and the piston to bias the piston in a direction to seat said valve, stop members within the coil of the spring to limit the movement of the piston against said spring, means to release the pressure from the section served by the first port through said passage in said first body, said piston moving against the action of said spring by reason of the pressure behind it to open the valve and project said disk against the target.

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