

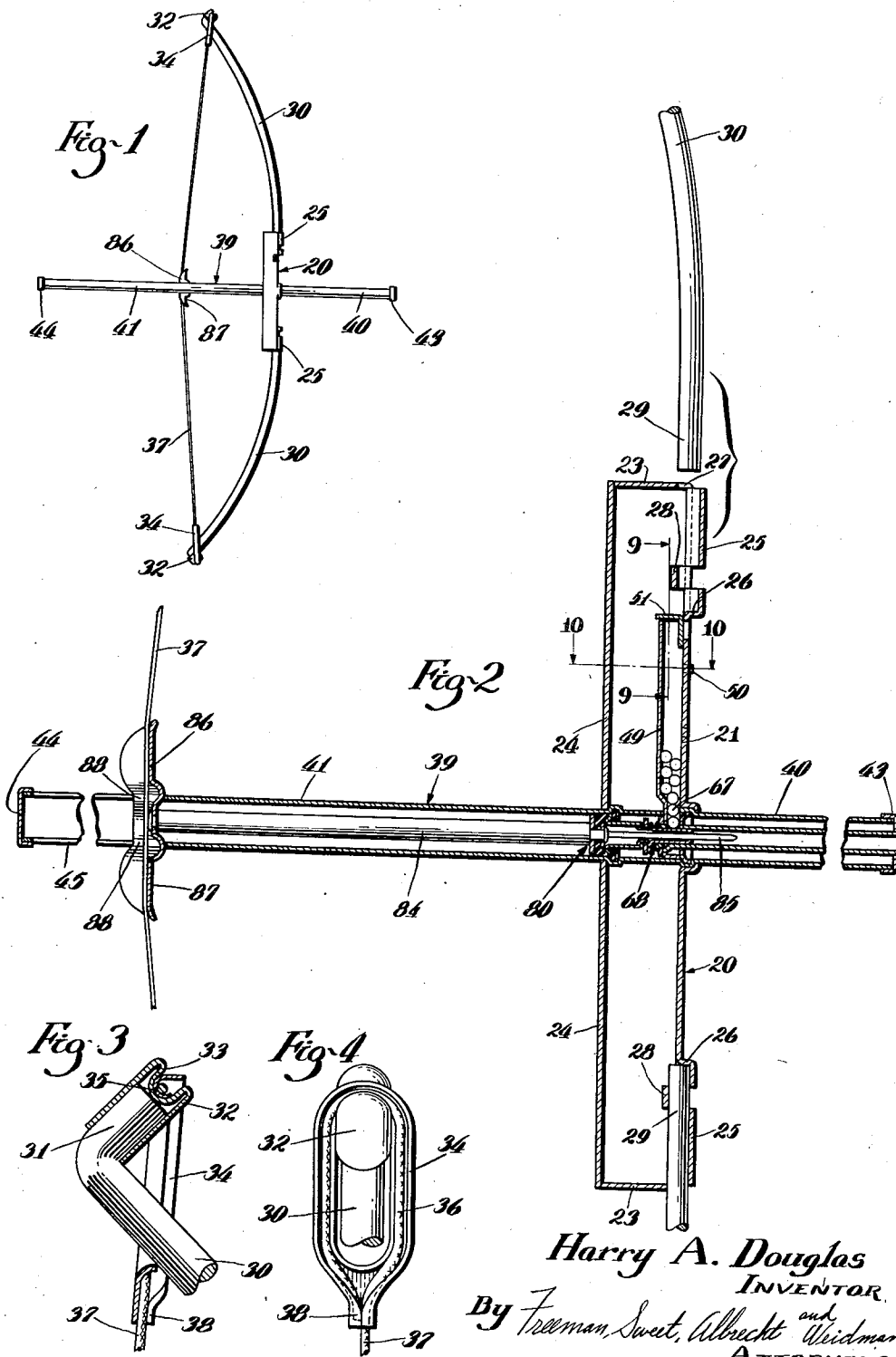
Sept. 10, 1940.

H. A. DOUGLAS
MISSILE PROJECTING DEVICE

2,214,224

Filed Jan. 7, 1937

2 Sheets-Sheet 1



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INVENTOR

By *Freeman, Sweet, Albrecht and Weidman*
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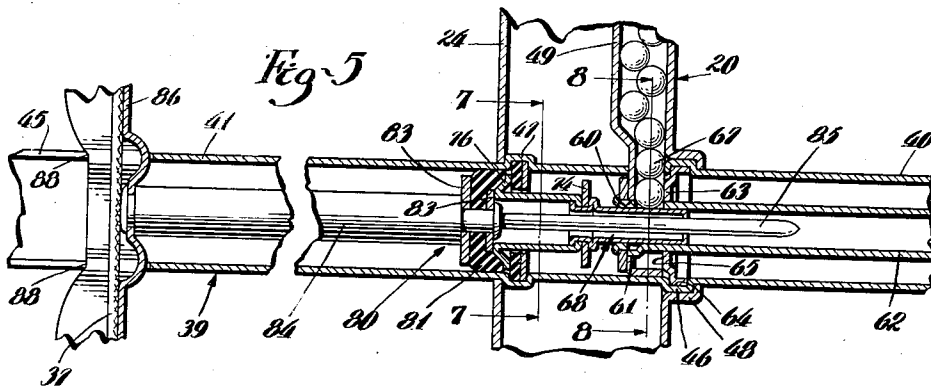
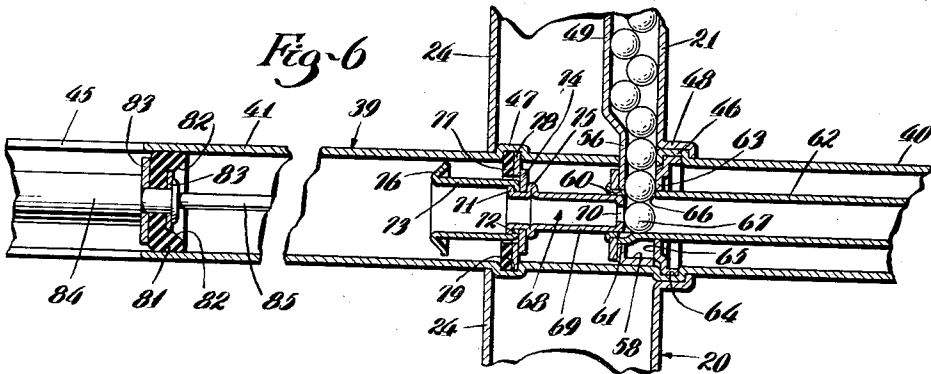
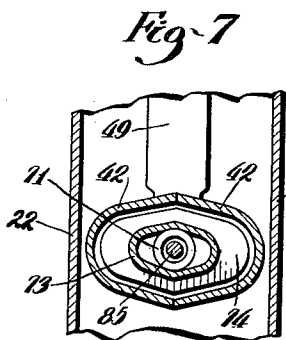
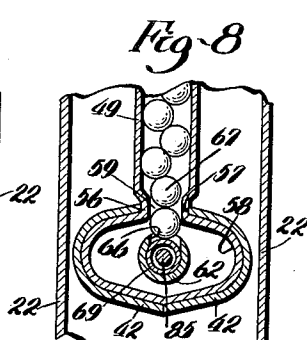
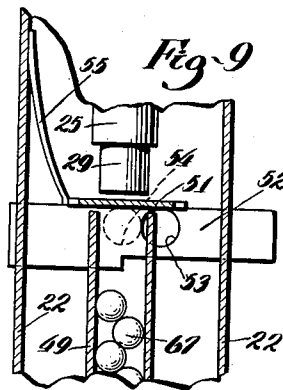
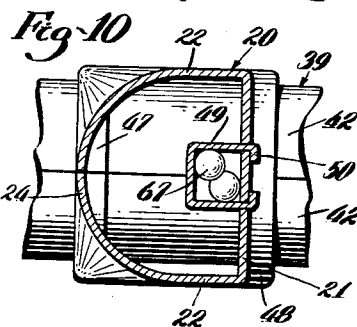
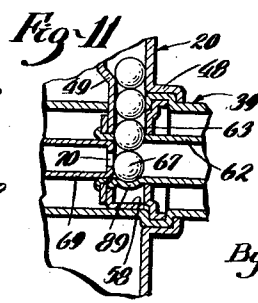
H. A. DOUGLAS

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MISSILE PROJECTING DEVICE

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,214,224

MISSILE PROJECTING DEVICE

Harry A. Douglas, Brenson, Mich.

Application January 7, 1937, Serial No. 119,423

13 Claims. (Cl. 124—15)

This invention relates to missile projecting devices, and has for an object the provision of new and improved devices of this character.

In the drawings accompanying this specification and forming a part of this application, I have shown, for purposes of illustration, embodiments which my invention may assume, and in the drawings:

Figure 1 is a side elevational view of the missile projecting device,

Figure 2 is a fragmentary vertical sectional view of the device, parts of the same being broken away to better accommodate the view to the sheet,

Figure 3 is an enlarged fragmentary view showing the connecting means between the bow and bow string, parts of the construction being shown in section,

Figure 4 is a fragmentary front elevational view of the construction illustrated in Figure 3,

Figure 5 is an enlarged, fragmentary vertical sectional view of the bow means, and the air compressor means carried thereby, the parts being shown in their normal positions,

Figure 6 is a vertical sectional view similar to Figure 5, showing the parts of the mechanism in the position assumed after the bow means have been tensioned and are ready to begin discharging movement,

Figure 7 is an enlarged fragmentary, transverse vertical sectional view, corresponding substantially to the line 7—7 of Figure 5.

Figure 8 is a view similar to Figure 7, corresponding substantially to the line 8—8 of Figure 5,

Figure 9 is a fragmentary sectional view, corresponding substantially to the line 9—9 of Figure 2,

Figure 10 is a horizontal transverse sectional view, corresponding substantially to the line 10—10 of Figure 2, while

Figure 11 is a fragmentary sectional view similar to a portion of Figure 5, and showing a different embodiment of the barrel structure.

Referring first to Figures 1 through 10 of the drawings, the invention comprises an elongated housing 20, preferably constructed of relatively heavy sheet metal, having a substantially flat forward wall 21, substantially parallel side walls 22, end walls 23, and a rear wall 24, all integrally formed, the end walls 23 at their rear portions being curved, and the side and rear walls, adjacent the opposite ends of the housing 20, being contoured to correspond to the curvature of the end walls, merging then with the central part of

the housing 20, which for an appreciable distance, is substantially square in cross-section (see Figures 2 and 10). The housing 20 is preferably cut out from a single piece of sheet metal, bent to shape, and the meeting edges welded together, the manner of assembly being hereinafter more particularly described.

Adjacent each end of the housing 20 the front wall 21 is provided with an embossment 25 extending inwardly from the end of the housing centrally along the front wall, and formed semicircular in cross-section, providing an abutment wall 26 at its inner end, and communicating with an aperture 27 in the adjacent end wall 23, and adjacent the abutment wall 26, the front wall 21 is formed with an inwardly bent loop 28. The embossment 25, the abutment wall 26, the aperture 27, and the loop 28, form seating means for the detachable accommodation of one end 29 of a bow member 30, two of the bow members 30 being employed, one at each end of the housing 20, as shown in the drawings. Each bow member 30 is preferably made up of a curved rod-like length of resilient steel, reversely turned at its outer end, as at 31, and each turned end 31 is provided with a sheet metal cap 32 snugly fitting thereover, and each cap 32 is grooved, as at 33, for the reception of a looped connector 34. The connector 34 is preferably of sheet metal, formed substantially channel-shaped in cross-section, open at one side, and providing an inner curved wall 35 for the reception of a looped portion 36 of a bow string 37, the looped portion 36 preferably being permanently secured to the connector 34 by crimping the sheet metal thereof onto the string, as at 38.

Extending through the front wall 21 and rear wall 24 of the housing 20, is a tubular means 39, oval in cross-section, with the major axis thereof lying at right angles to the long axis of the housing 20, having a portion 40 projecting forwardly of the housing 20 a substantial distance, and having a portion 41 projecting rearwardly of the housing 20, and a substantial distance rearwardly of the bow string 37. The tubular means 39 are preferably formed of complementary half oval sections 42 (Figures 7 and 8) closed by front and rear caps 43 and 44, and the rearwardly projecting portion of the tubular means 39 is cut out to provide transversely aligned longitudinally extending slots 45 for a purpose presently to appear, while the portion in advance of the slots 45 is rendered air-tight, preferably by placing solder along the meeting edges of the sections 42. The tubular means 39 are further provided with

transversely extending spaced peripheral embossments 46 and 47, the forward embossment 46 being accommodated in a seat 48 surrounding an aperture in the front wall 21, while the rear embossment 47 is disposed inwardly of the rear wall 24, as best shown in Figures 5 and 6.

A magazine for accommodating a plurality of missiles is employed in connection with the invention, and comprises an elongated member 49, channel-shaped in cross-section, disposed longitudinally of the housing 20, with its open side toward the inner surface of the front wall 21, and its edges provided with prongs 50 extending through apertures in the front wall 21, the prongs 50 being upset to hold the channel-shaped member 49 in position. The outer end of the member 49 is closed by a flange 51 forming part of a slide 52, slidably supported in apertures in the side walls 22, and the slide has an opening 53 adapted in one position to register with an opening 54 in the front wall 21, which is aligned with the open side of the magazine member 49, a spring 55 being fixed to one of the side walls 22, and normally positioning the slide 52 so that the openings 53 and 54 are out of register. At its inner end the magazine member 49 is reduced as at 56, the reduced portion being accommodated in notches 57 of the complementary sections 42, and inwardly of the reduced portion the magazine member 49 is provided with an oval cup-shaped section 58, snugly fitting the inner walls of the complementary sections 42, a passageway 59 being provided for passage of the missiles into the oval-shaped section 58. The oval-shaped section 58 is provided with a circular aperture 60, notched, as at 61, through which extends one end of a barrel member 62, having a projection disposed in the notch 61 to prevent rotation of the barrel member 62, the inner end of the barrel member 62 being provided with a flange, and between the flange and the rear face of the oval-shaped section 58 a suitable washer is interposed. The barrel member 62 also extends through a support 63, oval-shaped to fit within the groove 64 formed by the front embossment 46, and shaped to close the open mouth of the oval-shaped section 58, as at 65. The barrel member 62 is further provided with an aperture 66 aligned with the magazine member 49, to admit a spherical missile 67 to the barrel member 62. The forward end of the barrel member 62 extends centrally through, and is supported by, the front cap 43, and is provided with a flange which holds the cap 43 in position.

Cooperating with the magazine means 49 is a shuttle mechanism 68, comprising a tubular section 69 of a diameter to slidably fit into the rear end of the barrel member 62, the front portion of the tubular section having an aperture 70 for a purpose hereinafter referred to. The rear end of the tubular section is flanged, as at 71, to interconnect with the flange 72 of a flared section 73, a stop 74 of metal being interposed between the flange 71 and an abutment 75 formed on the tubular section 69. The flared section 73, beginning at a point adjacent to the flange 71, is flared or tapered horizontally in a rearward direction, as best shown in Figure 7, and at its rear end is provided with a reversely turned inclined flange 76, adapted in one position to abut against a buffer 77, preferably of rubber, which together with an oval ring-like support 78 is accommodated in the groove 79 formed by the rear embossment 47, the shuttle mechanism 68 thus formed being supported for

reciprocatory movement by the rear end of the barrel member 62, and by the oval ring-like support 78 through which it extends.

Reciprocally mounted in the rear portion 41 of the tubular means 39 is a piston 80, including a flexible cup-shaped packing means 81, having beveled surfaces 82 adapted in one position to contact the exterior surface of the inclined flange 76, the packing means 81 being secured between abutments 83 carried by a stem 84. The stem 84 has a pilot member 85 projecting therefrom, and of such size as to substantially close the aperture 70 of the tubular section 69 in one position of the mechanism. At its outer end the stem 84 is provided with a finger-piece 86, channel-shaped in cross-section for the reception of the bow string 37, of a width somewhat in excess of the width of the slots 45, along its forward surface being contoured, as at 87, to comfortably accommodate the fingers of a user, and at opposite sides being formed to provide depressed spaced transversely extending run-ways 88 in which the edges of the tubular means 39 defining the slots 45, are slidably accommodated, the run-ways 88 serving to maintain the stem 84 centered during reciprocation thereof.

In order to assemble the housing 20 and the tubular means 39, the rear of the housing 20 is initially left open, and after the tubular means 39 have had the magazine and related parts assembled therewith, the tubular means 39 are projected through the opening in the front wall 21, and the front embossment 46 thereof disposed in the seat 48, and the magazine fixed in position. The rear margins of the side walls 22 are then bent to provide angular portions which together form the rear wall 24 of the housing 20, the angular portions being notched to accommodate the tubular means 39, and when so bent, the angular portions are disposed in the rear of the rear embossment 47, and thus hold the tubular means 39 in position, the meeting edges of the portions forming the rear wall being welded, or otherwise secured together, and to the end walls 23.

Referring to Figure 11, all of the parts there shown, with a single exception, are identical to those already described, and will be designated by similar reference characters. The difference in construction resides in the provision of a depression 89 which is formed in the rear end of the barrel member 62, and serves the purpose of preventing a missile accidentally rolling from the barrel member 62.

In use the magazine member 49 is first filled with a plurality of missiles 67. This may be accomplished by moving the slide 52 so as to bring the openings 53 and 54 in alignment, after which the missiles 67 may pass into the magazine, the spring 55 moving the slide 52, when released, to dispose the apertures 53 and 54 out of alignment and close the magazine. The housing 20, forming part of the bow means, may then be grasped by one hand of the user, while the other hand grasps the finger-piece 86, in a manner familiar to archers. The finger-piece 86 may then be drawn rearwardly, sliding in the slots 45 of the tubular means 39, and causing rearward movement of the piston 80. Such movement of the piston lowers the pressure within the tubular means 39, and this lowered pressure creates suction sufficient to draw the shuttle mechanism 68 rearwardly, retracting the tubular section 69 sufficiently to permit a missile 67 to pass into the barrel member 62; also during this rearward

movement of the piston 80 the pilot member 85 is withdrawn from the aperture 70, and the flared section 73 is positioned rearwardly of the buffer 77, rearward movement of the shuttle mechanism being limited by the stop 74 coming into engagement with the ring-like member 78.

During the rearward movement of the piston, and of the bow string 37, the bow members 30 are placed under tension, and when the finger-piece 86 is released, the piston 80 is driven inwardly with great force, compressing the air within the tubular means 39, and this air entering the flared section 73 has its velocity increased in the manner of a Venturi tube, and concurrently the flared section 73 moves forwardly to bring the flange 76 into abutment with the buffer 77, this forward movement being also communicated to the tubular section 69, which starts the missile 67 on its way through the barrel member 62, the air at high velocity and pressure passing through the aperture 70, and projecting the missile 67 from the barrel member 62 with great force. Immediately following projection of the missile, and before the end of the stroke of the piston 80, the pilot member 85 enters the aperture 70 in the tubular section 69, blocking passage of air therethrough, and thus builds up a back pressure which cushions the impact of the piston 80 at the end of its stroke. After the missile has been discharged the operations described may be repeated so long as there are missiles 67 in the magazine member 49, the tubular section 69 upon discharge of the missile having been repositioned to control the passage of the missiles to the barrel member 62.

It will be apparent to those skilled in the art that I have accomplished at least the principal object of my invention, and it also will be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that my invention is not limited thereto.

I claim:

1. A bow means actuated pneumatic missile-projector, comprising: bow means, including a bow and a bow string operatively connected; air compressor means carried by said bow, and connected to said bow string, whereby said bow means when released from tensioned position operates said air compressor means; supporting means, adapted to support a missile in position to be projected; shuttle means movable in one direction to admit a missile to said projector and movable in a reverse direction to lodge said missile in proper position on said supporting means to be projected; said projector having a passage leading from said air compressor means to in rear of a missile so supported, whereby operation of said air compressor means by said bow means delivers compressed air in rear of said missile to project said missile, said shuttle means being traversed by said air, and constructed and arranged to provide a Venturi effect to augment the velocity of air causing projection of said missile; and means for generating back pressure within said projector to cushion the impact of said compressor means following delivery of its missile projecting energy to said missile.

2. A bow means actuated pneumatic missile-projector, comprising: bow means, including a

bow and a bow string operatively connected; air compressor means carried by said bow, and connected to said bow string, whereby said bow means when released from tensioned position operates said air compressor means; tubular supporting means, adapted to support a missile and through which said missile may be projected; magazine mechanism for accommodating a plurality of missiles, and including a housing extending substantially parallel with the long axis of said bow and through which said missiles move by gravity toward said tubular supporting means; and shuttle means movable in one direction to admit a missile from said magazine to said supporting means, and movable in a reverse direction to lodge said missile in proper position with respect to said supporting means to be projected; said projector having a passage leading from said air compressor means to in rear of a missile so supported, whereby operation of said air compressor means by said bow means delivers compressed air in rear of said missile to project said missile.

3. A bow means actuated pneumatic missile-projector, comprising: bow means, including a bow and a bow string operatively connected, air compressor means carried by said bow, and connected to said bow string, whereby said bow means when released from tensioned position operates said air compressor means; said air compressor means including elongated tubular means, oval in cross-section, with the major axis thereof disposed substantially at right angles to the long axis of said bow, and said bow including a centrally disposed housing through which said tubular means extends, said housing and said tubular means having interengaging means for securing the parts together, and said tubular means having spaced interiorly formed transverse grooves; a magazine; supporting means, adapted to support a missile in position to be projected; shuttle means, movable in one direction to admit a missile to said projector, and movable in an opposite direction to lodge said missile in proper position with respect to said supporting means to be projected therefrom; and mounting means disposed in each of said transverse grooves, constructed and arranged to position said supporting means, said magazine and said shuttle mechanism in cooperative relation; said projector having a passage leading from said air compressor means to in rear of a missile so supported, whereby operation of said air compressor means by said bow means delivers compressed air in rear of said missile to project said missile.

4. Pneumatic missile projecting means, comprising: tubular means; resilient means; piston means, within said tubular means, manually movable in one direction against the action of said resilient means to draw air inwardly of said tubular means, said piston when released being quickly urged in the opposite direction by the urging force of said resilient means, to expel air from said tubular means at considerable velocity; supporting means, for supporting a missile to be projected; shuttle means movable within said tubular means, having an opening through which air is expelled from said tubular means said shuttle means having a portion adapted to strike the missile to be projected, to overcome the inertia of the missile, and being so constructed and arranged that said shuttle means portion strikes the missile shortly after said piston means is released; and means constructed and arranged to close the opening in said shuttle

means before said piston means reaches the end of its travel, thereby entrapping air in said tubular means and cushioning the impact of said piston means following delivery of its missile projecting energy to the missile.

5 5. Pneumatic missile projecting means, comprising: tubular means; resilient means; piston means within said tubular means, and being manually movable in one direction against the action of said resilient means to draw air inwardly of said tubular means, said piston when released being quickly urged in the opposite direction by the urging force of said resilient means, to expel air from said tubular means at considerable velocity; supporting means, for supporting a missile to be projected; shuttle means movable within said tubular means, having an opening through which air is expelled from said tubular means, said shuttle means having a portion adapted to strike the missile to be projected, to overcome the inertia of the missile, and being so constructed and arranged that said shuttle means strikes the missile shortly after said piston means is released; and rod means, carried by and movable with said piston, of a predetermined length to extend into the opening in said shuttle means before said piston means reaches the end of its travel, and of a cross-sectional size to closely fit within the opening of said shuttle means, thereby entrapping air in said tubular means and cushioning the impact of said piston means following delivery of its missile projecting energy to the missile.

6. A bow means actuated pneumatic missile-projector, comprising: a housing, having clamping means at opposite ends; a pair of resilient members, each carried by respective clamping means in a detachable manner, said members when assembled with said housing forming a bow; a bow string extending from the free end of one member to the free end of the other member; a tubular member, secured to said housing, and having portions extending from opposite sides of said housing; a tubular barrel within that portion of said tubular means which extends from one side of said housing; a magazine within said housing, adapted to contain a plurality of missiles to be projected, having a first opening communicating with said barrel, and having a second opening communicating with a filling opening in the wall of said housing; piston means, movable within that portion of said tubular member extending from the opposite side of said housing, having connection with said bow string whereby tensioning of said bow causes movement of said piston means in one direction to draw air into said tubular member, and releasing of said bow string causes said piston to rapidly move in the opposite direction to quickly expel air from said tubular member and through said barrel; and means, constructed and arranged to provide for passage of a missile through said first opening in said magazine to position in said barrel when said piston moves in said one direction, and to close said first opening in said magazine when said piston means moves in the opposite direction.

7. Pneumatic missile projecting means, comprising: tubular means; resilient means; piston means, movable within said tubular means, movable in one direction against the action of said resilient means to draw air inwardly of said tubular means, said piston means when free to move in the opposite direction being urged to move in this opposite direction by the urging force of said

resilient means to expel air from said tubular means at considerable velocity; barrel means, so constructed and arranged that the expelled air is directed through the chamber of said barrel means; magazine means, adapted to contain a plurality of missiles, having an opening so positioned that a missile from said magazine means may pass to the chamber of said barrel means; and movable means, movable within said tubular means, having a portion adapted to control said magazine means opening, said movable means being so constructed and arranged that when air is drawn inwardly of said tubular means said movable means is moved by said indrawn air in a direction so that said portion uncovers said magazine means opening and provides for passage of a missile to said barrel means chamber, and when air is expelled from said tubular means, said movable means is moved by said expelled air in a direction so that said portion closes said magazine opening and prevents the passage of missiles to said barrel chamber.

8. Pneumatic missile projecting means, comprising: tubular means; resilient means; piston means, movable within said tubular means, movable in one direction against the action of said resilient means to draw air inwardly of said tubular means, said piston means when free to move in the opposite direction being urged by the force of said resilient means to move in this opposite direction to expel air from said tubular means at considerable velocity; barrel means, so constructed and arranged that the expelled air is directed through the chamber of said barrel means; and shuttle means, movable within said tubular means under influence of the movement of air within said tubular means, and so constructed and arranged that this air passes through an opening within said shuttle means, said shuttle means opening having an enlarged portion directed toward said piston means, and a small portion directed toward said barrel means chamber, so that the expelled air passes from said tubular means through said enlarged portion and then through said reduced portion to said barrel means chamber, thus causing the velocity of the expelled air to be augmented by such passage.

9. Pneumatic missile projecting means, comprising: resilient bow means; air compressor means, connected to said bow means in such manner as to draw in air when said bow means is tensioned, and to expel air at considerable velocity from said outlet opening when the tensioning force is released to permit the resiliency of said bow means to operate said air compressor means; barrel means, so constructed and arranged that the expelled air passes through the chamber of said barrel means; magazine means, adapted to contain a plurality of missiles, having an opening through which missiles may pass to the chamber of said barrel means, said magazine means being so constructed and arranged that when said bow means is held in predetermined substantially vertical position, missiles may be fed from said magazine means to the chamber of said barrel means by gravity.

10. Pneumatic missile projecting means, comprising: resilient bow means; air compressor means, connected to said bow means in such manner as to draw in air when said bow means is tensioned, and to expel air at considerable velocity from said outlet opening when the tensioning force is released to permit the resiliency of said bow means to operate said air compressor means; barrel means, so constructed and ar-

ranged that the expelled air passes through the chamber of said barrel means; magazine means, adapted to contain a plurality of missiles, having an opening through which missiles may pass to the chamber of said barrel means, said magazine means being so constructed and arranged that when said bow means is held in predetermined substantially vertical position, missiles may be fed from said magazine means to the chamber of said barrel means by gravity; and means, constructed and arranged to automatically provide for passage of a single missile from said magazine means to the chamber of said barrel means when air is drawn into said air compressor means, and to prevent the passage of missiles from said magazine means to the chamber of said barrel means when air is expelled from said air compressor means.

11. Pneumatic missile projecting means, comprising: air compressor means, including a cylinder, resilient means, and a piston movable in one direction within said cylinder to store energy in said resilient means and draw air into said cylinder, and quickly moved in the opposite direction to expel air from said cylinder when the energy stored in said resilient means is released; shuttle means movable with respect to said cylinder, and providing an outlet opening through which air passes when it is drawn into or expelled from said cylinder; support means, for supporting a missile in position to be projected; magazine means, adapted to contain a plurality of missiles, and including means providing for passage of a missile to proper position on said support means; said shuttle means having a portion controlling passage of the missiles from said magazine means to said support means, and being so constructed and arranged as to be moved in one direction when air is drawn in through its opening, movement of said shuttle means in this direction causing movement of said shuttle means portion to a position wherein it permits a missile to pass from said magazine means to said support means, and said shuttle means being moved in the opposite direction by air expelled through its opening, movement of said shuttle means in this opposite direction causing movement of said shuttle means portion so that it strikes and moves the positioned missile and substantially simultaneously interrupts passage of further missiles to said support means during projection of the positioned missile.

12. Pneumatic missile projecting means, comprising: air compressor means, including a cylinder, resilient means, and a piston movable in one direction within said cylinder to store energy in said resilient means and draw air into said cylinder, and quickly moved in the opposite direction to expel air from said cylinder when the energy stored in said resilient means is released; shuttle means movable with respect to said cylinder, and providing an outlet opening through which air passes when it is drawn into or expelled from said cylinder; support means, for supporting a missile in position to be projected; magazine means, adapted to contain a plurality of missiles, and including means pro-

viding for passage of a missile to proper position on said support means; said shuttle means having a portion controlling passage of the missiles from said magazine to said support means, and being so constructed and arranged as to be moved in one direction when air is drawn in through its opening, movement of said shuttle means in this direction causing movement of said shuttle means portion to a position wherein it permits a missile to pass from said magazine to said support means, and said shuttle means being moved in the opposite direction by air expelled through its opening, movement of said shuttle means in this opposite direction causing said shuttle means portion to strike and move the positioned missile and substantially simultaneously interrupt passage of further missiles to said support means during projection of the positioned missile; and means constructed and arranged to close the opening in said shuttle means before said piston reaches the end of its travel in the direction wherein it expels air from said cylinder, so as to entrap air in said cylinder and cushion the impact of said piston.

13. Pneumatic missile projecting means, comprising: air compressor means, including a cylinder, resilient means, and a piston movable in one direction within said cylinder to store energy in said resilient means and draw air into said cylinder, and quickly moved in the opposite direction to expel air from said cylinder when the energy stored in said resilient means is released; shuttle means movable with respect to said cylinder, and providing an outlet opening through which air passes when it is drawn into or expelled from said cylinder; support means, for supporting a missile in position to be projected; magazine means, adapted to contain a plurality of missiles, and including means providing for passage of a missile to proper position on said support means; said shuttle means having a portion controlling passage of the missiles from said magazine to said support means, and being so constructed and arranged as to be moved in one direction when air is drawn in through its opening, movement of said shuttle means in this direction causing movement of said shuttle means portion to a position wherein it permits a missile to pass from said magazine to said support means, and said shuttle means being moved in the opposite direction by air expelled through its opening, movement of said shuttle means in this opposite direction causing said shuttle means portion to strike and move the positioned missile and substantially simultaneously interrupt passage of further missiles to said support means during projection of the positioned missile; and rod means carried by said piston in advance thereof, said rod means being of such length and cross-section as to extend into and closely fit the opening in said shuttle means before said piston reaches the end of its travel in the direction wherein it expels air from said cylinder, so as to entrap air in said cylinder and cushion the impact of said piston.

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