

Serial Number 09/678,879
Filing Date 4 October 2000
Inventor David G. Reise

NOTICE

The above identified patent application is available for licensing. Requests for information should be addressed to:

OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
CODE 00CC
ARLINGTON VA 22217-5660

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

20010626 053

1 Attorney Docket No. 80101

2

3 MUZZLE DOOR LATCH FOR STATIC AND DYNAMIC CONDITIONS

4

5 STATEMENT OF GOVERNMENT INTEREST

6 The invention described herein may be manufactured and used
7 by or for the Government of the United States of America for
8 governmental purposes without the payment of any royalties
9 thereon or therefore.

10

11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

13 The present invention relates generally to door latches, and
14 more particularly to a door latch for retaining a cap on a muzzle
15 during static and dynamic loading.

16 (2) Description of the Prior Art

17 In firing systems for various projectiles, muzzle doors, or
18 caps, are used to prevent intrusion of foreign objects into the
19 muzzle prior to firing of the projectile. The design of the
20 muzzle door latch, i.e., its attachment to the muzzle, is such
21 that the cap can easily detach from the muzzle upon firing the
22 projectile. The caps are further designed to fall cleanly away
23 from the muzzle upon detachment so as to provide a clear
24 trajectory for the projectile.

25 FIG. 1 shows a prior art muzzle cap 10 in cross section. It
26 is noted that the cap assembly components are generally

1 symmetrical about the centerline of muzzle 12. Thus, reference
2 numerals may be indicated for only one of such symmetrical
3 components. Cap 10 is sized to fit within muzzle 12 with a
4 slight clearance 14 between cap 10 and muzzle wall 12a. Cap 10
5 includes a circumferential groove 10a about its edge 10b adjacent
6 interior muzzle wall 12a. Elastomeric ring seal 16 is positioned
7 in groove 10a, such that cap 10 is retained within muzzle 12 by
8 friction between seal 16 and muzzle wall 12a. To ensure cap 10
9 exits muzzle 12 cleanly upon firing a projectile from muzzle 12,
10 two roller guides 18 are attached to cap 10 in diametrically
11 opposed relation by means of bolts 20. Each guide 18 is attached
12 to front surface 10c of cap 10 and extends radially past the
13 exterior 12b of muzzle 12. Pin 22 and roller 24 are attached to
14 end 18a of guide 18, such that roller 24 is in a spaced apart
15 relation with end 18a. Muzzle extension plate 26 is affixed to
16 exterior 12b of muzzle 12 and extends slightly beyond end 12c of
17 muzzle 12. When cap 10, with attached guide 18, is positioned
18 into muzzle 12, roller 24 is seen to fit over plate 26, with
19 plate 26 extending between roller 24 and end 18a of guide 18.
20 Upon firing a projectile, the action of rollers 24 against plates
21 26 causes cap 10 to exit past end 12c of muzzle 12 without
22 rotating within muzzle 12. This prevents jamming of cap 10
23 within muzzle 12 and allows cap 10 to fall cleanly away from
24 muzzle 12. Additionally, rollers 24 assist in aligning cap 10
25 with muzzle 12 during insertion of cap 10 within muzzle 12. It
26 can also be seen from FIG. 1 that guides 18 allow muzzle cap 10

1 to be inserted into muzzle 12 only until guides 18 contact muzzle
2 end 12c, thus also ensuring proper positioning of cap 10 within
3 muzzle 12.

4 However, the prior art configuration of FIG. 1 allows muzzle
5 cap 10 to separate from muzzle 12 during vibrational loads.
6 Seals 16 begin to wear with repeated insertion and detachment of
7 cap 10. As only frictional forces between seal 16 and muzzle 12
8 hold cap 10 in place, wearing of seal 16 can cause cap 10 to
9 loosen within muzzle 12. Shearing pins may be added between the
10 cap and the muzzle such that the cap detaches at a predetermined
11 load. However, installation of shearing pins requires additional
12 operator training and involvement. Manual locking and unlocking
13 of the cap to the muzzle would suffice to keep the cap within the
14 muzzle. Such a design would require visual verification of the
15 lock condition prior to a firing exercise. Further, each of
16 these designs require the use of separate, small parts that may
17 be misplaced or damaged during firing.

18

19

SUMMARY OF THE INVENTION

20 Accordingly, it is an object of the present invention to
21 provide muzzle door latch that provides additional resistance to
22 vibration.

23 Another object of the present invention is to provide a
24 vibration resistant muzzle door latch that does not require
25 retraining of personnel for installation.

1 Still another object of the present invention is to provide
2 a muzzle door latch that is integral with current muzzle caps.

3 Other objects and advantages of the present invention will
4 become more obvious hereinafter in the specification and
5 drawings.

6 In accordance with the present invention, a muzzle door
7 latch, or attachment mechanism, incorporates spring-loaded
8 plungers acting within concave surfaces to provide additional
9 resistance to vibration. The door, or cap, has an elastomeric
10 seal about its outer circumference, which fits snugly within the
11 muzzle. Diametrically opposed guides are attached to the outer
12 side of the cap and extend radially past the circumference of the
13 muzzle, thus allowing the cap to be inserted into the muzzle only
14 until the guides meet the edge of the muzzle. A plate is
15 attached to the exterior of the muzzle, corresponding to each
16 guide, and each plate extends slightly beyond the end of the
17 muzzle. Each guide has a roller at its end furthest away from
18 the cap and attached to the guide so as to have a gap between the
19 roller and exterior of the muzzle. The axis of the roller is
20 oriented such that the roller is orthogonal to the axis of the
21 muzzle and tangential to its corresponding plate surface. When
22 the cap is positioned within the muzzle, the portions of the
23 plates extending beyond the end of the muzzle fit within the gap
24 and the rollers engage the outer surface of the plates. The
25 portions of the plates extending beyond the muzzle are machined
26 to have a concave indentation on their inner surface, i.e., the

1 surface facing towards the interior of the muzzle. Each guide
2 has a pocket formed in its surface facing the concave
3 indentation. The spring-loaded plunger fits within the pocket
4 and is biased in a direction against the concave surface. As the
5 cap is being placed within the end of the muzzle, the plungers
6 are depressed against the spring within the pocket while clearing
7 the end of the plate. Once the cap is fully seated into the
8 muzzle, i.e., when the guides contact the outer edge of the
9 muzzle, the springs force the plungers into the concave
10 indentation on the plate. Thus, even if the frictional force
11 between the seal and the muzzle is diminished by wear, the
12 plungers serve to hold the muzzle door, or cap, in place. As the
13 cap installs in the same manner as prior art caps, personnel need
14 not be retrained to install the cap. Further, the spring-loaded
15 plunger is an integral part of the cap so there are no
16 additional, or small parts that can be misplaced.

17 18 BRIEF DESCRIPTION OF THE DRAWINGS

19 A more complete understanding of the invention and many of
20 the attendant advantages thereto will be readily appreciated as
21 the same becomes better understood by reference to the following
22 detailed description when considered in conjunction with the
23 accompanying drawings wherein like reference numerals refer to
24 like parts and wherein:

25 FIG. 1 is a side sectional view of a prior art muzzle door
26 and latching mechanism;

1 FIG. 2 is a side sectional view of a muzzle door and
2 latching mechanism in accordance with the present invention; and

3 FIG. 3 is a partial front view of a muzzle door and latching
4 mechanism in accordance with the present invention.

5

6 DESCRIPTION OF THE PREFERRED EMBODIMENT

7 Referring now to FIGS. 2 and 3, there is shown a side
8 sectional view and a partial front view of a muzzle door, or cap,
9 incorporating the latching mechanism of the present invention.
10 The current invention incorporates the features of the prior art
11 muzzle door as previously described in FIG. 1, and these features
12 are described in an abbreviated manner in relation to FIGS. 2 and
13 3. Cap 10 fits within muzzle 12 with elastomeric ring seal 16
14 forming a friction fit to retain cap 10 within muzzle 12.
15 Rollers 24 on guides 18 engage the outer surfaces 26a of plates
16 26 to assist in aligning cap 10 with muzzle 12 and prevent
17 rotation of cap 10 within muzzle 12. Guides 18 also prevent cap
18 10 from being positioned too far into muzzle 12. Each plate 26
19 extends beyond end 12c of muzzle 12, such that inner surface
20 portion 26b of plate 26 is in opposing relation to end 18a of
21 guide 18 when cap 10 is seated within muzzle 12. Concave
22 depression 26c is machined in surface portion 26b. Pocket 18b is
23 provided in end 18a of guide 18 so as to retain plunger 30.
24 Plunger 30 is biased away from end 18a and towards depression 26c
25 by means such as spring 32. When the cap and guide assembly is
26 being positioned onto muzzle 12, plunger 30 contacts front edge

1 26d of plate 26 and is subsequently forced further into pocket
2 18b. As cap 10 enters muzzle 12, end 18a aligns with depression
3 26c and the spring bias of plunger 30 forces plunger 30 part way
4 out of pocket 18b and into contact with depression 26c. The
5 spring bias of plunger 30 is made sufficient to prevent cap 10
6 from detaching from muzzle 12 under anticipated vibrational
7 loads, yet not so strong as to interfere with a projectile being
8 fired from muzzle 12. In order to avoid interference with
9 projectile firing should the plungers be iced or jammed within
10 the pockets, the plungers can be fabricated of a material, such
11 as an acetyl copolymer, which will shear at the appropriate
12 force.

13 The invention thus described provides a positive latching
14 means for maintaining a muzzle door within a muzzle. The
15 plungers continue to provide positive latching even when the
16 frictional force between the seal and the muzzle is diminished by
17 wear. As can be readily seen, the cap of the present invention
18 installs in the same manner as prior art caps, only requiring
19 slightly more force to overcome the spring bias of the plungers
20 when pushing the cap into the muzzle. Thus, no retraining of
21 personnel is needed to use the cap of the present invention. As
22 the plunger is retained within its pocket, there are no
23 additional small parts, such as shear pins or locks, which could
24 be misplaced. It is also noted that extension and retraction of
25 plungers in opposing guides can accommodate some movement of the
26 door within the muzzle during vibrational loading.

1 Thus, it will be understood that many additional changes in
2 the details, materials, steps and arrangement of parts, which
3 have been herein described and illustrated in order to explain
4 the nature of the invention, may be made by those skilled in the
5 art within the principle and scope of the invention.

6

1 Attorney Docket No. 80101

2

3 MUZZLE DOOR LATCH FOR STATIC AND DYNAMIC CONDITIONS

4

5 ABSTRACT OF THE DISCLOSURE

6 A muzzle door latch, or attachment mechanism,
7 incorporates spring-loaded plungers acting within concave
8 surfaces to provide additional resistance to vibration. The
9 door, or cap, has an elastomeric seal about its outer
10 circumference, which fits snugly within the muzzle.
11 Diametrically opposed guides are attached to the outer side of
12 the cap and extend radially past the outer edge of the muzzle. A
13 plate is attached to the exterior of the muzzle, corresponding to
14 each guide, and each plate extends slightly beyond the end of the
15 muzzle. A roller on each guide engages the outer surface of the
16 plate when the cap is positioned within the muzzle. The plates
17 have a concave indentation on their inner surface, and a spring-
18 loaded plunger on each guide is biased against the concave
19 surface.

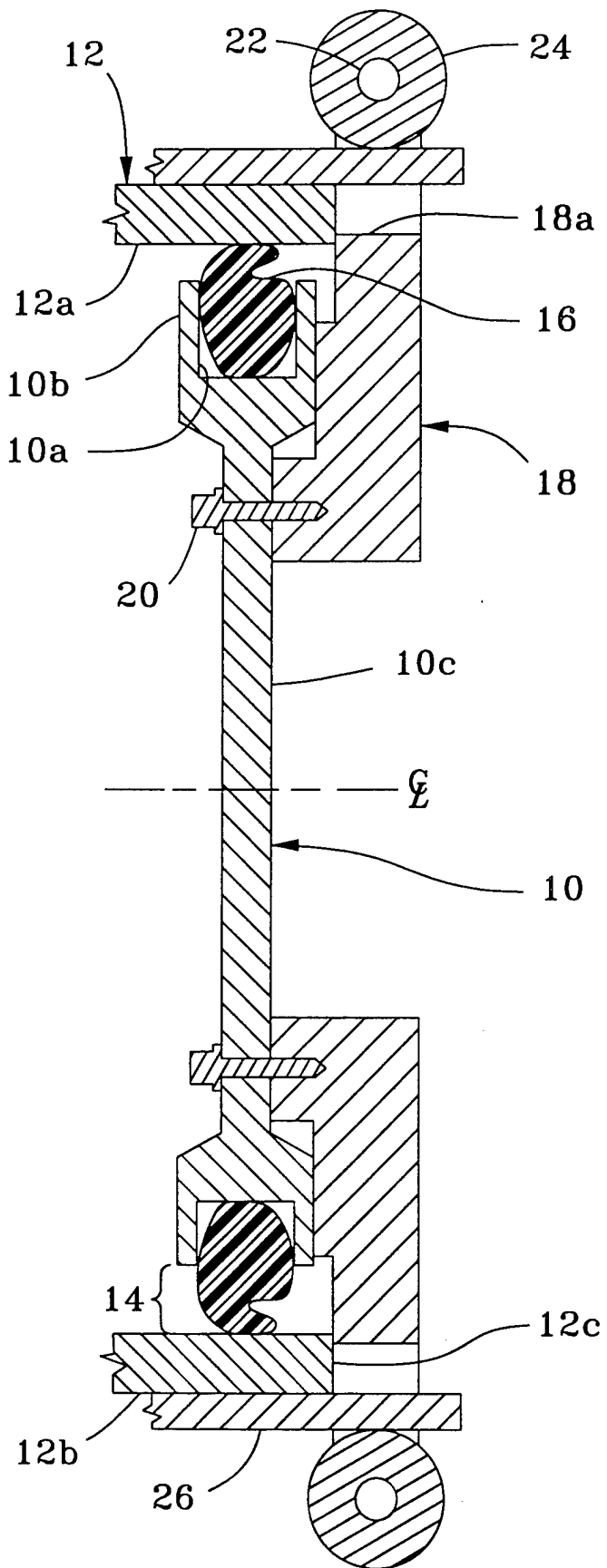


FIG. 1
(PRIOR ART)

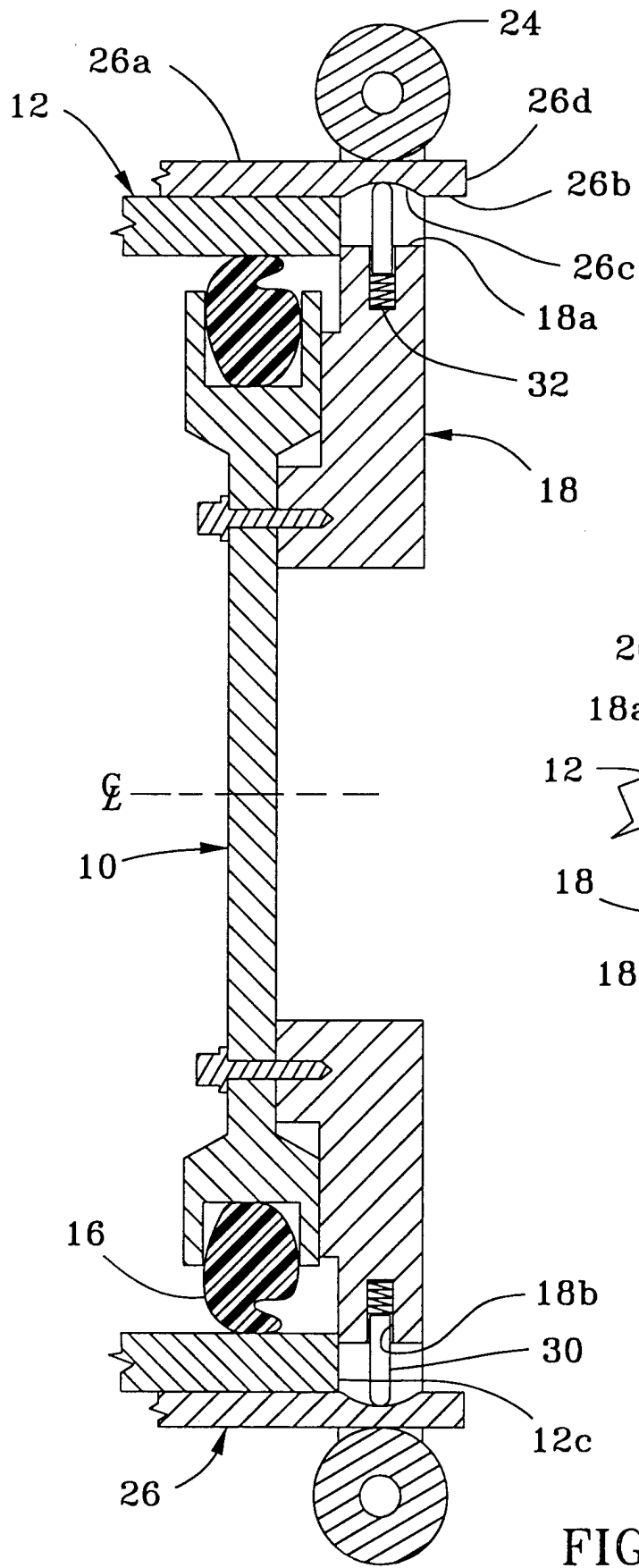


FIG. 2

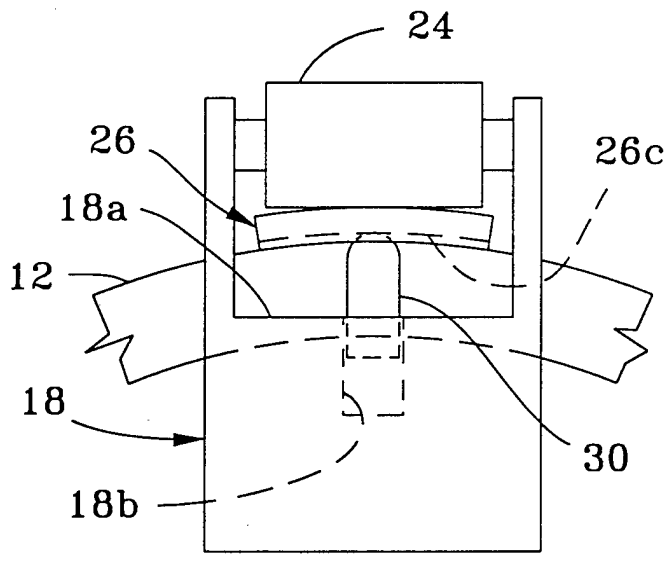


FIG. 3