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(54) **MODEL ROCKET MOTOR RETAINER APPARATUS**

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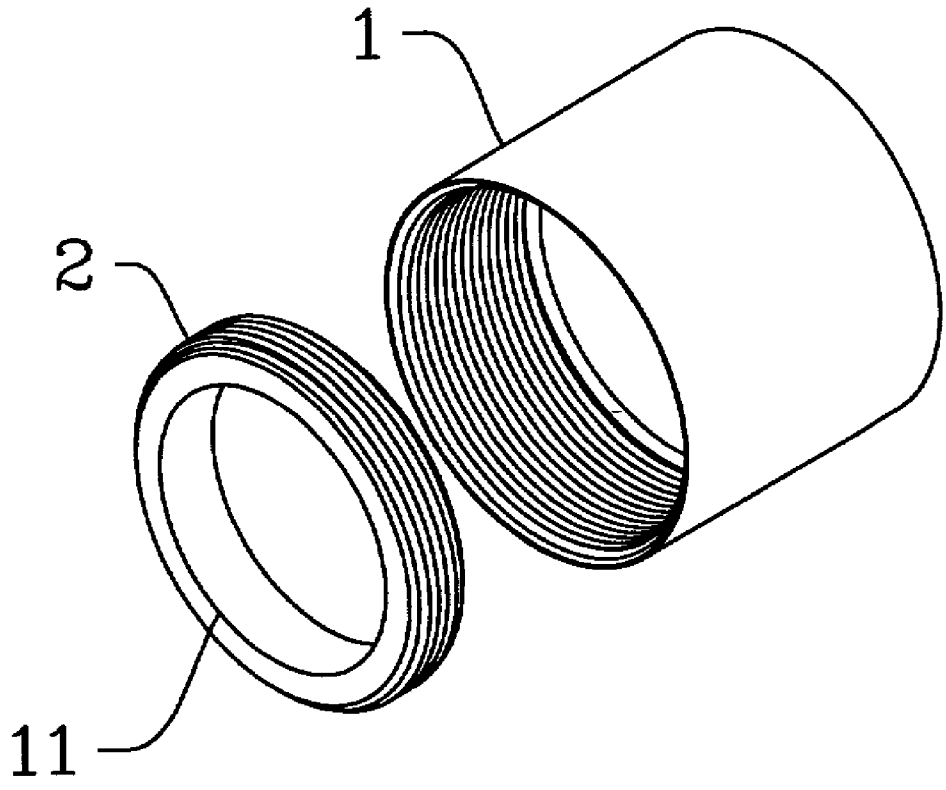
(57) **ABSTRACT**

A model rocket motor retainer apparatus for model rockets comprised of two components, a cylindrical retainer body (**1**) and an aft closure ring (**2**); wherein the retainer body is attached to a rocket motor tube (**3**), and the aft closure ring attaches into the aft end of the retainer body (**3**). Installation and tightening of the aft closure ring traps the rocket motor (**4**) between the aft closure ring and the rocket motor tube, thereby positively retaining the motor.



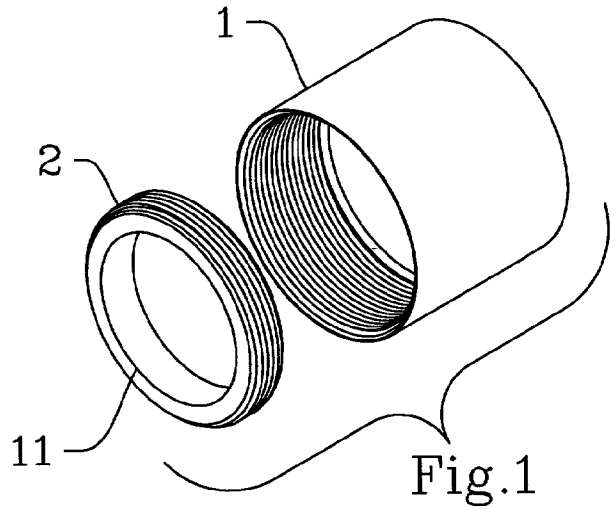


Fig.1

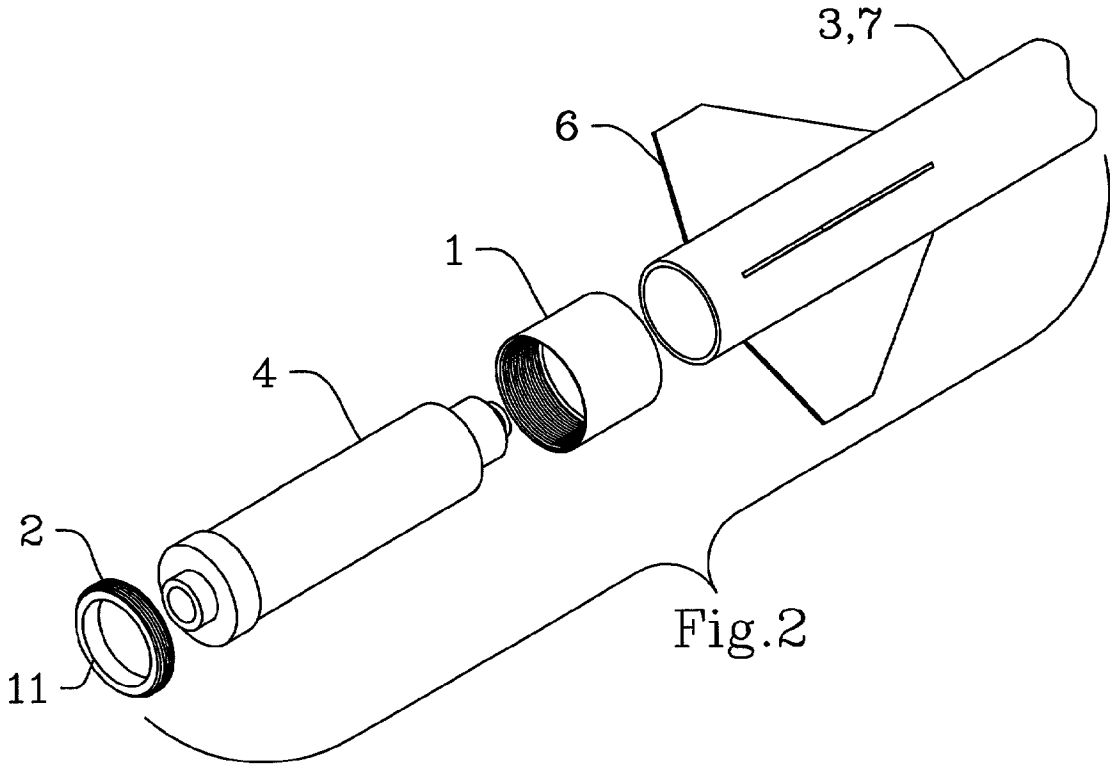


Fig.2

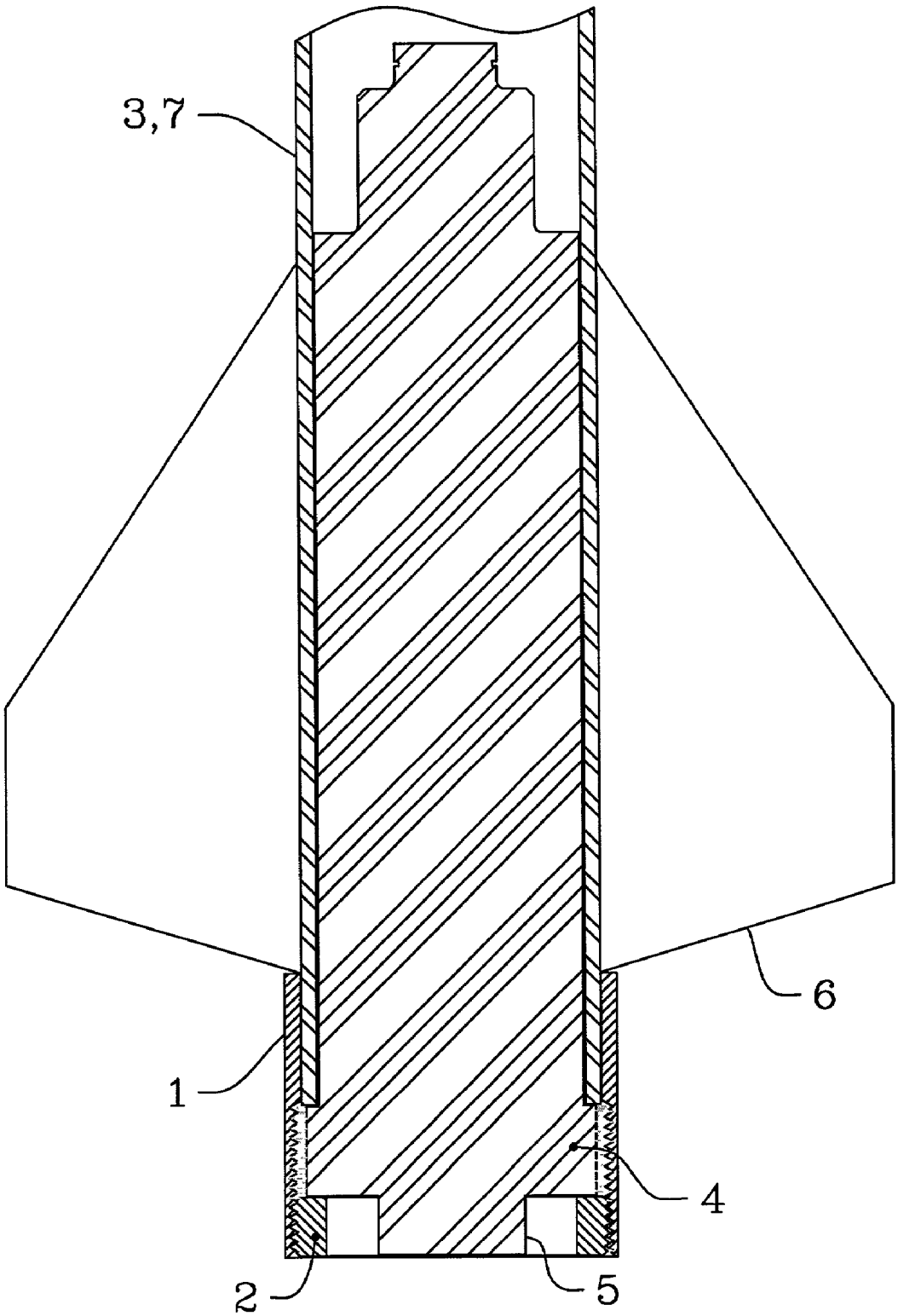


Fig.3

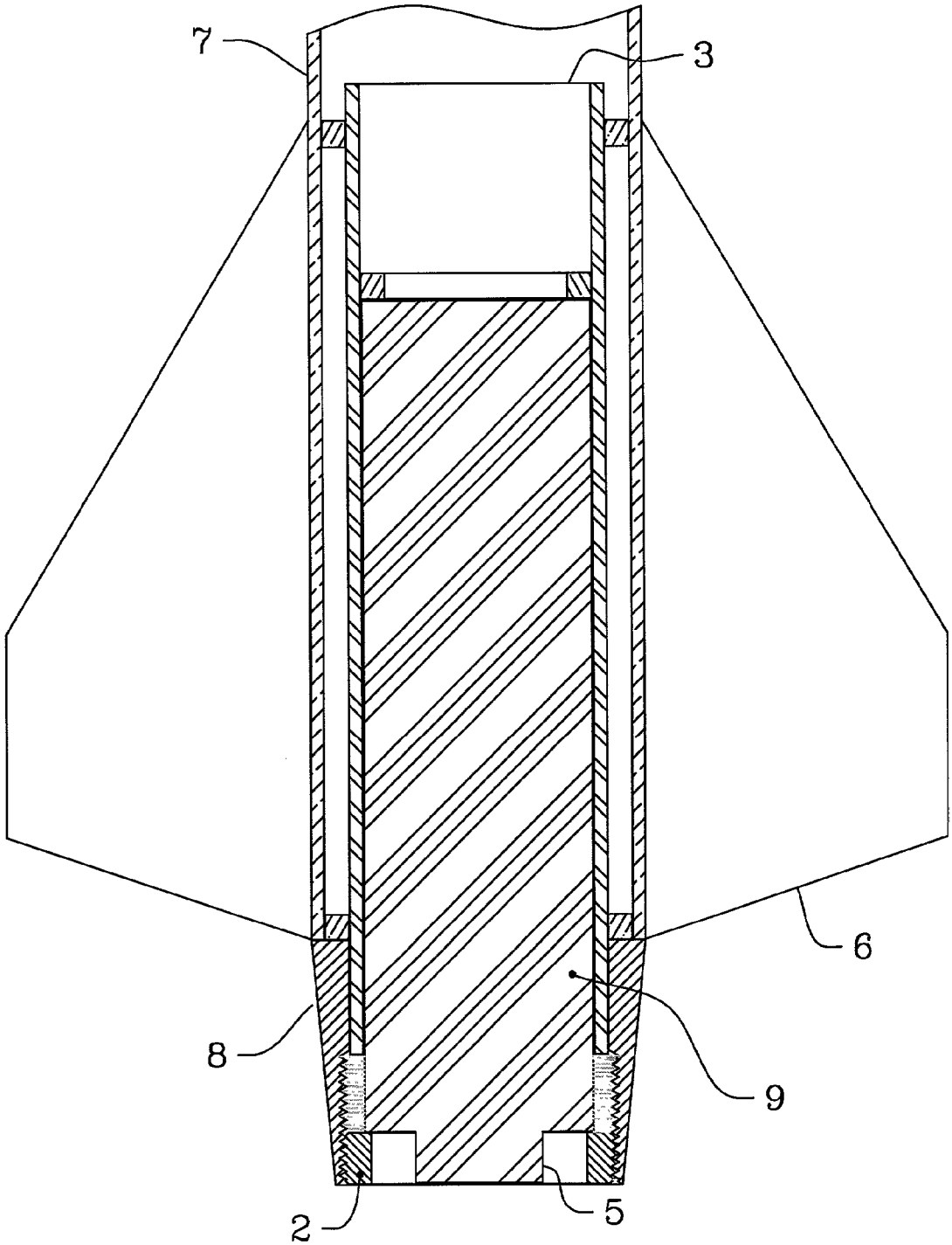


Fig.4

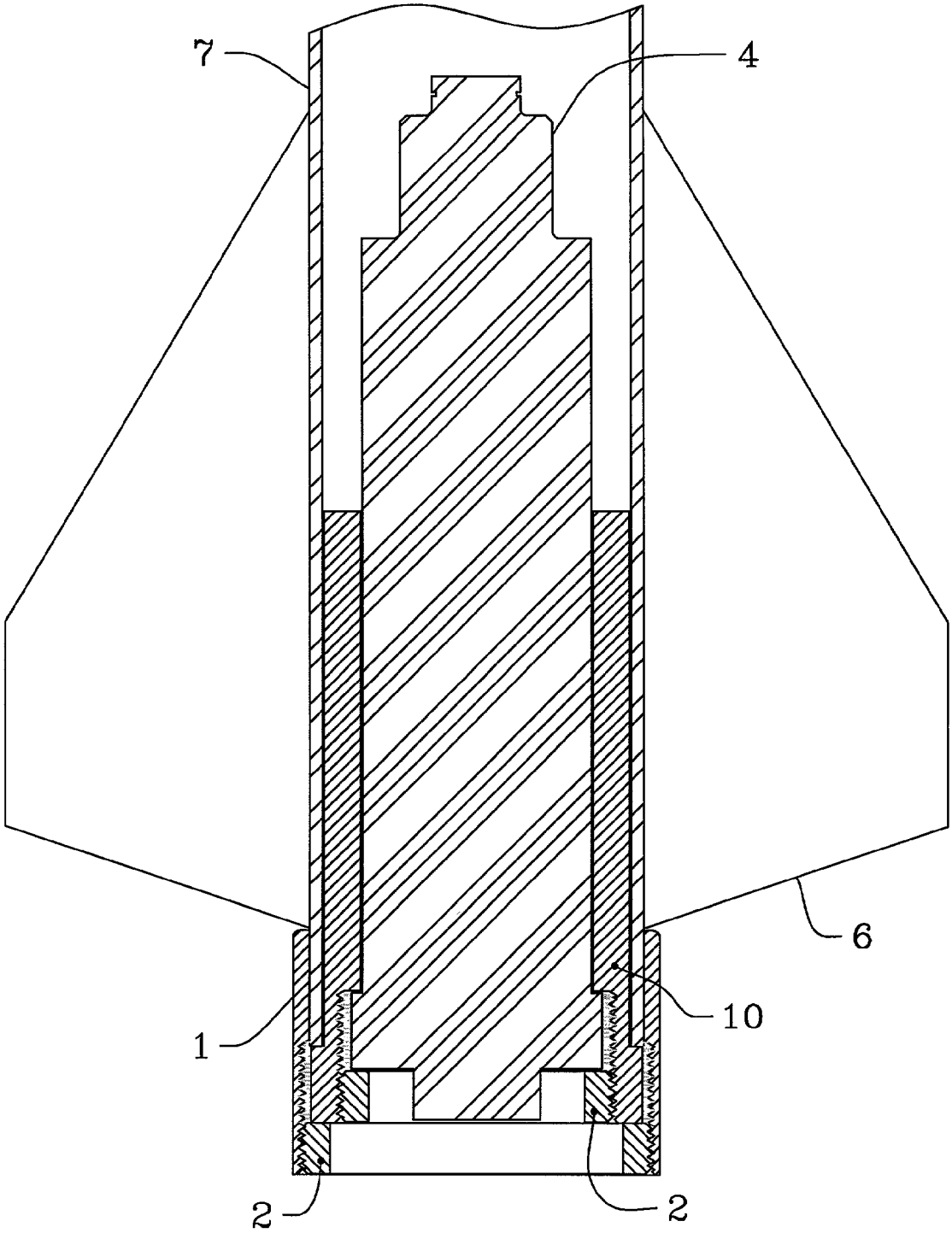


Fig.5

MODEL ROCKET MOTOR RETAINER APPARATUS

BACKGROUND

[0001] 1. Field of Invention

[0002] This invention relates generally to model rockets, specifically to such devices used for retaining a rocket motor within a rocket airframe.

[0003] 2. Description of Prior Art

[0004] One of the many challenges in the recreational hobby of model rocketry is the ability to retain the motor(s) during the recovery deployment phase of flight. Sometime after the boost phase of a model rocket flight the typical rocket relies on an ejection charge, firing in the forward direction, to deploy the recovery system thus insuring a soft landing. Most model rocket motor manufacturers build such ejection charges into their motors. In the event the motor is not adequately retained in the rocket airframe during the firing of the ejection charge, two undesirable actions may occur. First, the recovery system may not deploy due to lack of inner cavity pressure thus causing the rocket to crash dangerously to the earth. Second, motor casings might be ejected in the aft direction and possibly lost.

PRIOR ART

[0005] Existing motor retention designs include "motor hooks", bolt-on "bracket" style retainers, "screw-on cap" style retainers, and "retaining ring" style retainers.

[0006] "Motor hook" style retainers, as disclosed in U.S. Pat. Nos. 5,267,885 and 5,212,946, are basically a bent strip of metal, permanently attached to the motor tube, that extend over the rear of the rocket motor, thereby securing the motor.

[0007] Bolt-on "bracket" style retainers, such as described in U.S. Pat. Nos. 6,155,173, are a U-shaped or Z-shaped bent metal strip that bolts to the rear bulkhead of a rocket airframe, with a flange that extends over the rear of the rocket motor, thereby securing the motor.

[0008] "Screw-on cap" style retainers are comprised of an externally threaded cylindrical retainer body glued to the outside of the motor tube, and a mating external cap of a larger diameter than the retainer body, which screws onto the cylindrical retainer, thereby securing the motor.

[0009] "Retaining ring" style retainers are comprised of a cylindrical retainer body glued to the outside of the motor tube; the retainer body has a retaining ring groove machined on its inside diameter near the aft end, which mates with a commercially available retaining ring to trap the motor between the retaining ring and the motor tube.

OBJECTS AND ADVANTAGES

[0010] Accordingly, objects and advantages of the present invention include:

[0011] Provision of a method of motor retention of sufficient strength, yet which minimizes frontal area and thus aerodynamic drag for optimum model rocket stability and performance. Prior art, such as external screw-on cap type retainers, have a cap outside diameter significantly larger than the retainer body; use of these type retainers on minimal diameter rockets increases aerodynamic drag and thereby reduces rocket stability and performance.

[0012] Provision of a method of motor retention that accommodates motors with rear thrust rings of varying lengths. Prior art, including screw-on cap type retainers, bolt-on bracket style retainers, and retaining ring style retainers, once installed, accommodate only one rear thrust ring length. The present invention allows the rear closure to be screwed into the retainer body as required to trap rear thrust rings of less than nominal length, thereby providing adjustability and flexibility as compared to previous designs.

[0013] Provision of a method of motor retention that accommodates motors equipped with or without rear thrust rings. Existing retainer designs, such as retaining ring style motor retainers, are better suited to motors with rear thrust rings. When retaining ring style retainers are used with motors that do not have rear thrust rings, the smaller diameter of the recoiling motor bears against the inner diameter of the retaining ring, rather than against the full exposed diameter, thereby loading the retaining ring improperly and increasing the potential for failure.

[0014] Further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

SUMMARY, RAMIFICATIONS, AND SCOPE

[0015] In accordance with the present invention, a model rocket motor retainer apparatus comprises a cylindrical retainer body and an aft closure ring adaptable for various rocket motors.

[0016] Thus the reader will see that the rocket motor retainer of the present invention provides a highly reliable, economical, lightweight yet easy to operate device, components of which can be used interchangeably on many rocket kits by a model rocketry enthusiast.

[0017] While the above description contains specificity, this specificity must not be construed as limitations on the scope of the invention, but rather as an exemplification of one preferred embodiment thereof. Many variations are possible. For example, the described components of the invention can be made smaller or larger; they can be incorporated into related devices such as motor adapters or retainer tail cones, or can have various design accommodations made on the mount for other methods of attachment to the rocket frame.

[0018] Accordingly, the scope of the invention should be determined not by the embodiment(s) illustrated, but by the appended claims and their legal equivalents.

DESCRIPTION OF DRAWINGS

[0019] Reference Numerals in Drawings

[0020] **1** retainer body

[0021] **2** aft closure ring

[0022] **3** rocket motor tube

[0023] **4** rocket motor (with integral thrust ring)

[0024] **5** rocket motor nozzle

[0025] **6** rocket fin

[0026] **7** rocket airframe tube

[0027] **8** retainer body (as tail cone)

[0028] **9** rocket motor (without integral thrust ring)

[0029] **10** retainer body (as adapter)

[0030] **11** through bore

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] **FIG. 1** shows the isometric aspect of a model rocket motor retainer apparatus.

[0032] **FIG. 2** shows an isometric exploded view of the retainer installation on a minimum diameter rocket application.

[0033] **FIG. 3** shows a sectional view of an operational demonstration of a model rocket motor retainer apparatus in a typical minimum diameter rocket application.

[0034] **FIG. 4** shows a sectional view of an operational demonstration of a model rocket motor retainer apparatus in a typical non-minimum diameter rocket application. In addition, this view demonstrates the tail cone variant of the retainer body, as well as the retention capability for rocket motors without an integral rear thrust ring.

[0035] **FIG. 5** shows a sectional view of an operational demonstration of a model rocket motor retainer apparatus in a typical non-minimum diameter rocket application in which the inner retainer body demonstrated the adapter variant.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] A typical view of the model rocket motor retainer is illustrated in **FIG. 1** (isometric view), while an exploded view of the assembly of the retainer apparatus on a typical minimum diameter rocket is shown in **FIG. 2**. The retainer apparatus has a cylindrical retainer body **(1)** that may be adhesively or mechanically attached to the rocket's motor tube **(3)** and becomes a permanent component thereof. The aft end of the retainer body is internally threaded. The aft closure ring **(2)** is externally threaded and screws into the mating threads on the retainer body aft inner diameter.

[0037] Operation—**FIGS. 3, 4, & 5**

[0038] Motors with Integral Thrust Ring—**FIG. 3**:

[0039] Once the motor **(4)** has been inserted into the motor tube **(3)** such that the motor aft thrust ring abuts the aft end of the motor tube **(3)**, the threaded aft closure ring **(2)** is screwed into the aft end of the cylindrical retainer body **(1)** and tightened as required to contain the motor.

[0040] Motors without Integral Thrust Ring—**FIG. 4**:

[0041] Once the motor **(9)** has been inserted into the motor tube **(3)** such that the motor forward end abuts the thrust bulkhead integral to the motor tube **(3)**, the threaded aft closure ring **(2)** is screwed into the aft end of the cylindrical retainer body **(1)** and tightened as required to contain the motor.

[0042] **FIG. 4** also shows a retainer body variant **(8)** in which the outer contour aerodynamically transitions from the motor tube diameter **(3)** to the airframe tube diameter **(7)** for use on rockets with an airframe tube of larger diameter than the motor tube.

[0043] Adapter Retainer Body Variant—**FIG. 4**:

[0044] **FIG. 4** shows a retainer body variant **(10)** in which the outer contour of the retainer body simulates a larger model rocket motor with thrust ring. This adapter variant, which allows for use in installing smaller motors in larger motor tubes on retainer-equipped rockets, can be retained within the rocket airframe tube by a normal retainer body **(1)** and rear closure **(2)** as if it were a rocket motor.

I claim:

1. A model rocket motor retainer apparatus comprising a retainer body and an aft closure ring attached to said retainer body, as a means for retaining a model rocket motor within a rocket airframe.

2. A model rocket motor retainer apparatus per claim 1 wherein said aft closure ring further includes appropriately sized through-bores as a means to accommodate rocket model motors of various sizes.

3. A model rocket motor retainer apparatus per claim 1 wherein said retainer body further includes a minimal outside diameter as a means to provide improved aerodynamic characteristics through drag reduction.

4. A model rocket motor retainer apparatus per claim 1 wherein said retainer body further includes internal threading on the aft inside diameter as a means to accommodate rocket motors with rear thrust rings of varying lengths.

5. A model rocket motor retainer apparatus per claim 1 wherein said retainer body further includes an outer conical, ogive, or similar contour, that aerodynamically transitions from a rocket motor tube diameter to an airframe tube diameter for use on rockets with an airframe tube of larger diameter than the motor tube.

6. A model rocket motor retainer apparatus per claim 1 wherein said retainer body further includes an outer contour shaped to simulate a larger model rocket motor with a thrust ring as a means for adapting smaller rocket motors for installation in larger motor tubes.

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