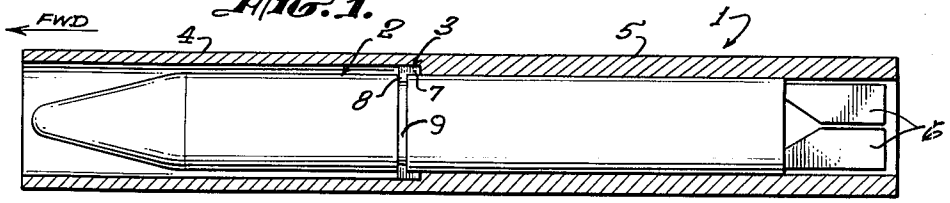
Dec. 28, 1965 R. T. INGLIS 3,225,655

CONTROLLED TIP-OFF LAUNCHER

Filed May 25, 1964

FIG. 1.



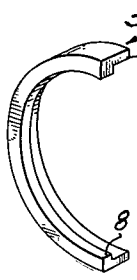


FIG. 2.

FIG. 3.

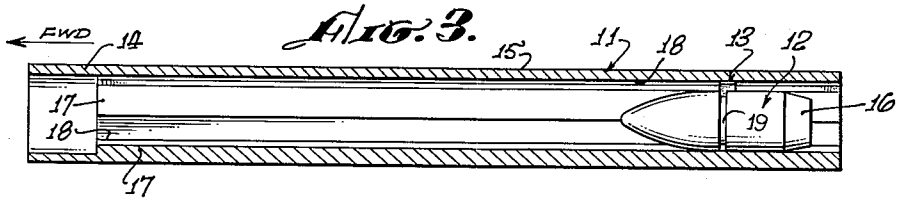


FIG. 4.

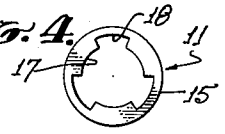


FIG. 5.

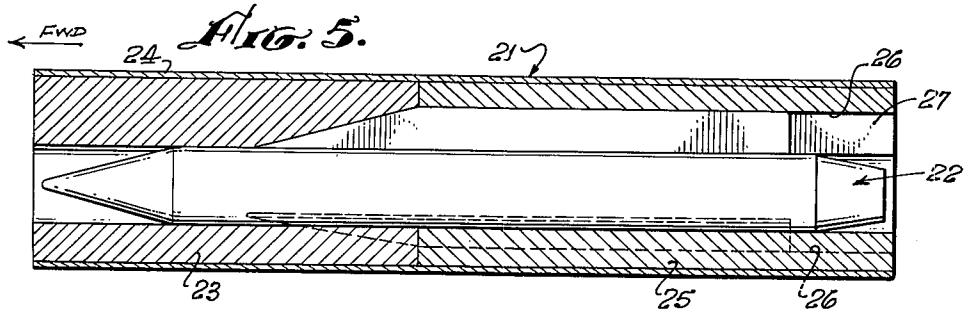
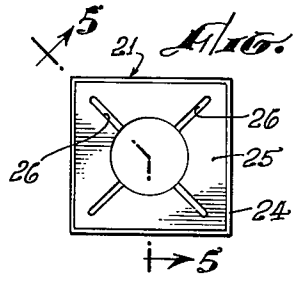


FIG. 6.



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3,225,655

CONTROLLED TIP-OFF LAUNCHER

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7 Claims. (Cl. 89—1.7)

This invention relates to launchers for missiles or projectiles, particularly to a launcher wherein the missile or projectile may be launched with a maximum degree fo accuracy, and more particularly to a launcher having means to reduce, eliminate, or induce desired tip-off for missiles and/or projectiles.

It is well known that one of the contributing causes of dispersion of a missile is the deflection imparted to the missile during emergence or separation from the launcher. In many prior art missile launchers, in the time interval during which the missile is not quite clear of the launcher, the aft end of the missile is still supported by the launcher when the center of gravity has passed the forward end of the launcher, and is no longer supported. The center of gravity starts to fall under the influence of gravitational forces causing a nose down angular acceleration in the missile attitude. If the missile is spinning, a transverse angular rate will be developed because of gyroscopic forces.

Attempts have been made to provide the missile with shoes or bourrelets which support the missile on a launching rail having differently constructed fore and aft sections, said shoes being so constructed as to simultaneously disengage from the fore and aft rails to allow the missile to be in free flight condition at the end of the launch rails. Examples of this approach are taught by U.S. Patent 2,818,779 to C. J. Koeper and U.S. Patent 2,998,752 to R. J. Couts.

In modern missiles, the launcher in many instances additionally serves as the handling, storage, and supporting mechanism for the missile, these modern missiles being of both the fin-stabilized or non-spinning type and the spin-stabilized or spinning type. Each of these types of missiles has specific launch requirements to prevent undesired tip-off. In addition to the above cited patents which relate to fin-stabilized missile launchers, U.S. Patents 2,549,778 to B. Crawley and 2,604,014 to E. C. Walker et al. teach launching means for the spin-stabilized type of missiles. However, none of the known prior art approaches provide a method of launching missiles from a carrier which additionally functions to prevent shock or provide support during the transportation, installation and launch while additionally controlling desired missile tip-off during launch.

This invention provides a missile launcher which can handle either the fin-stabilized or spin-stabilized missile, control the tip-off during launch, and provide support during the transportation, installation, and launch of the missile.

Therefore, it is an object of this invention to provide a missile or projectile launcher which will eliminate objectionable tip-off phenomenon.

A further object of the invention is to provide a missile launcher which will accurately align the missile on the intended course and which imposes a minimum amount of frictional resistance to the missile's launching.

Another object of the invention is to provide a missile launcher which can handle either fin-stabilized or spin-stabilized missiles.

Another object of the invention is to provide a missile launcher having means to reduce, eliminate, or induce tip-off for missiles or projectiles.

Another object of the invention is to provide a tubular type missile launcher which will eliminate undesirable tip-off of the missile during launch.

Another object of the invention is to provide a missile launcher which additionally functions to support the missile during the transportation, installation, and launch thereof while controlling the tip-off phenomenon.

Other objects of the invention will become readily apparent from the following description and drawings in which:

FIG. 1 is a longitudinal sectional view through an embodiment of the invention;

FIG. 2 is a portion of an embodiment of a shoe utilized in the FIG. 1 device;

FIG. 3 is a longitudinal sectional view through another embodiment of the invention which utilizes a short length missile;

FIG. 4 is an end view of the FIG. 3 embodiment;

FIG. 5 is a longitudinal sectional view through still another embodiment of the invention taken on the lines 5—5 of FIG. 6; and

FIG. 6 is an end view of the FIG. 5 embodiment.

This invention relates to a launching system for missile or projectile bodies in which the tip-off can be controlled to produce zero, negative or positive tip-off by suitably positioning a shoe at least on the forward portion of the body. The launcher may assume a variety of shapes, for example, a tube having an enlarged front bore in which the support shoe rides while the main bore supports the missile body. Thus, the tip-off is determined by the relative times at which the forward support shoe and the aft end of the missile become unsupported. The shoe can be designed to separate in a conventional manner from the missile after launch, if desirable.

Referring to FIG. 1, **1** designates a tubular type launcher body which supports missile **2**. A shoe or bourrelet **3** is attached to missile **2** and is supported in the larger internal diameter forward portion **4** of launcher body **1**. Launcher body **1** supports missile **2** in the aft portion **5**, said aft portion being of smaller internal diameter than forward body portion **4**. Missile **2** can be provided with a plurality of fins **6** at the aft end thereof. Shoe **3**, as shown in FIG. 2, consists of annular body sections **7** (only one shown) and annular inwardly extending flange sections **8** (only one shown). In this embodiment the shoes **3** are designed to be positioned in an annular groove **9** in the shell of missile **2**, as indicated in FIG. 1.

If it is desirable to have shoe **3** separate from missile **2** after launch, shoe **3** can be of the split ring or segmented type shown in FIG. 2 and can be ejected by a small force such as by spring or air-type actuators, such actuators being well known in the art. If missile **2** is rolling, centrifugal force can be used for the separation of shoe **3** from the missile. It is also within the skill of the art to design shoe **3** to be retracted into missile **2**.

The specific configuration and the desired flight pattern of the missile **2** in the FIG. 1 embodiment and the location thereof in launcher **1** will determine the construction of launcher **1** and the location of shoe **3**. The larger internal diameter portion **4** of launcher **1** must be sufficently larger in internal diameter than the internal diameter of portion **5** of the launcher, so that the aft part of missile **2** will not strike launcher portion **4** before clearing the end of launcher portion **4**. The location of the C.G. (center of gravity) of missile **2** must be considered when locating shoe **3** on missile **2** if gravity is to produce the desired torques.

The operation of the FIG. 1 embodiment is dependent upon the type of tip-off control desired and will be described accordingly as follows:

Zero tip-off.—In this type operation of missile **2** the location of shoe **3** on missile **2** and the position of mis-

sile 2 with respect to launcher 1 is so designed that as missile 2 is fired and moves outwardly from the launcher (to the left as shown), shoe 3 passes the forward end of launcher portion 4 at the same time that the aft end of missile 2 passes the forward end of launcher portion 5 and into the larger internal diameter portion 4 of launcher 1, thus providing a free flight condition of the missile 2 prior to the time it leaves the forward end of the launcher.

Positive tip-off.—In this nose down type operation of missile 2, shoe 3 passes the forward end of launcher portion 4 before the aft end of missile 2 passes from launcher portion 5 into larger internal diameter portion 4 of launcher 1, thus providing a free flight condition of the missile 2 within launcher 1 but with the desired degree of nose down flight condition.

Negative tip-off.—In the nose up type operation of missile 2, the aft end of missile 2 passes from launcher portion 5 into the larger internal diameter portion 4 of launcher 1 before shoe 3 passes from the forward end of launcher portion 4, thus providing a free flight condition of missile 2 within launcher 1 but with the desired degree of nose up flight condition.

Induced tip-off.—If lateral rates, or vertical rates greater than can be obtained from the above stated operations are desired, small forces (spring, air, etc.) can be applied to missile 2 when in the larger internal diameter portion 4 of launcher 1, thus providing an operation where missile 2 can be in free flight, restrained at shoe 3, or at aft end of missile 2.

In the FIGS. 3 and 4 embodiment, the missile is short in length in relation to the tubular type launcher and comprises generally a launcher 11, missile 12, and a shoe or bourrelet 13. Launcher 11 consists of a forward body portion or landless 14 of relatively large internal diameter with respect to the internal diameter of aft body portion 15 which is shown in FIG. 3 as supporting missile 12, body portion 14 being of the smooth bore type. Missile 12 may be provided with a tail section 16 at the aft end thereof, if desired. The body portion 15 of launcher 11 is provided with a plurality of lands 17 and grooves 18 which may be either straight or spiral (rifled), grooves 18 having an external diameter equal to the internal diameter of body portion 14. Shoe 13 is of the segmented type of construction similar to the FIG. 2 embodiment in which the flange portion of each section fits into grooves 19 in the shell of missile 12 and the body portion of shoe 13 is positioned in grooves 18 in launcher aft portion 15.

In operation of the FIG. 3 embodiment, missile 12 rides on lands 17 and the sections of shoe 13 ride in grooves 18 of launcher body portion 15. Tip-off is controlled by the time when the segments of shoe 13 clear the forward end of the larger internal diameter body portion or landless 14 of launcher 11 in relation to missile 12 clearing the forward ends of lands 17 of launcher portion 15 and passing into launcher portion 14.

Zero, positive, negative, and induced tip-off are controlled in the same manner in the FIG. 3 embodiment as described above with respect to the FIG. 1 approach. Also, the shoes 13 may be retracted into or separated from missile 12 after launching by conventional means, if desired.

In the FIGS. 5 and 6 embodiment, the missile is of the fin-stabilized type and the launcher is of a square configuration and consists generally of a launcher 21, missile 22, and shoe or support 23. Launcher 21 comprises an external skin 24 and an aft missile support section 25 which is fixed to launcher skin 24. Support or shoe 23 in this embodiment is segmented, positioned in the forward portion of launcher 21, and attached such as by keys or other conventional attaching means to missile 22, support 23 additionally functioning to support missile 22 during the transportation, installation and launch thereof. The aft missile support section 25 is

provided with a plurality of slots 26 within which fins 27 of the missile 22 are located. Aft missile support section 25 and support or shoe 23 may be constructed of material such as wood, plastic, foam, etc. which provides good support characteristics which support missile 22 over the entire length thereof.

In operation of the FIG. 5 embodiment, as missile 22 is launched it slides forward (to the left as shown) in aft support section 25 while support or shoe 23 slides in launcher skin 24. Tip-off is controlled by the time when shoe 23 clears the forward end of launcher 21 in relation to missile 22 clearing the forward end of aft support section 25 and passing into the large diameter portion within launcher skin 24 which has been vacated by support or shoe 23.

As in the FIGS. 1 and 3 embodiments, zero, positive, negative, and induced tip-off can be effectively controlled by the FIG. 5 embodiment. Missile support or shoe 23 would be preferably separated from missile 22 immediately after launch.

It has thus been shown that this invention provides a missile launcher which functions to support the missile during the transportation, installation, and launch thereof while additionally controlling the tip-off thereby preventing undesirable flight characteristics due to this phenomenon.

Although particular embodiments of the invention have been illustrated and described, modifications thereof would be readily apparent to persons skilled in the art, and it is intended to cover in the appended claims all such modifications as come within the spirit and scope of this invention.

What I claim is:

1. A controlled tip-off launcher mechanism for missiles or the like comprising: a launcher body defining forward and rearward portions of different internal diameters, the internal diameter of each of said forward and rearward portions having a substantially constant cross-sectional configuration along the length thereof, said rearward body portion being smaller in internal diameter than said forward body portion, said rearward body portion functioning to support an associated missile adapted to be positioned within said launcher body, and slidable means adapted to be attached to an associated missile and positioned in said launcher body so as to be movable with respect to at least the forward portion of said launcher body, said slidable means comprising a plurality of segments, whereby tip-off is controlled by the time relation between the slidable means clearing the forward end of the forward body portion of the launcher and the aft end of an associated missile clearing the forward end of the rearward body portion of said launcher, and whereby said slidable means is separated upon same clearing the forward end of the forward body portion of the launcher.

2. The launcher mechanism defined in claim 1 wherein said rearward body portion is provided with a plurality of slots adapted to guide fins of an associated missile, and wherein said slidable means and said rearward body portion function to support an associated missile.

3. The launcher mechanism defined in claim 2 wherein said slidable means consists of a body positioned in said forward body portion of said launcher and extending from the forward end of said launcher body forward portion to the forward end of said rearward body portion of said launcher.

4. A controlled tip-off launcher mechanism for missiles or the like comprising: a launcher body defining forward and rearward portions of different internal diameters, said rearward body portion being smaller in internal diameter than said forward portion and functioning to support an associated missile in said launcher body, and slidable means adapted to be attached to an associated missile and positioned in said launcher body so as to be movable with respect to at least the forward portion of said launcher body, the internal surface of said rearward body

portion being provided with a plurality of lands and grooves, said lands being adapted to support an associated missile and said slidable means being adapted to ride in said grooves and on the internal surface of said forward body portion.

5. The launcher mechanism defined in claim 4 wherein said slidable means consists of a plurality of segments each having a body portion and a flange portion.

6. In combination: a launcher mechanism having a forward body portion of larger internal diameter than the internal diameter of an aft body portion, the internal diameter of each of said body portions having a substantially constant cross-sectional configuration along the length thereof; a missile positioned in said launcher and supported by said aft body portion of said launcher, said missile being provided with an annular groove; shoe means positioned in said forward body portion of said launcher and operatively attached to said annular groove of said missile, whereby tip-off is controlled by the time relation between the shoe means clearing the forward end of the forward body portion of the launcher and the aft end of the missile clearing forward end of the aft body portion of said launcher.

7. The combination of elements defined in claim 6 wherein said shoe means consists of a plurality of segments, each segment including a body portion and an inwardly extending flange portion, said flange portion of each of said segments being operatively positioned in said annular groove of said missile.

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