

May 15, 1956

A. LIGHTBODY ET AL
SELF-PROJECTED MISSILES

2,745,347

Filed June 5, 1952

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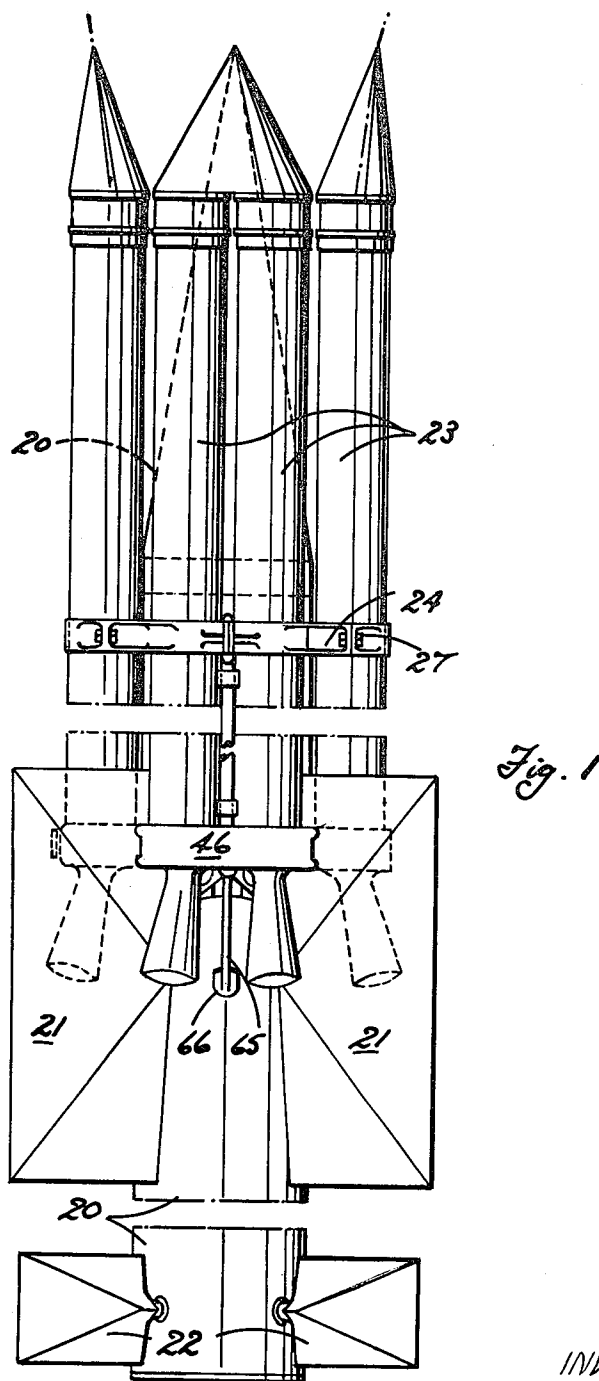


Fig. 1

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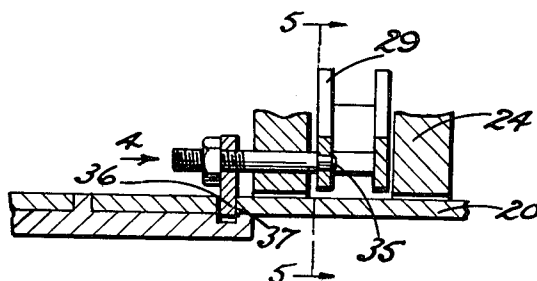
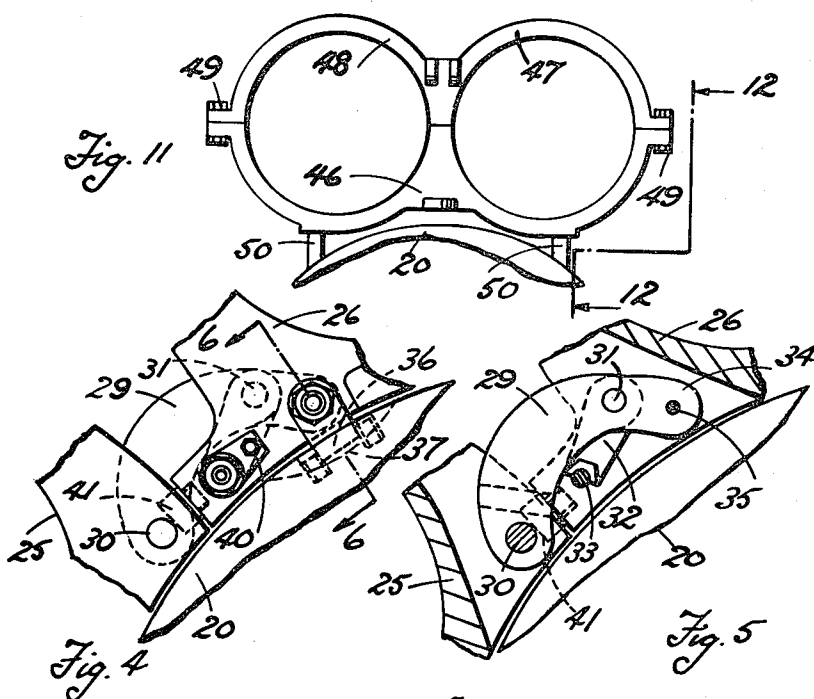
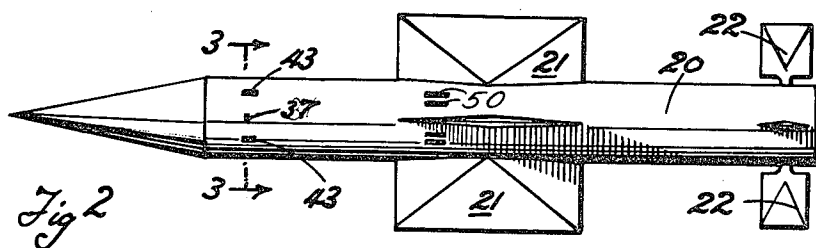


Fig. 6

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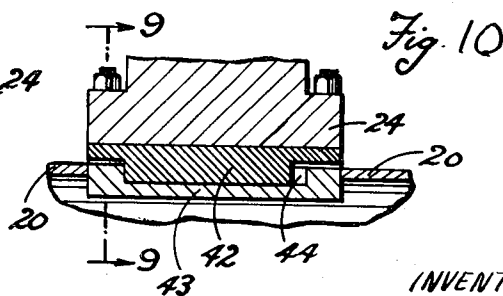
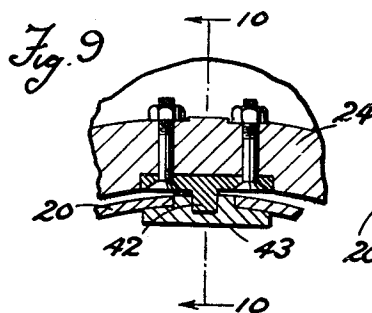
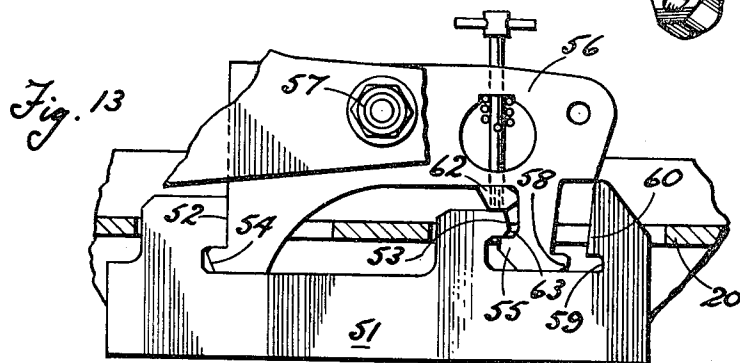
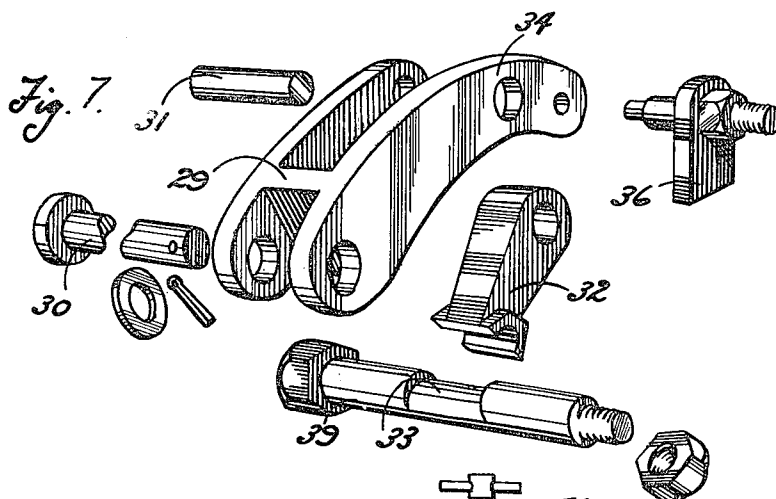
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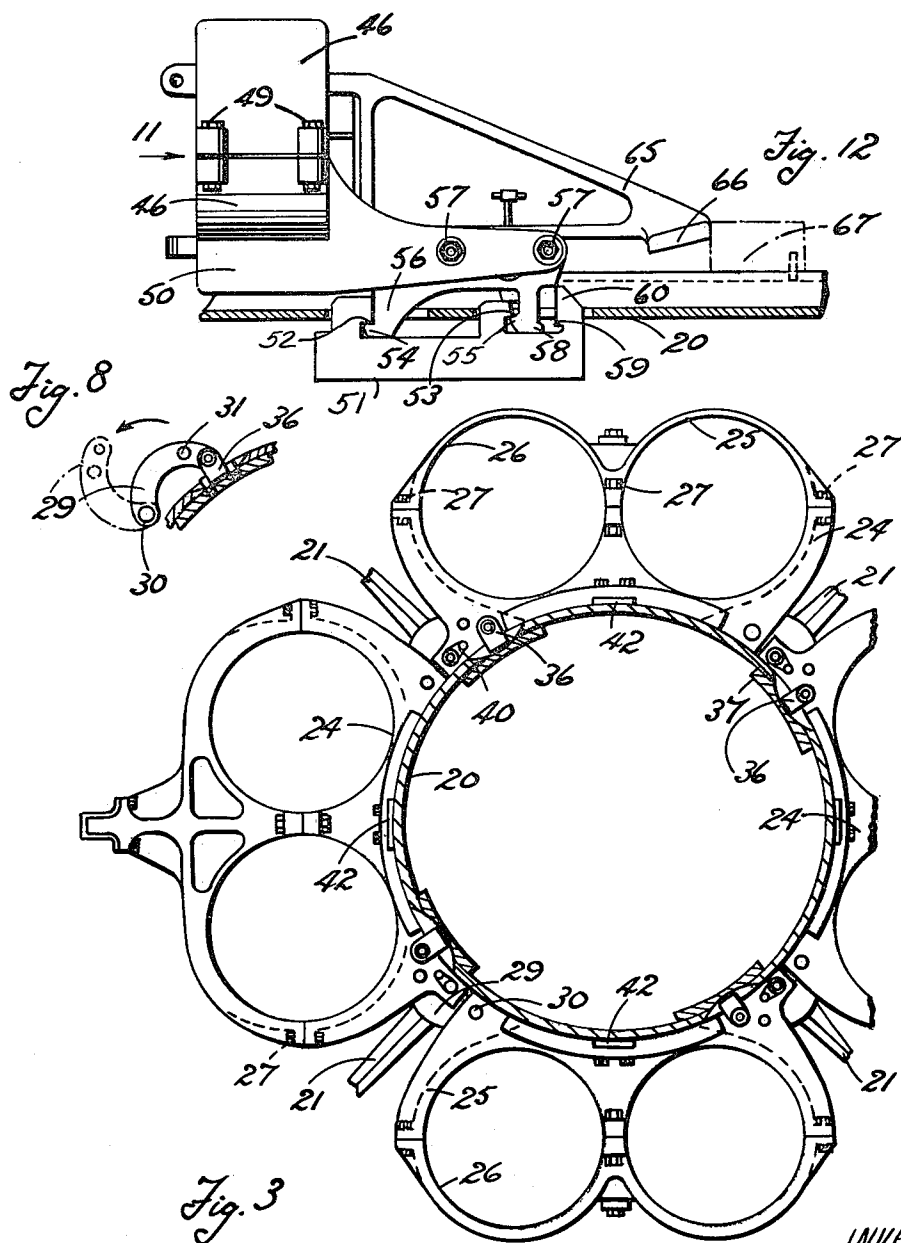
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2,745,347

SELF-PROJECTED MISSILES

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Application June 5, 1952, Serial No. 291,932

Claims priority, application Great Britain July 6, 1951

8 Claims. (Cl. 102—49)

This invention relates to a self-projected missile of the kind having discardable, "wrapped-round," boost motors—i. e., at least two symmetrically-arranged boost motors disposed round the missile, with their axes parallel thereto, to provide acceleration during the initial stage of the flight for a matter of a few seconds, prior to their being discarded.

In practice it is known to use four such symmetrically-arranged boost motors respectively disposed between four main wings of the missile. Alternatively, each boost motor could be replaced by a group of two or more motors.

The main object of the invention is to ensure that all the boost motors will be simultaneously discarded without damaging the missile or causing deviations in its course.

According to the invention, the boost motors are carried by frame members forming an axially-slidable ring round the missile, at the front, when secured to one another by catches (preferably in the form of toggles) which are releasable by rearward axial movement of the ring when the thrust of the motors is sufficiently reduced, each motor, or group of motors, being also carried by a member at its rear end which has a sliding or articulating hooked engagement, with the missile, releasable when the latter member is slid rearwardly, during which movement a means is applied to the latter member to prevent forward movement thereof.

According to a further feature of the invention, the boost motors are secured to the missile at two axially-spaced places, the forward attachment including arcuate frame members which carry the motors and are connected together, so as to form round the missile an axially slidable ring thereon, by releasable catches (preferably in the form of toggles) which are held in contracting position (whilst the thrust of the motors is sufficiently great) by engagement with rearwardly-extending pins which are restrained axially on the missile.

According to a still further feature of the invention, the boost motors are secured to the missile at two axially-spaced places in such a manner that the complete boost assembly can slide rearwardly when the thrust of the motors is sufficiently reduced, the rear attachment of each motor or group of motors including a rearwardly-open, hooked or female part fast with the missile and slidably engaged with a forwardly-directed hooked or male part fast with a member which carries the motor (or group), said member, when the assembly slides rearwardly as aforesaid, engaging a stop in which position the coacting hooked or male and female parts are just clear of one another, the said member being then restrained against side movement by means of a slotted connection, and being also axially located by mechanism which does not prevent pivotal movement of the said member in an outward direction about the rear attachment.

In the accompanying drawings:

Figure 1 is a fragmentary plan of a self-projected missile with four discardable groups of boost motors, each group comprising two boost motors and being disposed

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with their rear ends between an adjacent pair of main wings of the missile;

Figure 2 is an elevation of the missile, to a smaller scale, after the boost motors have been discarded;

Figure 3 is a fragmentary sectional elevation, taken on the line 3—3 of Figure 2 and to a larger scale, showing the front attachment means for the groups of boost motors;

Figure 4 is a still further enlarged, fragmentary view, looking in the direction of the arrow 4 of Figure 6, mainly of the connecting means between two of the front arcuate frame members, Figure 5 being a substantially similar view but taken on the line 5—5 of Figure 6, which latter figure is a fragmentary section taken on the line 6—6 of Figure 4;

Figure 7 is an exploded view of one of the toggle catches and associated parts in perspective;

Figure 8 is a fragmentary view, to a smaller scale, corresponding to those of Figures 4 and 5 when one of the toggle catches is released;

Figure 9 is a fragmentary section, to a smaller scale than that of Figures 4, 5 and 6, taken on the line 9—9 of Figure 10, and Figure 10 is a fragmentary section taken on the line 10—10 of Figure 9, showing keying means for slidably guiding the front ends of a group of boost motors;

Figure 11 is a fragmentary elevation, to the scale of that of Figure 3, of the rear attachment means for one group of boost motors, looking in the direction of the arrow 11 of Figure 12;

Figure 12 is an elevation of the rear attachment means at one of the laterally spaced attachment points, taken on the line 12—12 of Figure 11; and

Figure 13 is an enlarged fragmentary view thereof.

In the construction shown, the missile 20 has four main wings 21 spaced angularly from one another at 90°, and four similarly spaced tail wings 22. There are, as stated, four groups of boost motors 23, each group comprising two motors and being arranged with their trailing ends between an adjacent pair of the main wings 21, as disclosed in the specification accompanying co-pending Patent Application Serial No. 291,931 filed June 5, 1952.

The front attachment means comprises an arcuate frame member 24 for each group of boost motors, the arcuate member having two ring portions 25, 26 in which the respective boost motors of the group are mounted, the ring portions being bolted together by means of bolts 27. In addition, each arcuate frame member 24 is secured to the adjacent arcuate member, by means of releasable catches which are shown in the form of toggles, to form a continuous ring slidable on the front end of the missile.

Each toggle catch has one main curved arm 29 which is pivotally mounted on one of the arcuate frame members at 30 and hinged at 31, near its other end, to a short toggle arm 32 the free end of which is concave and adapted to engage with a cross pin 33 carried by the other arcuate member. Each toggle catch is mounted in a recess provided in the associated arcuate portions 24.

Figures 3, 4 and 5 show the toggle catches held in their closed position (in which they are slightly underset) by holes in the free ends 34 of the arms 29 being engaged by the ends 35 (Figures 5 and 6) of pins which are fast with keys 36 axially located in slots 37 in the surface of the missile. Rearward movement (relatively to the missile) of the boost motors, when their thrust falls below a predetermined value, causes the pin ends 35 to release the free ends 34 of the toggle arms 29, whereupon the toggle catches open out, as indicated by Figure 8, to allow the separation from one another of the arcuate frame members 24, such separation also removing the keys 36 from the axially locating slots 37.

For setting up purposes the pins 33 are constituted by

eccentric portions of bolts 39 (Figure 7) which, after angular adjustment, can be located in position in any usual or convenient manner, the locking means being indicated in Figures 3 and 4 at 40.

When the arcuate frame members 24 are built up in this way into an axially-slidable ring, the members of each adjacent pair also have a shallow spigotal engagement with one another, shown by the projection 41 in Figures 4 and 5, serving to maintain them in co-planar relationship. The loads of the forward ends of the boost motors are therefore not taken by the missile but by the built-up ring structure of the members 24.

Centrally, each arcuate frame member 24 has an axial sliding engagement with the missile provided by a key 42, fast with the arcuate portion, working in a slot of a member 43 carried by the missile, as shown by Figures 2, 9 and 10. The axial sliding motion can be limited, as shown at 44 in Figure 10, to an amount which is just sufficient for the pin ends 35 fully to withdraw from the holes in the main toggle arms 29 (Figure 6); more usually, the axial motion is limited by the contact of a bracket 56 with a stop portion 60, described below with reference to Figure 13.

Whereas the front attachment means for the boost motors forms a continuous ring, the rear attachment means comprises four separate members 46 of which one is shown in Figure 11, each being formed of two half-spectacles (47, 48 being one half) which are bolted together at 49 to form two rings adapted respectively to receive the boost motors near their rear ends. Each member 46 is in the present instance connected with the missile at two laterally spaced positions 50, which are similar to one another and as shown by Figures 12 and 13.

Thus, disposed mainly within the interior of the missile is a bracket 51 (Figure 12, and at each position 50, Figure 11) with rearwardly-extending female members in the form of hooks 52, 53 lying in slots provided for the purpose in the casing of the missile. Coacting with these hooks are forwardly extending hooks 54, 55 on a bracket 56 bolted at 57 to a tail of the member 46. The rear hook 55 on the member 46 has a heel 58 adapted to enter a corresponding socket 59 in a stop portion 60 of the bracket 51. The travel between the tail 58 and the socket 59, and that necessary to release the hooked portions 52, 54 from engagement, equals the travel necessary for the pin ends 35 to be fully withdrawn from the main toggle arms 29.

At the moment that the boost motors have moved rearwardly in this way (on a predetermined reduction of their thrust) to free the front ends, there is a threat that one group of boost motors might rebound slightly, again engaging the hook portions 52, 54. To prevent this from happening, spring-pressed wedges 62 are carried by the bracket 56, and, as soon as each group of boost motors has moved fully rearwardly, the wedge enters the space 63 (Figure 13) to prevent the possibility of such forward movement occurring.

Side movement is prevented by the provision of a slotted connection. Thus, the stems of the hooks 54, 55 may be in the form of blades working in slots machined in the missile 20 (Figure 13).

Thus, as stated, when the thrust of the boost motors is reduced sufficiently and rearward movement of the boost assembly takes place as aforesaid, the spring-pressed wedge-like members 62 carried by each member 56 enter the axial spaces 63 between the rear co-operating hooks to prevent any group of boost motors from again moving forwardly, as might otherwise happen in the case of a motor the propulsive effort of which was momentarily at a higher level than those of the other motors, and thus holds each member 56 against the back stops 60 in which the co-operating hooks are out of engagement with one another. Thereupon each release mechanism acts as a simple pivot, and all the groups of motors simultaneously pivot thereabout by virtue of the aerodynamic and centrifugal forces acting on them to positions at which the

groups separate from the missile. Figure 12 shows a spacing strut 65, with which each member 46 is provided, the tail 66 of which can bear on the missile casing during the pivotal movement of the group of motors. For setting up purposes use is made of block 67 to be engaged by the spacing strut, the block to be removed from the missile before the latter is fired.

What we claim as our invention and desire to secure by Letters Patent of the United States is:

1. A self-projected missile having discardable, wrapped round boost motors, including frame members adapted to form an axially-slidable ring round the missile, said frame members carrying the front ends of the boost motors, catches securing said frame members to one another to form said ring, axially withdrawable means which hold said catches in their said securing positions and which are connected to be withdrawn by rearward axial movement of said ring when the thrust of the motors is sufficiently reduced whereby to release said catches, separate members carrying the motors at the rear ends of the latter, means providing for each of said separate members a sliding, articulating hooked engagement, with the missile, which is automatically releasable when said separate members are all slid fully rearwardly, and means applied to each of said separate members to prevent forward movement thereon during said rearward movement of any of said separate members.

2. A self-projected missile having discardable, wrapped round boost motors, the boost motors being secured to the missile at two axially-spaced places, the forward attachment of the motors to the missile including arcuate frame members which carry the motors, releasable catches connecting said frame members together so as to form round the missile an axially-slidable ring thereon, means holding said releasable catches in contracting position, while the thrust of the motors is sufficiently great, said means being rearwardly-extending pins which engage said catches and are restrained axially on the missile.

3. A self-projected missile having discardable, wrapped round boost motors, the boost motors being secured to the missile at two axially-spaced places in such a manner that the complete boost assembly can slide rearwardly when the thrust of the motors is sufficiently reduced, each of the rear attachments for the motors including a rearwardly-open female part fast with the missile, separate members which carry the motors, forwardly-directed mate parts fast with said members, said female parts slidably engaged with said male parts, a stop fast with said missile, each of said members, when the boost assembly slides rearwardly as aforesaid, engaging said stop in which condition said coacting male and female parts are both clear of one another, means restraining any of said members against side movement, and means axially locating each of said members when slid rearwardly as aforesaid, said axial location means being arranged so as not to prevent the pivotal movement of the said members in an outward direction with respect to the missile.

4. A self-projected missile having a plurality of main wings equally spaced from one another round its periphery, discardable boost motor units the rear ends of which respectively terminate between the adjacent pairs of wings, the units being secured to the missile at two axially-spaced places so that the complete boost assembly can slide rearwardly when the thrust of the motors is sufficiently reduced, members fast with said boost motors, each of the rear attachments for the units including a rearwardly-open hooked part fast with the missile and a forwardly-directed hooked part fast with one of said members, said rearwardly-open and forwardly-directed hooked parts slidably engaged, a stop fast with said missile, each of said members when the boost assembly slides rearwardly as aforesaid engaging said stop in which position said coacting hooked parts are clear of one another, said forwardly-directed hooked part, formed as

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a blade, of each member working in a machined longitudinal slot in the missile to restrain said member against side movement, and spring-pressed wedging means carried by said member for axially locating it when slid rearwardly as aforesaid.

5. A missile according to claim 4, characterized by two axially-spaced coacting hooked parts for each rear attachment, said wedging means coacting with the rearwardly-placed coacting hooked parts.

6. A missile according to claim 3, in which each of said members carries a spacing strut having a tail which is normally spaced clear of the periphery of the missile but which is adapted to bear thereon during the outward pivotal movement of said member.

7. A self-projected missile having discardable, boost motor units secured fore and aft for rearward axial movement relatively to the missile when the thrust of the units is sufficiently reduced, in which the aft securing means for each unit includes a longitudinally-extending plate in the interior of the missile having two, axially-spaced rearwardly-directed hooks lying in a slot means in the surface of the missile, said plate also having at the rear end a stop member extending through the slot means in the surface of the missile, a member carrying the rear end of the unit a main forwardly-extending hook on the forward end of said member to fully engage with the for-

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ward of said rearwardly-extending hooks until said unit has moved fully rearwardly, and a forwardly-extending hook on the rear end of said member for lightly engaging the rearwardly-placed of said rearwardly-extending hooks, said stop member being positioned rearwardly of the rearward forwardly-extending hook by a distance which is not less than the rearward movement of the unit necessary to disengage the front pair of coacting hooks, in combination with a spring-pressed wedging device adapted when sufficient rearward movement of the unit takes place to engage between the rearwardly-placed coacting hooks and thus prevent forward movement of the unit, whilst holding the rearwardly-placed, forwardly-extending hook against said stop member.

8. A self-projected missile, according to claim 7, in which the rearward of the forwardly projected hooks, for each boost motor unit, has at its rear face and at its radially-inward end a rearward extension adapted to engage with a corresponding socket provided in the stop member when the unit has moved fully rearwardly.

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