

# United States Patent

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## [54] ANTISUBMARINE MISSILE

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[73] Assignee: The United States of America as represented by the Secretary of the Navy

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[51] Int. Cl. .... F42b 17/00

[58] Field of Search. .... 102/4, 7, 7.2, 49, 50;  
244/138; 114/20

[56]

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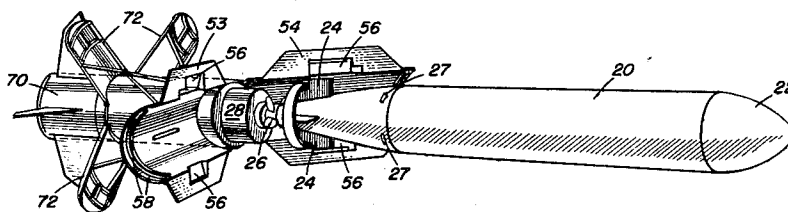
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### EXEMPLARY CLAIM

1. In an underwater missile that is launched from a conventional missile launcher with a conventional booster and underwater weapon attached thereto, wherein this improvement comprises an adapter for said underwater weapon comprising the combination of: a clamshell section provided with external fins and having forward attachment means for attachment to said underwater weapon, said external fins providing stability to the weapon during flight; said clamshell section being formed in two halves, each half of said section being adapted to receive one-half of the tail an aft section provided with additional external fins and having coupling means for connecting said aft section to said clamshell section, deceleration means and retaining means for said deceleration means, said additional external fins providing additional control and stability to said weapon during both the powered and the deceleration phases of the said deceleration means comprises a plurality of drag brakes attached to said aft section and kept in a closed position by said retaining means, releasing means for releasing said retaining means and restraining means for limiting the rate and extent of opening of said drag brakes upon the operation of said releasing means; said clamshell section having separation means for separating the underwater weapon from said adapter after said deceleration means have reduced the velocity of both the adapter and the weapon to a predetermined value, whereby said weapon falls freely into the water in search of a target.

3 Claims, 11 Drawing Figures



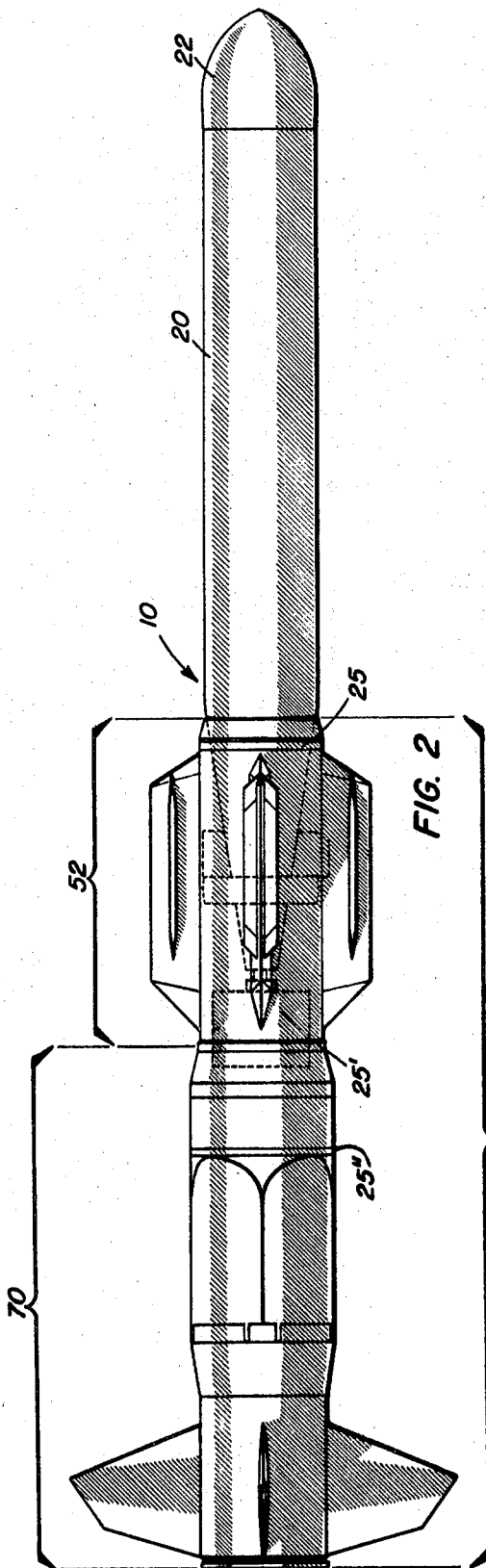


FIG. 2

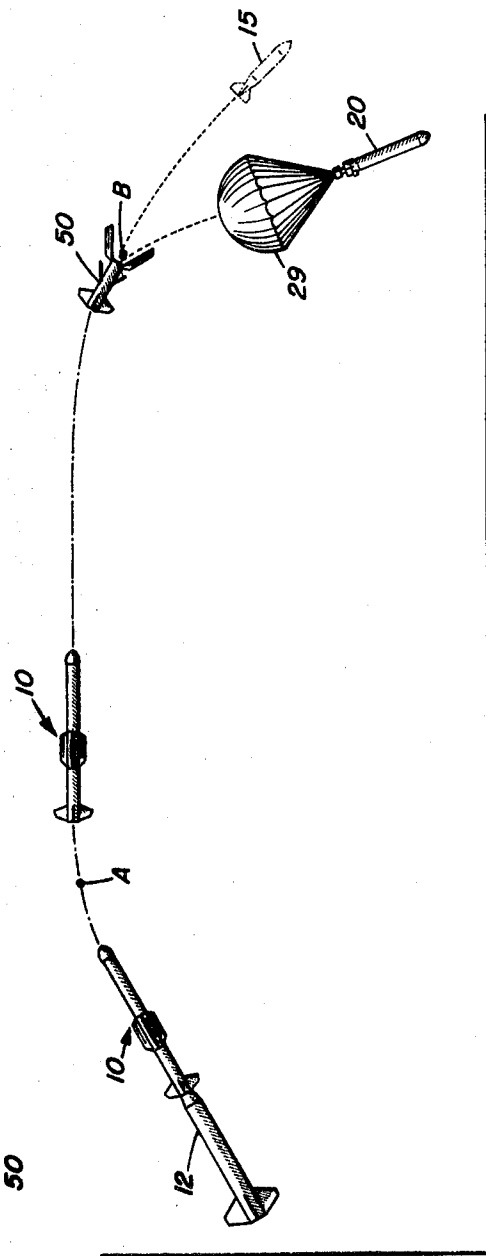


FIG. 1

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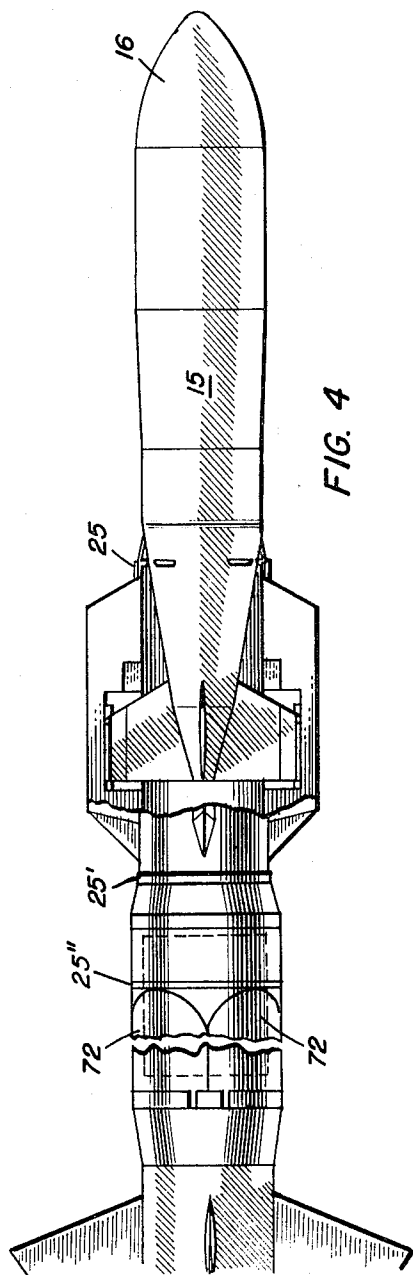
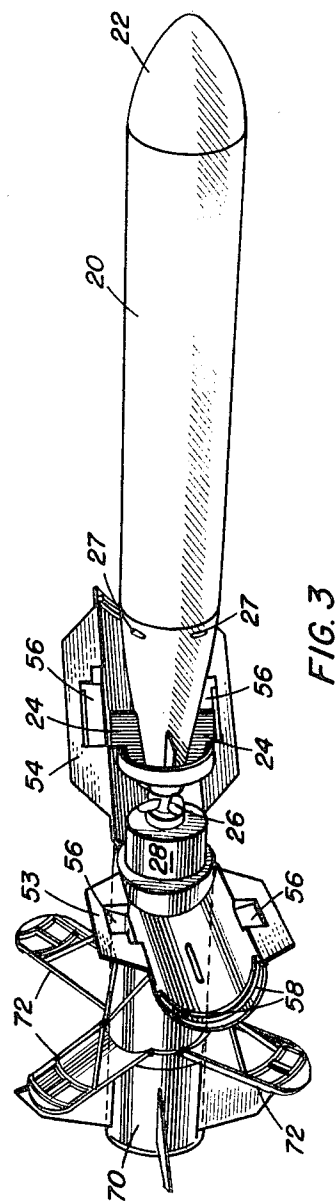
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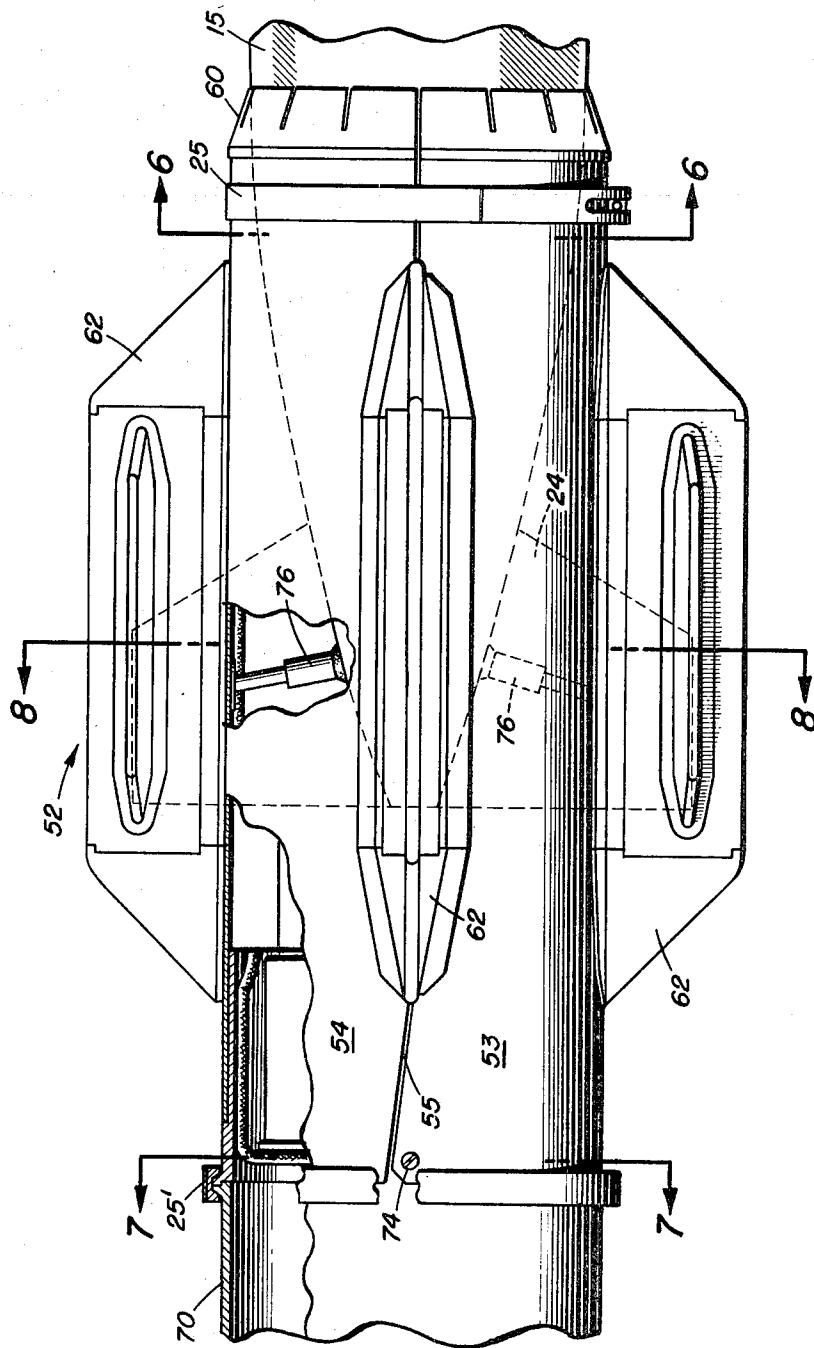


FIG. 5

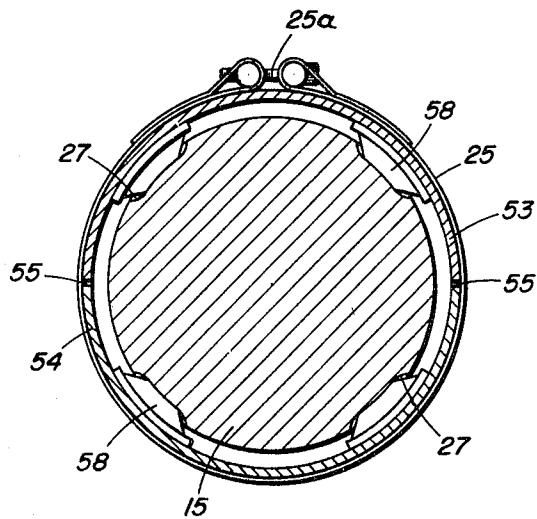


FIG. 6

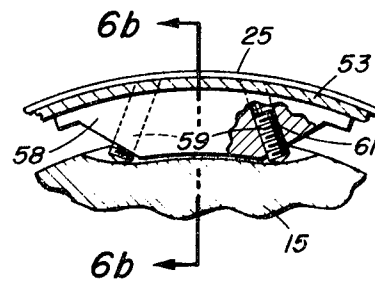


FIG. 6a

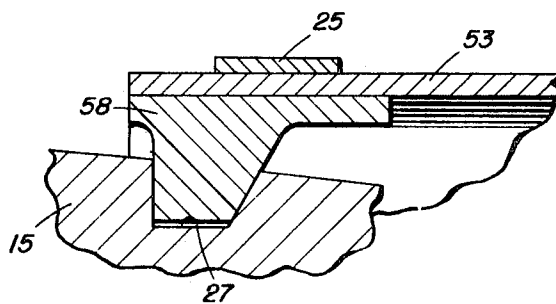


FIG. 6b

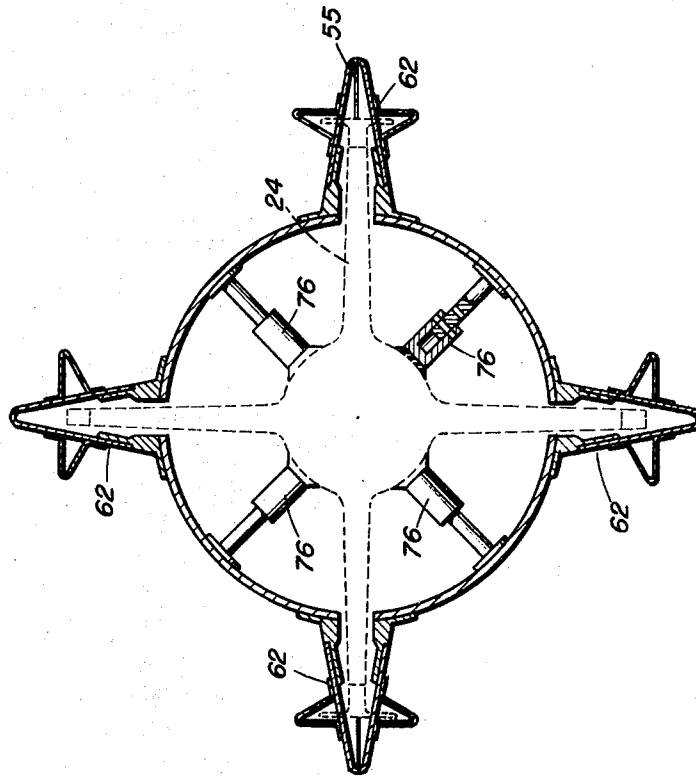


FIG. 8

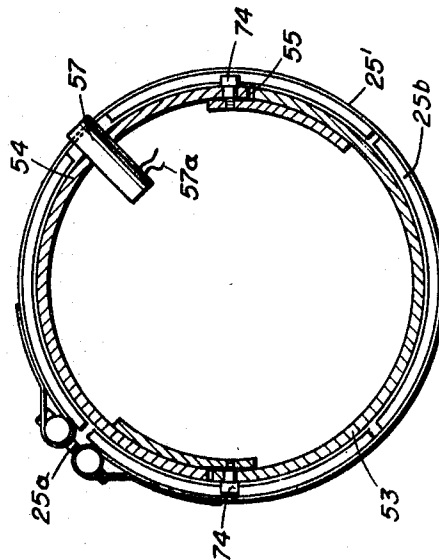


FIG. 7

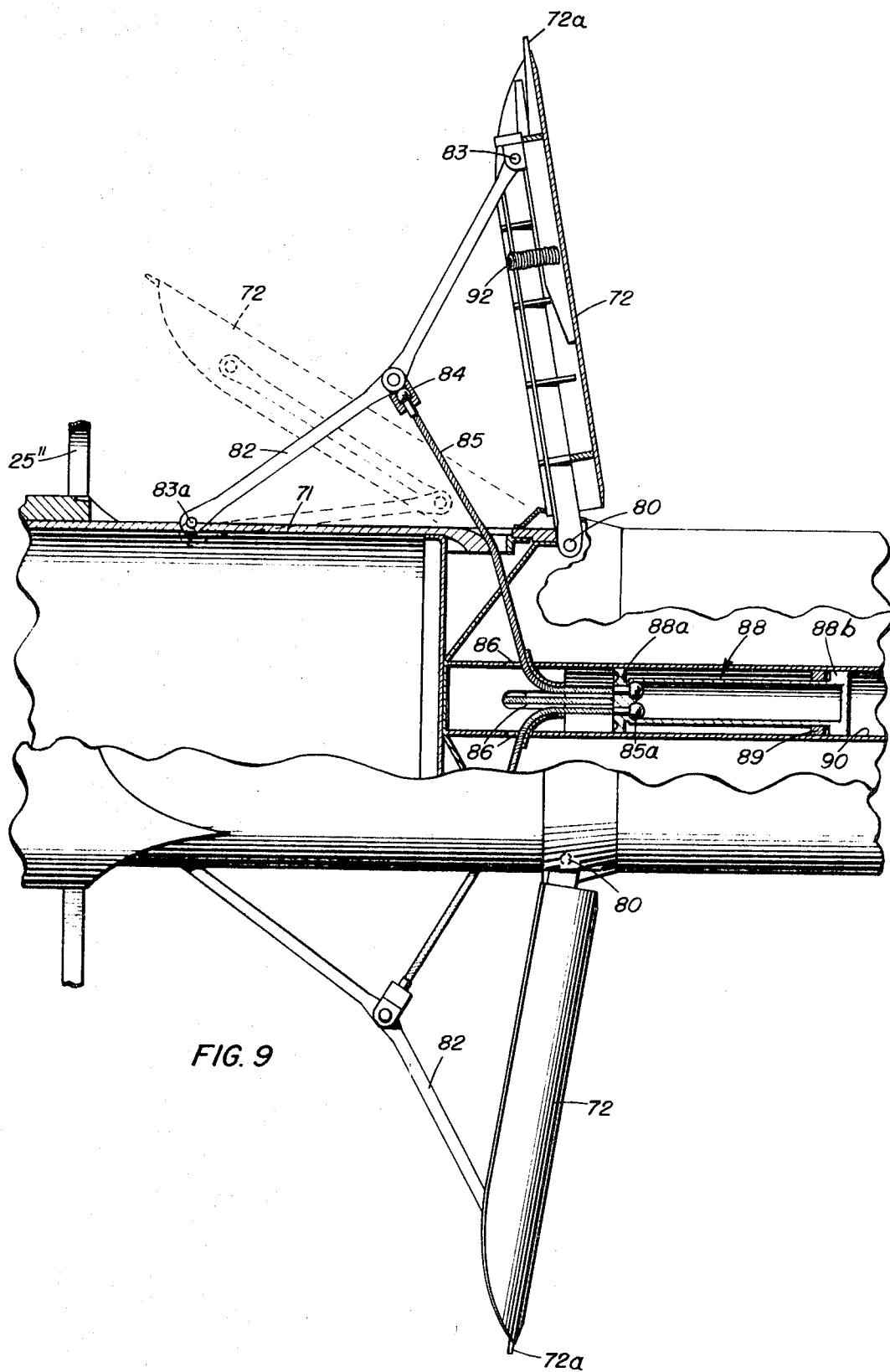


FIG. 9

## ANTISUBMARINE MISSILE

The present invention relates to a weapon system and more particularly to an antisubmarine weapons system utilizing substantially the same launching components as the Terrier-missile system.

The Antisubmarine Terrier, the name by which the present invention is known, is intended to complement the antisubmarine weapons presently in use and deliver a torpedo or depth charge at underwater targets to ranges representing a significant increase over presently known systems, the maximum range of a comparable system presently in use is approximately 10,000 yards. A modified nuclear warhead may also be carried by Antisubmarine Terrier described below.

An object of the present invention is the provision of a weapon system which is capable of launching torpedoes at underwater targets.

Another object of the invention is to provide a weapon system capable of launching depth charges at underwater targets.

A further object of the invention is the provision of an adapter which will adapt a torpedo to a missile launcher for launching.

Still another object is to provide an adapter which will reduce the velocity of the torpedo or depth charge prior to its entry into the water.

A further object of the present invention is to adapt presently available torpedoes and/or depth charges to the launcher system used by the Terrier-missile system.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a diagrammatic showing of the sequence of flight events for the torpedo and depth charge.

FIG. 2 is an elevation view illustrating the configuration of the torpedo unit with the braking mechanism closed.

FIG. 3 is an elevation of the torpedo unit having its drag brakes and clamshell open.

FIG. 4 is an elevation view illustrating a depth charge unit attached to its adapter.

FIG. 5 is an enlarged elevational view illustrating the clamshell portion of the adapter in its closed position.

FIG. 6 is a sectional view taken along the line 6-6 of FIG. 5.

FIG. 6A is an enlarged detail of a thrust lug engaging the weapon body.

FIG. 6B is a sectional view taken along the line 6-6 of FIG. 6A.

FIG. 7 is a sectional view taken substantially along the lines 7-7 of FIG. 5.

FIG. 8 is a sectional view taken substantially along the lines 8-8 of FIG. 5.

FIG. 9 is an enlarged elevational view illustrating the manner of operation of the drag brakes.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1, a missile 10 which is launched with the Terrier rocket booster 12 from a conventional Terrier launcher, not shown. Immediately after launch the missile booster assumes a ballistic path for the first few seconds of boost, at the end of which the missile 10 separates from the booster at a velocity of approximately 3,000 feet per second, the point of booster separation being indicated at point A in FIG. 1.

During the next 0.5 seconds, the missile roll-captures and flies according to a zero-g command. Within a few seconds thereafter, the missile starts to capture in the capture beam which has simultaneously started its program downward according to a modified shore bombardment program. When a predetermined value of differential range between missile and target is obtained, a command is sent to the missile to return to a zero-g command for 0.5 seconds in order to minimize

transients when the drag brakes are employed. At the conclusion of this period, the drag brakes are opened, the missile at this time being at an altitude of several thousand feet. Deceleration of the missile to a velocity less than 850 feet per second is accomplished at which time the missile 10 separates into an adapter 50 and an underwater weapon 15 or 20, as indicated at point B on FIG. 1.

As pointed out previously, this system is capable of delivering either a depth charge or a torpedo. If the underwater weapon is a depth charge 15, as indicated in FIG. 1, it proceeds into the water on a free fall course. If on the other hand it is a torpedo, such as the MK 44 or MK 46, it must be further decelerated to a velocity less than 200 feet per second at the time of water entry. As previously mentioned, this additional deceleration is accomplished by a parachute 29, as shown in FIG. 1, which is an existing part of the MK 44 and MK 46 torpedoes. Inasmuch as both the MK 44 and MK 46 are homing type torpedoes, once the torpedo enters the water, its homing system takes over to seek out and destroy its target.

It is to be noted that both the depth charge 15 and the torpedo 20 are equipped with frangible nose sections, 16 and 22 respectively. These nose sections are provided to reduce air drag and to reduce the shock of water impact. The nose caps, 16 and 22, are designed to break away on water impact at the speeds anticipated for water entry.

Referring now to FIG. 2, there is shown an underwater missile 10 which comprises a torpedo 20 at its forward end and an adapter 50 at its aft end. The missile 20 illustrated in FIG. 2 has not been mated with its booster 12 as shown in FIG. 1. The adapter 50 comprises a clamshell section 52 which is the portion of adapter 50 that fastens to the tail end of the underwater weapon whether it be a depth charge or a torpedo. In addition to the clamshell section 52, there is an aft section 70. The details of the adapter 50 will be more clearly set forth hereinafter.

FIG. 3 illustrates a torpedo 20 identical to that of FIG. 2, however, in FIG. 3 the clamshell 52, which comprises two halves, 53 and 54, is shown in the open position. Recesses 56 are provided in each half of clamshell 52 to accommodate the tail fins 24 of the torpedo 20. Immediately aft of the torpedo propeller 26 is the parachute package 28 which contains parachute 29. The inner surface of the forward end of each clamshell half is provided with a plurality of spaced thrust lugs 58. Lugs 58 are received by slots 27 in the skin of the weapon whether it be a depth charge 15 or a torpedo 20. When the clamshell halves 53 and 54 are in their closed position they are retained as such by means of a forward standard band clamp 25 which is explosively released at the proper time to permit opening of the clamshell halves 53 and 54 and to cause separation of the weapon from the adapter 50.

The aft section 70 of the adapter 50 is secured to the clamshell section 52 by means of an intermediate band clamp 25' as shown in FIG. 5. The band clamp 25' is identical to that used at the forward end of adapter 50 and it is released in the same manner previously set forth.

There is shown a plurality of drag brakes 72 which are shown in their extended position. There are four equally spaced drag brakes 72, each of which is pivotally attached to the aft section 70. The details of securing and releasing the drag brakes 72 will be explained below.

FIG. 4 illustrates the manner in which the adapter 50 is mated with a depth charge 15. It is to be noted that the means of assembly and release of the drag brakes 72 and the clamshell halves 53 and 54 is identical for either weapon. There is a slight difference in attaching the adapter 50 to the weapon, but this is merely due to a slight difference in the external configuration of the weapon and is not illustrated.

FIG. 5, which is an enlarged detail view of the clamshell section 52, illustrates the manner in which the weapon is attached to the adapter 50. Illustrated in FIG. 5 is a depth charge, the tail section of which is shown in broken lines. The forward end of the clamshell section 52 is tapered at 60 for streamlining purposes to reduce the drag to a minimum. Centrally located

on the outer portion of clamshell section 52 are four equally spaced fins 62. The purpose of fins 62 is to accommodate the fins 24 of the weapon and also to give stability to the missile 10 during flight. As pointed out above, the clamshell section 52 comprises two halves 53 and 54. Each half, 53 and 54, is attached to aft section 70 by means of a pin 74. After the clamshell halves 53 and 54 are closed, then the forward and after ends of the clamshell section 52 are secured to the weapon 15 and aft section 70, respectively, by means of clamp bands 25 and 25'. The sections are provided with interlocking lips which are mated prior to the securing of clamp bands 25 and 25'.

It is to be noted that the separation line of the clamshell halves 53 and 54 is not a straight line. From the pivot pin 74 forward it can readily be seen that the parting line 55 tapers down at a slight angle to the fin area and then continues for the remainder as a straight line. The reason for the parting line 55 being such, is to permit the opening of the halves 53 and 54 without any interference with the skin of the aft section 70 when the clamshell opens. With this particular design of the hinge, there is sufficient play in the rear area to permit opening of the clamshell without any difficulty.

There is also shown in FIG. 5, in the cutaway portion, a support or snubber 76. The purpose of the snubber 76 is to align and steady the depth charge 15 within the adapter 50. There are only two snubbers 76 shown, however there are actually four such snubbers used.

FIG. 6, which is a sectional view taken along the lines 6—6 of FIG. 5, serves to more clearly illustrate the manner in which the thrust lugs 58 engage the slots 27. Also shown, is the forward band clamp 25 which is fastened in place by means of the bolt 25a. The parting line 55 is shown, permitting the clamshell to be formed in halves, 53 and 54.

FIG. 6A is an enlarged detail of the lug 58 and its engagement with slot 27, as illustrated in FIG. 6. Also shown, are two setscrews 59 which are threaded into a bore 61. The setscrews 59 engage the base of slot 27 and are used primarily to prevent any rocking of the weapon with respect to the adapter portion 50.

FIG. 6B is an enlarged view taken along the line 6B—6B of FIG. 6A. This figure clearly illustrates the thrust lug 58 as it engages slot 27 in the depth charge 15. Numeral 25 represents the forward band clamp which holds the clamshell intact on the missile body until the missile begins its descent in flight.

FIG. 7, which is a sectional view taken along the lines 7—7 of FIG. 5, illustrates the relationship of the intermediate band clamp 25' and the other components. The band 25' is secured, by spot welding or other suitable means, to four channel-shaped clamping sections 25b which mates with the lip portions of the clamshell 52 and aft section 70. There is also shown a burster charge 57 having a pair of detonator leads 57a. The purpose of burster charge 57 is to burst the band clamp 25' and this permits the clamshell halves 53 and 54 to pivot at the proper time.

FIG. 8, is a sectional view taken through the fins 62 of the clamshell 52 and also the tail fins 24 of torpedo 15. This figure also clearly illustrates the manner in which the snubbers 76 support the tail section of the torpedo 15 within clamshell section 52.

FIG. 9, which is an enlarged view, illustrates the manner of operation of the drag brakes 72. Only two drag brakes 72 are shown to eliminate any possible confusion; however there are, in fact, four such drag brakes 72, spaced 90° apart about the skin of aft section 70. As illustrated, drag brakes 72 are shown in their fully opened position. When the drag brakes are in their closed position, the outer surface of brakes 72 is flush with the outer surface of aft section 70. An aft band 25'' engages tabs 72a, which are an extension of drag brakes 72. This band is secured and released in the same manner as the other bands 25 and 25' discussed previously.

Each brake 72 pivots about hinge 80 and its opening is controlled by a jackknife strut 82. Strut 82 is pivotally attached to the underside of drag brake 72 at pivot 83 and to the skin of

the aft section at pivot 83a. At the center of jackknife strut 82 there is a connector 84 which is connected to one end of restraining cable 85. The other end of cable 85 is fed into the interior of the body and through aperture 86, through apertures in the forward end 88a of piston 88, here the cable 85 terminates and is provided with an enlarged ball 85a to prevent its being pulled through forward end 88a. The rear end of piston 88 is provided with an enlarged portion 88b which is the same size as the inner diameter of tube 90 within which the piston 88 reciprocates as the drag brakes are opened or closed. Within tube 90 is stop member 89, the purpose of stop member 89 is to limit the forward travel of piston 88 and consequently the opening of drag brake 72 via cable 85.

There is also shown a spring 92 which is attached to the underside of the drag brake 72 and when the aft band 25'' is released, springs 92 (only one being shown) kick the drag brakes 72 outward into the airstream which then supplies the open force. To assure reasonable uniformity in the fully open position of drag brakes 72, the cable 85 acts as common restraint in conjunction with piston 88 and stop member 89.

For purposes of clarity and to give a better understanding of the instant invention a general description of its manner of operation is as follows:

The missile-booster combination is launched from a conventional missile launcher, a ballistic path being followed for the first several seconds of flight, at the end of which the booster separates from the missile upon command from the shipboard control system. The missile continues on course toward its target until a predetermined value of differential range between missile and target is obtained, a command is sent to the missile to return to a zero-g command for a short interval in order to minimize the transients when the drag brakes are employed. At the conclusion of this period, a command is sent whereby the burster charge 57 is ignited and the aft band clamp 25'' is broken. When the clamp 25'' is broken, the springs 92 which are mounted on the underside of drag brakes 72 force the brakes 72 outward a sufficient distance to permit the air to get under the brakes 72 and open them to their fully open position. The missile at this time being at an altitude of several thousand feet, and its range from the target being several thousand feet.

After the missile has been decelerated to a velocity of less than 850 feet per second, then a command signal is sent at which time the forward and intermediate clamps 25' are broken, permitting the clamshell to open and the underwater weapon to separate therefrom. If the underwater weapon is a depth charge, it proceeds into the water on a free fall course. If on the other hand it is a torpedo, it must be further decelerated to a velocity less than 200 feet per second at water entry. As previously mentioned, this additional deceleration is accomplished by a parachute which is an existing part of the particular torpedo employed. If the weapon is a torpedo, upon water entry, the homing device of the torpedo takes over and guides the torpedo on its proper course to its target.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In an underwater missile that is launched from a conventional missile launcher with a conventional booster and underwater weapon attached thereto, wherein this improvement comprises an adaptor for said underwater weapon comprising the combination of:

a clamshell section provided with external fins and having forward attachment means for attachment to said underwater weapon, said external fins providing stability to the weapon during flight;

said clamshell section being formed in two halves, each half of said section being adapted to receive one-half of the tail section of the weapon employed;

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an aft section provided with additional external fins and having coupling means for connecting said aft section to said clamshell section, deceleration means and retaining means for said deceleration means, said additional external fins providing additional control and stability to said weapon during both the powered and the deceleration phases of the flight,

said deceleration means comprises a plurality of drag brakes attached to said aft section and kept in a closed position by said retaining means, releasing means for releasing said retaining means and restraining means for limiting the rate and extent of opening of said drag brakes upon the operation of said releasing means;

said clamshell section having separation means for separating the underwater weapon from said adaptor after said deceleration means have reduced the velocity of both the adaptor and the weapon to a predetermined value, whereby said weapon falls freely into the water in search of a target.

2. In a device of the character described in claim 1 wherein said restraining means for limiting the rate and extent of open-

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ing of said drag brakes comprises a jackknife strut pivotally attached at one end to the underside of said drag brake;

the other end of said jackknife strut being pivotally attached to said aft section;

5 cable means securely attached at one end to the center of said jackknife strut;

the other end of said cable means attached to a piston operably mounted within said aft section whereby said piston and cable means serves to limit the extent and rate of opening of said drag brakes and also insure that said drag brakes are opened uniformly.

3. In a device of the character described in claim 2 wherein said separation means comprises explosive burster charges which are mounted in said forward attachment means and said coupling means;

said explosive charges upon ignition breaking said forward attachment means and said coupling means thus permitting said clamshell halves to open and permitting said underwater weapon to separate from said adaptor and freely falling into the water.

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