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Schillreff

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[54] **DECOY ROUNDS FOR COUNTER MEASURES SYSTEM**

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Related U.S. Application Data

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[52] **U.S. Cl.** ..... **102/37.6,** 102/37.8, 343/18 E

[51] **Int. Cl.** **H04k 3/00**

[58] **Field of Search** 102/34.4, 37.6, 49, 63; 340/5; 343/18

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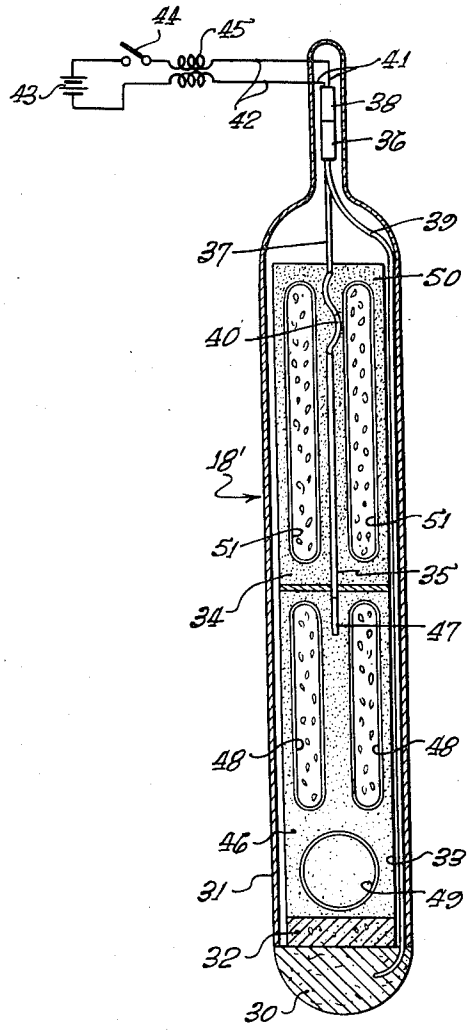
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Primary Examiner—Robert F. Stahl

[57] **ABSTRACT**

This disclosure relates to decoy rounds for launching from launcher systems which may be installed aboard a ship or the like, or which may be of a portable type. The decoy rounds provide a protective cover for craft such as war ships, against homing devices operating upon infrared or microwave-reflected energy or against craft utilizing sound navigation and ranging systems. The decoy rounds contain one or more bundles of either RF chaff, infrared energy creating pellets, or bubble creating pellets, or any combination thereof, and are provided with a launch charge and a dispersion charge for each of the bundles of decoy material therein.

10 Claims, 5 Drawing Figures



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SHEET 1 OF 3

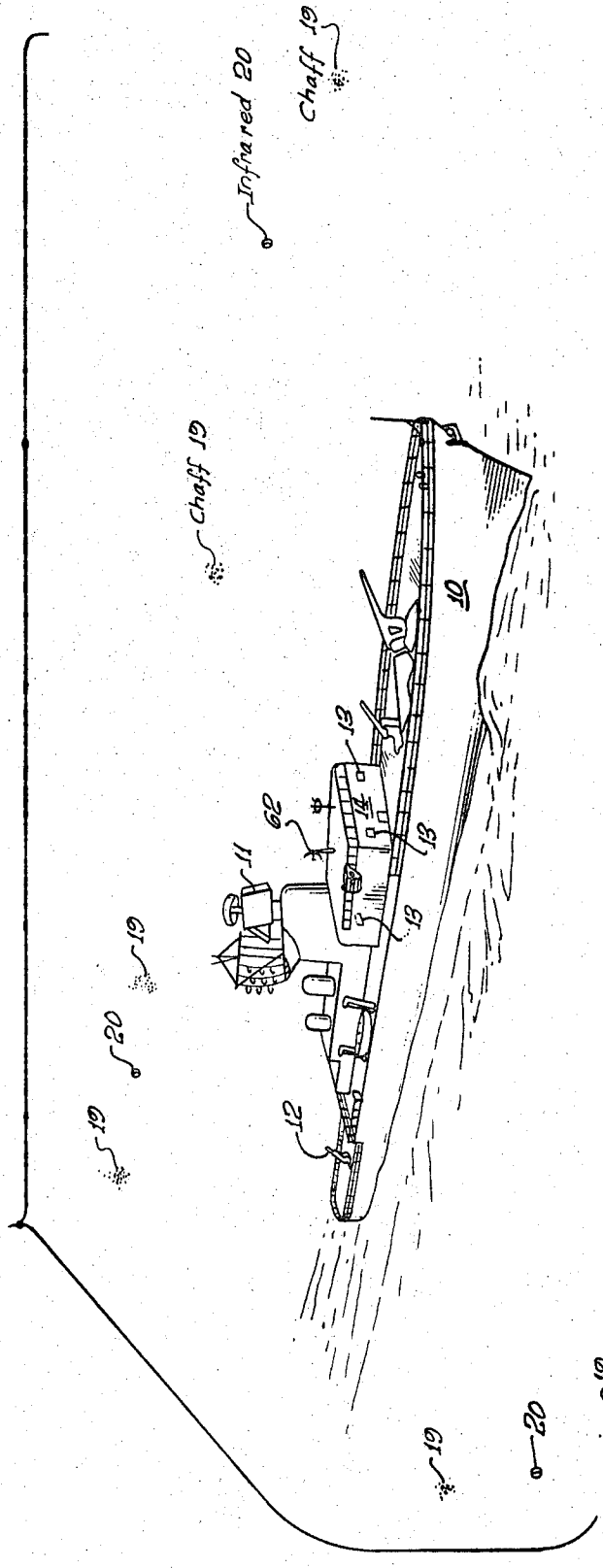


FIG. 1.

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FIG. 2.

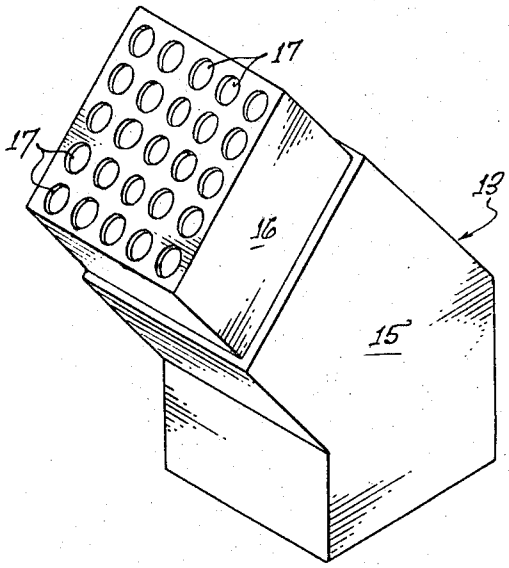


FIG. 4.

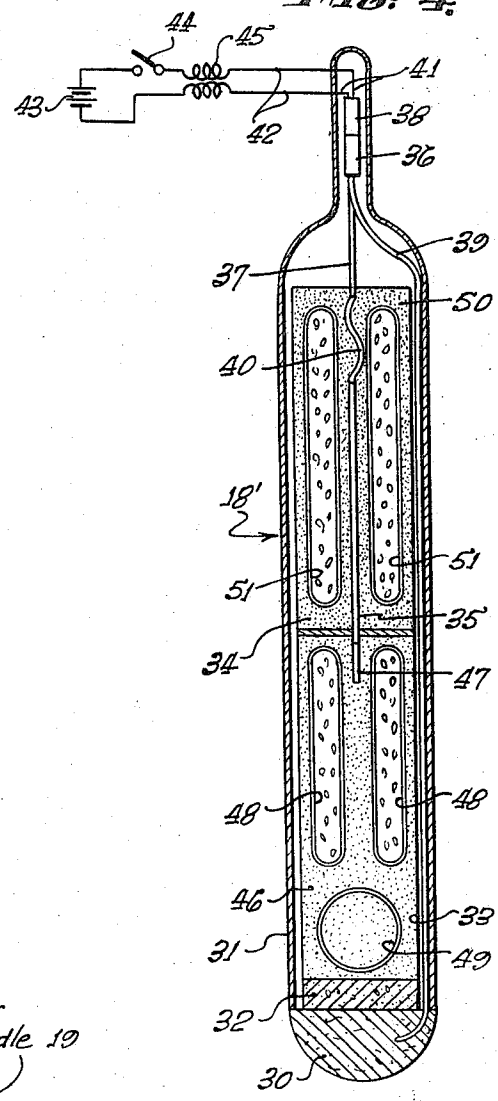
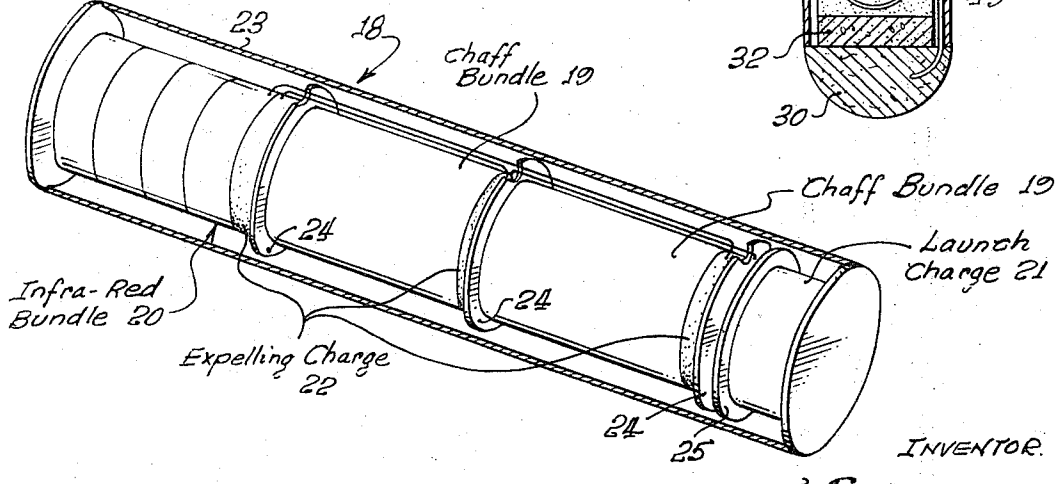


FIG. 3.



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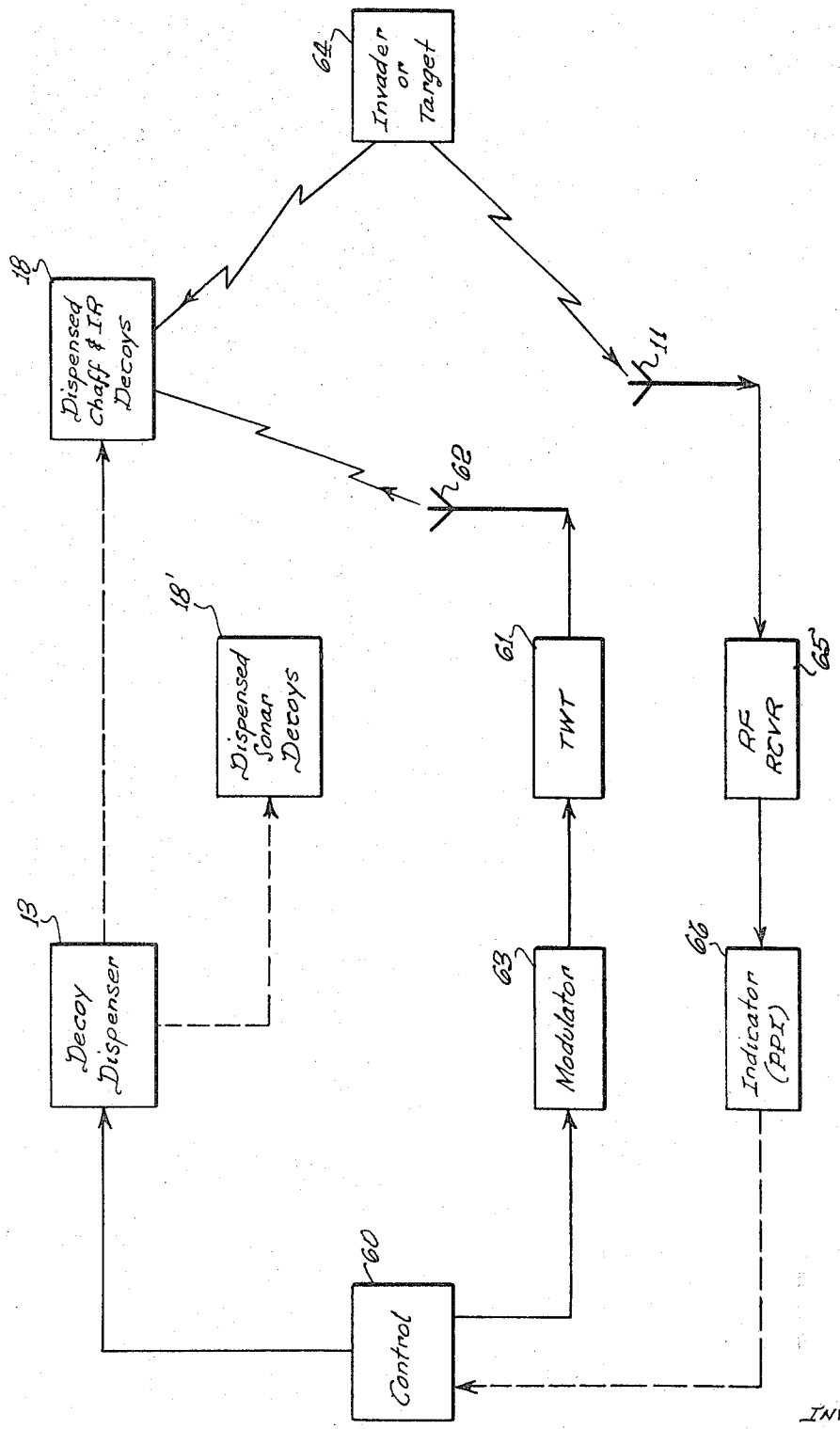


FIG. 5.

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DECOY ROUNDS FOR COUNTER MEASURES SYSTEM

This application is a divisional application of U.S. Pat. application Ser. No. 389,525, filed Aug. 12, 1964, and assigned to the same assignee.

This invention relates to countermeasures systems, and more particularly to a system for providing a protective cover for war ships against homing and/or fire control devices operating upon infrared or microwave-reflected energy.

It is well known that many missiles are capable of homing on objects which emit infrared or microwave-reflected energy. If there is more than one energy radiating object within the homing cone of the missile, the point it will target on will depend on the intensity, distance to, and distribution of the several energy sources. This invention is directed to a system for dispensing infrared and/or microwave-reflected energy by firing a projectile or a plurality thereof from ships or the like which carries the energy sources and dispenses the same at a predetermined point in time or position along its trajectory or path of travel whereby these additional energy sources confuse the sensor system of the incoming missile and divert it from its intended target.

Therefore, it is an object of this invention to provide a countermeasure system.

Another object of the invention is to provide a countermeasure system for providing a protection cover for craft against homing and/or fire control devices operating upon infrared or microwave-reflected energy.

Another object of the invention is to provide a countermeasure system including means for dispensing infrared and/or microwave-reflected energy sources for confusing the homing devices.

These and other objects of the invention will become readily apparent from the following description and accompanying drawings wherein:

FIG. 1 is a perspective view of a craft utilizing the invention;

FIG. 2 is a perspective view of the decoy launcher of the invention;

FIG. 3 is a view partially in cross-section of a decoy round of the invention;

FIG. 4 is a view partially in cross-section of decoy round for sonar applications; and

FIG. 5 is a block diagram illustrating the invention.

This invention broadly relates to a system for providing a protective cover for craft such as war ships against homing devices operating upon infrared on microwave-reflected energy. Specifically, the warship is provided with decoy launchers which fire a round containing chaff and infrared pellets into the area surrounding the vessel, the chaff being of three bands *x*, *s*, and *c* and being adapted to form an artificial cloud which can be intermittently illuminated by shipboard radar. The cover devices are operated from a countermeasure control console.

Referring now to the drawings, FIG. 1 shows a warship **10** incorporating a fast reaction fighting system (FRFS) which includes sensors, computers, launchers, and missiles for effectively conducting anti-air and anti-surface ship combat. A modern volume scanning radar indicated generally at **11** is employed as the primary input. Target information from the primary radar **11** is processed for display by a digital computer (not shown). Target tracks and predicted tracks as generated in the digital computer are used to analyze the battle situation. In addition to providing the information for data displays, the same track predictions from the digital computer are used to provide information for aiming target illuminators, for aiming a missile launcher **12**, and for generating prelaunch instructions for the missile which may be of the Tartar guided missile class.

To maintain the fighting ability of the FRFS in a heavy countermeasures environment, a countermeasures/counter-countermeasures control center is included. All enemy countermeasures (ECM) information is collected and displayed at this control display console. The operator then has the option of selecting the optimum counter-countermeasures (CCM) mode for the equipment being jammed, or alternately, to establish countermeasures of his own to confuse the enemy or to cause the enemy to withdraw his countermeasure pressure.

An aggressive and resourceful enemy will present a countermeasure (CM) situation to the FRFS which varies from engagement to engagement over the full range of his technological capability. Any CM scheme he uses which fails will be rapidly supplanted by one which is different and therefore has a greater chance for success.

The CM/CCM portion of the FRFS is designed to allow a flexible reaction to changing enemy tactics and strategies. Information concerning the enemy's jamming and the general tactical situation is fed to a central point. Analysis of this information allows a rapid determination of the best strategy. A combination of multiple receivers, decoys, and RF jamming transmitters allows facilitation of the selected strategy.

The CM portion of the system is designed to deceive, confuse, and/or deny information to the enemy. The CCM portion of the system is designed to gain information the enemy is trying to conceal.

The CM operator has the option of trying to deceive, confuse or deny information to the enemy by the use of the following techniques:

1. Deception
   a. Chaff and infrared decoys can be launched.
   b. The decoys can be enhanced by RF illuminators.
   c. Multiple target response can be transmitter-generated.
2. Confusion
   a. Conical scan inversion responses can be transmitted.
   b. Range gate-stealing or track-breaking modulated RF can be transmitted.
   c. With consort ship cooperation, blinking of jammers of each type can be produced.
3. Denial
   a. Selective, programmed or responsive barrage jamming can be provided.
   b. Spot, multi-spot or enhanced multi-spot jamming can be provided.
   c. Smoke generators for visual denial are available.
   d. Many chaff decoys can be launched toward the enemy to screen and prevent radar penetration.

e. Directional antennas can be employed on the intership link (aimed by track information from central computer).

The CCM operator has a number of ways to gain information the enemy is trying to conceal. These methods can be grouped into those based on frequency diversity, geometry, burn-through, or the use of home-on-jamming.

1. Diversity
   a. Radar receivers
   b. Stabilized optical sight
2. Geometry
   a. Directional antennas of known pattern on each radar receiver.
   b. Two servo-driven parabolic dish antennas (port and starboard).
   c. Angular information on jammers from consort ship allowing triangulation.
3. Burn-through
   a. Long pulse burn-through mode on primary 3D radar.
   b. Can use maximum power (flight time duty factor) from single illuminator.
4. Home-on-Jam
   a. The Tartar missile's "Home-on-Jam" mode will allow destruction of X-band jamming targets within range.

This invention is directed primarily to the countermeasure (CM) system of the fast reaction fighting system (FRFS) and specifically to the deception techniques utilizing infrared and RF chaff decoys which can be enhanced by RF illuminators. Ship **10** is provided with a plurality of multicell mortar type decoy dispensers or launchers **13** (shown in detail in FIG. **2**). As shown in FIG. **1**, dispensers or launchers **13** are mounted starboard and port in the forward end of main superstructure **14** and on the outboard thereof (only the starboard outboard launcher being shown). Launchers **13** may also be positioned in the aft portion of ship **10**. Each launcher is operatively connected into the firing circuit connectors and the intervalometer (not shown). Data as to number of rounds fired is automatically displayed on the CM control console launcher status panel (not shown). Fail safe and automatic protection for the magazine handling crew is provided.

Launcher or dispenser **13**, as shown in FIG. **2**, comprises a mounting base **15** and a disposable launcher portion **16**, portion **16** being provided with a plurality of mortar-like cells **17**. Each of cells **17** is adapted to fire decoy rounds **18** shown and described with respect to FIG. **3**.

As shown in FIG. **3**, decoy rounds **18** are combination chaff and infrared rounds, the chaff being radiant energy-reflecting metallic particles such as aluminum, for example, which are quickly and widely scattered so that an effective radar target is promptly obtained. Rounds **18** are self-contained mortar-type projectiles. Each round **18** carries two (**2**) C-, S-, and X-band chaff bundles **19**, a bundle of infrared (sodium or potassium pellets) candles **20**, a launch charge **21**, three (**3**) expelling charges **22** for bundles **19** and **20**, and necessary wiring all contained within a casing **23**. A separator plate **24** is positioned between an expelling charge **22** and the adjacent decoy bundle; while a plate **25** separates the launch charge **21** from the wiring connections adjacent the aft separator plate **24**. The decoy rounds **18** are electrically fired by the CM controller as individual rounds, in intervalometer timed automatic sequences, or as massive simultaneous launches where all fore, aft, port and starboard rounds are fired simultaneously. Each round is automatically fused at launch to fire the chaff and infrared bundles **19** and **20** at or near the apogee of the flight path or at a preset altitude. The individual expelling or powder charges between each bundle are fired to separate and deploy the payload. Each decoy round **18** produces a radar and infrared target similar to the launching ship **10**.

As shown in FIG. **1**, decoy rounds **18** having been fired from launchers **13** of ship **10** disintegrate by the explosion of charges **22** and disperse the chaff **19** and infrared candles **20** at a predetermined distance from the ship where the chaff spreads due to the air currents, and creates microwave or infrared-sensing targets thereby providing a deceptive countermeasure system against an impending attack.

Referring now to FIG. **4**, an embodiment of a decoy round **18'** is provided for applications above and beneath the water. The round **18'** comprises a propellant charge **30** attached to a decoy cartridge casing **31**. Casing **31** contains ballast material **32**, a sub-surface load chamber **33**, an above-surface load chamber **34**, a delay fuse **35** interconnecting chambers **33** and **34**, a fuze initiator **36**, a delay fuze **37** interconnecting initiator **36** and chamber **34**, an electric squib **38** operatively connected with initiator **36**, a fuze **39** interconnecting propellant charge **30** with initiator **36**, a fuze **40** interconnecting delay fuzes **35** and **37**, and electric wiring **41** connected to squib **38**. Wiring **41** is removably connected to electrical leads **42** which extend into casing **31** and which are connected with a battery **43** through a switch **44** and electronic apparatus **45**. Sub-surface load chamber **33** includes a dispensing explosive charge **46** which is adapted to be fired by a fuze **47** connected with delay fuze **35**, a pair of lithium hydroxide capsule containers **48**, and a lithium powder container **49**. The above-surface load chamber **34** includes a dispensing explosive charge **50** which is adapted to be fired by fuze **40**, and a pair of lithium hydroxide capsule containers **51**.

In operation, closing of switch **44** directs electrical energy from battery **43** through leads **42** and wires **41** to the electric squib **38** which activates fuze initiator **36** which ignites fuze **39** and delay fuze **37**. Ignition of fuze **39** fires the propellant charge **30** which propells the round **18'** from launcher or dispenser **13** into a predetermined trajectory. At a certain point in the trajectory of the round, delay fuze **37** ignites fuze **40** which in turn ignites the dispensing explosive charge **50** which disintegrates containers **51** and dispenses the lithium hydroxide capsules above the surface of the water. Ignition of fuze **40** also ignites delay fuze **35**. The remainder of the round, namely, chamber **33** and ballast **32** enters the water while delay fuze **35** is burning. At a predetermined time after the chamber **33** enters the water delay fuze **35** ignites fuze **47** which in turn ignites the dispensing explosive charge **46** which disintegrates containers **48** and **49** and dispenses the lithium hydroxide capsules and the lithium powder under the surface of the water, thus generating bubbles in the water for sonar deception.

The control system of the invention as shown in FIG. **5** comprises a control center or console **60** which controls the operation of decoy dispenser or launcher **13**

which, when activated, fires decoys **18** and/or **18'** as described above. The radio frequency (RF) chaff **19** (see FIG. **1**) dispensed by decoy round **18** can be intermittently illuminated by a shipboard traveling-wave tube broad band coherent receiver/transmitter (TWT) **61** having an antenna **62** mounted on superstructure **14** of ship **10.** The RF energy being transmitted by the TWT **61** and antenna **62** corresponds discretely in frequency and phase with that being received from enemy radars, as presently described. The effect will be equivalent to multiple-blinking coherent jammers which will provide a curtain of confusion in front or surrounding the ship. The transmitted RF energy to the TWT **61** is modulated by modulator **63.** Signals from an invader or target **64** are received by primary radar **11,** processed through an RF receiver **65** to a plan position indicator (PPI) **66,** whereby a visual indication of the invader **64** is observed at the control center or console **60.**

In operation, when a signal of an approaching invader or target **64** is received by the primary radar **11,** it is processed through RF receiver **65** to the plan position indicator **66** of control console **60.** The controller or operator at the console **60** determines the type of countermeasures necessary and if the deceptive technique is to be utilized the controller activates the dispenser or launcher **13** to fire decoy rounds **18** and/or **18'** as individual rounds in automatic sequence, or all fore, aft, port and starboard rounds fired simultaneously, or any combination thereof. Firing of decoys **18,** for example, dispenses RF chaff bundles **19** and infrared bundles **20** (see FIG. **3**) as shown in FIG. **1** which spread out due to wind currents, etc. On command from control console **60,** the RF chaff **19** can be intermittently illuminated by the TWT **61** through antenna **62** at an energy level which corresponds discretely in frequency and phase with the signal received from invader or target **64.** Thus as the plurality of dispersed RF chaff bundles **19** are illuminated the enemy sensor picks up blips from each illuminated bundle thereby confusing the homing system and diverting the invader from its initial course and proposed target. The infrared decoy bundles **20** similarly function to confuse an approaching invader utilizing a homing system sensitive to infrared energy.

While the invention has been described with respect to a ship incorporating the fast reaction fighting system, it may be utilized on any type of ship or the launcher and rounds may be of the "portable" type and thus utilized in a variety of applications. Also, the FIG. **4** embodiment may be of the same general configuration as the FIG. **3** embodiment. In addition, the rounds may contain only infrared, sonar, or microwave-reflecting decoys or any combination thereof.

It has thus been shown that this invention provides an effective and yet relatively simple and inexpensive countermeasure system for providing a protective cover for craft, such as war ships, against homing devices operating upon infrared or microwave-reflected energy. While the invention has been illustrated and described with respect to a war ship, it can be effectively used for any land, sea or air vehicle requiring protection from homing devices operating on infrared or microwave-reflected energy.

While particular embodiments have been illustrated and described, modifications thereof will 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 the invention.

What I claim is:

1. A decoy round adapted to be fired from a launcher comprising: a launch charge, a plurality of RF chaff bundles, a bundle containing material capable of creating infrared energy, and a plurality of explosive charges for individually dispersing said bundles.

2. The decoy round defined in claim **1,** wherein said launch charge, said plurality of RF chaff bundles, said bundle containing material capable of creating infrared energy, and said plurality of explosive charges are positioned longitudinally within a housing, said plurality of explosive charges being separated from one another by one of said bundles.

3. A decoy round for sonar confusion comprising: means for launching said round, means for dispensing a portion of said round above surface of the water, means for sinking the remainder of said round beneath the water surface, and means for dispensing the remainder of said round beneath the water surface, said round including means capable of creating a sonar signal reflector.

4. The decoy round defined in claim **3,** wherein said means for launching said round includes a propellant charge and a fuze means for igniting said charge; wherein said round dispensing means includes a pair of explosive charges and fuze means, said last mentioned fuze means includes a pair of delay fuzes and a pair of fuzes for igniting said pair of explosive charges, one of said delay fuzes interconnecting said explosive charge igniting fuzes, the other of said delay fuzes and said propellant charge igniting fuze means being operatively connected such that each are activated substantially simultaneously.

5. The decoy round defined in claim **3,** wherein said material in each of said portions of said round includes at least an amount of lithium hydroxide, whereby contact of said lithium hydroxide with water generates bubbles.

6. The decoy round defined in claim **3,** wherein said material in at least said portion of said round dispensed under water includes at least lithium powder.

7. A decoy round adapted to be fired from a launcher comprising: a launch charge, means for igniting said launch charge, dispersible decoy material, explosive material for dispersing said decoy material, fuse means for igniting said explosive material, and means for substantially simultaneously actuating said launch charge igniting means and said explosive material igniting fuse means.

8. The decoy round defined in claim **7,** wherein said dispersible decoy material includes at least one bundle containing RF chaff.

9. The decoy round defined in claim **7,** wherein said dispersible decoy material includes at least one bundle containing material capable of creating infrared energy.

10. The decoy round defined in claim **7,** wherein said dispersible decoy material includes at least one bundle containing means capable of creating a sonar signal reflector.

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