April 14, 1964 W. H. MAIRS ETAL 3,128,671

DYNAMIC MISSILE SIMULATOR

Filed Dec. 31, 1962 6 Sheets-Sheet 1

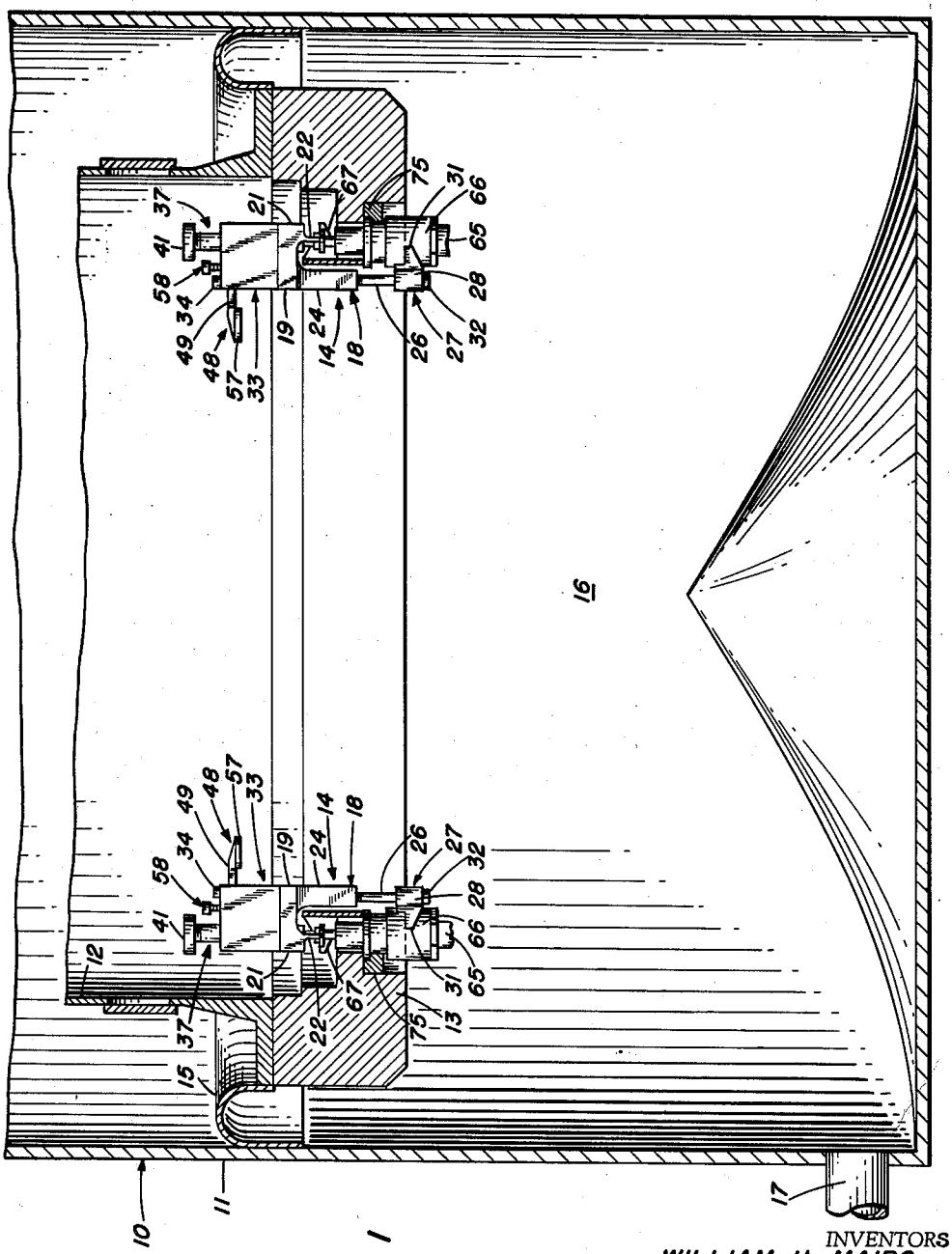


FIG. 1

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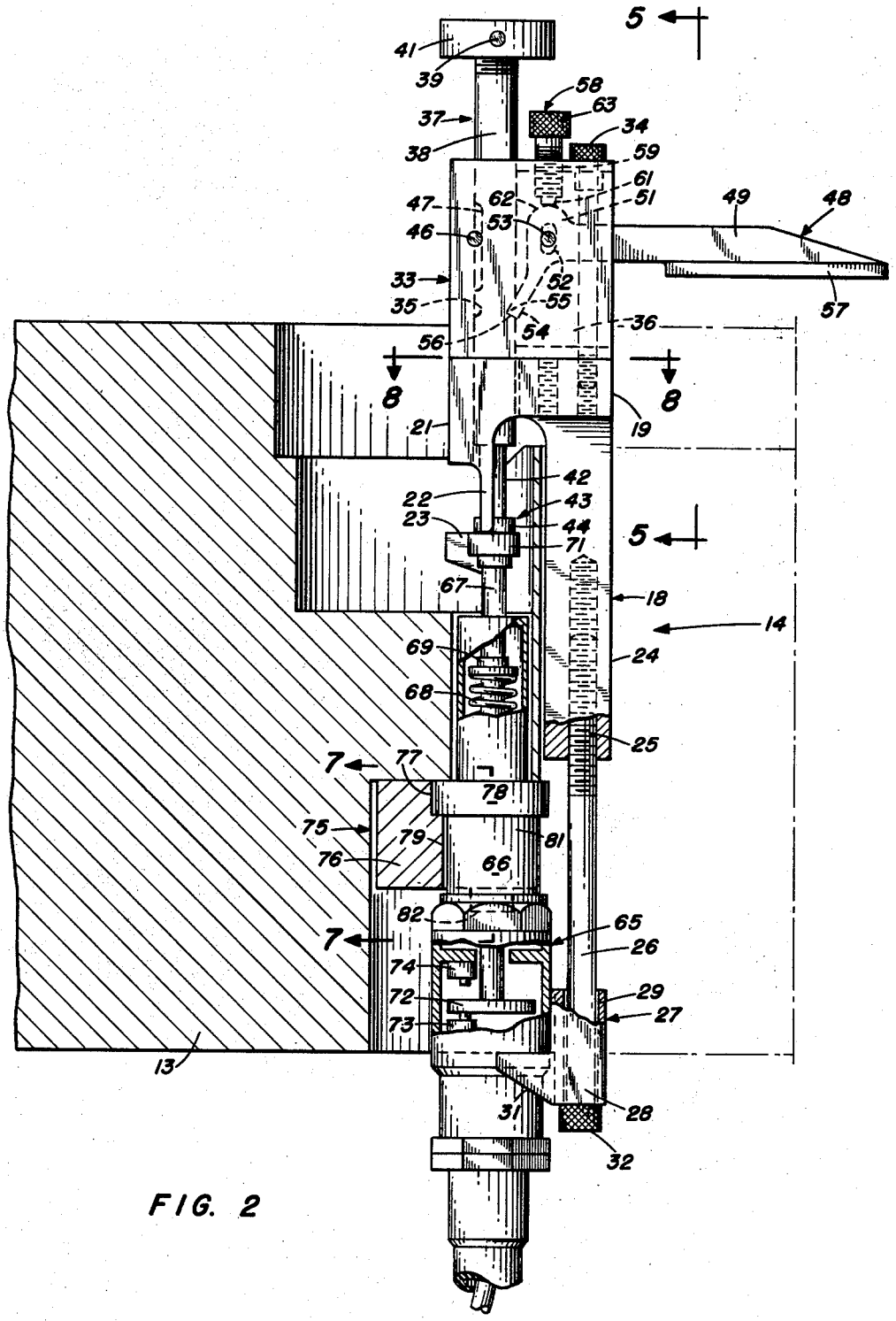


FIG. 2

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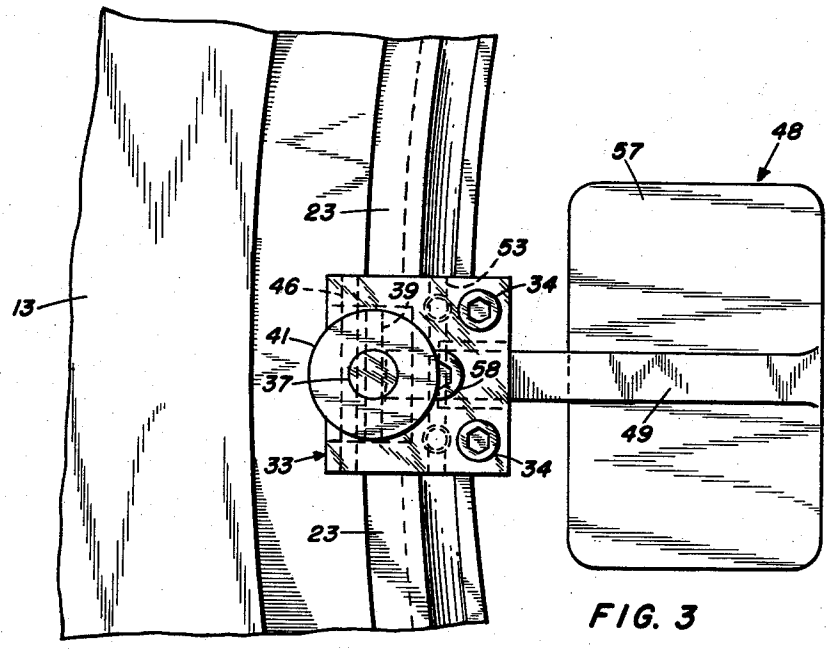


FIG. 3

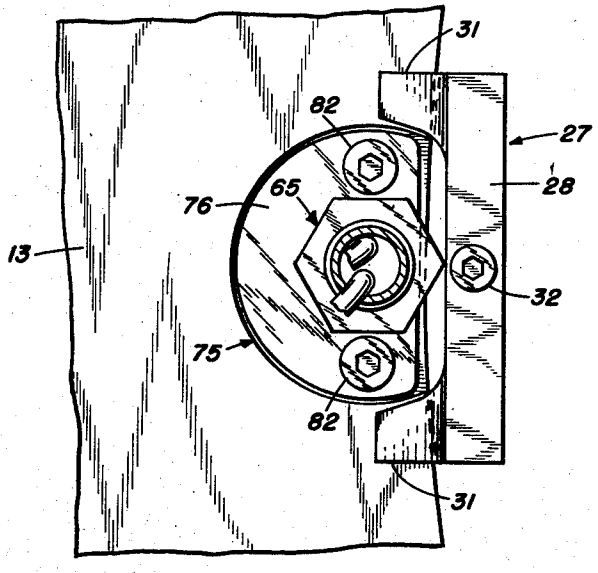


FIG. 4

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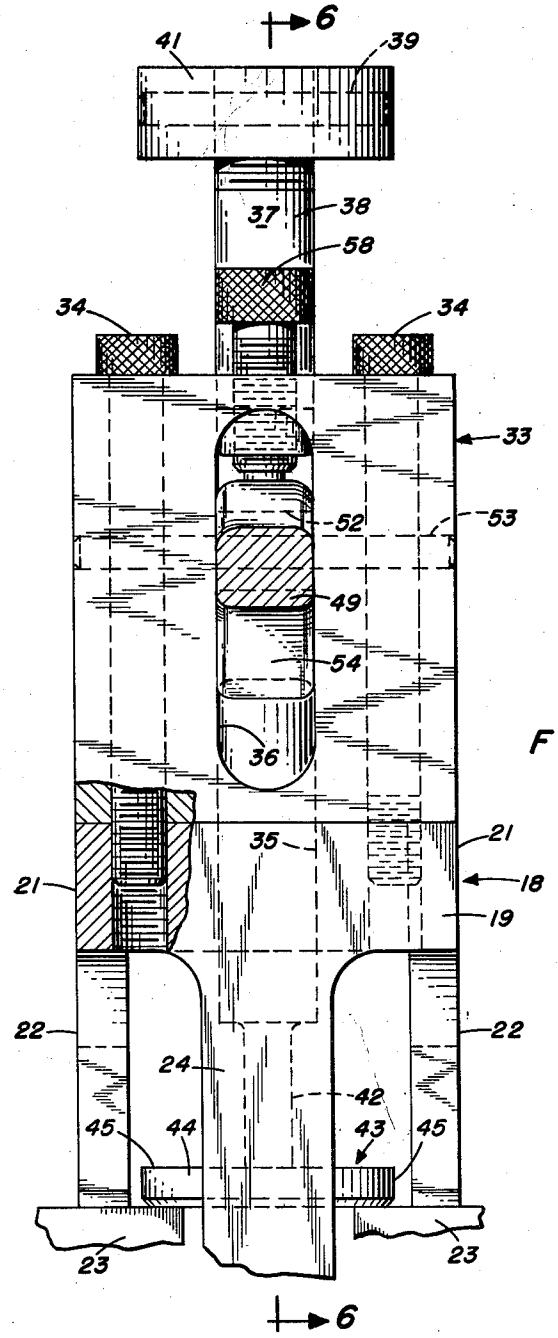


FIG. 5

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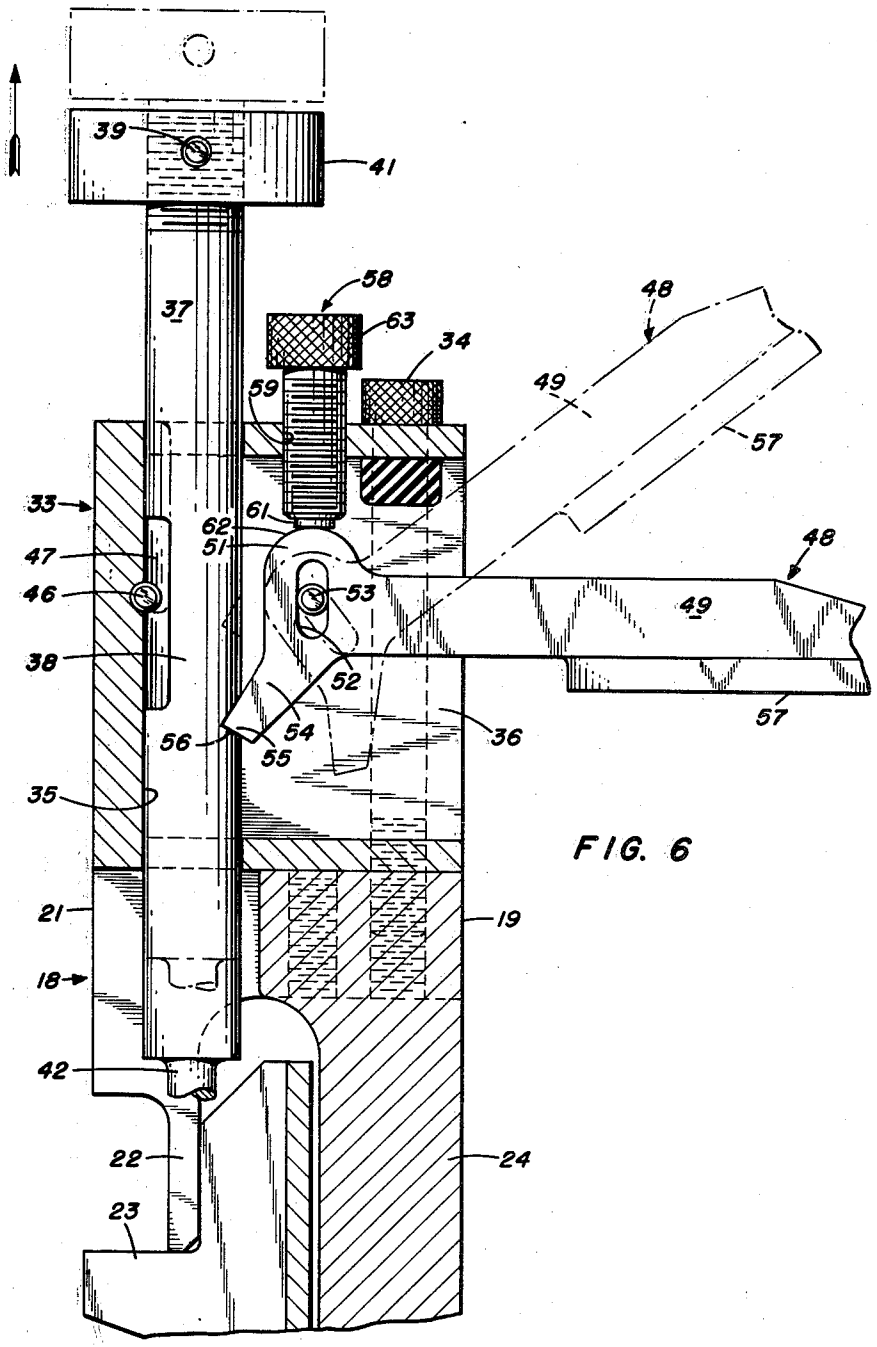


FIG. 6

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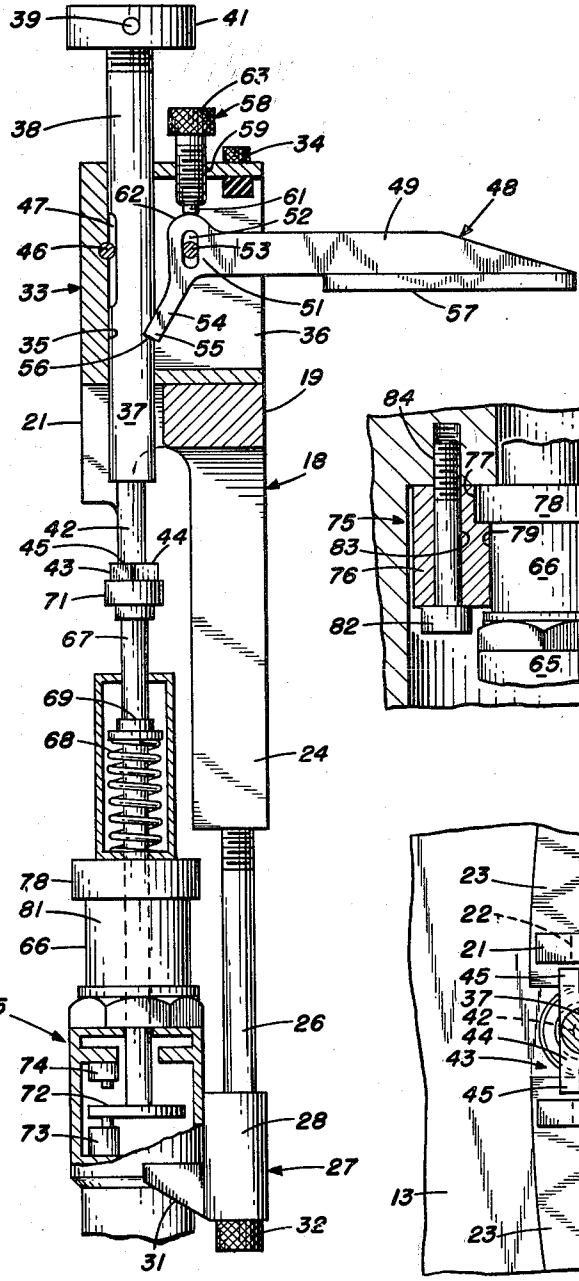


FIG. 9

FIG. 7

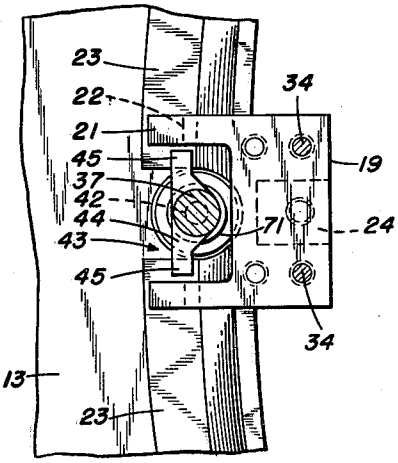


FIG. 8

United States Patent Office 3,128,671
Patented Apr. 14, 1964

3,128,671

DYNAMIC MISSILE SIMULATOR

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Filed Dec. 31, 1962, Ser. No. 248,821
16 Claims. (Cl. 89—1.7)

This invention relates to a simulator and more particularly to a missile simulator suitable for use with a missile launcher tube structure such, for example, as the type used for underwater missile launching.

The control of post-launching function in prior missile system launchers is based upon two identical missile-in-plate indicating switches. In such an arrangement missile launching is prevented if the switches are not in an open condition and similarly the events after launching are not started unless the switches move to a closed condition. Test launching simulations to exercise the equipment require a way of providing the pre-launch indication of a missile-in-place when the launcher tube is in fact in an empty condition and then after exercise of the eject energy system without a missile or partial missile being launched the switches must indicate the apparent motion of the non-existent missile.

In accordance with the present invention a new and improved missile simulator has been devised which performs both of the two essential indications such, for example, as "missile-in-place" and "missile-away." Briefly, the device comprises a combination lever and brake, a slidable shaft which can be depressed to hold the switch in an open condition against its spring and a pressure actuated vane which is disposed in the path of travel of the missile eject energy gas of the system. The vane is sized to be the proper weight to act on one end of the lever to cause the opposite end to lock and maintain the depressed shaft against upward or release movement by the force of the switch spring. The size of the vane is also sufficient to be responsive to the launcher eject energy gas to actuate the lever and release the brake or lock from the shaft, whereupon the switch is moved from "missile-in-place" position to a "missile-away" position by the aforesaid switch spring.

An object of the invention is to provide a new and improved missile simulator suitable for use with a missile launcher system.

Another object of the invention is to provide a device for producing a "missile-in-place" signal and a "missile-away" signal.

Still another object of the invention is to provide a missile simulator wherein a normally locked means maintains a switch in position to produce a "missile-away" signal.

Another object of the invention is to provide a missile simulator having a pressure actuated device for relasing a normally locked switch actuator.

A still further object of the invention is to provide a device having a pressure actuated means for producing a "missile-in-place" signal and a "missile-away" signal when a missile launcher tube is in an empty condition.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings wherein:

FIG. 1 is a fragmentary sectional view of a conventional missile launcher tube illustrating a pair of missile simulators constructed in accordance with the present invention attached thereto, the simulators being shown in elevation;

FIG. 2 is an enlarged elevational view of one of the simulators of FIG. 1 and a fragmentary portion of the conventional missile supporting ring;

FIG. 3 is an enlarged top plane view of the simulator of FIG. 2;

FIG. 4 is an enlarged bottom plane view of the simulator of FIG. 2;

FIG. 5 is an enlarged sectional view taken substantially on the line 5—5 of FIG. 2;

FIG. 6 is a sectional view taken substantially on the line 6—6 of FIG. 5;

FIG. 7 is a sectional view taken substantially on the line 7—7 of FIG. 2;

FIG. 8 is a sectional view taken substantially on the line 8—8 of FIG. 4; and

FIG. 9 is a schematic view of the simulator and one form of switching arrangement suitable for use in connection therewith.

Referring now to the drawings and more particularly to FIG. 1 thereof, the numeral 10 generally indicates a conventional missile launcher structure such, for example, as the type employed in the submarines and comprises an outer tube 11 and an inner launcher tube 12, the tubes being supported in the usual manner. The launcher tube 12 carries a missile support ring 13 upon which the simulator, indicated generally by the numeral 14 is mounted, the structure and mounting of the simulator will be more fully described as the description proceeds. The launching structure further includes a sealing element 15 disposed between the inner and outer tube and secured thereto in any conventional manner, whereupon a sealed chamber 16 is provided beneath the launcher tube 12, the chamber being in communication with a suitable air supply source (not shown) by a conduit 17.

For a more complete understanding of the simulator 14 and the manner in which the device is attached to the missile supporting ring 13, attention is directed to FIGS. 2, 3, and 4. The simulator comprises a bracket indicated generally by the reference character 18 having a base or platform 19 at one end thereof terminating in a pair of mutually spaced arms 21, each arm being provided with a downwardly extending leg 22, as best shown in FIG. 5. The legs are each disposed within the ring 13 with each leg in abutting engagement with a shoulder or stop 23 formed on the ring 13, FIGS. 2 and 8. The base 19 of the bracket 18 is further provided with a centrally disposed downwardly extending member 24 having a threaded bore 25 formed therein, in threaded engagement with an adjusting screw 26.

A clamping element 27 comprising an elongated body 28 is slidably mounted on the adjusting screw 26 by reason of a bore 29 extending therethrough, the body 28 being provided at each terminal end thereof with a clamping or gripping lug 31 in engagement with bottom surface or face of the ring 13, FIGS. 2 and 4. It will be apparent from the aforesaid structure that upon rotation of the adjusting screw by the knurled head 32 the simulator will be securely clamped to the ring 13.

A housing indicated by the reference character 33 is secured to the base 19 of bracket 18, as by means of screws or the like 34, FIGS. 2, 5 and 8. The housing is substantially square in shape. It is provided with a bore 35 extending therethrough and a slot 36 formed therein, FIGS. 5 and 6. Slidably mounted in the bore 35 is a plunger 37 comprising a shaft 38 having secured to one end thereof, as by a pin or the like 39, a knob or grip 41. The other end of the shaft 38 is reduced in diameter as at 42, FIGS. 5 and 6, and has secured thereto in any conventional manner a head or member 43 which includes a body 44 having oppositely disposed arms or lugs 45 in engagement with the stops 23 on ring 13 when the device is in a "missile-in-place" condition,

FIG. 8. In order to maintain proper alignment of the lugs 45 on the head 43 and to prevent rotation of the shaft 38 of plunger 37, a pin 46 carried by the housing and extending therethrough engages in a slot 47 formed in the shaft 38, FIG. 6.

A pressure or blast responsive device indicated generally by the reference character 48 comprises an arm 49 which is enlarged as at 51 and provided with a slot 52 therein for receiving a pin 53 carried by the housing 33. The pin 53 functions to pivotally mount the device 48 thereon; the lever arm 49 operating in slot 36 of the housing 33. The lever arm 49 is provided at one end with a downwardly inclined dog or detent 54, the end 55 thereof being in locking engagement with a notch 56 formed in the shaft 38. The other end of the lever arm 49 is provided with a large plate or vane 57.

It will be noted, FIGS. 6 and 9, that the lever 48 is maintained in extended or operating position with the end 55 of dog 54 in engagement with notch 56 in shaft 38 by a set screw 58 threaded into the housing 33, as at 59, and having a reduced portion or member 61 at one end thereof in engagement with a cam surface 62 on lever 48. The other end is provided with a knurled operating head 63 whereby the portion 61 may be moved into holding engagement with the cam surface 62. The aforesaid screw 58 may be composed of any material suitable for the purpose such, for example, as nylon or Delrin, so that the desired frictional holding characteristics are provided to maintain the lever 48 in the proper position until a sudden blast is directed against the vane 57 of the lever.

A conventional switch assembly indicated generally by the reference character 65 is disposed within the missile supporting ring 13 and comprises a casing 66 having a switch actuator 67 slidably mounted therein. The actuator or rod 67 is provided with a spring 68 having one end in engagement with the casing 66 and the other end thereof in engagement with a collar or stop 69 carried by the actuator. The actuator is further provided with a head 71 at one end for engagement with the head 43 on the plunger shaft 38, the other end thereof being provided with a disc or flange 72. The disc or flange 72 is adapted to operate switches 73 and 74 according to the position of the actuator or shaft 67 such, for example, as to simulate a "missile-in-place" or a "missile-away."

As more clearly shown on FIGS. 4 and 7, a clamping device or support 75 is employed to clamp the switch casing 66 to the ring 13. The clamping device includes a body 76 having a recess 77 at one end thereof for receiving the flange 78 on casing 66 and a counterbore for receiving portion 81 of casing 66. The clamping device is secured to the ring 13, as by screws or the like 82, disposed in bores 83 formed in the body 76 and threaded into openings 84 formed in ring 13, FIG. 7. Thus by this arrangement the casing 66 is clamped to the ring with the plunger shaft 38 in alignment with the actuator 67 and the heads 43 and 71 thereon are disposed in abutting engagement, FIG. 2.

For a more complete understanding of the operation of the simulator, attention is directed to FIG. 9 wherein the device is shown in a "missile-in-place" position with the plunger 37 in a depressed condition. The plunger 37 is locked in this condition against the tension of switch spring 68 by the end 55 of dog 54 which is disposed in notch 56 in plunger shaft 38 with the vane 57 on lever arm 49 in a position to receive the missile eject air admitted into the outer tube 11 by way of air conduit 17. It will be understood, however, that upon depression of the plunger head 43 on plunger shaft 38 it engages head 71 on switch actuator 67 and thus the switch 73 is actuated to a closed position by disc 72 on actuator 67. When this occurs a visible or audible device is operated to indicate a "missile-in-place" condition. However, when missile eject air is admitted into the outer tube in the aforesaid manner and impinges upon vane 57, lever arm 49 is rocked upon pivot pin 53 and end 55 on dog 54 of lever 49 moves out of locking engagement with notch 56 in plunger shaft 38, whereupon the shaft is released. As the shaft is released the actuator 67 is moved under the influence of spring 68 an amount sufficient to move disc 72 out of engagement with switch 73 and into engagement with switch 74. Thereupon switch 73 is opened and switch 74 is closed. When this occurs visible or audible devices operate to indicate a "missile-away" condition.

While the device has been shown and described in connection with a specific type launching tube arrangement, it will be understood that without any modifications thereto the device may be used with various other types of launching tube arrangements to develop a "missile-in-place" signal and a "missile-away" signal.

From the foregoing, it will be apparent that a novel simulator has been devised wherein a "missile-in-place" signal is developed when the plunger is actuated to a locked condition and a "missile-away" signal is developed when the plunger is released in response to operation of a blast responsive device.

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

What is claimed is:

1. An electrical circuit control device comprising:
   - a support,
   - a casing releasably attached to said support,
   - normally cocked movable means mounted in said casing,
   - a blast responsive device pivotally mounted in said casing, means carried by said blast responsive device in locking engagement with said movable means for maintaining said movable means in a cocked condition, means carried by said movable means for moving the movable means to said cocked condition, means carried by said blast responsive device and actuated in response to a sudden blast received thereby for releasing the means on the blast responsive device from locking engagement with the movable means,
   - means controlled by said movable means for establishing a first electrical control circuit as the movable means moves to said cocked condition,
   - additional means operated as said movable means is released and moved a predetermined amount for establishing a second electrical circuit, and means for moving said movable means said predetermined amount as the movable means is released from said cocked position.

2. A control device according to claim 1 wherein said movable means includes
   - a shaft having an actuating knob at one end for moving said shaft to said cocked condition,
   - an enlarged head at the other end thereof engageable with said support for preventing movement of the movable means beyond said cocked condition, and
   - a notch disposed between the knob and the head engageable by said means on the blast responsive device for maintaining the movable means in said cocked position.

3. A control device according to claim 1 wherein said blast responsive device includes
   - a lever pivotally mounted on the casing and having a substantially rectangularly shaped vane on one end and locking detent on the other end thereof in locking engagement with the movable means whereby the movable means is maintained in said cocked condition until a sudden blast is received by the vane.

4. A control device according to claim 1 wherein said means for establishing first and second electrical circuits includes
   - a pair of switches,

a spring biased switch actuator engageable by said movable means, and

means on said switching actuator for operating one switch of said pair of switches when the movable means is in said cocked condition, said last named means operating the other switch of said pair of switches when the movable means is released and moves said predetermined amount.

5. A circuit control device which comprises, in combination,

a support,

a casing releasably locked to said support,

means on the casing for releasably locking the casing to said support,

a plunger slidably mounted in said casing and movable to a cocked position,

means carried by said plunger for moving the plunger to said cocked position,

means pivotally mounted in the casing, and actuated by a sudden blast,

means on said pivotally mounted means in engagement with said plunger for maintaining the plunger in a cocked position,

means carried by said pivotally mounted means and responsive to said sudden blast for releasing the plunger from said cocked position,

a switch actuator movable in one direction by the plunger as the plunger is moved to said cocked position,

a first switch device operated by said switch actuator for establishing a first control circuit as the actuator is moved in said one direction to said cocked position,

a second switch device operated by said switch actuator as the actuator is moved in a reverse direction for establishing a second control circuit, and

resilient means operatively connected to said switch actuator for moving the actuator in said reverse direction as the plunger is released from said cocked position.

6. The combination of structure according to claim 5 wherein said means for releasably attaching the casing to the support includes

an adjustable screw in threaded engagement with the casing,

a clamping device slidably mounted on said adjustable screw and movable along said adjustable screw as the screw is threaded into said casing, and

lugs formed at the terminal ends of the clamping device engageable with said support for releasably clamping the casing to said support when said clamping device has been moved along said adjustable screw a predetermined amount.

7. The combination according to claim 5 wherein said pivotally mounted means includes

a lever having a vane element at one end,

a plunger locking detent at the other end thereof engageable with said plunger when the plunger is in said cocked position, and

a slot in said pivotally mounted means for receiving a pivot pin carried by said casing.

8. The combination of structure according to claim 5 wherein

said plunger includes an actuating knob at one end for moving the plunger to said cocked position,

a head at the other end of the plunger for engaging and operating the switch actuator as the plunger moves to said cocked position, said head being engageable with said support for preventing movement of said plunger beyond said cocked position, and

a notch for receiving said means on the blast responsive means.

9. The combination of structure according to claim 5 wherein said switch actuator includes

a head at one end thereof for engaging the plunger at one end,

a switch engaging and operating element at the other end thereof for operating said first switch device as the plunger moves to said cocked position, and

a spring for moving the switch actuator in a reverse direction as the plunger is released from said cocked position.

10. A circuit control device which comprises, in combination,

a support,

a casing releasably attached to said support,

a screw in threaded engagement with said casing,

a clamping bracket slidably mounted on said screw and movable into clamping engagement with said support as the screw is threaded into the casing for releasably locking the casing to the support,

a plunger slidably mounted within said casing and movable to a cocked position, said plunger having an actuating knob at one end thereof for moving the plunger to said cocked position, a switch engaging head element at the other end of said plunger and a locking notch disposed between the knob and the head element,

a normally locked blast responsive device pivotally mounted within said casing and actuated by a sudden blast,

a vane element formed at one end of the blast responsive device for releasing the device in response to a sudden blast received thereby,

a detent formed at the other end of the blast responsive device in locking engagement with said notch for maintaining the plunger in said cocked position and the blast responsive device in a locked condition and for releasing the plunger as the detent means is moved out of locking engagement with said notch by actuation of the blast responsive device in response to a sudden blast received by the vane element,

a switch actuator engageable by the head element and movable thereby in one direction as the plunger moves to said locked cocked position,

a first switch operated by said switch actuator as the actuator is moved in said one direction for establishing a first control circuit,

a second switch operated by said switch operator as the actuator is moved in a reverse direction for establishing a second control circuit, and

a spring operatively connected to said switch actuator for moving the actuator in said reverse direction as the plunger is released from said cocked position.

11. In a missile simulating device suitable for use with a missile launcher structure, the combination of

an outer tubular member,

a missile launcher tube disposed within said outer tubular member,

an annular missile supporting ring carried by said launcher tube,

a casing releasably locked to said ring,

means including an adjustable clamping element carried by the casing in engagement with the ring for releasably locking the casing to the ring,

a plunger slidably mounted in the casing and movable to a cocked locked position, a slidably mounted actuator in engagement with said plunger and operated thereby,

means operated by said actuator for developing a "missile-in-place" signal as the actuator is moved by said plunger a predetermined amount and the plunger reaches said cocked locked position,

means for establishing an external electrical connection to said signal developing means,

blast responsive means pivotally mounted on said casing, means on said blast responsive means in engagement with said plunger for locking and maintaining

the plunger in said cocked position, means for moving the plunger predetermined amount to said cocked locked position,

means on said blast responsive means and actuated in response to a sudden blast for releasing the locking and maintaining means from engagement with the plunger,

additional means operated by the actuator as the plunger is released for developing a "missile-away" signal,

means for establishing an external electrical connection to said additional means, and

means in communication with the outer tubular member for supplying said sudden blast to said means the blast responsive means.

12. The combination of structure according to claim 11 wherein said adjustable clamping element includes an elongated screw having one end in threaded engagement with said casing and a pair of lugs slidably mounted on the other end thereof in clamping engagement with said ring for releasably clamping the casing to the ring and within said launching tube.

13. The combination of structure according to claim 11 wherein said plunger includes a shaft having an actuating knob on one end for actuating the plunger to said cocked position, a head on the other end thereof engageable with the ring for preventing movement of the plunger beyond said cocked position, and a notch disposed between the knob and head and receiving said locking and maintaining means on the blast responsive means for locking and maintaining the plunger in said cocked position.

14. The combination according to claim 11 wherein said blast responsive means includes a lever pivotally mounted on the casing and having a blast receiving vane on one end thereof and a locking detent on the other end thereof in locking engagement with the plunger for locking and maintaining the plunger in said cocked position.

15. In a missile simulating device suitable for use with a missile launching structure, the combination of

an outer tubular member,

a missile launcher tube disposed within and in spaced relation with respect to said outer tubular member,

an annular missile supporting ring carried by said launcher tube,

a casing,

means for releasably attaching the casing to said ring,

slidable means mounted in said casing and movable to a cocked position,

means including a plunger controlled by said slidable means for establishing a first electrical connection as the slidable means is moved in one direction to said cocked position,

means pivotally mounted on said casing,

detent means carried by said pivotally mounted means in locking engagement with said slidable means for maintaining the slidable means in said cocked position,

vane means carried by said pivotally mounted means and actuated in response to a sudden blast for moving said pivotally mounted means an amount sufficient to unlock the detent means from the slidable means, and

means on said plunger for establishing a second electrical connection as the slidable means is unlocked from said cocked position and the plunger is moved in a reverse direction, and

spring means for moving the plunger in said reverse direction.

16. In a missile simulating device suitable for use with a missile launching structure and operable to indicate a "missile-in-place" condition and a "missile-away" condition, the combination of

an outer tubular member,

a missile launcher tube disposed within and in spaced relationship with said outer tubular member,

an annular missile supporting ring carried by said launcher tube,

a casing releasably locked to said ring,

means including a pair of clamping elements for releasably locking the casing to the ring,

plunger means slidably mounted in the casing and movable to a cocked position, means on the plunger means for moving the plunger means to said cocked position,

a slidably mounted actuator in engagement with and operated by said plunger means as the plunger means is moved to said cocked position,

switch means operated by said actuator for establishing a "missile-in-place" signal as the plunger is moved to a cocked position,

lever means pivotally mounted on said casing, a detent carried by said lever means in locking engagement with the plunger means for locking and maintaining the plunger means in said cocked position,

vane means carried by said lever means and operated in response to a sudden blast received thereby for actuating the lever means an amount sufficient to release said detent from locking engagement with said plunger,

additional switch means, means operated by the actuator for establishing a "missile-away" signal as the plunger means is released from locking engagement with the detent, means for moving said actuator in operative engagement with said additional switch means as the plunger means is released, and

means on the outer tubular member for establishing an external air connection thereto.

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