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[54] **RIGID WARHEAD DETONATION TRANSFER SYSTEM**

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[73] Assignee: **The United States of America as represented by the Secretary of the Army,** Washington, D.C.

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[51] **Int. Cl.**[4] **F42B 13/12**

[52] **U.S. Cl.** **102/476**

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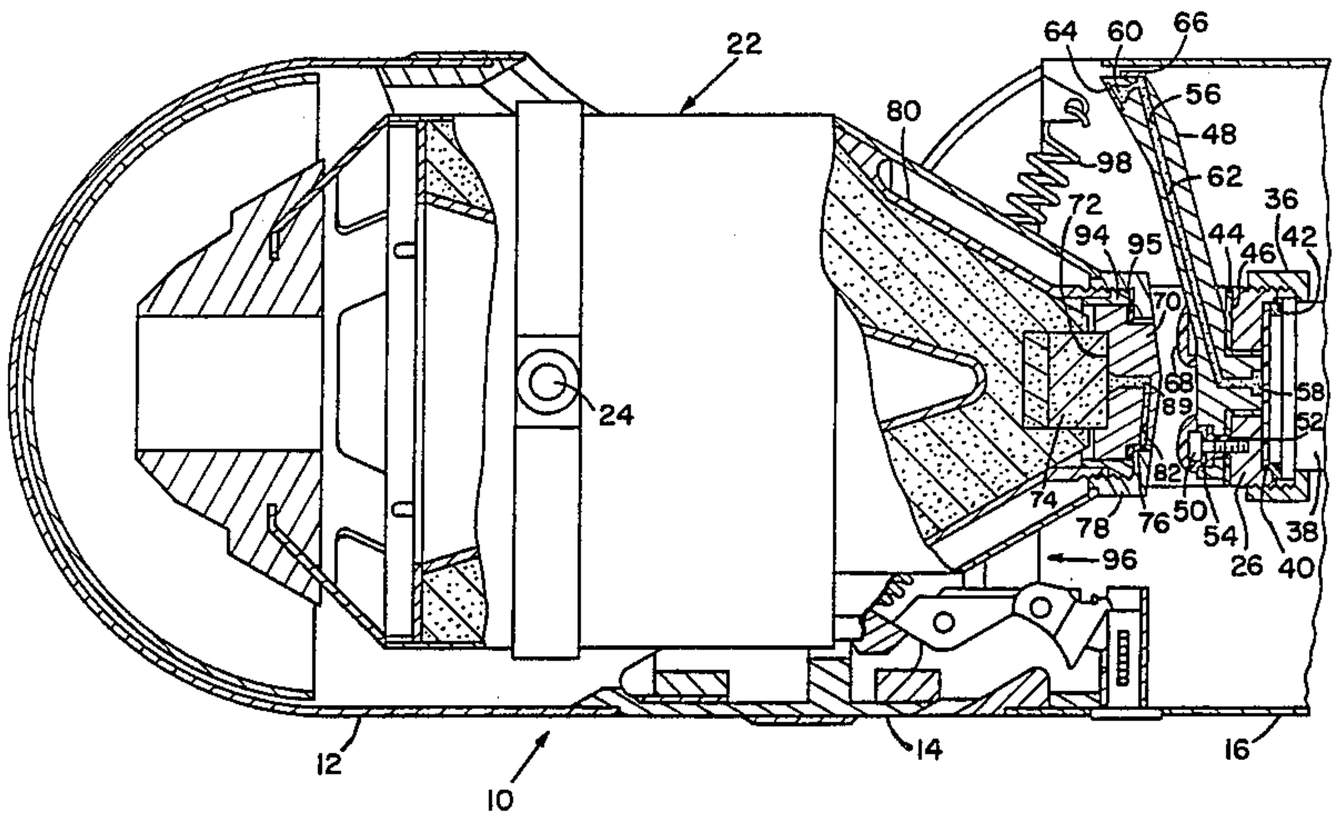
[57] **ABSTRACT**

In a missile having a shaped charge warhead that is pivotable from a position in which the axis of the shaped charge is in alignment with the axis of the missile to a canted position in which the axis of the shaped charge warhead is canted relative to the axis of the missile and a rigid detonation transfer system for transferring detonation from safe and arm mechanism of the missile to the shaped charge warhead and utilizing a rigid arm with explosive therein and a precision initiation coupler on the shaped charge warhead to transfer detonation from the safe and arm mechanism to the shaped charge of the warhead to initiate explosion thereof.

4 Claims, 11 Drawing Figures



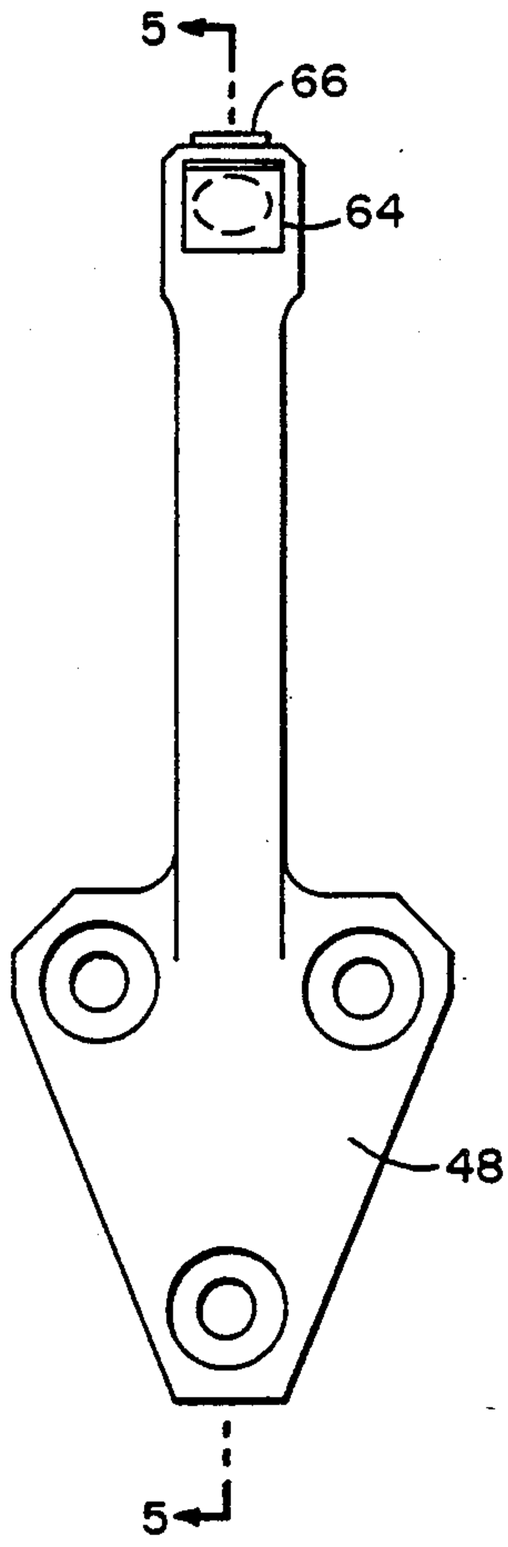


FIG. 4

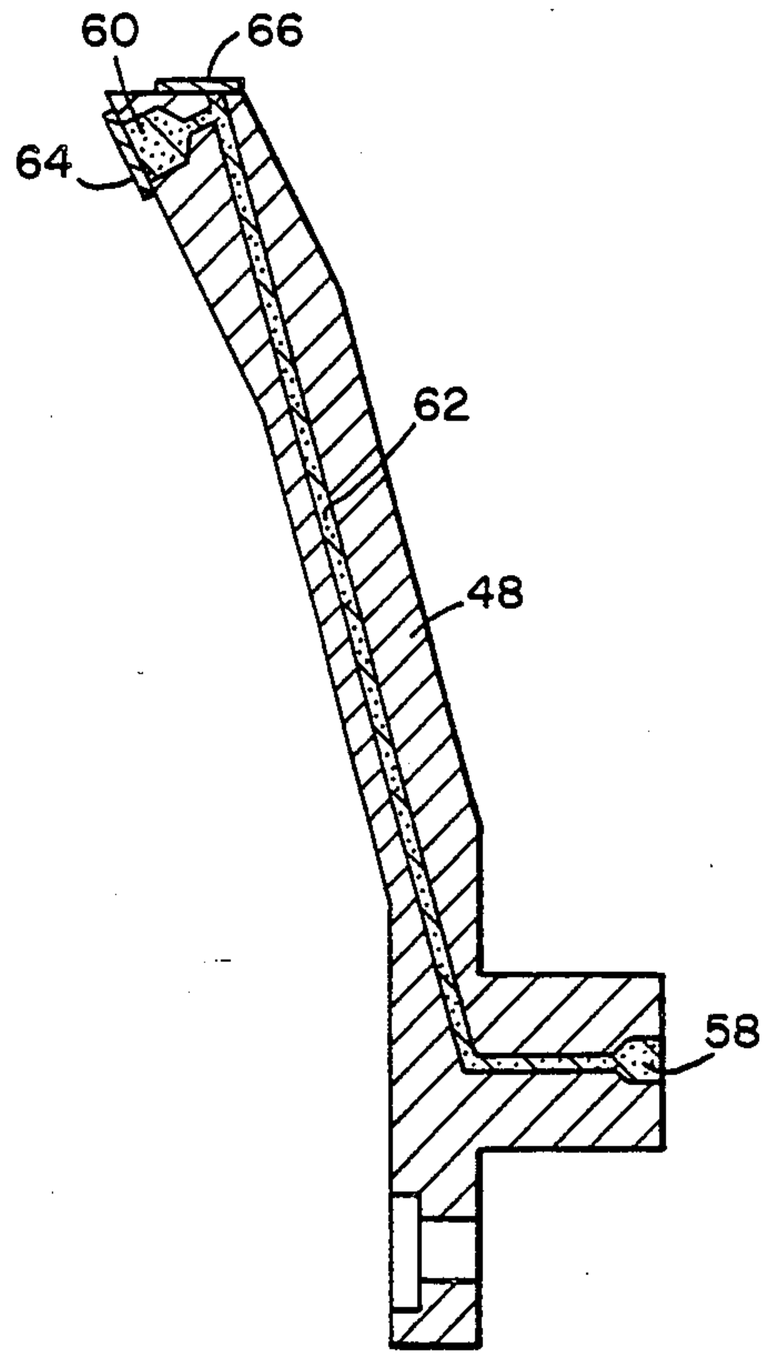


FIG. 5

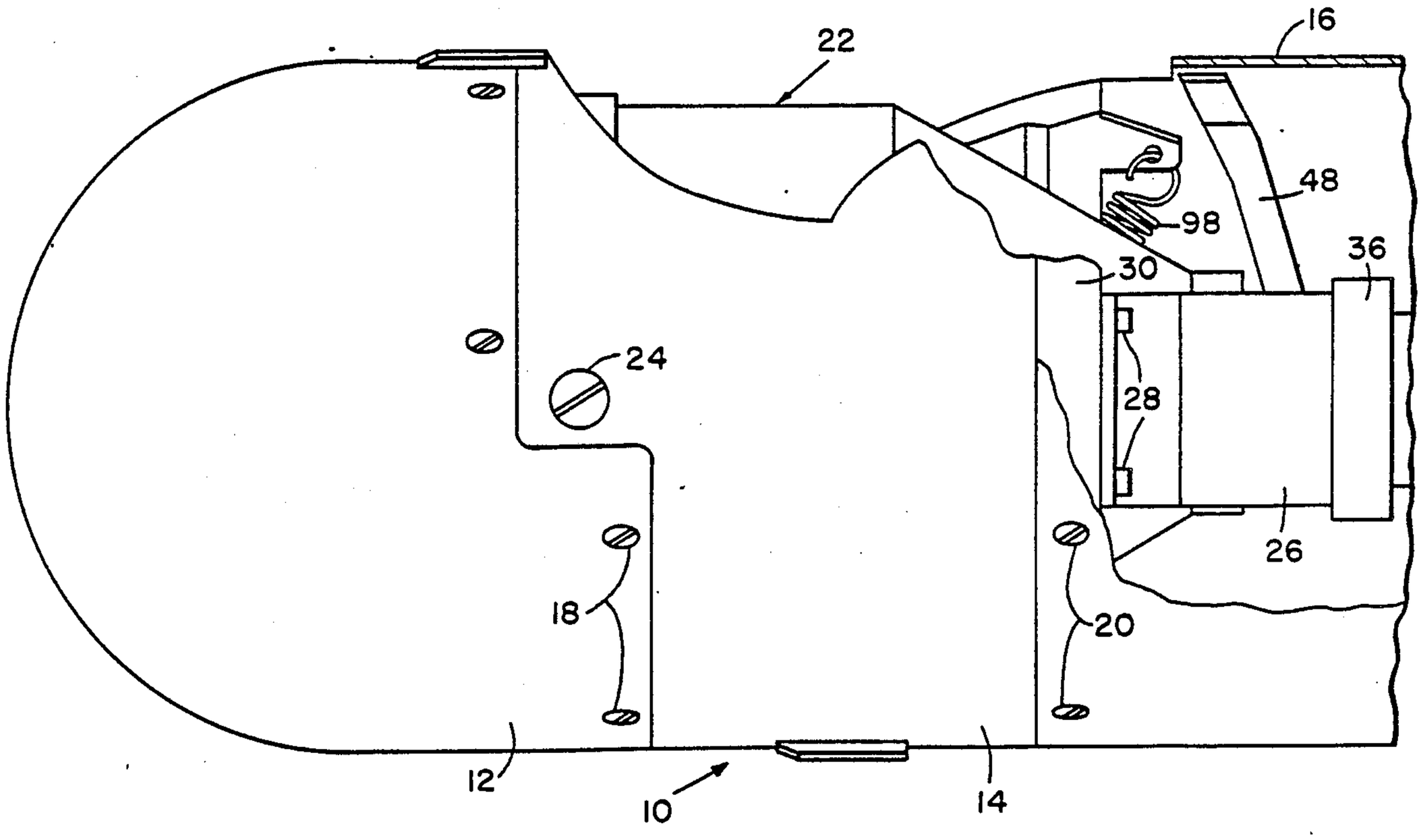


FIG. 1

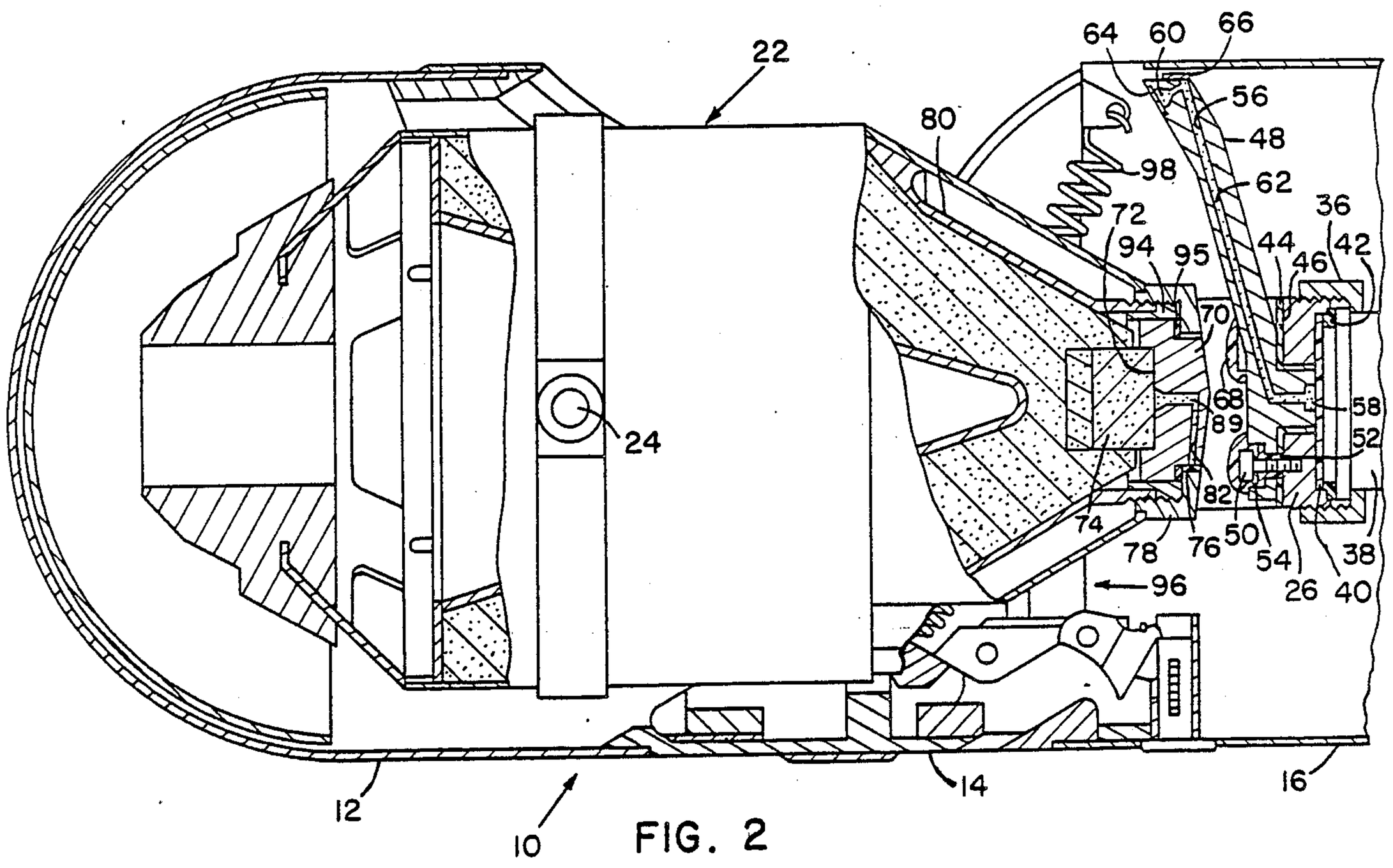
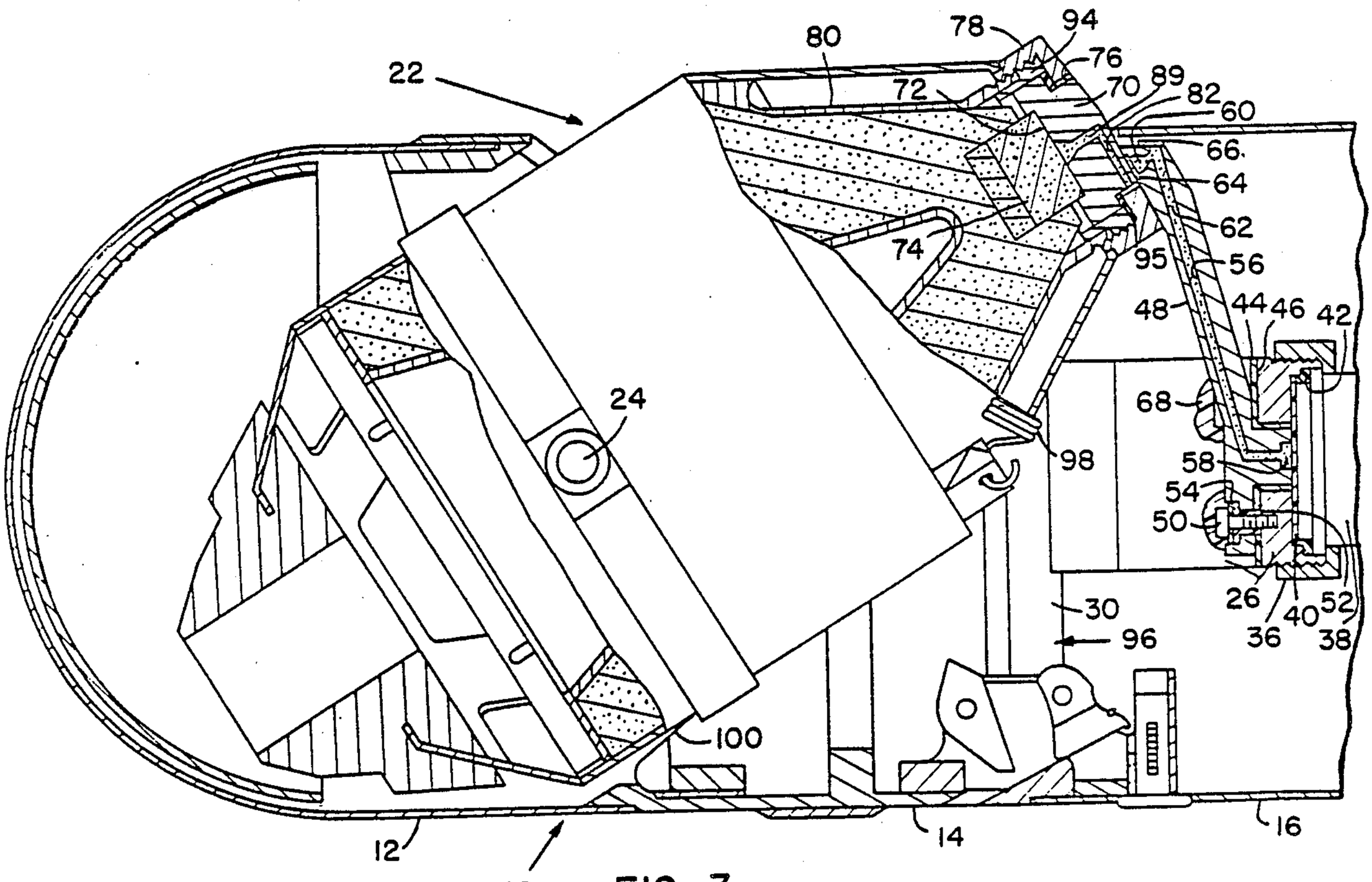

22
64
60
66
56
48
62
36
42
44
46
80
98
72
94
95
70
68
89
58
52
82
74
78
76
50
54
38
26
40
96
24
12
10
14
16

FIG. 2


22
80
78
94
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89
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44
46
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36
38
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100
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16

FIG. 3

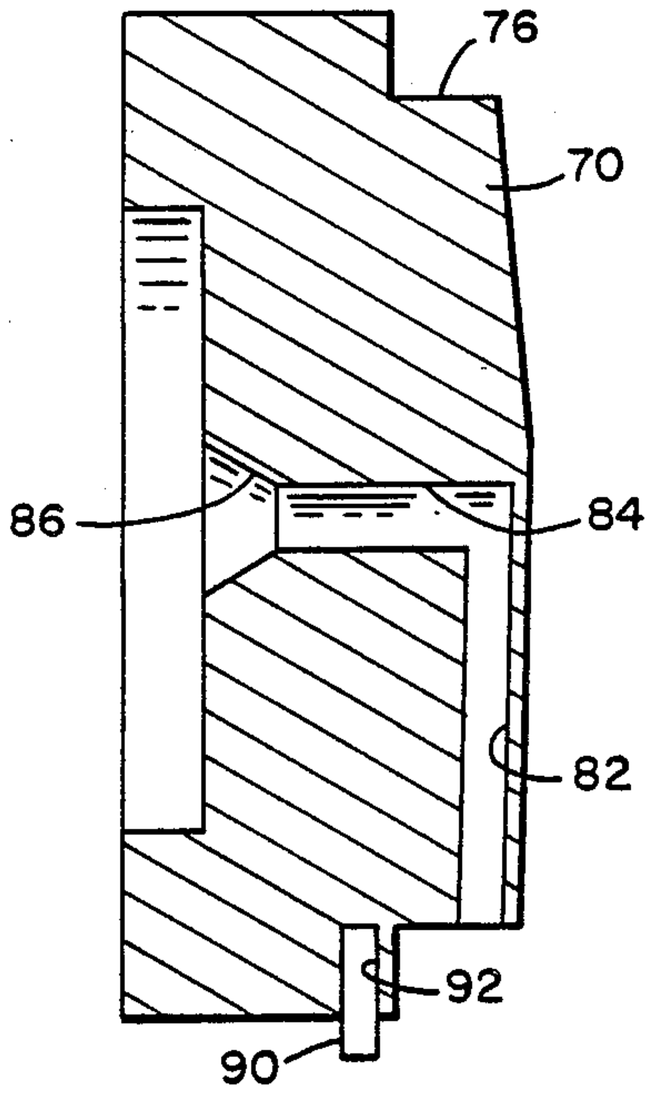

FIG. 8

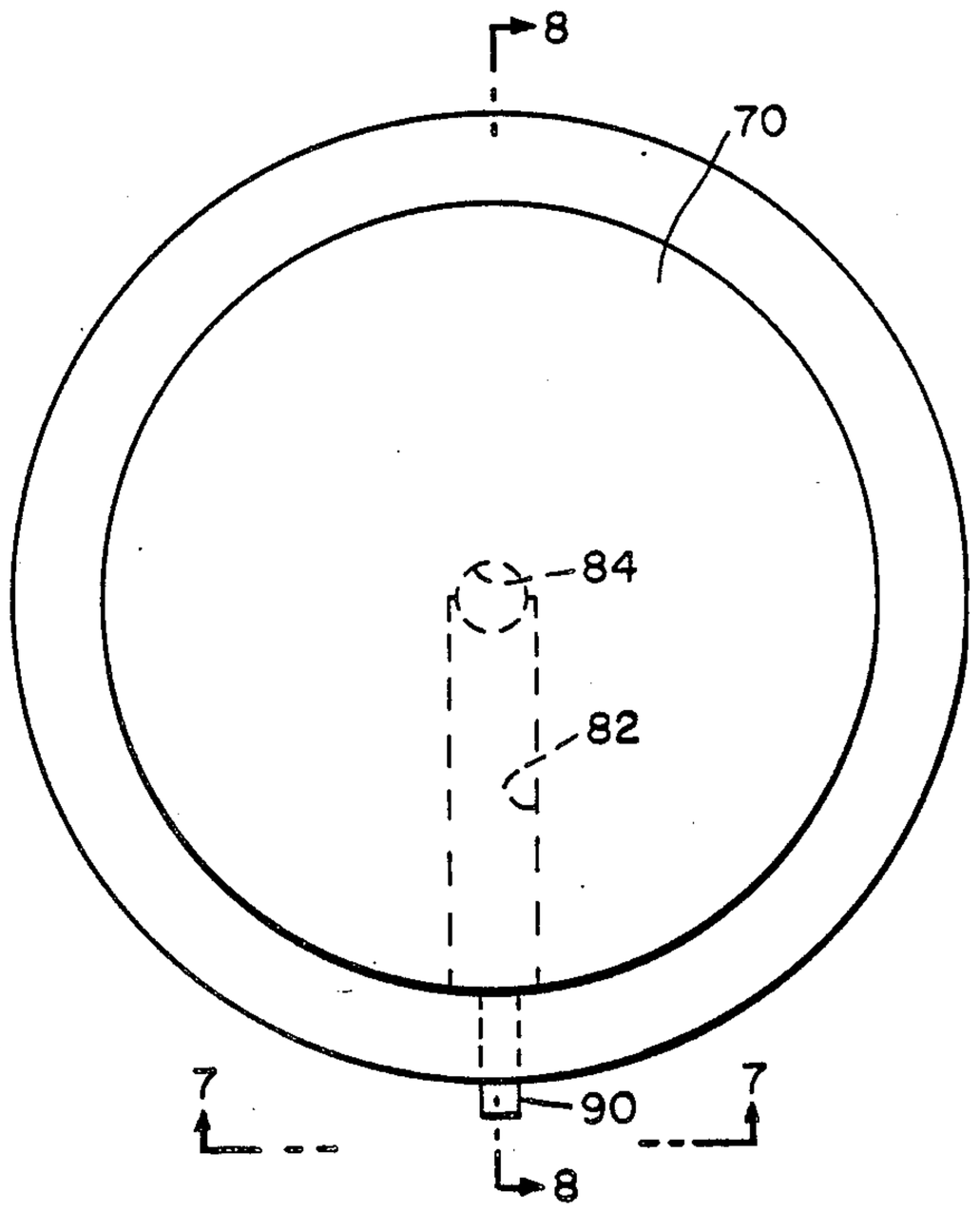

FIG. 6

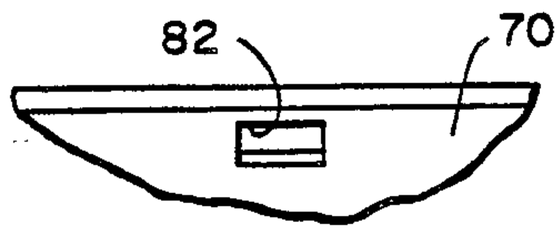

FIG. 7

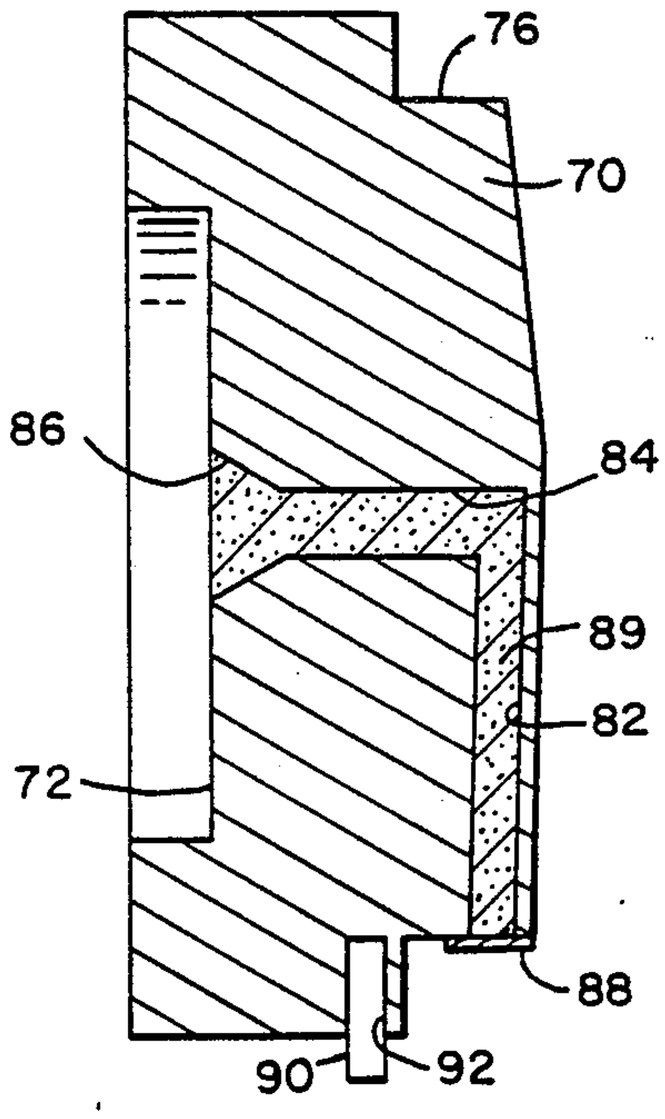

FIG. 9

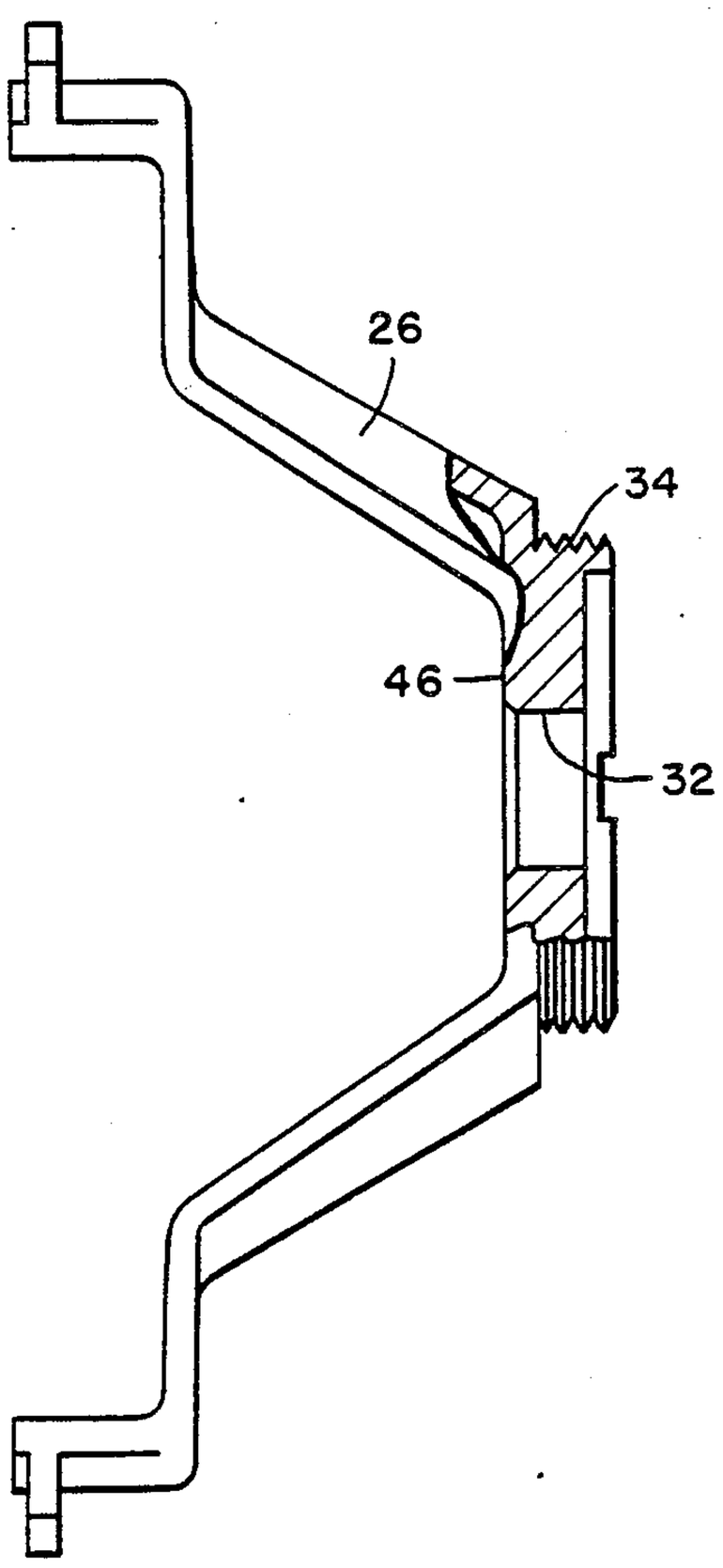

FIG. 10

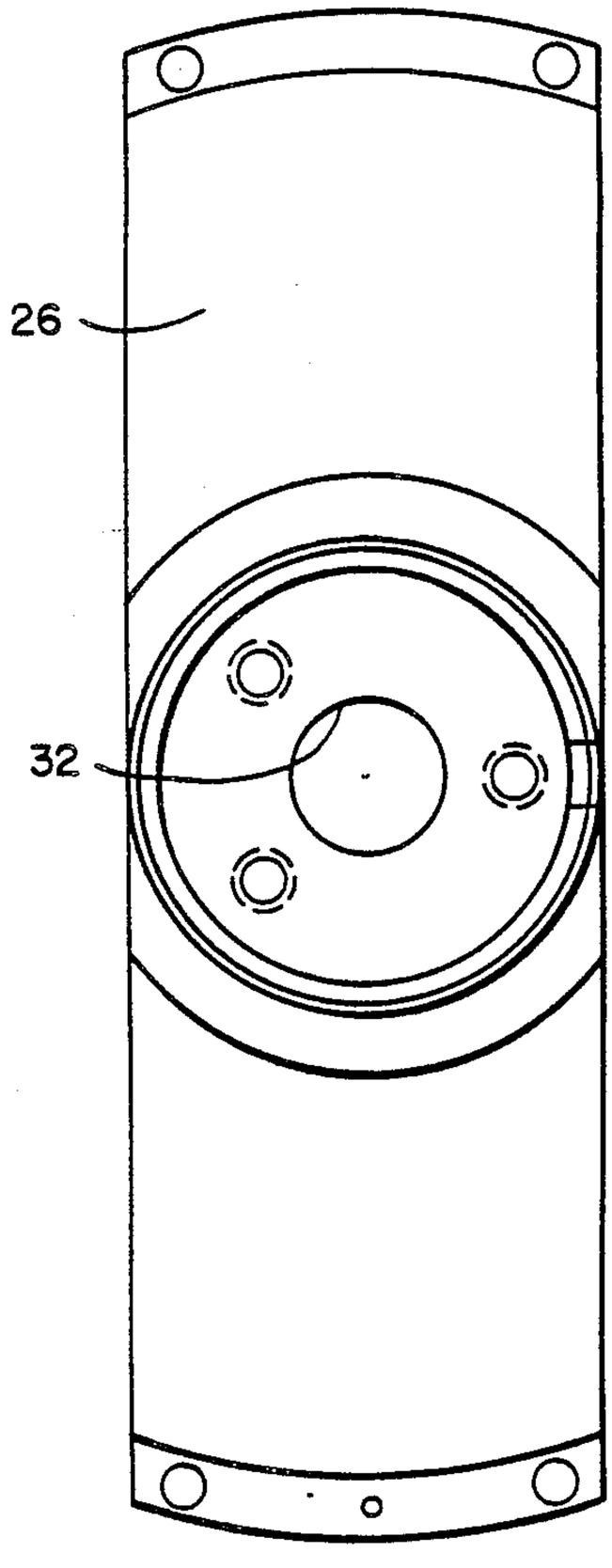

FIG. 11

RIGID WARHEAD DETONATION TRANSFER SYSTEM

DEDICATORY CLAUSE

BACKGROUND OF THE INVENTION

In the past, shaped charge warheads have been aligned along the axis of the missile with the safe and arm mechanism attached to the rear of the warhead. In certain applications, this is not a sufficient arrangement for the shaped charge warhead in that it is desirable at times to cant the shaped charge warhead relative to the axis of the missile. Accordingly, there is a need for an arrangement in which the warhead can be canted and still have rigid means for transferring the detonation from the safe and arm mechanism to the shaped charge warhead.

Accordingly, it is an object of this invention to provide a rigid detonation transfer system for transferring detonation from the safe and arm mechanism to a canted shaped charge warhead of a missile.

Another object of this invention is to provide a detonation transfer system in which an acceptable gap exists between the end of the detonation transfer arm of the system and a precision initiation coupler of the shaped charge warhead.

A still further object of this invention is to provide a detonation transfer system for a shaped charge warhead in which the detonation transfer system is insulated electrically from the missile structure.

Still another object of this invention is to provide a detonation transfer system which enables the shaped charge warhead to be canted after the missile has been launched from its launch tube.

Other objects and advantages of this invention will be obvious to those skilled in this art.

SUMMARY OF THE INVENTION

In accordance with this invention, a rigid warhead detonation transfer system is provided for transferring detonation from a safe and arm mechanism to a shaped charge warhead that has been tilted relative to the center line of the missile and this rigid warhead transfer system includes a rigid arm with explosive therein for transferring the explosive train from the safe and arm mechanism to explosive in an initiation coupler which couples the detonation energy to the warhead for setting off the shaped charge warhead. Utilizing this system, the detonation wave from the rigid arm must jump a predetermined gap between the end of the rigid arm and the precision initiation coupler in order to properly transfer the detonation and always cause detonation of the shaped charge warhead.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view partially in section of a front end of a missile with a warhead therein and illustrating a rigid warhead detonation transfer system,

FIG. **2** is a sectional view of a front portion of a missile and illustrating details of the rigid warhead detonation transfer system,

FIG. **3** is a sectional view of the front portion of a missile with a shaped charge warhead therein and illustrating the shaped charge warhead in a pivoted position with the rigid warhead detonation transfer system in position for firing the warhead.

FIG. **4** is a plan view of a detonation transfer arm in accordance with this invention,

FIG. **5** is a sectional view along line **5**—**5** of FIG. **4**,

FIG. **6** is a top view of a precision initiation coupler in accordance with this invention,

FIG. **7** is a view along line **7**—**7** of FIG. **6**,

FIG. **8** is a sectional view along line **8**—**8** of FIG. **6**,

FIG. **9** is a sectional view of the precision initiation coupler with the explosive in the explosive channel thereof,

FIG. **10** is a side view partially in section illustrating a mounting bracket for the detonation transfer arm, and

FIG. **11** is a top view of the safe and arm bracket.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, a missile **10** includes a forward nose module or crush switch section **12**, an intermediate adapter section **14**, and a rear housing section **16**. Forward section **12** is secured to adapter section **14** by a plurality of screws **18** and adapter **14** is secured to rear section **16** by a plurality of screws **20**. Adapter section **14** has a shaped charge warhead **22** pivotally mounted therein by trunnion shafts **24**. Warhead **22** is adapted to be launched in the position illustrated in FIG. **1** and has spring biasing means that biases it to a canted position after launch as illustrated in FIG. **3**. The rigid detonation transfer system for the shaped charge warhead in the canted position includes safe and arm bracket **26** which is secured by bolts **28** at opposite sides of safe and arm bracket **26** to ring structure **30** of intermediate adapter **14**. Safe and arm bracket **26** has a stepped bore **32** therethrough as illustrated in FIG. **10** and has threads **34** for receiving threaded retainer ring **36** for securing a conventional safe and arm mechanism **38** to bracket **26**. An insulator pad **40** is placed between one end of safe and arm mechanism **38** and the enlarged portion of bore **32** and insulator bushing **42** is placed around an end portion of safe and arm mechanism **38** and an end portion of bracket **26**. An insulator bushing **44** is positioned in the smaller of stepped bore **32** and over interface **46** of safe and arm bracket **26**. Detonation transfer arm **48** is secured to safe and arm bracket **26** by three bolts **50**. An insulator bushing **52** is mounted around each bolt **50** to insulate the bolt from detonation transfer arm **48**. A washer **54** is also provided between the head of each bolt **50** and insulator bushing **52**. Detonation transfer arm **48** has a bore opening **56** therethrough with enlarged openings **58** and **60** at opposite ends. An explosive **62** is placed in bore **56** and enlarged opening **58** and a booster pellet explosive is placed in enlarged opening **60**. A foil disk **64** is placed in sealing relationship over the explosive booster pellet and a foil seal **66** is placed in sealing relationship over an end of bore **56** to close the bore at this position. To ensure that arm **48** is completely and electrically insulated, the heads of bolts **50** have an insulating sealant **68** placed thereover.

A precision initiation coupler **70** is provided and includes a recessed circular area **72** at one side for receiving one end of booster pellet **74**. Precision initiation coupler **70** also has a reduced diameter portion **76** and a retainer ring **78** is utilized to clamp precision initiation coupler **70** to housing structure **80** of shaped charge

warhead **22**. Precision initiation coupler **70** has a generally rectangular opening **82** therein from one side that connects with a central bore **84** and an enlarged tapered opening **86**. Openings **82**, **84** and **86** have an explosive therein that fills each of these and a foil disk **88** seals one end of opening **82** as illustrated, (see FIG. **9**). A pin **90** is mounted in opening **92** of precision initiation coupler **70** and pin **90** keys the precision initiation coupler **70** to insulation bushing **94** and insulation bushing **94** is keyed to a slot in one end of housing member **80** to ensure that explosive **89** in passage **82** is aligned with booster pellet **60** in arm **48**. A compression pad **95** is also positioned between retainer ring **78** and a surface of precision initiation coupler **70**. The arrangement of precision initiation coupler **70** relative to the warhead structure and arm **48** is such that the gap between booster pellet **60** and the surface of precision initiation coupler **70** when the shaped charge warhead is in the tilted position is no more than about 0.005 to 0.083 inches. If this gap is too large, the detonation transfer from booster pellet **60** to explosive **82** will not occur properly. The explosive in arm **48** and in the passages of precision initiation coupler **70** must be of an explosive material that can be placed in the passages of these members to completely fill all turns and crevices. Applicant has found that these explosive materials **62** and **89** must be an extrudable material and it has been found preferrable to pull a vacuum on these passages and then allow the explosive to be extruded into the passages to completely fill the passages. The specific pressures of vacuum that have been found acceptable has been from 1000 to 16000 psi. A specific explosive extrudable compound that can be used is one of the type found in military spec MIL-E-82-740. Any good extrudable explosive can be used.

Warhead **22** is held in the position illustrated in FIG. **2** by locking mechanism **96** that is tripped when the missile is launched from its launch tube and springs **98** at opposite sides of warhead **22** bias the warhead to the canted position illustrated in FIG. **3**. In this position, leaf spring **100** holds warhead **22** locked in the canted position illustrated.

In operation, when the missile is fired from its launch tube, warhead **22** cants to the locked position illustrated in FIG. **3** and safe and arm mechanism **38** is armed in the normal manner. When the missile impacts a target, the ogive/crush switch **12** completes a circuit (not illustrated) to cause a detonator (not illustrated) in safe and arm mechanism **38** to fire into the explosive at **58** in the base of arm **48** and then up arm **48** to booster pellet **60** at the tip of arm **48**. The detonation wave from booster pellet **60** traverses or jumps the gap between the end of arm **48** and the face of precision initiation coupler **70**. This detonation wave initiates explosive **89** in channel **82** and the detonation travels to the center of precision initiation coupler **70** and travels through the center and initiates booster pellet **74** in the base of shaped charge warhead **22** which, in turn, initiates the shaped charge of the warhead. As will be appreciated, detonation transfer arm **48** is electrically insulated from the mounting structure to ensure against accidental detonation of the explosive therein and the gap defined between the end of arm **48** and precision initiation coupler **70** is maintained between limits in order to provide an accurate and reliable explosive path for ensuring that the shaped charge warhead is always set off.

I claim:

1. In a missile having an adaptor housing mounted along a longitudinal portion thereof with a shaped charge warhead pivotally mounted relative to said adaptor housing and pivotable from a longitudinal position in which the warhead is longitudinal of the central longitudinal axis of the missile to a tilted position in which the shaped charge warhead is canted relative to the longitudinal axis of the missile, a rigid detonation transfer system for the shaped charge warhead and including a generally U-shaped bracket secured to said adaptor structure and having safe and arm mechanism secured on one side of said bracket at a central portion thereof, a detonation transfer arm mounted on another side of said bracket and opposite said safe and arm mechanism, and a precision initiation coupler connected at an end of the shaped charge warhead, and said detonation transfer arm and said precision initiation coupler having explosive means therein for providing an explosive path for transmitting detonation in the safe and arm mechanism through said detonation transfer arm and said precision initiation coupler to the shaped charge warhead to cause the shaped charge warhead to be detonated when said shaped charge warhead is positioned in the canted position.

2. In a missile as set forth in claim **1**, wherein said detonation transfer arm is electrically insulated in its mounting relative to said mounting bracket.

3. In a missile as set forth in claim **2**, wherein said detonation transfer arm and said precision initiation coupler have a gap therebetween that is no more than 0.005 to 0.083 inches.

4. In a missile as set forth in claim **3**, wherein said precision initiation coupler has a passage with said explosive means therein, and said passage extending from one side of the precision initiation coupler to a central portion and said explosive means also being in the central portion and connected by a booster pellet to the shaped charge of the shaped charge warhead to initiate explosion of the shaped charge warhead.

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