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PROTECTIVE CONTAINER FOR ELECTRONIC ASSEMBLIES

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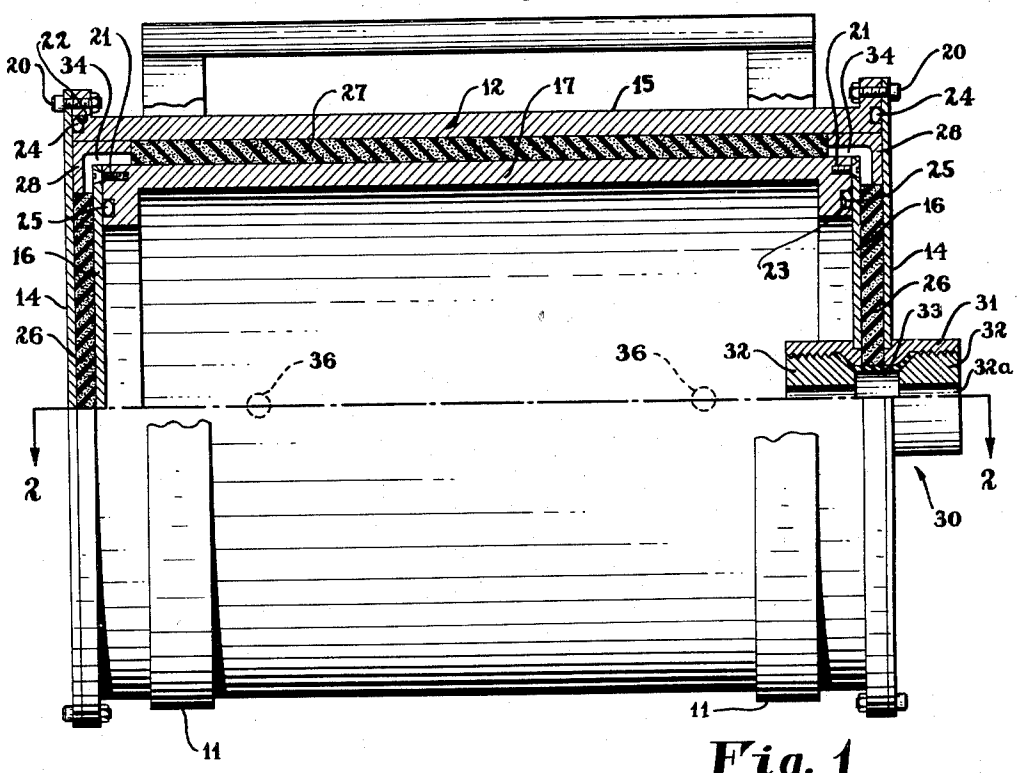


Fig. 1

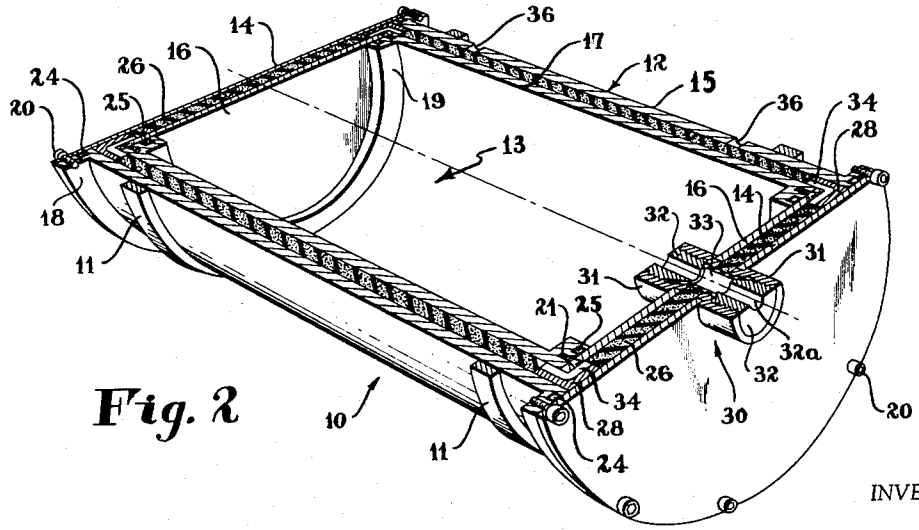


Fig. 2

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PROTECTIVE CONTAINER FOR ELECTRONIC ASSEMBLIES

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to a novel protective container for the protection of electronic components or assemblies used in guided missiles from harmful environmental effects such as shock, vibration, noise, and high temperatures. The invention provides superior protection of guided missile electronic equipment during storage and handling, as well as under the very severe conditions encountered during missile flight.

While known prior art packaging units or containers may protect the electronic component against any one of these conditions, these systems do not package the electronic components so that they simultaneously control and minimize the effect of all these environmental conditions.

It is the object of this invention, therefore, to provide a container which will ensure that electronic components are properly isolated from vibration and noise; that shocks impinging on the package are filtered of damaging high-frequency components, shaped into simple waveforms and prevented from being excessively amplified; and that high internally or externally generated temperatures will be reduced and positively controlled.

The specific nature of the invention, as well as other objects, uses and advantages thereof, will clearly appear from the following description and from the accompanying drawing, in which:

Fig. 1 is a side view of the packaging unit of this invention, one quarter of the unit being shown in section.

Fig. 2 is a perspective view of the packaging unit of Fig. 1 taken through lines 2—2.

As shown in Figs. 1 and 2, container **10** consists of outer and inner casings **12** and **13**, respectively. Outer casing **12** is designed to be fixed by brackets **11** (Fig. 1) or by any other suitable means to the inside of the body of any missile (not shown).

Outer casing **12** comprises a pair of flat circular end plates **14** and a hollow cylindrical shell **15**. Shell **15** is provided with outwardly extending flanges **18** at both ends. Flanges **18** are cut with annular slots **22** of rectangular cross-section into which O-rings **24** are tightly pressed. Flat plates **14** are fixed by machine screws **20** to flanges **18**, as shown.

Inner casing **13**, like outer casing **12**, consists of a hollow cylindrical shell **17** and a pair of flat circular end plates **16** which are fastened by screws **21** to inwardly extending flanges **19**. Flanges **19**, like flanges **18**, are provided with annular slots **23** into which O-rings **25** can be tightly pressed. Electronic components which are required in the missile are mounted to the inside of inner cylinder **13**.

Outer casing **12** is separated from inner casing **13** by circular angle-shaped resilient rings **28**. Rings **28** act as a spring and cause inner casing **13** to resonate at a frequency determined by the stiffness of the spring. A spring material found to be satisfactory is silicone rubber. Also

positioned between outer casing **12** and inner casing **13** is a cylindrical sleeve **27** composed of a compressible cellular material possessing good damping characteristics. The purpose of this material is to control the amplitudes of inner casing **13** when casing **13** is vibrated at resonance by shock, vibration or noise. A material which has been found satisfactory for this purpose consists of polyurethane foam. Circular flat plates **26** are shaped substantially as plates **14** and **16** and are also composed of polyurethane foam. Any other materials possessing characteristics similar to silicone rubber and polyurethane foam could be substituted for these.

Cylindrical sleeve **27** and end plates **26** are partially saturated with an evaporative coolant. The degree of saturation depends on the amount of heat input anticipated in service. A preferred evaporative coolant consists of a 40% to 60% methanol alcohol-water mixture. Any coolant having large specific heats and suitable freezing and boiling points could also be used.

When the outer casing **12** experiences a high temperature as a result of missile flight, the methanol alcohol-water mixture will evaporate and in evaporating will keep inner casing **13** at a controlled and substantially constant temperature during the flight of the missile.

Escape vents **36** formed in shell **15** allow the evaporating cooling fluid to escape from between casing **12** and casing **13**. Circular angle-shaped damping ports **34** formed between angle-shaped rings **28**, end plates **16** and shell **17**, allow the evaporating coolant to escape to vents **36** from plates **26** and sleeve **27**. Damping ports **34** trap air between plates **26** and sleeve **27**. This trapped air dampens the amplitudes of inner casing **13** when casing **13** is vibrating at resonance as a result of missile vibration.

O-rings **24** and **25** is slots **22** and **23**, respectively, ensure that the mixture of methanol alcohol and water will not leak out from between the end plates **14** and **16** and shells **15** and **17**.

A feed-through connection **30** provides a means for hermetically sealing the electronic components (not shown) which are housed in inner casing **13** from the environment surrounding outer casing **12**. Connection **30** consists of two substantially cylindrical elements **31** which are internally threaded so that inserts **32** can be screwed into elements **31**. Inserts **32** are designed to press the flared ends of hollow sleeve **33** against the tapered sides of elements **31** as shown in Figs. 1 and 2. Sleeve **33** is composed of a flexible material such as synthetic rubber. Electrical wiring (not shown) which connects the electrical components housed in inner casing **13** to other circuits in the missile will pass through bore **32***a* formed in insert **32** and in sleeve **33**. The wiring when positioned in bore **32** can be sealed in bore **32***a* by any suitable resin or rubber seal. Thus, all the electronic components housed in inner casing **13** are hermetically sealed therein.

As described above, high temperatures received by outer casing **12** will cause evaporation of the alcohol coolant mixture absorbed in plates **26** and sleeve **27**. This will ensure that the outermost surface of inner casing **13** remains at a substantially constant temperature regardless of the temperature reached by outer casing **12**.

Plates **26** and sleeve **27** also dampen out the detrimental effects of noise, which is ordinarily produced by missile flight. If great noise attenuation is required, plates **26** and sleeve **27** should contain little or no coolant. The coolant mixture of methanol alcohol and water can be applied to the package **10** by placing a cylindrical sleeve of absorbent material containing the coolant mixture around the periphery of shell **15** in the same manner as sleeve **27** is wrapped around shell **17**. Or, the cooling fluid could be placed in a hollow cylindrical shell or jacket encasing container **10** so that outer casing **12** is

immersed completely in the fluid. In most instances, the system shown in Figs. 1 and 2 will dampen out noise ordinarily encountered during missile operation.

When container **10** is positioned properly inside the missile body inner casing **13** will cooperate with the spring and damping materials, **26** and **27**, respectively, so that detrimental vibration and noise are isolated from the electronic components mounted in inner casing **13** and shock impinging on outer casing **12** are filtered of damaging high-frequency components, shaped into simple waveforms and prevented from being amplified. The resilience of rings **28** isolates vibration and noise and filters, shapes and controls shock. The damping material of polyurethane foam in plates **26** and sleeve **27** prevents inner casing **13** from vibrating with uncontrolled amplitudes at resonance.

While casings **12** and **13** have been described as cylindrical, they may also have other shapes. For example, casings **12** and **13** may be in the shape of hollow cubes in which case the polyurethane damping material therebetween would consist of a hollow square sleeve and two square ends.

It will be apparent that the embodiment shown is only exemplary and that various modifications can be made

in construction and arrangement within the scope of the invention as defined in the appended claims.

I claim as my invention:

1. A container for housing electronic components comprising: first and second hollow cylinders, said first cylinder being encased in said second cylinder, the longitudinal axis of said first cylinder being substantially coaxial to the longitudinal axis of said second cylinder, a substantially cylindrical member positioned between said first and second cylinders, said member consisting of a spongy cellular material and a pair of resilient rings, said rings forming the corners of said member, said material being partially impregnated with an evaporative coolant liquid, and vents in said first cylinder for permitting the escape of coolant gas therethrough.

2. The container as recited in claim 1 in which said rings are composed of silicone rubber.

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