Dec. 19, 1961 T. W. R. GALWAY ET AL 3,013,745

METHOD FOR COOLING MISSILE ELECTRONIC PACKAGES

Filed Feb. 17, 1959 2 Sheets-Sheet 1

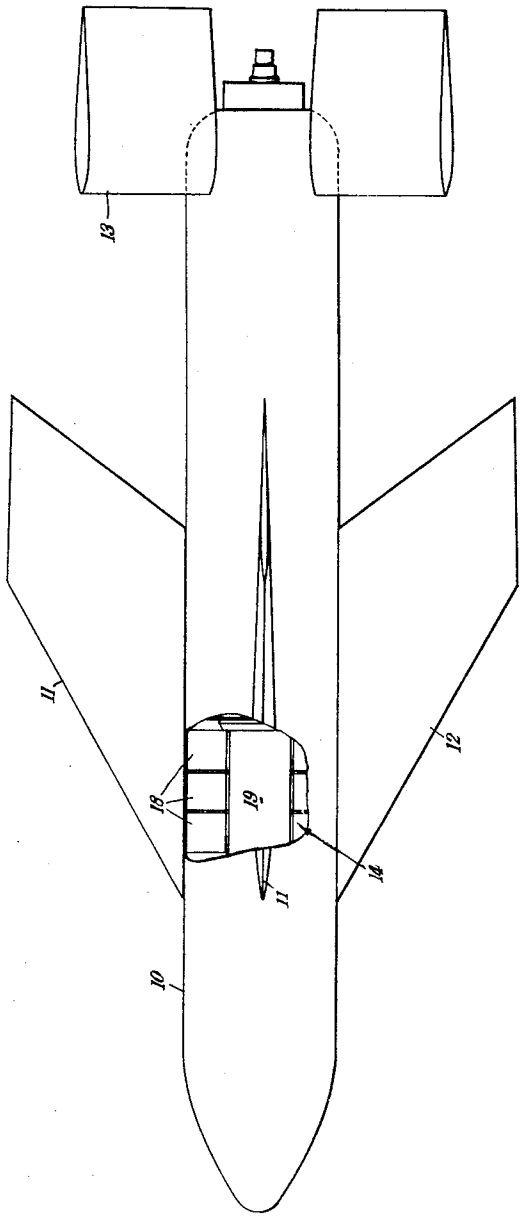


Fig. 1.

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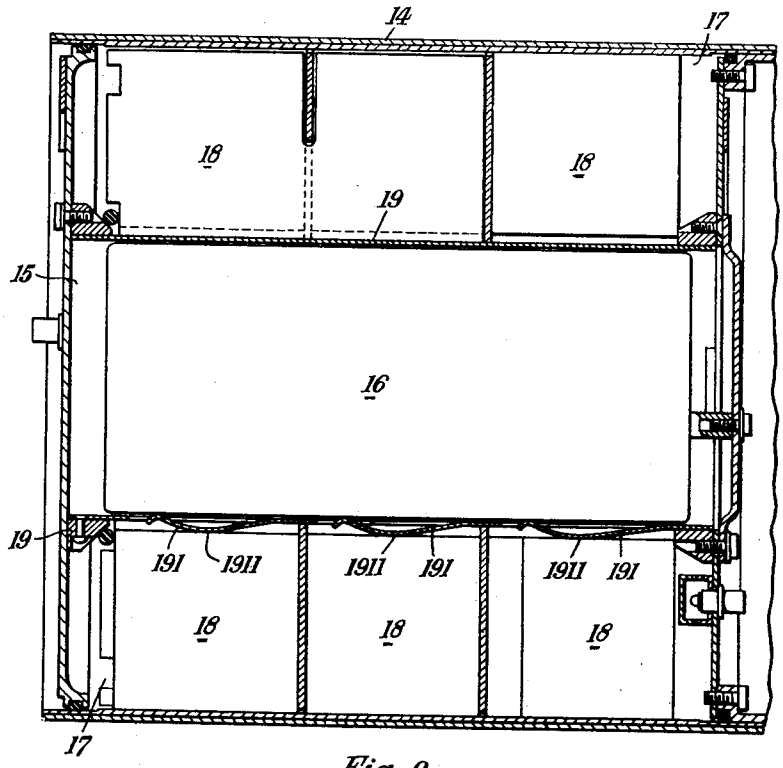


Fig. 2.

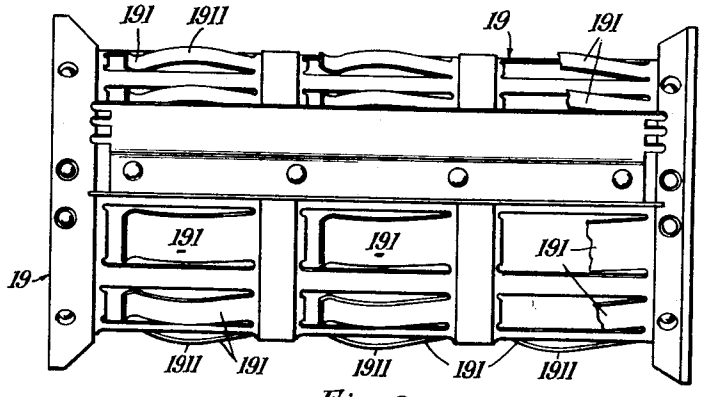


Fig. 3.

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3,013,745

METHOD FOR COOLING MISSILE ELECTRONIC PACKAGES

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3 Claims. (Cl. 244—14)

This invention has reference to guided missiles and other aerodynes of the type in which control in flight is determined by the response to radio signals from a distant station or reflected from a distant object and received by electronic control apparatus in the missile or the like, such apparatus being effective to amplify and transmit such signals to servo-mechanism by which the necessary adjustments of flight control organs are performed. In some circumstances a considerable amount of heat may be developed within the electronic control apparatus during its operation, and the present invention has for its object to provide a manner of housing and packing the control apparatus in the missile casing in such manner as to ensure rapid dissipation of heat from the apparatus.

According to the invention a missile of the type referred to is furnished with a compartment for housing electronic apparatus in discrete component sections, said compartment containing a resilient member of such characteristics that the operation of packing said compartment is effective to deform said member and thereby to press the circumjacent component sections outwardly into contact with the inner skin of the missile, for the purpose stated.

The deformation of said resilient member may result either from the insertion into the compartment of a section of the control apparatus or of a part ancillary thereto, said section or part being arranged to bear against deformable portions of the member, or from the axial pressure on said member of end closures applied to the compartment after completion of the packing operation.

In a preferred form the operation of stressing the resilient member is effected by the insertion into the pack of the final component portion, said member being of cylindrical form and being adapted to enclose said final section the insertion whereof is effective to distort parts of the cylinder radially thereof, thereby applying centrifugal pressure to sections of the apparatus which are disposed about the cylinder.

Said preferred embodiment of the invention is illustrated in, and is hereinafter described with reference to the accompanying drawings.

FIG. 1 of said drawings is a general longitudinal elevation of a guided missile incorporating the invention,

FIG. 2 is an enlarged longitudinal section of the compartment of the missile body in which the electronic control apparatus is housed, showing the manner in which the component sections of said apparatus are packed in accordance with the present invention, and

FIG. 3 is an elevation of the resilient packing member shown separately.

The guided missile illustrated in FIG. 1 comprises a body **10**, two pairs of wing-like control organs **11, 12**, and a tail unit **13**. The two pairs of wings **11, 12** are

disposed in planes at right angles to each other, and being movable in flight, one pair is devoted to deviations in pitch and roll and the other pair to deviations in yaw. Each wing is arranged for adjustment by a hydraulic motor controlled through suitable servo-mechanism in response to radio signals received by electronic control apparatus which is housed within the body compartment **14**, illustrated in detail in FIG. 2, to which reference should now be made.

The compartment **14** incorporates an axial chamber **15** for a thermal battery **16**, and an annular space **17**, surrounding the battery chamber **15**, in which the electronic control apparatus is housed. Said apparatus is conveniently packaged in discrete units **18, 18** of a shape such that they will fit snugly between the cylindrical outer wall of the compartment **14** and the cylindrical surface of a member **19** by which the chamber **15** is separated from the space **17**.

Said member **19** is a sheet metal cylinder, the wall of which has tongues **191** formed therein at a number of axially and circumferentially spaced positions, said tongues **191** being made by pressing out the material of the cylinder wall, the free ends of the tongues lying within the cylinder and their intermediate portions being bowed outwardly as at **1911**.

The interior of the cylindrical member **19** forms the battery chamber **15**, and the arrangement is such that when, after the component packaged sections **18** of the electronic control apparatus have been inserted in the space **17**, the final component item of such apparatus, viz. the thermal battery **16**, is inserted axially into the chamber **15**. The effect is to cause the free ends of the tongues **191** to be pushed outwardly by the sides of the battery, until they assume the position shown in FIG. 2, so that the bowed intermediate portions **1911** are pressed outwardly into contact with the inner face of the sections **18**, causing these to bear tightly against the outer wall of the compartment **14**. In this manner the heat generated within the control apparatus pack is dissipated rapidly and efficiently by conduction in the skin of the missile.

In another embodiment of the invention, not shown in the drawings, the battery compartment is surrounded by a number of springs, which are arranged to be compressed axially by the operation of screwing the ends of the compartment in position, the resultant centrifugal bowing of the springs causing the circumjacent components of the control apparatus to be pressed firmly into contact with the inner skin of the missile.

What we claim as our invention and desire to secure by Letters Patent is:

1. A missile having a skin defining a housing, at least one heat generating unit packaged within said skin housing, and engaging means within said skin housing to place said unit in direct thermal contact with said skin for conducting heat exchange thereto, said means comprising deformable resilient means pressing said heat generating unit into engagement with said skin housing.

2. Apparatus as in claim 1 further comprising an additional component and wherein said engaging means is pressed into engagement with said unit by insertion into the skin housing of said additional component.

3. Apparatus as in claim 1 wherein the skin housing includes an axial chamber for housing a thermal battery

and further includes an annular chamber surrounding said battery chamber for housing separate portions of heat generating electronic apparatus, said axial chamber being constituted by a sheet metal cylinder having portions of its wall pressed out to form tongue-like protuberances of which the free ends lie within the axial chamber and their intermediate portions are bowed outwardly beyond the mean diameter of the axial chamber, the arrangement being such that the insertion into the axial chamber of a member conforming generally to its mean inner dimensions will cause the outwardly bowed portions of said tongue-like protuberances to be pressed substantially radially outwards.

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