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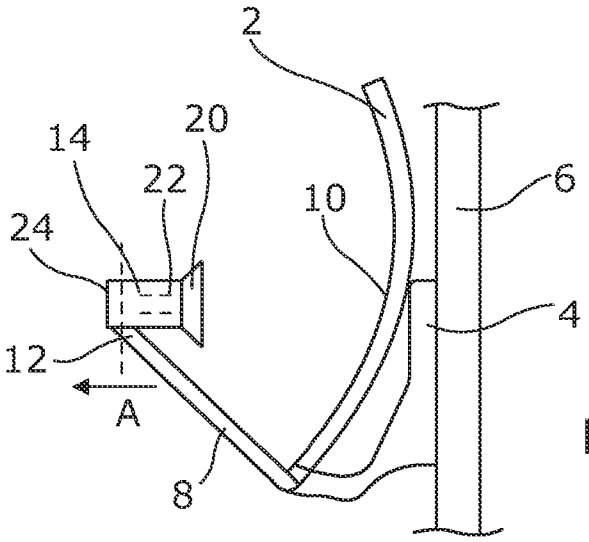

Figure 1

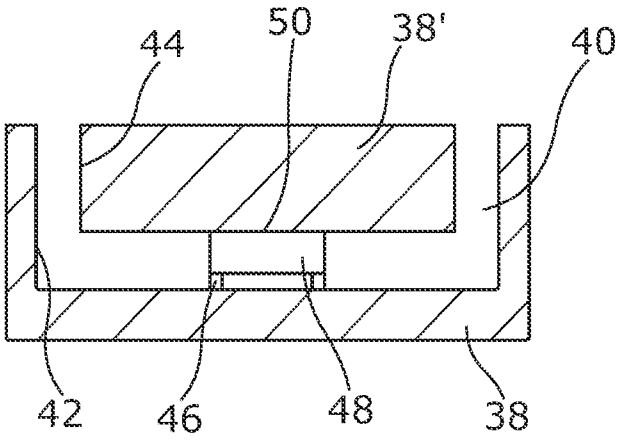

Figure 2a

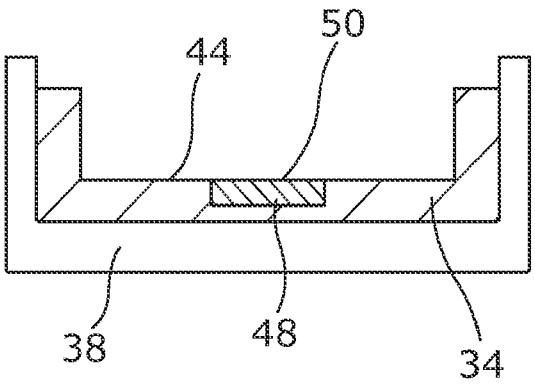

Figure 2b

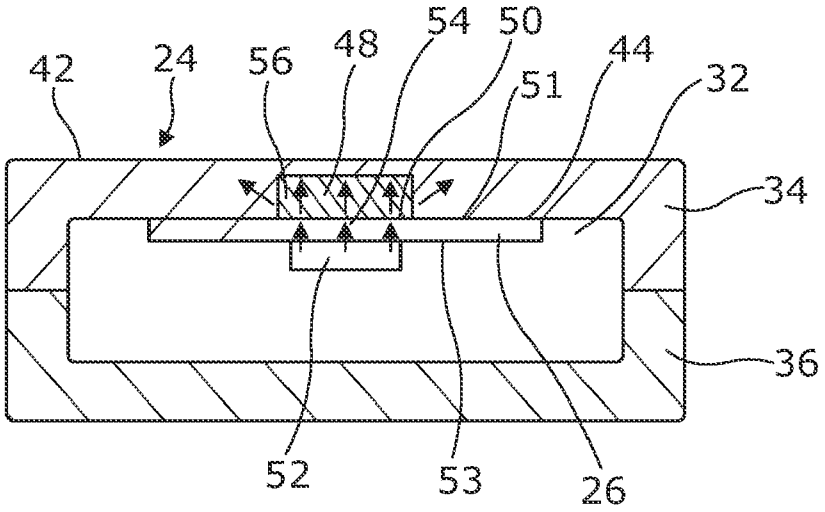

Figure 3

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Apparatus to provide improved cooling of data signal processing apparatus

The invention to which this application relates is to an improvement in the form of apparatus which is used to receive and/or transmit data and, most typically, but not necessarily exclusively, apparatus which operates within relatively tight confines of available space and, in one embodiment, apparatus which is used in conjunction with an antenna so as to allow the reception and/or transmission of data to and from one or more satellites.

Apparatus of the type referred to above is well-known and typically comprises, as an assembly, the antenna, an arm depending to the front of the antenna and on which is mounted a housing with a feedhorn, waveguide and data processing components, and which form a transceiver. Received data signals and/or data signals that are to be transmitted, are processed by the transceiver and then passed along the waveguide structure in one direction to allow the same to be transmitted therefrom or received and passed along the waveguide in the opposite direction for further processing and use such as to form, for example, audio and/or video.

The data processing components of the transceiver are typically located in the housing which is mounted on the arm of the antenna along with the feedhorn and waveguide. Data signals of the required frequency range which are received by the feedhorn are able to pass along the waveguide and as they pass along the same the data signals are filtered and passed to appropriate data processing means in order to allow the data signals to be further processed.

When the apparatus is provided to transmit data signals the processed data signals pass along the waveguide in the opposite direction towards the feedhorn and are emitted from the apparatus and transmitted to one or more remote locations.

The housing is typically formed by casting one or more parts from a metal or metal alloy, such as aluminium or an aluminium alloy. The parts are then joined together to form the housing in which there is defined a sealed substantially waterproof cavity in which the data processing components, typically located on one or more circuit boards, are located. The number of components and/or circuit boards, in combination with the relatively confined size of the cavity in which the same are

located, means that problems are created with respect to the heat which is generated in the cavity by the operation of the data processing components.

It is found that if the heat is not effectively dissipated then the heat can be generated to reach a temperature which means that the operation of one or more components and, as a result, the apparatus itself, is adversely affected and to such an extent that no or inferior quality data processing is achieved.

This problem is well known and is particular problematic with regard to the operation of certain types of components, such as power amplifiers which are provided to amplify the data signals so as to allow the data signals to have sufficient strength of signal to be passed for further processing and also to minimise loss and error in the subsequent processing of the data signals. In order to achieve this amplification, one or more of the amplifier components are typically located on the printed circuit boards located in the housing. However, the need for the location of the one or more amplifiers in the housing causes a significant amount of heat to be generated.

In order to address the problem, the conventional approach has been to provide the external surface of the cast parts which are used to form the housing with a series of fins or other formations so as to increase the effective external surface area of the housing and thereby increase the ability for heat dissipation. While this can be effective, the amount of heat dissipation which can be achieved is still limited and, in certain instances, is not sufficient so as to allow or ensure optimum performance of the components. It is also known to machine the cast parts, once removed from the casting moulds, and/or to provide additional components in the housing, in order to try and dissipate and hence reduce the heat which is created but the provision of these additional items, means that inconsistencies can be created in the internal surfaces of the housing and, when one considers that a key part of the formation of the housing is to ensure minimal or no inconsistencies in the internal surfaces, as these can cause malfunction of the apparatus, it will be appreciated that the addition of components, and the inconsistencies which are caused, can be outside acceptable tolerances for the required operation of the apparatus to be achieved. As a result, the most common means of addressing this problem is still the provision of a series of fins on at least one external wall of the housing despite

the fact that the provision of the fins, increases the size of the housing and creates difficulties in casting the same. Furthermore, it is found that as requirements for amplification increase for certain apparatus types, the fins are not sufficiently effective so as to create the said required level of cooling.

The option of performing further machining after the casting of the parts, represents additional expense and time to the manufacturer which is generally to be avoided given the relatively tight time and cost constraints that the manufacturer may be operating under.

An aim of the present invention is therefore to provide apparatus in a form which provides the ability for improved heat dissipation from the interior cavity of the apparatus housing to be achieved to thereby allow more reliable operation of the apparatus and greater freedom in the selection of components which can be used.

A further aim of the invention is to allow efficient heat dissipation to be achieved in the apparatus whilst, at the same, time minimising or removing the need for machining of the cast parts used to form the housing in which the components are located.

In a first aspect of the invention, there is provided apparatus for the processing of data signals which are received by and/or transmitted from said apparatus, said apparatus including at least first and second parts which, when joined together, form a housing with a cavity in which is located a plurality of data processing components mounted and connected so as to allow the processing of the said data signals, said parts at least partially formed of a first metal or metal alloy and wherein at least a portion of at least one of said parts is formed of a second metal or metal alloy which has a greater heat conducting characteristic than that of the said first metal or metal alloy.

In one embodiment the said at least one portion of the second metal or metal alloy is selectively located on the said at least one part with respect to the position of one or more of the data processing components which are known to generate the greatest amount of heat when operating. Typically said second metal or metal alloy

portion is positioned adjacent said one or more components when the housing is formed and the apparatus is operational.

In one embodiment the said at least one portion is located such that a surface of the same lies substantially flush with the adjacent internal face of the said part and which is formed by the first metal or metal alloy.

Typically the said portion of the second metal or metal alloy has a depth which extends from said internal face of the part towards the external surface of the part so as to allow heat to transfer through the said second metal or metal alloy portion more quickly than it would pass through the first metal or metal alloy, to the external surface of the housing and to be dissipated therefrom.

In one embodiment, the said data processing component or components are located with respect to one or more printed circuit boards located in the cavity and the printed circuit board or boards are located with respect to said at least one portion of second metal or metal alloy such that the said printed circuit board is substantially flush with the external surface of said portion or portions of the second metal or metal alloy .

In one embodiment the external surface of the housing is provided with fins and/or other heat dissipation formations to further encourage heat transfer and dissipation from the portion formed of the second metal or metal alloy. In one embodiment the pattern, dimension and/or shape of said fins and formations is designed specifically with respect to the location of the said at least one portion of the second metal or metal alloy so as to enable effective heat transfer and dissipation.

In one embodiment the said one or more data proessing component with respect to which the at least one portion of the second metal or metal alloy is located is, or includes, a power amplifier.

In one embodiment the melting point of the second metal or metal alloy is greater than the melting point of the first metal or metal alloy.

In one embodiment the said first metal or metal alloy is, or includes, aluminium and the second metal or metal alloy is, or includes, copper.

In one embodiment the said at least one portion of the second metal or metal alloy is stamped or otherwise formed as a unitary portion and the first metal or metal alloy is cast around the said at least one portion so that the said at least one portion forms an integral part of the cast part.

Typically the said housing is provided as part of a transceiver or block upconverter for transmitting data signals via one or more satellite communication systems.

In one embodiment the transceiver or block upconverter is mounted on an arm located with respect to a reflecting antenna or dish. Typically the apparatus is provided to process data signals provided in a particular format and frequency range.

In a further aspect of the invention there is provided a method for forming apparatus for the reception and/or transmission of data signals, said method including the steps of forming a housing with a cavity in which a plurality of components are located to process said data signals, forming said housing from at least first and second parts, at least one of said parts formed from a first metal or metal alloy and then joining said parts together to form the said housing with the cavity therein and, wherein said at least one part includes a portion of a second metal or metal alloy formed integrally therewith.

In one embodiment said at least one portion is located in the said part such that an internal face of the said portion is positioned substantially flush with the adjacent internal face of the first metal or metal alloy of said part.

In one embodiment at least said one, and typically both of said parts are formed by casting the first metal or metal alloy in respective casting moulds or dies.

In one embodiment said at least one portion of the second metal or metal alloy is provided in a solid form and positioned in the mould or die and the said first metal or metal alloy is introduced into the mould or die in a liquid form to solidify and

include the said second metal or metal alloy portion as an integral part thereof when the part is removed from the mould or die.

Typically, the said one or more portions of the said second metal or metal alloy, are held on location means during the formation of the housing part and said location means are, in turn, held in location in the mould into which the first metal or metal alloy is introduced in a fluid condition so as to fill the mould to the required level and, as the said first metal or metal alloy flows into the mould, the same flows to the edges of the said one or more portions so as to locate the same therewith and locate the said one or more portions as integral parts of the said internal surfaces or walls of the housing.

Typically when the parts are joined together, with the said processing components located therein, said portions of the second metal or metal alloy are located adjacent to the one or more components which are known to generate the most heat when operating.

Typically the said second metal or metal alloy has a higher heat conductivity characteristic than said first metal or metal alloy and/or has a higher melting temperature than the first metal or metal alloy.

In one embodiment, the method includes a further step of locating one or more printed circuit boards in the said cavity which is then formed by joining the said housing parts together such that the said one or more components on the printed circuit boards which are known to create the greatest amount of heat during operation, are located at or adjacent to the said one or more portions on the internal surface of the cavity of the housing so as to maximise the dissipation of heat from the said component.

Thus, as a result of the provision of the one or more portions of the second metal or metal alloy which has improved heat dissipation characteristics with regard to the first metal or metal alloy, and then locating the said heat creating data processing components at or adjacent to the said portion, so improved heat dissipation from the housing cavity as a whole can be achieved and, as the said portion or portions are formed as part of the housing wall during the formation of the housing then the

parameters and tolerances with regard to the internal walls of the cavity are achieved and so no reduction of performance of the data processing is caused.

Specific embodiments of the invention are now described with reference to the accompanying drawings wherein:

Figure 1 illustrates apparatus in accordance with one embodiment and in which the current invention can be utilised;

Figures 2a-b illustrate the process steps in accordance with one embodiment of the invention; and

Figure 3 illustrates schematically a cross sectional elevation of a part of the housing and cavity and a data processing component in accordance with one embodiment of the invention;

Referring firstly to Figure 1, there is illustrated apparatus for the transmission of data signals which, in this embodiment, are broadcast via a satellite system, said apparatus including an antenna, or dish, 2, which typically, is mounted via a mounting means 4 on a wall 6 of a building or may be self supporting on a stand in other embodiments of use. The antenna is provided with an arm 8 which extends to the front of the receiving surface 10 of the antenna 2.

At the free end 12 of the arm, there is provided a transceiver or block upconverter apparatus 14 which is positioned so as to transmit data signals towards the front surface 10 of the antenna and received data signals reflected from the front surface of the antenna. Data signals are transferred between further apparatus in the premises 18.

The transceiver or block upconverter apparatus 14 includes a feed horn 20 which transmits the data signals towards the antenna front surface 10 and receives data signals from the antenna front surface 10 via a waveguide structure 22 within the housing 24. The waveguide is dimensioned so as to only allow data signals within particular frequency bands, to pass along the same and certain formats of the data signals which are received are filtered by the waveguide structure and passed to data

processing means typically located on one or more printed circuit boards 26 in a cavity 32 formed in the housing 24. The housing 24 is typically formed of, in this embodiment first and second cast parts 34,36 which are joined together to form a sealed cavity therein.

At least one, but typically both, of the parts 34, 36 are formed by casting a metal such as aluminium, or a metal alloy, typically including aluminium. In accordance with the invention at least one of the parts 34,36 includes at least one portion of a second metal, such as copper, or a metal alloy such as an alloy which includes copper.

A casting process for at least one of the parts 34 so that it includes a portion of the second metal or metal alloy is illustrated in Figures 2a-b. Referring to Figure 2a there is illustrated a mould formed by base 38 and insert 38' which is shown in cross sectional elevation and schematically for the purposes of illustration. The empty volume 40 of the mould is formed so as to define the shape of the external walls 42 of the part and the internal wall or surface 44 of a part of the cavity 32 which is formed when the parts 34, 36 are moved together. In addition, there is provided a holder 46 which is located in the mould 38. The holder has mounted thereon a portion 48 of the second metal or metal alloy which is already formed as a solid item. The portion 48 is located by the holder 46 as the molten first metal or metal alloy is poured into the space or volume 40 so that the first metal or metal alloy fills the space 40 and flows around the portion 48. The setting of the location of the portion 48 on the holder 46 ensures that the face 50 of the portion 48 lies substantially flush with the adjacent wall or surface 44 formed by the solidified first metal or metal alloy as illustrated in Figure 2b. In Figure 2b the insert 38' has been removed and the solidified and cast part 34 is shown with the portion 48 integral with the part 34.

It should be appreciated that there may be a number of portions 48 provided in the same part 34 and/or in the other part 36. The location of the portion or portions 48 is to ensure that the same are located at the most effective location when the cavity is formed so as to maximise the cooling or heat dissipation effect on one or more of the heat producing data processing components 52 as illustrated in Figure 3.

Figure 3 illustrates a power amplifier component 52 mounted on a printed circuit board 26 and the same is mounted within the cavity 32 which is formed when the

parts 34, 36 have been joined together and is illustrated as a sectional elevation along line A-A. In accordance with the invention, the portion 48 is located so that the face 50 of the same lies flush with the wall or surface 44 of the cavity so as not to adversely affect the operation of the apparatus while, at the same, ensure that it is the second metal or metal alloy portion 48 with the superior heat conductive characteristics which is positioned closest to the component 52.

The face 51 of the PCB 26 is mounted so as to be flush with the surface 44 with the component mounted on the opposing side 53 of the printed circuit board 26. As a result of this heat generated by the component passes through the PCB and immediately into the appropriately positioned second metal or metal alloy portion 48 and then is dissipated in and through the portion 48 to a significant extent and then further dissipates into the cast part 34. As the second metal or metal alloy of the portion 48 has superior heat conductivity in comparison to the first metal or metal alloy, so the heat generated by the amplifier component 52 is more effectively and efficiently dissipated from the data processing component by the portion 48 as indicated by arrows 56 and therefore is moved away from the component and the cavity 32 more quickly and efficiently than in the conventional apparatus. It should be appreciated that the same heat dissipation arrangement can be provided on other locations of the same part 34 and/or the other the other part of the housing 36 as required, instead of, or in addition to, the arrangement shown in part 34 in order to suit the particular design and operating characteristics of the apparatus.

This, in turn, prevents build-up of heat and allows the correct operation of the components and hence the apparatus to be achieved. It also provides the potential for the use of data components which generate heat when in use and, which previously could not be used due to concerns over the effect that the heat will produce on the operation of the apparatus.

Claims-clean copy

1 A method for forming apparatus for the reception and/or transmission of data signals, said method including the steps of forming a housing with a cavity in which at least one printed circuit board including a plurality of components is located to process said data signals, forming said housing from at least first and second parts, at least one of said parts formed in a mould or die from a first metal or metal alloy and including a portion of second metal or metal alloy with a greater heat conductivity characteristic than the first metal or metal alloy, joining said parts together to form the said housing with the cavity therein and wherein said at least one portion of the second metal or metal alloy has a face positioned so as to be substantially flush with the adjacent internal face of the first metal or metal alloy of said part, said second metal or metal alloy portion provided in a solid form and positioned in the mould or die and the said first metal or metal alloy is introduced into the mould or die in a liquid form to solidify and include the said second metal or metal alloy portion as an integral part thereof when the part is cast and removed from the mould or die, locating said at least one printed circuit board in the said cavity prior to joining the said housing parts together such that one or more of said components which are known to create the greatest amount of heat during operation of the apparatus are located at or adjacent to the said portion of the second metal or metal alloy so as to dissipate heat from the said one or more components via said portion of second metal or metal alloy.

2 A method according to any of claim 1 wherein the said second metal or metal alloy which is selected has a higher melting point than the first metal or metal alloy.

3 A method according to any of claims 1-2 wherein the said at least one portion is held on location means during the formation of the housing part and said location means are, in turn, held in location in the mould into which the first metal or metal alloy is introduced in a fluid condition so as to fill the mould to the required level and, as the said first metal or metal alloy flows into the mould, the same flows to the edges of the said at least one portion to locate the same therewith.

4 A method according to any of the claims 1-3 wherein a plurality of said portions of the second metal or metal alloy are located with one or more of the parts of the said housing.

5. A method according to any of the preceding claims wherein the said printed circuit board or boards are located intermediate the said data processing component and the said portion of the second metal or metal alloy

6 A method according to any of the preceding claims wherein the external surface of the housing is provided with fins and/or other heat dissipation formations.

7 A method according to any of the preceding claims wherein the said one or more components with respect to which the at least one portion of the second metal or metal alloy is located, is, or includes, a power amplifier.

8 A method according to any of the preceding claims wherein the said first metal or metal alloy is, or includes, aluminium.

9 A method according to any of the preceding claims wherein the second metal or metal alloy is, or includes, copper.

10 A method according to any of the preceding claims wherein the at least one portion of the second metal or metal alloy is formed as a unitary portion and the first metal or metal alloy is cast around the said at least one portion so the said at least one portion is integral with the cast part.

11 Apparatus including a housing formed using a method according to any of claims 1- 10

12 Apparatus according to claim 11 wherein the housing is provided as part of a transceiver apparatus.

13 Apparatus according to claim 11 wherein the said housing is provided as part of a block up convertor apparatus.

14 Apparatus according to any of the claims 11-13 wherein the apparatus is provided to process data signals within a predetermined frequency range and format.