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(56) Documents Cited:
GB 2500119 A
DE 102013208984 A1
JP 2009077211 A
JP 2008005461 A
US 20130293322 A1
US 20080020727 A1
US 20030021095 A1
DE 102013223309 A1
DE 102012222674 A1
JP 2009071764 A
US 20150098198 A1
US 20110063810 A1
US 20040036661 A1

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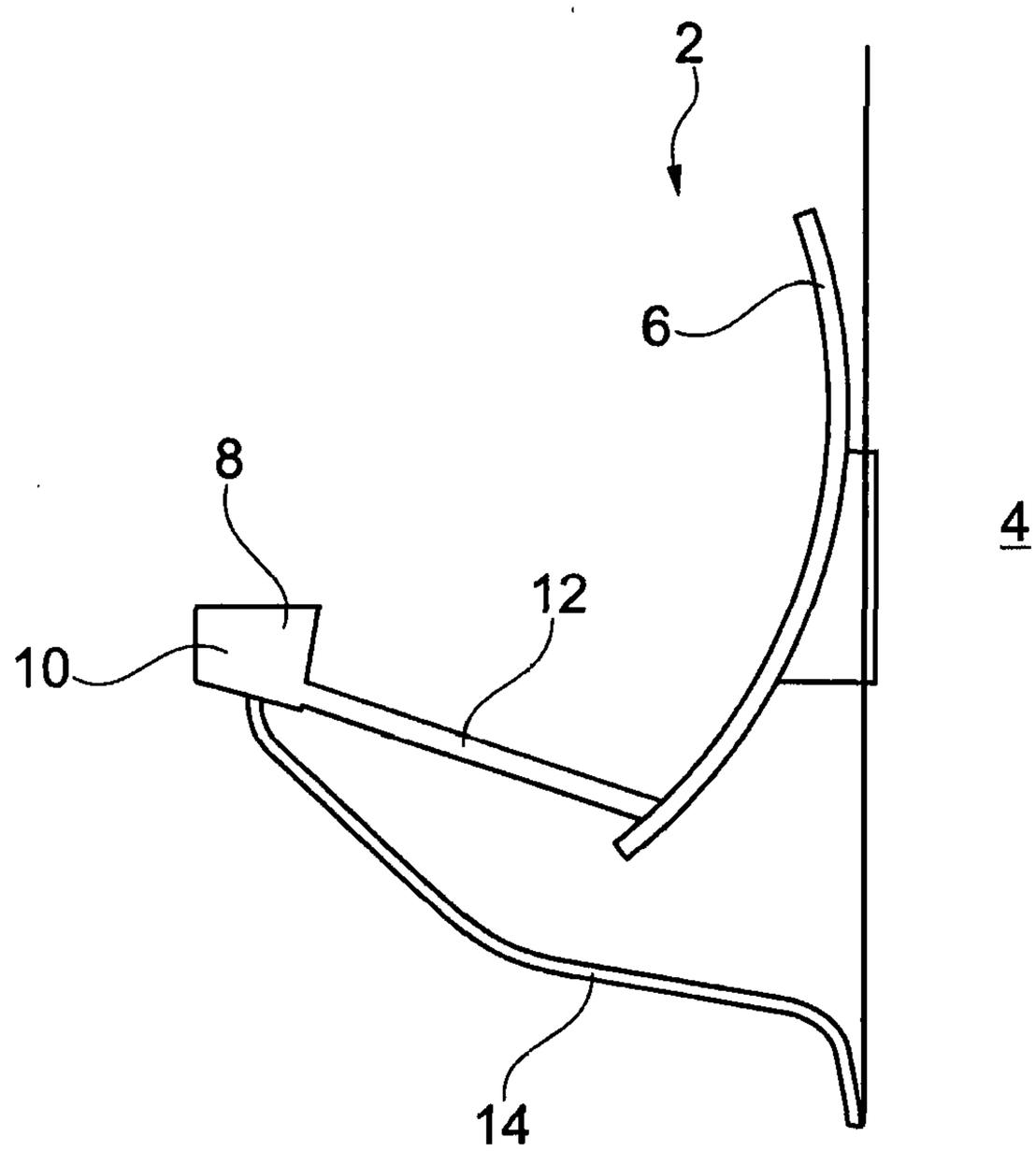

Fig. 1a

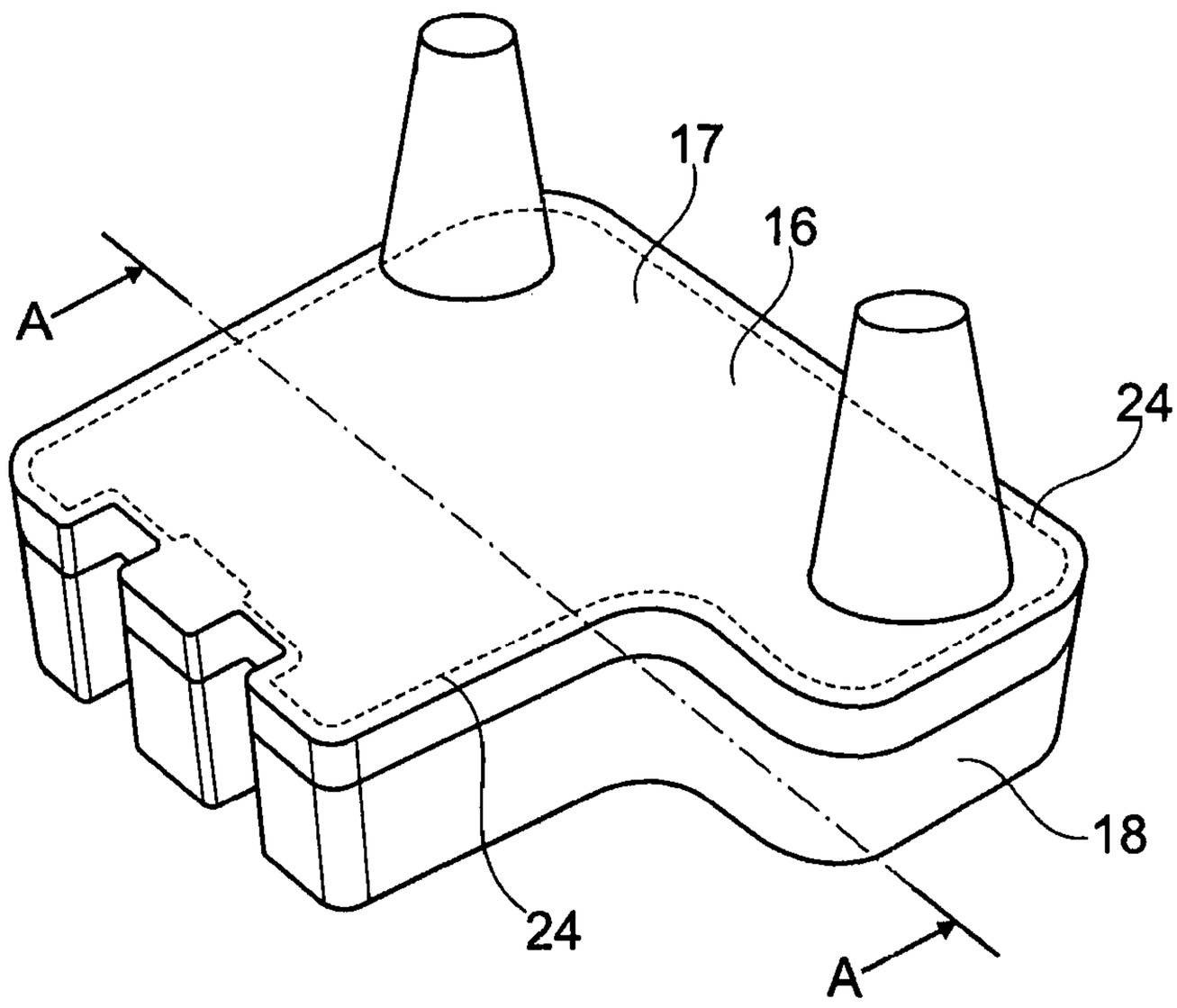

Fig. 1b

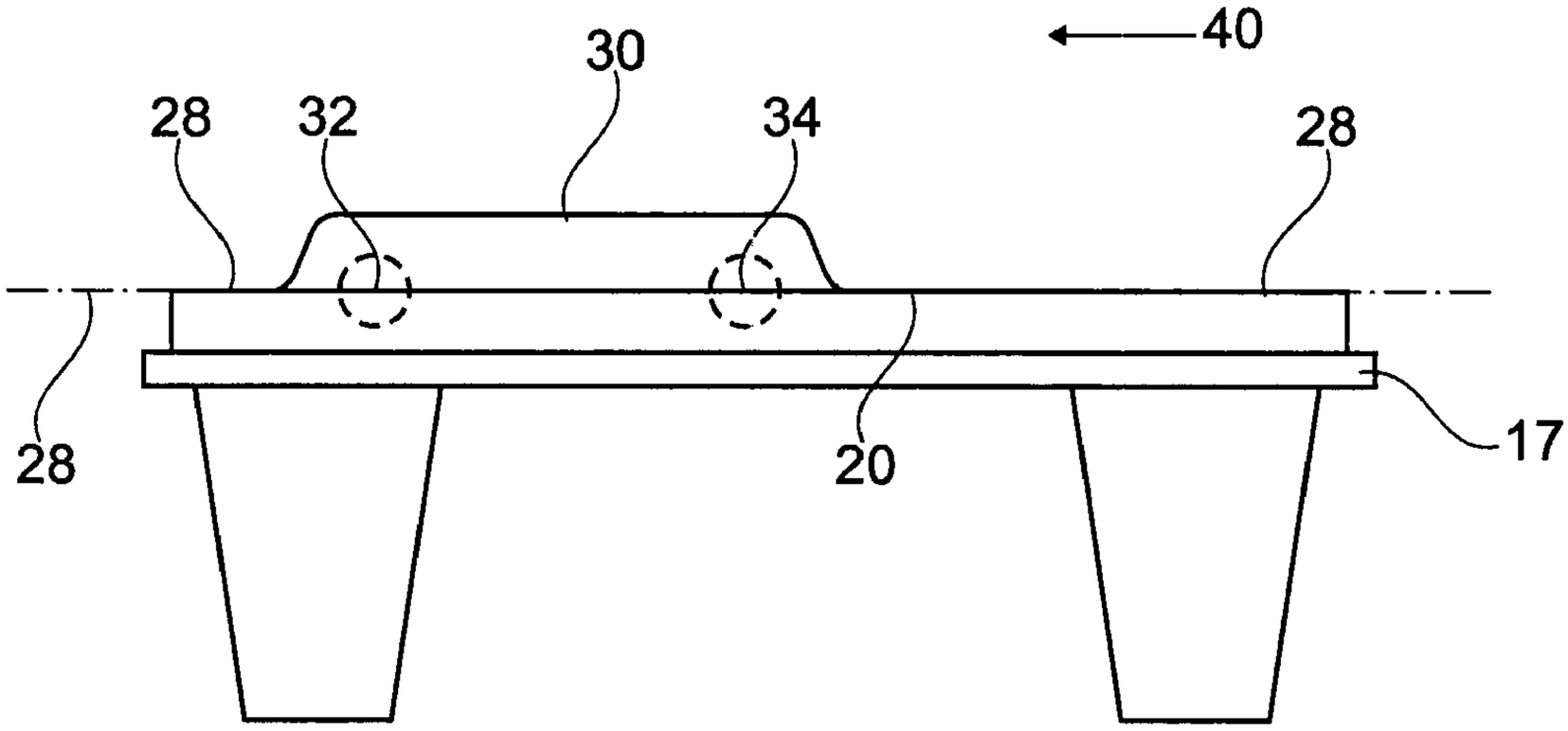

Fig. 2a

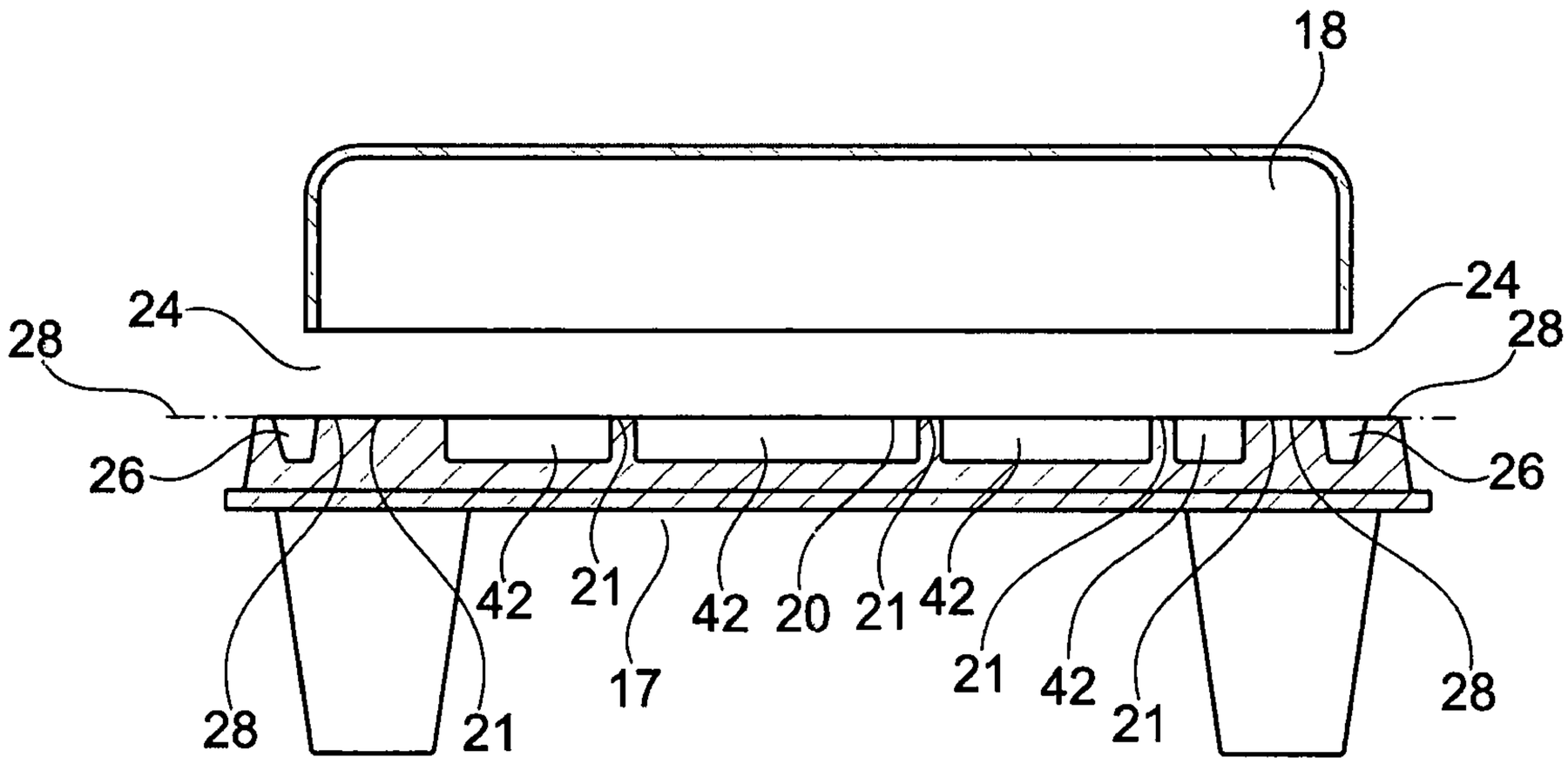

Fig. 2b

Fig. 3

Improvements to a method of forming Receiving apparatus for Satellite transmitted data

The invention which is the subject of this application relates to the provision of an improved method of forming receiving apparatus for use at a receiving location. The apparatus is provided to receive, process and transmit data onwardly to a distribution system by which at least some of the received data can be passed to a broadcast data receiver or set top box apparatus at one or more user locations. At the user location, processing apparatus within the broadcast data receiver can be used to generate video and/or audio which can be provided to a user via a display screen and/or speakers and thereby allow selected television and/or radio programmes to be provided to the user at that location.

The invention relates more specifically to the method of forming the Low Noise Block provided as part of the receiving apparatus which is provided at the receiving location and which apparatus typically also includes at least one antenna or dish which is directed and positioned so as to receive data signals which are transmitted to the same from a broadcast location, via one or more satellites. The antenna is provided with an arm which extends to the front of the same and at the free or distal end of the arm there is provided a waveguide through which the data signals reflected by the antenna, pass. The waveguide is connected to the one or more Low Noise Blocks and the Low Noise Block is provided to allow the passage of data therethrough in selected paths in different polarisations, such as Circular and Linear, and/or in different orthogonal components such as vertical and horizontal. The data signals may also be up or down converted to suit particular frequencies and operating requirements.

The LNB typically also has a number of outputs for the different data signal paths and, in one embodiment, the format of the data may be converted from an RF mode to an optical mode. In either case the data is then carried from the LNB to the one or more user locations using suitable cabling such as coaxial cables or fibre optic cables as appropriate.

The LNB typically comprises the required processing circuitry implemented on one or more printed circuit boards which are located by and within a housing, which is formed of a suitable metal such as aluminium or alloy. When one considers that the LNB is typically provided to be located externally and is therefore susceptible to, sometimes extreme, external environmental conditions, it will be appreciated that it is critical that the housing which is provided is capable of maintaining the circuit boards and components thereon in a waterproof and stable environment for a significant period of time, typically for several years. The circuitry which is used may vary from LNB to LNB but the requirement for the LNB housing to be stable and mechanically sound is the same in each case.

In particular, problems can be experienced in the provision of the mounting for the one or more printed circuit boards within the housing of the LNB. Conventionally, the printed circuit boards are mounted on pillars which are provided as part of the housing, with the pillars typically formed as part of the housing body, which, typically, is cast. However the formation of the dowels and pillars are required to be extremely accurate in terms of their dimensions and location and this requirement for accuracy increases as the provision of multilayers of printed circuit boards are provided and each are required to be located in a specific layered configuration.

When the overlapping boards are provided so the same are conventionally provided or mounted at different levels on the same pillars or posts. However as the multi-layered printed circuit boards are required to be aligned and, in particular, apertures which may be provided in each of the boards need to be aligned, to allow the probes from the associated waveguide to be correctly contacted with the printed circuit board so the levels of accuracy which is required in the mounting of the same increases.

It is found that, in practice, the tolerance requirements cannot be achieved repeatedly in manufacturing and, as such, in practice significant reworking of the product is required which means that the yield and quality of the products which can be achieved using the conventional casting procedure is adversely affected. Typically, even if accurate casting techniques are used, the accuracy of the mould tools which are used wear over time which makes the required accuracy increasingly difficult to achieve over time or the expense of forming new moulds has to be incurred.

An aim of the present invention is therefore to provide an improved LNB housing of a form which allows the accurate, and repeatedly accurate, formation of the same and hence the accurate mounting of printed circuit boards thereon.

In one aspect of the invention there is provided a method of forming a Low noise block (LNB) apparatus provided to receive and process data from which audio and/or video can be generated, said method including the steps of; forming a housing by joining a body and lid together along an interface which includes a recess formed in the body in a mounting face along the periphery thereof, to form a cavity in the housing in which is located at least one printed circuit board on which a plurality of components

and one or more data processing paths for received data are formed, and one or more outputs to allow the onward distribution of the data, locating the at least one printed circuit board with respect to the mounting face formed on the said body by a plurality of portions with respective mounting surfaces, said mounting surfaces formed in a block of the material from which the body is formed by a fly cutting or face milling machining operation on the said block of the material such that the said mounting surfaces lie substantially in the same plane across the said body, inserting a plurality of pins into respective ports formed in the said body and locating the one or more printed circuit boards thereon and wherein the body is formed with a matrix of said portions forming the mounting face and channels formed therebetween.

In one embodiment the machining operation is performed as a single pass.

In one embodiment the fly cutting or face milling operation is performed from one edge to an opposing edge across the portions to form the said mounting face.

In one embodiment said series of ports are formed in the said mounting surface of said body at spaced intervals

It is found that by mounting the printed circuit boards on the pins rather than dowels formed as part of the casting in the conventional form, so the location of the printed circuit boards can be significantly more accurately achieved.

Typically this also allows the probes which are provided from the waveguide located with the LNB to be more accurately located with the appropriate components on the printed circuit board.

In one embodiment a number of printed circuit boards are provided and, in one embodiment at least a portion of the respective printed circuit boards overlap and/or are offset.

In one embodiment the mounting surface of the portions adjacent the recess are in the same plane as the mounting face of the body for more than 75% of the length of the interface.

The location of the pins used to locate the PCB's with respect to the matrix and with respect to each other, in ports formed in the body portion of the LNB and provide a more accurate location means for the PCB'S during assembly of the LNB and therefore avoids problems in meeting quality requirements and reduces the need for reworking of the apparatus components to meet manufacturing tolerance requirements.

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

Figures 1a and b illustrate schematically apparatus in accordance with one embodiment of the invention;

Figures 2a and b illustrate an end view and a cross sectional end view of the body of the LNB of Figure 1b; and

Figure 3 illustrates an embodiment of a mounting arrangement for overlapping Printed Circuit Boards in accordance with the invention.

Referring firstly to Figures 1a and b there is illustrated apparatus 2 provided at a receiving location 4 to receive and process data received from a satellite broadcast system. The apparatus includes at the receiving location at least one antenna 6 connected to at least one waveguide assembly 8 and LNB 10 mounted on an arm 12 which depends to the front of the antenna 6.. The LNB is connected to cables 14 to allow the onward distribution of the data therefrom to within the receiving location 4.

As shown in Figure 1b, the LNB includes a housing 16 formed by a body portion 17 and a lid portion 18. A cross sectional elevation of the body portion 17 and lid portion 18 separated is shown in Figure 2b and an end view of the body portion on it's own is shown in Figure 2a.

The body portion is provided with a mounting face 20 which is formed by a plurality of surfaces 21 of upstanding portions of the body and these surfaces 21 are provided to lie in substantially the same plane 28 across the body portion. At least one printed circuit board (not shown) is located with respect to the mounting face 20 and substantially parallel therewith. At least some of the components and circuitry which allow the LNB to function in a desired manner are formed and located on the at least one printed circuit board.

Also illustrated is an interface 24 which includes a recess 26 formed in the body portion 17. It will be seen that the plane 28 of the body forms the mounting face 20. It is only the portion 30 which is raised in order to allow external connection ports 32, 34 to be located. In accordance with the invention, the body portion is formed from a block of material such as aluminium or a metal alloy and the mounting face 20 in the plane 28 is formed by a machining operation such as by a single pass fly cut machining operation.

Fly cutting is a form of a milling machining operation and the fly cutter can, in one embodiment, be formed by a body into which one or two tool bits are inserted such that as the body is rotated the tool bits take broad, shallow facing cuts in the material. Fly cutters are analogous to face mills in that their purpose is face milling and their individual cutters are replaceable and these could be used but face mills tend to be more expensive.

The fly cutter will typically have a cylindrical body that holds one or more tool bits. In another form the fly cutter may be provided in the form of a fly bar.

In either form the fly cutter is passed across the material in the direction indicated by arrow 40 and parallel to the plane 28 in which the mounting face is to be formed to remove the required amount of material and form the said surfaces 21 in the same plane 28 and hence form the mounting face 20.

The location of the printed circuit boards is required to be accurate with respect to the matrix formed by the portions on which the surfaces 21 are formed. These portions are located so as to form a number of recesses and channels 42 in the body portion 17 in order for the appropriate connections to be made and the printed circuit board mounted components and hence the LNB as a whole to operate correctly in the body 17.

Figure 3 illustrates the manner in which printed circuit boards 44, 46 can be mounted to overlap and are mounted at different levels on the same, common, pins 48. The pins are received and located in ports 50 which are formed in the body portion 17 and which allows a more accurate location of the printed circuit boards with respect to the matrix 42 surfaces 21 and the LNB body portion 17.

There is therefore provided an accurately formed LNB body portion with a mounting surface formed in the same plane and which therefore allows a more accurate location for the printed circuit board or boards thereon, and, in turn, a more accurate location of the components with respect to components such as the waveguide probes and therefore improving the operation of the apparatus. Furthermore, the provision of the formation of the mounting surface by using a fly cutting operation means that the formation of the LNB can be achieved more rapidly and with greater repeated accuracy than is conventionally the case.

Claims-

1. A method of forming a Low noise block (LNB) apparatus provided to receive and process data from which audio and/or video can be generated, said method including the steps of; forming a housing by joining a body and lid together along an interface which includes a recess formed in the body in a mounting face along the periphery thereof, to form a cavity in the housing in which is located at least one printed circuit board on which a plurality of components and one or more data processing paths for received data are formed, and one or more outputs to allow the onward distribution of the data, locating the at least one printed circuit board with respect to the mounting face formed on the said body by a plurality of portions with respective mounting surfaces, said mounting surfaces formed in a block of the material from which the body is formed by a fly cutting or face milling machining operation on the said block of the material such that the said mounting surfaces lie substantially in the same plane across the said body, inserting a plurality of pins into respective ports formed in the said body and locating the one or more printed circuit boards thereon and wherein the body is formed with a matrix of said portions forming the mounting face and channels formed therebetween .

2. A method according to claim 1 wherein the fly-cutting or face milling operation is performed from one edge to an opposing edge across the said block of material to form the mounting face.

3 A method according to claim 2 wherein the machining operation is performed as a single pass.

4 A method according to claim 1 wherein a number of printed circuit boards are provided and at least a portion of the respective printed circuit boards overlap and/or are offset.

5 A method according to claim 1 wherein the face of the body portion adjacent the recess lies in the same plane as the said mounting face for greater than 75% of the length of the said interface.