ELECTRONIC APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2014-266736, filed December 26, 2014; the entire contents of which are incorporated herein by reference.

FIELD

Embodiments described herein relate generally to an electronic apparatus.

BACKGROUND

Recently, an electronic apparatus which is manufactured by inserting a resin around electrical components that are inserted into a gap portion formed by closing a mould and by integrating the electrical components and the resin using insert molding, has been known.

An example of related art includes JP-A-2003-94479.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an electronic apparatus according to a first embodiment.

FIG. 2 is a side view in a longitudinal direction of a substrate illustrating a shape of the substrate of the electronic apparatus and an example of a disposal of electrical components provided on the substrate according to the first embodiment.

FIG. 3 is a side view in a lateral direction of the substrate illustrating the shape of the substrate of the electronic apparatus and the example of the disposal of the electrical components provided on the substrate according to the first embodiment.

FIG. 4 is a plan view illustrating the shape of the substrate of the electronic apparatus and the example of the disposal of the electrical components provided on the substrate according to the first embodiment.

FIG. 5 is a plan view illustrating an inserted state of the substrate and an image of flow of a synthetic resin material in an inside of a mould at the time of molding a housing of the electronic apparatus according to the first embodiment.

FIG. 6 is a side view illustrating an inserted state of the substrate in the inside of the mould at the time of molding the housing of the electronic apparatus according to the first embodiment.

FIG. 7 is a diagram illustrating a flow of a resin at the time of molding the housing of the electronic apparatus according to the first embodiment.

FIG. 8 is a diagram illustrating a positional relationship between the substrate of the electronic apparatus according to the first embodiment and a gate of the mould.

FIG. 9 is a diagram illustrating a flow of a resin at the time of molding a housing of an electronic apparatus according to a second embodiment.

FIG. 10 is a diagram illustrating a flow of a resin at the time of molding a housing of an electronic apparatus according to a third embodiment.

FIG. 11 is a plan view illustrating a shape of a non-flat portion of a substrate of an electronic apparatus according to a fourth embodiment.

FIG. 12 is a plan view illustrating a shape of a non-flat portion of a substrate of an electronic apparatus according to a fifth embodiment.

FIG. 13 is a plan view illustrating a shape of a non-flat portion of a substrate of an electronic apparatus according to a sixth embodiment.

FIG. 14 is a plan view illustrating a shape of a non-flat portion of a substrate of an electronic apparatus according to a seventh embodiment.

FIG. 15 is a plan view illustrating a shape of a non-flat portion of a substrate of an electronic apparatus according to a eighth embodiment.

FIG. 16 is a diagram illustrating a usage example of an electronic apparatus according to a ninth embodiment.

DETAILED DESCRIPTION

[0004]

Exemplary embodiments provide an electronic apparatus which is obtained as a finished product in which a void or sink marks is decreased.

[0005]

In general, according to one embodiment, an electronic apparatus includes a substrate, a plurality of electrical components, a plurality of electrodes, and a housing. The substrate includes a first end portion, a second end portion on an opposite side to the first end portion, a first surface provided between the first end portion and the second end portion, and a second surface provided between the first end portion and the second end portion, on an opposite side to the first surface, and in which a non-flat portion that includes at least one of a convex portion protruded on a side far apart from the second end portion, and a concave portions recessed on a side close to the second end portion, is provided in the first end portion. The electrical components are provided in at least one of the first surface and the second surface. The electrodes include a contact portion which is provided in one of the first surface and the second surface, and is in contact with at least one of a subject and an external conductor. The housing includes an outer surface, in which a trace of a gate provided in a injection molding mould exists in a position on an opposite side to the second end portion of the non-flat portion, on the outer surface, and which includes a synthetic resin material that covers the substrate, the electrical components, and the electrodes, in a state in which at least the contact portion is exposed and the substrate, the electrical components, and the electrodes are inserted.

<First Embodiment>

[0007]

An electronic apparatus 10 according to the embodiment is, for example, a portable sensor unit which can detect a cardiac potential or the like. The electronic apparatus 10 includes a housing 12 of a flat cuboid that includes a surface 12a (sensor surface, top surface, surface wall), a rear surface 12b (bottom surface, rear surface wall), and side surfaces 12c, 12d, 12e, and 12f. For example, the housing 12 may be shaped so as to exhibit an appearance of a polygonal shape, a circular shape, an elliptical shape, or the like in a view of a direction perpendicular to the surface 12a.

[0008]

As illustrated in FIG. 1, end portions 14a, 14b, 14c, and 14d (sides, side portions, edges) of the surface 12a, and corners 16a, 16b, 16c, and 16d (apex portions, corner portions) at which end portions intersect each other, respectively shaped chamfer. In addition, end portions 14e, 14f, 14g, and 14h (sides, side portions, edges) of the rear surface 12b, and corners 16e, 16f, 16g, and 16h (apex portions, corner portions) at which end portions intersect each other, respectively shaped a chamfer. In addition, a side 17a in a width direction of a housing 12 interposed between corner 16a and a corner 16e, a side 17b interposed between corner 16b and a corner 16f, a side 17c interposed between corner 16c and a corner 16g, and a side 17d interposed between corner 16d and a corner 16h are also respectively shaped a chamfer. A sense of touch can be increased by this chamfer shape, when a user touches the electronic apparatus 10. In addition, when the electronic apparatus 10 is mounted on a body surface to be used, when being touched a hand or being in contact with an object, the electronic apparatus 10 is hardly caught by the chamfer shape, and detachment of the electronic apparatus 10 can be suppressed. The chamfer shape may be a chamfer shape of a curved surface shape, and may be a chamfer shape of a flat surface shape.

[0009]

In the surface 12a of the housing 12, electrodes 18a and 18b (proves, terminals, metals, conductors) for detecting a biological signal in a state of being in contact with a subject, are disposed in such a manner that detection surface (contact portion, sensor surface, end portion, surface, one end surface) thereof is exposed from the surface 12a. The electrode 18a (first electrode) is, for example, a “+ electrode”, the electrode 18b (second electrode) is, for example, a “- electrode”, and both electrodes are disposed so as to be separated from each other. When the electronic apparatus 10 detects a biological signal (potential, cardiac potential) in order to create an electrocardiogram, a stable detection result can be obtained by a case in which a distance between the electrode 18a and the electrode 18b is equal to or longer than a predetermined distance. Meanwhile, the smaller the electronic apparatus 10 is, the more portability or ease of handling of the electronic apparatus 10 increases. Therefore, in the embodiment, the electrode 18a and the electrode 18b are disposed in a diagonal position on the surface 12a, and thereby a size increase of the electronic apparatus 10 is suppressed, while a predetermined distance between the electrode 18a and the electrode 18b is secured. As illustrated in FIG. 1, the electrode 18a is disposed in a position close to the corner 16c. Meanwhile, the electrode 18b is disposed in a position close to the corner 16a. In this way, the electrode 18a and the electrode 18b are disposed in a diagonal position, and thereby, it is possible to lengthen a distance between the electrode 18a and the electrode 18b without increasing a size of the housing 12, compared to a case in which the electrodes 18a and the electrode 18b are disposed in a position parallel to the end portion 14b or in a position parallel to the end portion 14a.

[0010]

In addition, the housing 12 may include flexibility (softness) and may be bendable. For example, it is possible to be bent in a shape in which a bus occurs in a direction intersecting the end portions 14b and 14d in a longitudinal direction of the housing 12. The electrode 18a is disposed in a position close to the corner 16c, that is, on one end side in a longitudinal direction of the housing 12. The electrode 18b is disposed in a position close to the corner 16a, that is, on the other end side in a longitudinal direction of the housing 12. As a result, when the electronic apparatus 10 is in contact with a body surface including a curved surface, it is possible to increase stickiness of the electrode 18a and the electrode 18b which exists in both positions in a longitudinal direction, to the body surface, using bending of the housing 12.

[0011]

In order to further increase adhesion of the electrode 18a and the electrode 18b to a body surface, there is a case in which an adhesive material (gel material) with conductivity is interposed between the electrode 18a and the electrode 18b, and the body surface. In this way, the adhesive material is relatively and easily deformed, and thus there is a case in which a biological signal is not detected by a disposal state or a change with passage of time, for example, by an electrical connection made by a contact of an adhesive material on the electrode 18a (+ electrode) side with an adhesive material on the electrode 18b (- electrode) side, or by an electrical connection made by sweat made on the body surface. In order to suppress occurrence of such inconvenience, it is preferable that a distance between the electrode 18a and the electrode 18b is set to be long. Other embodiments, disposing the electrodes 18a and 18b in a diagonal position may be realized by disposing the electrode 18a in a position close to the corner 16b and by disposing the electrode 18b in a position close to the corner 16d, for example.

[0012]

Data input and output terminals 20a and 20b (connectors, contact points, electrodes, metals, conductors) are disposed so as to be exposed on the surface 12a. The input and output terminals 20a and 20b include contact portions that are in contact with an external conductor, and can be electrically connected to a terminal of an adaptor apparatus only for, for example, a cradle or the like, for example, when a detected value that the electronic apparatus 10 acquires, or data, information, or the like based on the detected value is transferred to an external apparatus using a wired method, or when update of software for controlling the electronic apparatus 10 is performed using the wired method. Here, the external conductor is an external conductor of the electronic apparatus 10, is a conductor which is not included in the electronic apparatus 10, is electrically connected to the input and output terminals 20a, 20b, electrodes 18a and 18b, and other conductor (not illustrated) which are included in the electronic apparatus 10, and receives and transmits a power, data, a signal or the like. The external conductor is electrically connected to other electronic apparatuses, or conductor portions embedded in a power device or the like.

[0013]

As illustrated in FIG. 1, the input and output terminals 20a and 20b are disposed approximately in parallel to the end portion 14b, in a position close to the end portion 14b. The input and output terminals 20a and 20b are not used in a situation in which the electronic apparatus 10 is in contact with a subject. In addition, a current does not flow between the input and output terminal 20a and the input and output terminal 20b. Thus, the input and output terminals 20a and 20b are not necessary to be disposed so as to be separated long like as the electrodes 18a and 18b, and can be disposed so as to be relatively close to each other. The input and output terminals 20a and 20b can be disposed in a position of any one of the electronic apparatus 10, but it is possible to increase an assembly effect by forming the electrodes 18a and 18b and the input and output terminals 20a and 20b which are similar shaped, on the same surface of a substrate 22 which is supported by the housing 12.

[0014]

As illustrated in FIG. 2 to FIG. 4, the substrate 22 includes a first surface 22a (surface), a second surface 22b (rear surface), end portions 22c, 22d, 22e, and 22f (sides, side portions, edges), and corners 22g, 22h, 22i, and 22j (apex portions, corner portions, end portions). In the embodiment, for convenience, the end portion 22c can be referred to as a first end portion, and the end portion 22e on an opposite side to the end portions 22c can be referred to as a second end portion. In addition, the first surface 22a which is provide in an extended manner between the end portions 22c (first end portion) and the end portion 22e (second end portion) can be referred to as a first surface, and the second surface 22b which is provide in an extended manner between the end portions 22c (first end portion) and the end portion 22e (second end portion) can be referred to as a first surface, on an opposite side to the first surface 22a (first surface). Then, a non-flat portion 24 that includes at least one of a convex portion protruded on a side far apart from the end portion 22e, and a concave portion recessed on a side close to the end portion 22e, is provided in the end portion 22c. FIG. 1 to FIG. 8 illustrating the first embodiment illustrate, for example, a case in which the non-flat portion 24 is a concave portion. When the non-flat portion 24 is a concave portion, the concave portion can be formed in an arch shape. In addition, the substrate 22 on which a plurality of electrical components illustrated in FIG. 2 to FIG. 4 is mounted can be referred to as a sub-assembly. Here, the end portions 22c and 22e are portions (areas) become ends in a view from a width direction of the substrate, that is, a direction (crossing direction) orthogonal to a surface of the substrate 22, and are also referred to as, for example, sides or edges. The end portions 22c and 22e are respectively not necessary to be shaped a straight line. In addition, the end portions 22c and 22e are also not necessary to be parallel to each other. In addition, the first surface 22a and the second surface 22b are provided in an extended manner between the end portions 22c and 22e, that is, the end of one side of the first surface 22a is the end portion 22c, and the end of the other side of the first surface 22a is the end portion 22e. That is, the first surface 22a and the second surface 22b exist between the end portions 22c and the end portion 22e. The first surface 22a and the second surface 22b may be positioned in an opposite side to each other, and may respectively include some roughness portions, a difference in level, or the like. In addition, a concave portion, a thorough-hole, a notch, or the like may be provided on the first surface 22a and the second surface 22b. In addition, in a view from a thickness direction of the substrate 22, the non-flat portion 24 in the end portion 22c is not flat, that is, is not shaped a straight line, is a portion including at least one of a concave shape and a convex shape, and includes, for example, a notch (concave portion), a protrusion (convex portion), a difference in level, or the like that is provided in the end portion 22c which is an outer edge. A concave direction of a concave shape and a convex direction of a convex shape are directions (orthogonal direction) intersecting the end portion 22c in a view in the width direction of the substrate 22. The non-flat portion 24 may include a slope extended in the width direction of the substrate 22, a difference in level, or the like. In addition, the non-flat portion 24 may be shaped a roughness, when compared to a peripheral portion (adjacent portion, general portion) thereof, and the end portion 22c may be not necessary to be shaped a straight line in a view from the width direction of the substrate 22, and may be curved.

[0015]

A biological signal that is detected in the electrodes 18a and 18b is stored in a storage unit (nit illustrated) which is mounted in the substrate 22 in an inside of the electronic apparatus 10, is transferred to an external apparatus such as an electrocardiogram output device (electrocardiograph, monitoring device, printing device) at a desired timing, or is transferred to a personal computer, a server, or the like. In addition, the biological signal is also transferred to an electrocardiogram output device, a portable terminal, or the like in real time. The electronic apparatus 10 according to the embodiment can transfer the biological signal to an external apparatus using a wired method using the input and output terminals 20a and 20b. In addition, the biological signal can be transferred to an external apparatus through a communication unit such as Bluetooth (registered trademark). In this case, for example, the electrocardiogram can be monitored for 24 hours. It is possible to perform a data transfer in a predetermined interval, a transfer in a desired timing, or updating of software of the electronic apparatus 10, or the like, through a communication unit such as Bluetooth.

[0016]

The housing 12 is configured by a synthetic resin material (silicon rubber, elastomer, flexibility resin) with, for example, flexibility (softness). The housing 12 is molded in a state in which a sub-assembly is inserted into the housing 12, by insert molding (injection molding) that uses as a core the sub-assembly in which a plurality of electrical components is mounted. That is, the housing 12 is molded in a state in which the sub-assembly is inserted and covered by the synthetic resin material. The substrate 22 exhibits, for example, a flat rectangular plate shape. The housing 12 includes outer surfaces (surface 12a, rear surface 12b, side surfaces 12c, 12d, 12e, and 12f). A trace of a gate which is molded in a shape of injection molding exists in a position (side surface 12d) which is an opposite side to the end portion 22e (second end portion) of the substrate 22 on which the non-flat portion 24 among the outer surfaces is formed. For example, the outer surface of the housing 12 includes a side surface 12d (third surface) positioned on an opposite side to the end portion 22e (second end portion) of the end portion 22c (first end portion). A concave portion 26 is provided as a trace of a gate in a first middle portion between two fifth end portions (side 17a, side 17b) of a front and rear of a second direction P along the end portion 22c, on the side surface 12d. Here, the outer surface is a surface exposed in an outer side of the housing 12, and may also be referred to as a surface. In addition, the outer surface is not necessary to be an outermost surface as the electronic apparatus 10. That is, for example, the terminal, the electrode, or the like may be protruded more than the housing 12. In addition, a three-dimensional shape of the outer surface may be variously set. In addition, a concave portion, a convex portion, a difference in level, or the like may be provided on the outer surface. The concave portion or the convex portion which is provided on the outer surface is not flat, that is, is not a flat surface, and is a portion which includes at least one of the concave portion and the convex portion. The concave portion is, for example, depression which does not penetrate, a through-hole, a difference in level, or the like. The concave portion is, for example, a protrusion, a difference in level, or the like. The convex portion or the convex portion may be shaped a roughness when compared to a peripheral portion (adjacent portion, general portion) thereof, the outer surface is not necessary to have a flat shape, and may be curved, in a position in which the concave portion or the convex portion is provided. In addition, the gate is provided in a mould of injection molding, and is an injection hole (inlet) of a resin which configures the housing 12 and flows into a cavity portion, in the mould. The trace includes a shape or magnitude corresponding to the gate as a shape change of the outer surface of the housing 12, may be anything (mark) that can be estimated to be a position or an area corresponding to the gate, and it is not necessary to visually know.

[0017]

In the embodiment, the trace of the gate may be, for example, the concave portion 26 included in the side surface 12d, and the concave portion 26 may be a ring shape. The ring shape does not simply mean a circular shape, and may be a minimum endless shape.

[0018]

FIG. 2 to FIG. 4 illustrate a shape of the substrate 22 which is supported in an inside of the housing 12 by the electronic apparatus 10, and a disposal example of a plurality of electrical components which is mounted on or supported by the substrate 22. The substrate 22 includes the first surface 22a (surface, first mounting surface), and the second surface 22b on an opposite side to the first surface 22a (refer to FIG. 2). In the embodiment, as an example of a plurality of electrical components, a microprocessor (MPU) that controls the whole electronic apparatus 10, a communication chip that transmits data such as a detected biological signal to and receives the data from an external apparatus, a chip capacitor, a chip resistor, and the like are mounted on a first surface 22a side. In the embodiment, a plurality of electrical components which is supported on the first surface 22a side is divided into three types of small components 28, medium components 30, and large components 32 for convenience, based on a size (surface area, volume, side area) or a height, and is illustrated. In the embodiment, as an example, the small components 28, the medium components 30, and the large components 32 are mounted on the substrate 22, in such a manner that the height of the electrical components is gradually heightened from the end portion 22c of the substrate 22 in which non-flat portion 24 is formed as illustrated in fig 3, toward the end portion 22e. In addition, the first surface 22a supports terminals 34 of a circular shape as other components. The substrate 22 according to the present supports, for example, four terminals 34 (FIG. 2 and FIG. 3 illustrate only two terminals). For example, two of the terminals 34 can be used as terminals for charging a battery (not illustrated) which is included in the electronic apparatus 10. In this case, the terminal 34 can be electrically connected a terminal for charging which is included in, for example, a cradle. In addition, the terminals 34 can be used as terminals for connecting to an external battery. In addition to this, the terminal 34 can be used as a terminal for transmitting and receiving data. Meanwhile, the second surface 22b supports the electrodes 18a and 18b, and input and output terminals 20a and 20b which are metal components, as illustrated in FIG. 2 and FIG. 3.

[0019]

Next, the insert molding that molds the housing 12 of the electronic apparatus 10 which includes the configuration described above will be described. As illustrated in FIG. 5 and FIG. 6, the sub-assembly (substrate 22 which supports small components 28, medium components 30, large components 32, terminals 34, electrodes 18a and 18b, input and output terminals 20a and 20b) illustrated in FIG. 2 to FIG. 4 is inserted into an insert molding mould M, a synthetic resin material MJ is filled around the sub-assembly, and thereby the electronic apparatus 10 including the substrate 22 which is inserted into the synthetic resin material MJ is produced.

[0020]

The insert molding mould M includes a first mould 36 (lower mould, fixed mould) and a second mould 38 (upper mould, lifting mould), as illustrated in FIG. 6. As illustrated in FIG. 5, for example, the first mould 36 is scraped in a shape in which a metal block corresponds to an outer shape of the housing 12, and side wall portions 36a, 36b, 36c, and 36d, and corner 36e, 36f, 36g, and 36h at which the side wall portion intersects the side wall portion, are formed. The side wall portions 36a, 36b, 36c, and 36d, and the corner 36e, 36f, 36g, and 36h are chamfered in correspondence to the shape of the housing 12, and as necessary, draft extending in an opening end side (surface side of first mould 36) is attached. The second mould 38 is also configured by scraping in a shape in which a metal block corresponds to an outer shape of the housing 12, in the same manner as the first mould 36.

[0021]

Then, when manufacturing an electronic apparatus 10, the substrate 22 (sub-assembly) in which a plurality of electrical components (small components 28, medium components 30, large components 32, terminals 34) are mounted or supported on the first surface 22a, and electrodes 18a and 18b, and the input and output terminals 20a and 20b are mounted or supported on the second surface 22b, is inserted in a gap portion S which is formed when the insert molding mould M is closed. In this case, a positioning protrusion 40 (only the positioning protrusion 40 for pin, concave portion, or electrode 18a is illustrated) formed in a predetermined position of the first mould 36 fits in a concave portion 18c formed in a tip portion of the electrode 18a (18b) which is supported on the second surface 22b of the substrate 22. As a result, positioning and support of the substrate 22 of the gap portion S is performed. In addition, in this way, the positioning protrusion 40 fits in the concave portion 18c, and thereby a detection surface of the electrode 18a (18b) can be exposed on the surface 12a, and the substrate 22 can be positioned in a predetermined position of the inside of the housing 12. That is, the electrodes 18a and 18b function as positioning members which position the position of the substrate 22 in the housing 12. A protrusion 40a (pin, convex portion) is also formed in a position corresponding to the input and output terminals 20a and 20b, and the protrusion 40a is in contact with the input and output terminals 20a and 20b. As a result, as illustrated in FIG. 1, it is possible to form the housing 12 in a state in which tips of the input and output terminals 20a and 20b are recessed from the surface 12a. By this recessed shape, for example, the input and output terminals 20a and 20b can be prevented from being inadvertently and electrically connected, when being in contact with a finger or the like of a user. That is, the input and output terminals 20a and 20b also function as positioning members which position the substrate 22 in the housing 12. As illustrated in FIG. 1, since the electrodes 18a and 18b are diagonally disposed and in addition to this, the input and output terminals 20a and 20b exist, the substrate 22 is supported by four points in the first mould 36, thereby being supported in a stable attitude in the first mould 36.

[0022]

Similarly, a protrusion 42 (pin, convex portion) is also formed in a predetermined position of the second mould 38 (refer to FIG. 6, only two locations are illustrated), and the protrusion 42 is in contact with a tip of the terminal 34. As a result, the housing 12 can be molded in such a manner that the tip of the terminal 34 is recessed from the rear surface 12b. That is, the terminal 34 can be prevented from being inadvertently and electrically connected, when being in contact with a finger or the like of a user. As illustrated in FIG. 4, the terminals 34 are disposed in the vicinity (only a portion of the corner 22h is shifted in order to avoid interference with other components) of the corners 22g, 22h, 22i, and 22j of the substrate 22. Thus, the terminals 34 determine a position of the substrate 22 in the inside of the gap portion S of the second mould 38. That is, the terminals 34 function as positioning members which determine the position of the substrate 22 in the inside of the housing 12. In this way, in the embodiment, since the substrate 22 is supported by a plurality of supporting points in both the first surface 22a side and the second surface 22b side, the substrate 22 can maintain a stable attitude, even while the synthetic resin material MJ is filled and cured.

[0023]

A gate 44 which becomes a supply inlet at the time of filling the gap portion S with the synthetic resin material MJ is provided in the insert molding mould M. FIG. 5 illustrates an example in which the gate 44 is provided on the first mould 36 side, but the gate 44 may be provided on the second mould 38 side. In addition, the gate may be formed over the first mould 36 and the second mould 38 (for example, divided into two equal portions). The position of the gate 44 can be appropriately selected according to a configuration of the insert molding mould M, a shape or a position of the substrate 22 which is inserted into the gap portion S.

[0024]

However, in the same manner as the embodiment, when the insert molding is performed in which the substrate 22 is inserted into the dap portion S of the insert molding mould M and a periphery thereof is filled with the synthetic resin material MJ, it is necessary to study, in such a manner that the synthetic resin material MJ flows well. That is, in the same manner as the substrate 22 according to the embodiment, when the small components 28, the medium components 30, the large components 32, the terminals 34, the electrodes 18a and 18b, the input and output terminals 20a and 20b, and the like which are different in shape and size are multiply supported, the synthetic resin material MJ is hardly spread to every corner in a smooth manner. That is, a void or sink marks occurs in the housing 12, thereby causing a quality decrease. In order to avoid such a problem, it is necessary to take a measure in which a molding time is lengthened or the gap portion S is filled with the synthetic resin material MJ while applying a high pressure, and this can cause a decrease of a manufacturing efficiency.

[0025]

However, the substrate 22 included in the electronic apparatus 10 according to the embodiment includes a non-flat portion 24 for changing a flow direction of the synthetic resin material MJ which flows in from the gate 44. The non-flat portion 24 is formed in a second intermediate portion between two sixth end portions (corners 22g and 22j) front and rear of a second direction (refer to FIG. 4) along the end portions 22c, in the end portions 22c. In addition, in the insert molding mould M, the gate 44 is formed in a position facing the non-flat portion 24 of the substrate 22 inserted in the gap portion S.

[0026]

If flowing into the dap portion S, the synthetic resin material MJ flowing toward a gate outlet 44b side from an inlet 44a of the gate 44 is spread between (gap portion S) the first surface 22a of the substrate 22 and a bottom surface of the second mould 38, and between (gap portion S) the second surface 22b and a bottom surface of the first mould 36. In addition, the synthetic resin material MJ flows in between the end portion 22c of the substrate 22 and a side wall portion 36a of the first mould 36, between the end portions 22d and a side wall portion 36b, between the end portion 22e and the a side wall portion 36c, and between the end portion 22f and a side wall portion 36d. In this case, since the gate 44 exhibits, for example, a straight tube shape, a flow direction of the synthetic resin material MJ flowed in the dap portion S of the insert molding mould M easily and strongly appear in a linear manner toward the side wall portion 36c facing the side wall portion 36a in which the gate 44 is formed, and the synthetic resin material MJ may hardly flow in a direction of the side wall portion 36b or the side wall portion 36d. As a result, unevenness (void, sink marks) of the synthetic resin material MJ can occur on the side wall portion 36b side or the side wall portion 36d side.

[0027]

The substrate 22 according to the embodiment includes the non-flat portion 24 of recessed arch in a position facing the gate 44, as illustrated in enlarged views of FIG. 5 and FIG. 7. If the non-flat portion 24 of recessed arch exists, the synthetic resin material MJ tends to deflect so as to be perpendicular to the non-flat portion 24. That is, a change is made in the flow direction by a shape of the arch portion of the non-flat portion 24, the synthetic resin material MJ flows in a direction of the side wall portion 36b or the side wall portion 36d of the insert molding mould M, and thereby a filling efficiency is increased, a void or sink marks can be suppressed when the molding of the housing 12 is completed. Since the non-flat portion 24 is formed in an approximately the central portion of the side 22c of the substrate 22, the synthetic resin material MJ substantially evenly flows on the side wall portion 36b and the side wall portion 36d around the position of the non-flat portion 24, and thus efficient filling is made. In addition, it is preferable that a concave depth or a concave width in a second direction P (refer to FIG. 4) on a side close to the end portion 22e of the concave portion which is the non-flat portion 24, is appropriately determined according to the size (interval between the side wall portion 36a and the side wall portion 36c, or interval between the side wall portion 36b and the side wall portion 36d) of the housing 12 to be molded. A diffusion mode of the synthetic resin material MJ can be adjusted according to the roughness shape of the non-flat portion 24.

[0028]

Furthermore, in the embodiment, in order to increase diffusivity at the time of filling of the synthetic resin material MJ, the protrusion 46 is provided in an end portion of the gate outlet 44b of the gate 44 of the insert molding mould M (first mould 36). As an example, in FIG. 7, a circular protrusion 46 is provided so as to surround the gate outlet 44b. In the protrusion 46, at least an inner diameter wall is configured by a taper surface wall 46a in which a tip side of the protrusion 46 exhibits a large diameter in the gate outlet 44b. FIG. 7 illustrates a case in which a cross-sectional shape of the protrusion 46 is a triangular shape as an example.

[0029]

In this way, the protrusion 46 including the taper surface wall 46a around the gate outlet 44b is provided, and thus when the synthetic resin material MJ flows toward the gate outlet 44b from the gate inlet 44a and moves to the gap portion S, a portion of the synthetic resin material MJ flows along the taper surface wall 46a, as illustrated in FIG. 6. That is, when flowing from the gate 44, the synthetic resin material MJ is deflected along the taper surface wall 46a by viscosity or a flow resistance of the synthetic resin material MJ. As a result, if the synthetic resin material MJ flows straight toward the side wall portion 36c (refer to FIG. 5) in the formed direction of the gate 44, a flow can be deflected by the taper surface wall 46a of the protrusion 46 and can be formed toward the side wall portion 36b and the side wall portion 36d. That is, when the gap portion S is filled with the synthetic resin material MJ, the synthetic resin material MJ can be diffused in a wide range. As a result, the filling efficiency of the synthetic resin material MJ is increased, and a void or sink marks can be suppressed when the molding of the housing 12 is completed. In addition, the protrusion 46 is formed in the gate 44 facing the non-flat portion 24 described above, and thereby both the diffusion of the synthetic resin material MJ made by the non-flat portion 24 and the diffusion of the synthetic resin material MJ made by the protrusion 46 can be made, and more efficient filling of the synthetic resin material MJ and a wide range of diffusions can be realized.

[0030]

In this way, by providing the protrusion 46 in the insert molding mould M (for example, first mould 36), the concave portion 26 is formed as the trace of the gate recessed in a depth direction of the non-flat portion 24 in the housing 12 to be completed, as illustrated in FIG. 1. In FIG. 1, the substrate 22 is disposed so as to be deflected on the surface 12a side in the inside of the housing 12. For this reason, the concave portion 26 of FIG. 1 is formed on a side closer to the side 14b than the side 14f, in a position according to an amount of filling of the synthetic resin material MJ on two sides of the housing 12, and in a thickness direction (direction along sides 17a and 17b) of the housing 12. In FIG. 1, a trace of a circular shape corresponding to the gate 44 remains in the central portion of the concave portion 26 of a circular shape. That is, the housing 12 is molded so as to form the concave portion 26, and thus the synthetic resin material MJ can be effectively diffused in the inside of the insert molding mould M at the time of insert molding, efficient filling of the synthetic resin material MJ can be realized, and a void or sink marks can be suppressed. Since the concave portion 26 is formed by, for example, a size which can be recognized at the time of being in contact with a hand, a finger, or the like of a user, and thus the concave portion 26 can be used as an indicator for confirming a surface orientation (for example, side surface wall 12d) when the electronic apparatus 10 is fixed to a body surface of a user. In addition, the concave portion 26 can be configured as a portion of design of the side surface wall 12d of the housing 12. For example, the concave portion 26 can also be used for a portion of a mark by being used as “O” of the alphabet. In addition, the protrusion 46 is not limited to a ring shape surrounding the gate outlet 44b, and may also intermittently surround the gate outlet 44b. In addition, while not limited to a case in which the cross-section of the gate 44 illustrated in FIG. 1 is a circular shape, the shape of the gate 44 may be, for example, an elliptical shape, rectangular shape, triangular shape, or the like, the protrusion 46 surrounds the periphery of the gate 44, and thus the same effect as in the embodiment described above can be obtained. In FIG. 7, the cross-section of the taper surface wall 46a is shaped a straight line, but is not limited to this, and for example, the cross-section of taper surface wall 46a may be a curved surface. A diffusion direction of the synthetic resin material MJ can be adjusted by the shape of the taper surface wall 46a or a taper angle.

[0031]

However, when the housing 12 is formed in a state in which the first surface 22a side (surface side) and the second surface 22b side (rear surface side) of the substrate 22 are filled with the synthetic resin material MJ and the substrate 22 is inserted, the embodiment is not limited to that an amount of the synthetic resin material MJ is equal on the first surface 22a side and the second surface 22b side. For example, as illustrated in FIG. 5, as a plurality of electrical components, the small components 28, the medium components 30, the large components 32, the terminals 34, and the line are mounted on the first surface 22a side, in the electronic apparatus 10 according to the embodiment. Meanwhile, as illustrated in FIG. 6, only the electrodes 18a and 18b and the input and output terminals 20a and 20b are mounted on the second surface 22b side, and the number of electrical components on the second surface 22b side is smaller than that on the first surface 22a. That is, volumes to be filled with the synthetic resin material MJ are different from each other, on the first surface 22a side and the second surface 22b side. In addition, in the electronic apparatus 10 according to the embodiment, as illustrated in FIG. 5, the substrate 22 is inserted into the insert molding mould M so as to be biased to the first mould 36 more than the second mould 38, in the gap portion S, and in this attitude, the first surface 22a side and the second surface 22b side are filled with the synthetic resin material MJ. That is, an amount of the synthetic resin material MJ required for the first surface 22a side and the second surface 22b side is different from each other, in a state in which the substrate 22 is interposed between the first surface 22a side and the second surface 22b side. In this way, there are many cases in which a mounting situation (the number of mounting or occupied volume) of electrical components, or a position of the substrate 22 in the gap portion S is changed depending on specification of the electronic apparatus 10. That is, there are many cases in which an amount of the synthetic resin material MJ in the first surface 22a side and the second surface 22b side is changed.

[0032]

However, in the embodiment, the concave portion 26 which is a trace of the gate including a third end portion 44d on an opposite side to the second surface 22b rather than the first surface 22a in a view from the first direction M (refer to FIG. 4) along the first surface 22a or the second surface 22b of the substrate 22, and a fourth end portion 44e on an opposite side to the first surface 22a rather than the second surface 22b in a view from the first direction M. The concave portion 26 is provided between the third end portion 44d and the fourth end portion 44e. That is, the concave portion 26 is provided so as to straddle the first surface 22a and the second surface 22b of the substrate 22 (refer to FIG. 6 and FIG. 8). That is, the gate 44 is disposed in the insert molding mould M so as to face the non-flat portion 24. By performing this disposal of the gate 44, the synthetic resin material MJ can efficiently flow into the first surface 22a and the second surface 22b of the surface 22, and by the diffusing of the synthetic resin material MJ performed by the non-flat portion 24 and the protrusion 46 which are described above, more efficient filling of the synthetic resin material MJ can be made. Here, in a view from a direction along the first surface 22a or the second surface 22b of the surface 22, the fact that a trace of the gate 44 exists between an area (area on the first surface 22a, first area) the first surface 22a on an opposite side to the second surface 22b and an area (area on the second surface 22b, second area) the second surface 22b on an opposite side to the first surface 22a, is expressed as the fact that the trace of the gate 44 straddles the first area and the second area.

[0033]

In addition, in the electronic apparatus 10 illustrated in the embodiment as described above, as an example, an amount of filling of the synthetic resin material MJ on the first surface 22a is more than that on the second surface 22b side. Thus, when the gate 44 faces the non=-flat portion 24, as illustrated in FIG. 8, the gate 44 is biased to a side in which an amount of filling of the synthetic resin material MJ is more. In FIG. 8, an opening width A of the gate 44 on the first surface 22a side in which an amount of filling of the synthetic resin material MJ is much, is larger than an opening width B of the gate 44 on the second surface 22b side in which an amount of filling of the synthetic resin material MJ is small. That is, an amount of the synthetic resin material MJ flowing out of the gate 44, per unit time, is more on the first surface 22a side than that on the second surface 22b side. As a result, the filling of the synthetic resin material MJ on the first surface 22a side of the substrate 22 and the filling of the synthetic resin material MJ on the second surface 22b side of the substrate 22 can be performed more efficiently. The opening width A and the opening width B can be determined based on an experiment or the like, by taking the volume of the synthetic resin material MJ necessary for the first surface 22a side and the second surface 22b side, liquidity of the synthetic resin material MJ on the first surface 22a, liquidity of the synthetic resin material MJ on the second surface 22b, or the like, into account.

[0034]

However, as described above, when the housing 12 is formed by the non-flat portion 24 or the protrusion 46, liquidity of the synthetic resin material MJ can be decreased by the disposal of the electrical components mounted on the substrate 22, even when the synthetic resin material MJ is diffused in a wide range. For example, if a large electrical component (for example, tall component or wide component) exits on an upstream side of the flow of the synthetic resin material MJ, the flow of the synthetic resin material MJ is disturbed by the electrical component, a flow velocity of the synthetic resin material MJ is decreased, and furthermore, the synthetic resin material MJ can hardly reach the periphery of the electrical components existing in a downstream due to electrical components blocking the synthetic resin material MJ.

[0035]

However, in the electronic apparatus 10 according to the embodiment, when being disposed on the substrate 22, the electrical components are disposed in accordance with a predetermined disposal law, as illustrated in FIG. 2 to FIG. 4. For example, the substrate 22 includes a first electrical component which is one of the plurality of components (small components 28, medium components 30, large components 32, or the like) provided in one of the first surface 22a and the second surface 22b, and a second electrical component which is one of the plurality of components provided in one of the first surface 22a and the second surface 22b, a height from a surface of the substrate 22 is higher than that of the first electrical component is high, and is disposed farther from the non-flat portion 24 than the first electrical component. As an example, package components are included in the electrical components which are mounted on the first surface 22a side of the substrate 22. In addition, the substrate 22 includes the side 22c (first end portion) in which the non-flat portion 24 is provided, and the side 22e (second end portion) on an opposite side to the side 22c. Thus, package components are disposed so as to be biased to the side 22e more than the side 22c.

[0036]

Here, the package component can be configured by a large component 32 such as a microprocessor (MPU) or a chip for communication (Bluetooth). Since the large component 32 includes a package substrate covered with resin, or the like, there are many cases in which a width of the large component (side surface area) is large and a height of the large component is high. In contrast, there are many cases in which the small component 28 such as a chip capacitor or a chip resistor other than the package component, or the medium component 30 is small in side surface area and a height thereof is low. Thus, the large component 32 which can disturb the flow of the synthetic resin material MJ is disposed far away from the gate 44, and the medium component 30 or the small component 28 which hardly disturb the flow of the synthetic resin material MJ is disposed on an upstream side (side close to gate 44) above the large components 32. For example, the electrical components are disposed in the sequence of the small components 28, the medium components 30, and the large components 32 from a side close to the gate 44. As a result, a decrease of liquidity occurring (flow velocity is decreased) as soon as the synthetic resin material MJ diffused by the non-flat portion 24 or the protrusion 46 flows out from the gate outlet 44b is suppressed, and a position (side 22e of the substrate 22) far apart from the gate 44 can also be filled more efficiently with the synthetic resin material MJ. As illustrated in FIG. 2, the electrodes 18a and 18b and the non-flat portion 24 which are mounted on the second surface 22b of the substrate 22 are disposed so as to be separated from each other. Thus, also in the second surface 22b side, a decrease of liquidity occurring (flow velocity is decreased) as soon as the synthetic resin material MJ diffused by the non-flat portion 24 or the protrusion 46 flows out from the gate outlet 44b is suppressed, and a position (side 22e of the substrate 22) far apart from the gate 44 can also be filled more efficiently with the synthetic resin material MJ.

[0037]

FIG. 5 schematically illustrates an example in which the synthetic resin material MJ flowed out from the gate outlet 44b flows through the insert molding mould M. In this case, immediately after flowing out of the gate outlet 44b, the synthetic resin material MJ diffused toward the side wall portion 36b or the side wall portion 36d by the non-flat portion 24 or the protrusion 46 is not in contact with the large component 32 which greatly decreases the flow velocity of the synthetic resin materials MJ. That is, the gap portion S is filled with the synthetic resin materials MJ1, MJ2, MJ3, and MJ4 which pass through the side 22c, the side 22d, the side 22f, and the like of the substrate 22, to the extent that the synthetic resin materials are not in contact with the electrical components or are contact with the small component 28 more than once, in a state in which liquidity is not decreased at the time of flowing out of the gate outlet 44b. In addition, in the example of FIG. 5, the synthetic resin material MJ5 reaches the side wall portion 36c just by being in contact with the medium component 30. Even in this case, the gap portion S is filled with the synthetic resin material MJ5 in a state in which liquidity at the time of flowing out of the gate outlet 44b is not decreased. Meanwhile, as the synthetic resin materials MJ6 and MJ7 that are in contact with the small component 28 or the medium component 30 more than once in the process of flowing, or graze against the large component 32 approaches the side wall portion 36c, the flow velocity of the synthetic resin materials is decreased (gradual narrowing of a width of arrows indicates a velocity decrease). In addition, as the synthetic resin materials MJ8 and MJ9 that are in contact with the small component 28 or the medium component 30 more than once in the process of flowing, and are in further contact with the large component 32 approaches the side wall portion 36c, the flow velocity of the synthetic resin materials is further decreased (further gradual narrowing of a width of arrows indicates a velocity decrease).

[0038]

In this way, the large component 32 (package component) which easily disturb the flow of the synthetic resin material MJ is disposed in a position far apart from the gate 44, and thereby the filling of the synthetic resin material MJ for molding the housing 12 can be made more efficiently, and a void or sink marks of the housing 12 can be suppressed. In addition, liquidity can be increased by the disposal of the electrical components, together with an effect of liquidity improvement of the synthetic resin material MJ made by the non-flat portion 24 or the protrusion 46 which is described above, or with the efficient filling of the synthetic resin material MJ based on a facing position of the substrate 22 and the gate 44, and thus, furthermore, efficient filling of the synthetic resin material MJ and high quality of the housing 12 can be realized.

[0039]

The electrical components on the substrate 22 may be arranged, for example, in such a manner that a flow path with a width equal to or greater than a predetermined width in which the synthetic resin material MJ easily flows is formed, in addition to an arrangement of the package components (large components 32) to a position far apart from the gate 44 as described above. In this case, for example, the flow path may be radially formed from the position of the non-flat portion 24. In addition, the electrical component is disposed in such a manner that a surface orthogonal to the flow direction of the synthetic resin material MJ becomes small, or the electrical component (for example, component of cylindrical shape) in which a surface orthogonal to the flow direction of the synthetic resin material MJ is a curved surface of a convex shape is widely used, and thus a decrease of the liquidity of the synthetic resin material MJ may be suppressed.

<Second Embodiment>

[0040]

FIG. 9 is a diagram illustrating a resin flow at the time of molding a housing of an electronic apparatus according to the second embodiment. The second embodiment is the same as the first embodiment, except that the substrate 22 included in the electronic apparatus 10 does not include the non-flat portion 24 which is formed in the position corresponding to the gate 44. That is, the insert molding mould M provides the protrusion 46 of a ring shape so as to surround the end portion of the gate outlet 44b. The protrusion 46 is formed of a taper surface wall 46a in which at least an inner diameter wall on a tip side of the protrusion 46 is larger than the gate outlet 44b. FIG. 9 illustrates a case in which a cross-sectional shape of the protrusion 46 is a triangular shape as an example. Even in this case, in the same manner as in the first embodiment, a portion of the synthetic resin material MJ flows along the taper surface wall 46a. That is, when flowing out of the gate 44, the synthetic resin material MJ is deflected along the taper surface wall 46a by viscosity or flow resistance of the synthetic resin material MJ. As a result, if the synthetic resin material straight flows along toward the side wall portion 36c (refer to FIG. 5) in a forming direction of the gate 44, the flow is deflected by the taper surface wall 46a of the protrusion 46 and is formed toward the side wall portion 36b and the side wall portion 36d. That is, when the gap portion S is filled with the synthetic resin material MJ, the synthetic resin material MJ can be diffused in a wide range. As a result, the filling efficiency of the synthetic resin material MJ is increased, and a void or sink marks at the time of completing the molding of the housing 12 can be decreased. In addition, since the shape of the substrate 22 is simplified, a manufacturing cost can be reduced.

<Third Embodiment>

[0041]

FIG. 10 is a diagram illustrating a flow of a resin at the time of molding a housing of an electronic apparatus according to a third embodiment. In the third embodiment, the substrate 22 included in the electronic apparatus 10 includes, for example, a protrusion portion 50 which protrudes in an arch shape as the non-flat portion 24 in a position corresponding to the gate 44. Meanwhile, the insert molding mould M does not include the protrusion 46 of a ring shape surrounding the end portion of the gate outlet 44b described in the first embodiment or the second embodiment. In the third embodiment, a flow direction of the synthetic resin material MJ flowing out of the gate outlet 44b tends to be deflected by a protruded curved shape of the protrusion portion 50. That is, the flow direction of the synthetic resin material MJ is changed by a shape of the arch shape portion, the synthetic resin material MJ flows in a direction of the side wall portion 36b or the side wall portion 36d of the insert molding mould M, and thus filling efficiency of the synthetic resin material MJ is increased, and a void or sink marks at the time of completing the molding of the housing 12 can be decreased. Since the protrusion portion 50 is formed in approximately a central portion of the side 22c of the substrate 22, the synthetic resin material MJ approximately equally flows on the side wall portion 36b side and the side wall portion 36d side by using the position as a center, and thus efficient filling can be made. In addition, it is preferable that a height (height in a direction parallel to the side 22c) or a protrusion width (width in a direction parallel to the side 22d) of the protrusion portion 50 is appropriately determined according to a size (interval between the side wall portion 36a and the side wall portion 36c, or interval between the side wall portion 36b and the side wall portion 36d) of the housing 12 to be molded. Specification of the diffusion of the synthetic resin material MJ can be adjusted by the size of the protrusion portion 50. In the third embodiment, the protrusion 46 of a ring shape may be provided so as to surround the end portion of the gate outlet 44b, in the same manner as in the first embodiment or the second embodiment. In this case, in the same manner as in the first embodiment, more efficient filling of the synthetic resin material MJ can be made by the diffusion of the synthetic resin material MJ made by the protrusion portion 50 or the protrusion 46.

<Fourth Embodiment>

[0042]

FIG. 11 illustrates a modification example of the non-flat portion 24 of the substrate 22 of the electronic apparatus 10 according to a fourth embodiment. In FIG. 11, the non-flat portion 24 provides a plurality of convex portions 24a (for example, two convex portions) of an arch shape in, for example, a central portion (second intermediate portion) of the end portion 22c. In this way, by changing the shape of the non-flat portion 24, a change different from that of other embodiments occurs in the flow of the synthetic resin material MJ, and thus a diffusion effect of the synthetic resin material MJ can be obtained.

<Fifth Embodiment>

[0043]

FIG. 12 illustrates a modification example of the non-flat portion 24 of the substrate 22 of the electronic apparatus 10 according to a fifth embodiment. In FIG. 12, the non-flat portion 24 provides a plurality of concave portions and a convex portion (for example, two concave portions 24a, one convex portion 24b between the two concave portions) of an arch shape in, for example, a central portion (second intermediate portion) of the end portion 22c. In this way, by changing the shape of the non-flat portion 24, a change different from that of other embodiments is made in the flow of the synthetic resin material MJ, and thus a diffusion effect of the synthetic resin material MJ can be obtained.

<Sixth Embodiment>

[0044]

FIG. 13 illustrates a modification example of the non-flat portion 24 of the substrate 22 of the electronic apparatus 10 according to a sixth embodiment. In FIG. 13, the non-flat portion 24 provides a concave portion 24 of a triangular shape in, for example, a central portion (second intermediate portion) of the end portion 22c. In this way, by changing the shape of the non-flat portion 24, a change different from that of other embodiments is made in the flow of the synthetic resin material MJ, and thus a diffusion effect of the synthetic resin material MJ can be obtained.

<Seventh Embodiment>

[0045]

FIG. 14 illustrates a modification example of the non-flat portion 24 of the substrate 22 of the electronic apparatus 10 according to a seventh embodiment. In FIG. 14, the non-flat portion 24 provides a plurality of concave portions 24c (for example, two concave portions) of a triangular shape in, for example, a central portion (second intermediate portion) of the end portion 22c. In this way, by changing the shape of the non-flat portion 24, a change different from that of other embodiments is made in the flow of the synthetic resin material MJ, and thus a diffusion effect of the synthetic resin material MJ can be obtained.

<Eighth Embodiment>

[0046]

FIG. 15 illustrates a modification example of the non-flat portion 24 of the substrate 22 of the electronic apparatus 10 according to a eighth embodiment. In FIG. 15, the non-flat portion 24 provides a concave portion 24d of a trapezoidal shape in, for example, a central portion (second intermediate portion) of the end portion 22c. In this way, by changing the shape of the non-flat portion 24, a change different from that of other embodiments is made in the flow of the synthetic resin material MJ, and thus a diffusion effect of the synthetic resin material MJ can be obtained.

[0047]

The forms of the non-flat portion 24 illustrated in FIG. 11 to FIG. 15 are examples. Since flow difficulty of the synthetic resin material MJ is changed by a type, number, disposal, or the like of the electrical components which are mounted on the substrate 22, it is preferable that the number or a shape of concave portions or convex portions is appropriately selected.

<Ninth Embodiment>

[0048]

A usage example of the electronic apparatus 10 according to the above-described embodiments will be described using FIG. 16. When the electronic apparatus 10 detects, for example, a biological signal (potential, cardiac potential, detected value) for an electrocardiogram, the electronic apparatus 10 transmits biological information (information, transmission information) which is obtained based on the detected biological signal to an external apparatus. The electronic apparatus 10 transfers the biological information (information, transmission information) to a communication terminal 200 (mobile phone, smart phone) being carried by a user through an embedded communication function, such as Bluetooth. The communication terminal 200 transmits the acquired biological information to a server 206 which is an external apparatus through a base station 202 or a network 204. The electronic apparatus 10 may be configured so as to transmit the detected biological signal as it is to the server 206. In addition, when including a connection function to the network 204 such as a Wi-Fi communication function, the electronic apparatus 10 may be configured so as to transmit the biological information (biological signal) to the server 206 through the base station 202 and the network 204. In addition, when being able to be connected to a wireless LAN, the electronic apparatus 10 transmits the biological information to the server 206 through a wireless router 208 and the network 204. The electronic apparatus 10 may be configured so as to transmit the biological information through the wireless router 208 via a personal computer 210 once. In the above-describe example, a communication network (electrical communication circuit) using wireless is described, but a communication network using a wire may be used. The communication network includes, for example, a router, a modem, an access point, a cable, and the like. In addition, each apparatus can transmit and receive data according to a predetermined communication protocol.

[0049]

Each time acquiring the biological information, the electronic apparatus 10 may transmit the acquired information to the server 206, and may transmit the information after a predetermined amount of signal is accumulated. In addition, the electronic apparatus 10 may transmit the information every predetermined time period, and may transmit the information at a desired timing of a user in accordance with an operation of the electronic apparatus 10.

[0050]

When transmitting the biological information to the server 206, the electronic apparatus 10 transmits the biological information together with, for example, personal ID and password which are given to each user, in such a manner that each user can be identified on the server 206 side. It is also possible to transmit the information using a method without specifying an individual person, and using a guest ID.

[0051]

When acquiring biological information, the server 206 stores the biological information in a storage device 206a, and performs processing according to the biological information. For example, when the biological information indicates a cardiac potential, the server 206 creates an electrocardiogram. Furthermore, the server 206 performs a creation of health state information for performing analysis based on the electrocardiogram. In addition, when the biological information indicates a pulse wave signal or a temperature signal, the server 206 converts the signal into a pulse or body temperature, and creates the health state information based on the pulse or the body temperature. When creating the health state information, for example, the server 206 creates an electrocardiogram based on development of the biological information of a predetermined time period, and creates a development graph of a pulse or body temperature. In addition, the server 206 may create diagnostic information based on the development. In addition, when the user continually transmits the biological information to the server 206 using a personal ID, the server 206 may perform development or diagnosis of a long-term health state based on a comparison of a past analysis result or diagnostic information and a newest analysis result or diagnostic information, and for example, may create future advice or the like as health state information.

[0052]

The server 206 stores the created health diagnosis information in the storage device 206a, and returns the health diagnosis information to the user who sends the biological information through the network 204. For example, when the user transmits the biological information through the communication terminal 200, the health diagnosis information is displayed on a display screen of the communication terminal 200. In addition, when the user directly transmits the biological information to the server 206, using the communication function of the electronic apparatus 10, the server 206 transmits the health diagnosis information to the electronic apparatus 10. When receiving the health diagnosis information, the electronic apparatus 10 transfers the health diagnosis information which is received in the communication terminal 200 or the personal computer 210 that user has, and the health diagnosis information is displayed on a display screen of the communication terminal 200 or the personal computer 210. In the same manner, when the electronic apparatus 10 transmits the biological information to the server 206 through the wireless router 208, the health diagnosis information may be transmitted to the personal computer 210 of the user, and the health diagnosis information may be displayed on the display screen of the personal computer 210 of the user. The health diagnosis information transmitted from the server 206 may be stored in the communication terminal 200 or the personal computer 210. The biological signal detected by the electronic apparatus 10 may be stored in the communication terminal 200 or the personal computer 210 as original data.

[0053]

In the embodiment, an example in which biological information based on a biological signal detected by the electronic apparatus 10 is transmitted to server 206 and is analyzed there is described, but in another embodiment, a dedicated program may be installed in the communication terminal 200 or the personal computer 210, and a creation of an electrocardiogram or the like, or a creation of health diagnosis information may be performed in the communication terminal 200 or the personal computer 210, thereby being provided to a user. In addition, a creation of a simple analysis or simple health diagnosis information may be performed in the communication terminal 200 or the personal computer 210, and a creation of more detailed analysis or health diagnosis information may be performed in the server 206 according to a request of a user, thereby being provided to the user.

[0054]

As described above, an electronic apparatus according to the embodiment includes: for example, a substrate which includes a first end portion, a second end portion on an opposite side to the first end portion, a first surface provided between the first end portion and the second end portion, and a second surface provided between the first end portion and the second end portion, on an opposite side to the first surface, and in which a non-flat portion that includes at least one of a convex portion protruded on a side far apart from the second end portion, and a concave portions recessed on a side close to the second end portion, is provided in the first end portion; a plurality of electrical components that is provided in at least one of the first surface and the second surface; a plurality of electrodes that includes a contact portion which is provided in one of the first surface and the second surface, and is in contact with at least one of a subject and an external conductor; and a housing which includes an outer surface, in which a trace of a gate provided in a injection molding mould exists in a position on an opposite side to the second end portion of the non-flat portion, on the outer surface, and which includes a synthetic resin material that covers the substrate, the electrical components, and the electrodes, in a state in which at least the contact portion is exposed and the substrate, the electrical components, and the electrodes are inserted. According to this configuration, for example, by the non-flat portion, a change is made in a flow direction of the synthetic resin material, and the synthetic resin material is diffused in correspondence to the shape of the non-flat portion. As a result, an electronic apparatus is provided in which a filling direction of the synthetic resin material becomes wide and which includes the housing in which a void or sink marks is decreased.

[0055]

In addition, the trace of the electronic apparatus according to the embodiment may include, for example, a convex portion. According to this configuration, for example, when the housing is molded, a molding mould is used which includes a protrusion and molds a concave portion recessed toward the non-flat portion. In this case, the synthetic resin material flows along the protrusion, and thus diffusion of the synthetic resin material can be expedited.

[0056]

In addition, the concave portion of the electronic apparatus according to the embodiment may be shaped a ring, for example. According to this configuration, for example, the synthetic resin material flowing out of the gate is spread along the ring shape, and a diffusion efficiency of the synthetic resin material is increased.

[0057]

In addition, the trace of the electronic apparatus according to the embodiment may include, for example, a third end portion on an opposite side to the second surface rather than the first side in a view from a first direction along the first surface or the second surface, and a fourth end portion on an opposite side to the first surface rather than the second side in a view from the first direction, and the trace may be provided between the third end portion and the fourth end portion. According to this configuration, for example, the synthetic resin material can be diffused on the first surface side and the second surface side of the substrate, and thus the filling efficiency of the synthetic resin material can be increased.

[0058]

In addition, the outer surface of the electronic apparatus according to the embodiment may include, for example, a third surface positioned on an opposite side to the second end portion of the first end portion, and the trace may be provided in a first intermediate portion between two fifth end portions in front and rear of a second direction along the first end portion, in the third surface. According to this configuration, for example, compared to when the fifth end portion, that is, the trace exists in the end portion on a front side or on a rear side of the second direction on the third surface, a bias of the flow at the time of resin molding is easily reduced. Thus, variation depending on a location of a property of the molded resin is easily reduced.

[0059]

In addition, in the electronic apparatus according to the embodiment, for example, the non-flat portion may be provided in a second intermediate portion between two sixth end portions in front and rear of a second direction along the first end portion, in the first end portion. According to this configuration, for example, a bias of the flow at the time of resin molding is easily reduced in front and rear of the second direction. Thus, variation depending on a location of a property of the molded resin is easily reduced.

[0060]

In addition, the non-flat portion and the electrodes of the electronic apparatus according to the embodiment may be disposed so as to be separated from each other, for example. According to this configuration, for example, when the non-flat portion and the electrodes are provided so as to be close, the resin hardly flows between the non-flat portion and the electrodes at the time of resin molding. Meanwhile, by separating the non-flat portion and the electrodes from each other, resin molding failure due to a narrow interval between the non-flat portion and the electrodes may be reduced.

[0061]

In addition, the electronic apparatus according to the embodiment may further include: for example, a first electrical component which is one of a plurality of electrical components provided in one of the first surface and the second surface; and a second electrical component which is one of the plurality of electrical components provided in one of the first surface and the second surface and a height of the one is higher than that of the first electrical component, and is positioned farther from the non-flat portion than the first electrical component. According to this configuration, for example, compared to when the second electrical component with a height higher than that of the first electrical component is close to the non-flat portion, a bias of the flow at the time of resin molding is easily reduced. Thus, variation depending on a location of a property of the molded resin is easily reduced.

[0062]

In addition, a package component functioning as the electrical component of the electronic apparatus according to the embodiment may be positioned closer to the second end portion than the first end portion, for example. According to this configuration, for example, a decrease of liquidity of the synthetic resin material due to contact with the package component can be delayed, and thus an electronic apparatus can be provided in which filling of the synthetic resin material is more efficient and easy, and which includes a housing in which a void or sink marks is decreased.

[0063]

In each embodiment described above, when the insert molding mould M is filled with the synthetic resin material MJ, the synthetic resin material MJ is pressured so as to be pushed into the gap portion S by a designated amount, and thereby an electronic apparatus 10 (housing 12) of an aimed shape can be made. In this case, a gas vent hole through which air exhausted at the time of pushing the synthetic resin material MJ into the gap portion S is pulled out is provided in the insert molding mould, and thereby occurrence of a void or sink marks can be suppressed. In addition, in other embodiments, as illustrated in FIG. 5, the connection portion 44c which performs vacuum deaeration of the insert molding mould M is provided, and the gap portion S is deaerated prior to filling or during filling of the synthetic resin material MJ, and thereby filling efficiency of the synthetic resin material MJ can be increased, deaeration of air contained in the synthetic resin material MJ can be performed. Thus occurrence of a void or sink marks can be suppressed.

[0064]

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

WHAT IS CLAIMED IS:

1. An electronic apparatus comprising:

a substrate which includes a first end portion, a second end portion on an opposite side to the first end portion, a first surface provided between the first end portion and the second end portion, and a second surface provided between the first end portion and the second end portion, on an opposite side to the first surface, and in which a non-flat portion that includes at least one of a convex portion protruded on a side far apart from the second end portion and a concave portion recessed on a side close to the second end portion, is provided in the first end portion;

a plurality of electrical components that is provided in at least one of the first surface and the second surface;  
 a plurality of electrodes that includes a contact portion which is provided in one of the first surface and the second surface, and is in contact with at least one of a subject and an external conductor; and

a housing which includes an outer surface, in which a trace of a gate provided in an injection molding mould exists in a position on an opposite side to the second end portion of the non-flat portion,on the outer surface, and which includes a synthetic resin material that covers the substrate, the electrical components, and the electrodes, in a state in which at least the contact portion is exposed and the substrate, the electrical components, and the electrodes are inserted.

2. The apparatus according to Claim 1, wherein the trace includes a convex portion.

3. The apparatus according to Claim 2, wherein the concave portion is shaped a ring.

4. The apparatus according to any one of Claims 1 to 3, wherein the trace includes a third end portion on an opposite side to the second surface rather than the first side in a view from a first direction along the first surface or the second surface, and a fourth end portion on an opposite side to the first surface rather than the second side in a view from the first direction, and the trace is provided between the third end portion and the fourth end portion.

5. The apparatus according to any one of Claims 1 to 4,

wherein the outer surface includes a third surface positioned on an opposite side to the second end portion of the first end portion, and

wherein the trace is provided in a first intermediate portion between two fifth end portions in front and rear of a second direction along the first end portion, in the third surface.

6. The apparatus according to any one of Claims 1 to 5, wherein the non-flat portion is provided in a second intermediate portion between two sixth end portions in front and rear of a second direction along the first end portion, in the first end portion.

7. The apparatus according to any one of Claims 1 to 6, wherein the non-flat portion and the electrodes are disposed so as to be separated from each other.

8. The apparatus according to any one of Claims 1 to 7, further comprising:

a first electrical component which is one of a plurality of electrical components provided in one of the first surface and the second surface; and

a second electrical component which is one of the plurality of electrical components provided in one of the first surface and the second surface and a height of the one is higher than that of the first electrical component, and is positioned farther from the non-flat portion than the first electrical component.

9. The apparatus according to any one of Claims 1 to 8, wherein a package component functioning as the electrical component is positioned closer to the second end portion than the first end portion.

10. An electronic apparatus comprising:

a substrate which includes a first end portion and a second end portion on an opposite side to the first end portion;

an electrical component which is provided on the substrate; and

a housing which includes an outer surface, in which a trace of a gate exists in a position on an opposite side to the second end portion of the first end portion of the outer surface, and which includes a synthetic resin material that covers the substrate and the electrical component, in a state in which the substrate and the electrical component are inserted.

ABSTRACT

According to one embodiment, an electronic apparatus includes: a substrate which includes a first end portion, a second end portion, a first surface, and a second surface , and in which a non-flat portion that includes at least one of a convex portion protruded on a side far apart from the second end portion, and a concave portion recessed on a side close to the second end portion, is provided in the first end portion; a plurality of electrical components that is provided in at least one of the first surface and the second surface; a plurality of electrodes that includes a contact portion which is provided in one of the first surface and the second surface, and is in contact with at least one of a subject and an external conductor; and a housing which includes an outer surface, in which a trace of a gate provided in an injection molding mould exists in a position on an opposite side to the second end portion of the non-flat portion, on the outer surface, and which includes a synthetic resin material that covers the substrate, the electrical components, and the electrodes, in a state in which at least the contact portion is exposed and the substrate, the electrical components, and the electrodes are inserted.

Drawings

FIG. 16

208: wireless router

202: base station

204: network

206: server

206a: storage device