

CIRCUIT ORIGINAL SUBSTRATE, METHOD OF MANUFACTURING CIRCUIT
SUBSTRATE MODULE, AND ELECTRONIC TIMEPIECE

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a tape-like flexible circuit original substrate used in manufacturing a circuit substrate for timepiece, in which circuit substrate forming parts having circuit pattern parts and component disposing holes have been regularly formed in left and right two rows in its longitudinal direction. Further, the present invention relates to a method of manufacturing a circuit substrate module for timepiece, which contains a process of manufacturing the tape-like flexible circuit original substrate in which the circuit substrate forming parts having the circuit pattern parts and the component disposing holes have been regularly formed in the left and right two rows in its longitudinal direction, a process of mounting an electrical component to the circuit pattern part of the tape-like flexible circuit original substrate, and a circuit substrate separating process in which the circuit pattern part mounted with the electrical component is cut off from the tape-like flexible circuit original substrate to thereby form the circuit substrate module.

Description of the Prior Art:

In a movement of the timepiece, there are incorporated

machine components, such as main plate and various gear wheels, and electrical components. In the electrical components, there are contained the circuit substrate, a quartz oscillator, an IC chip, a coil body, and the like. The number of these components is as many as several hundreds and, as to their sizes, there are one of centimeter unit to one of millimeter unit. Accordingly, a manufacture of the movement of the timepiece is being effectively performed by an automated line.

As shown in Fig. 6 of JP-A-2003-283096 Gazette (Patent Document 1) for instance, in a flow of the automated manufacture of the movement of the timepiece, there are punctured a carrying slot, a substrate attaching hole, a component disposing hole for disposing the quartz oscillator, and the like in a long tape-like flexible plate by a blanking of a press, thereafter a copper foil or the like is adhered onto a surface of the tape-like flexible plate, and a conductor pattern containing a predetermined circuit pattern part and a plated lead part is formed by applying a publicly-known photolithography technique. Next, an electrolytic plating of Au or the like is applied to a surface of the above circuit pattern part by using the plated lead part. Thereafter, the individual circuit pattern part is electrically separated by forming a cut hole obtained by blanking a wiring path of the plated lead part. Through the processes till this, a long tape-like flexible circuit original substrate is completed.

As mentioned above, in the manufacturing line of the long tape-like flexible circuit original substrate, there are contained the press process, the circuit pattern manufacturing process, and the plating process. And, a feeding side reel is installed in an inlet of the manufacturing line of the long tape-like flexible circuit original substrate, and a receiving side reel in an outlet. The long tape-like flexible circuit plate wound in the feeding side reel is intermittently carried by a predetermined length by a tape feeding device, the blanking is performed by a press machine, a formation of the circuit pattern is performed by a circuit pattern forming line, and a plating is applied by a plating line. Accordingly, when reeled by the receiving side reel, in the long tape-like flexible circuit plate, there are made the predetermined circuit patterns of plural rows and the predetermined blanking. And, when having been wholly reeled by the receiving side reel, the long tape-like flexible circuit original substrate is completed.

The completed long tape-like flexible circuit original substrate is set to a next component mounting line while being wound in the reel intact, and intermittently carried by a predetermined length by a carrying device. In the component mounting line, the IC chip is mounted onto the circuit pattern of the long tape-like flexible circuit original substrate, and there is performed an electrical connection test as to whether or not there exists a problem in a conductive connection between

the IC chip and the circuit pattern part. And if there is no abnormality, the IC chip is molded. Additionally, terminals of the quartz oscillator are mounted to the above circuit pattern such that the quartz oscillator is disposed inside the above component disposing hole and, thereafter, there are performed a confirmation as to whether or not the quartz oscillator normally oscillates, an adjustment of an oscillation frequency of the quartz oscillator, and an electrical test of the whole circuit substrate.

It is carried from the component mounting line to a press line. That is, in the press line, the above circuit pattern part is blanked through by the blanking of the press, thereby completing the circuit substrate module. Here, the circuit substrate module means a module in which the quartz oscillator and the IC chip have been already mounted to the circuit substrate. This circuit substrate module is incorporated into the movement of the timepiece together with the machine components such as the main plate and the various gear wheels, and the like.

Here, by referring to Fig. 3, it is explained about a structure of a conventional long tape-like flexible circuit original substrate 20, and a method of manufacturing the circuit substrate module using this long tape-like flexible circuit original substrate 20. That is, Fig. 3 shows one part of the conventional long tape-like flexible circuit original substrate 20 in which a circuit substrate forming part 21L and

a circuit substrate forming part 21R have been regularly formed in left and right two rows in its longitudinal direction. The circuit substrate forming part 21L has a circuit pattern part 22L and a component disposing hole 24L. The circuit substrate forming part 21R has a circuit pattern part 22R and a component disposing hole 24R. A circuit substrate attaching hole 23L is formed in the circuit pattern part 22L, and a circuit substrate attaching hole 23R in the circuit pattern part 22R, respectively. Additionally, carrying slots 25L and 25R are formed in the tape-like flexible circuit original substrate 20 in its end parts of both sides. As apparent from the drawing, the adjoining left and right circuit substrate forming parts 21L and 21R are mutually in a disposition relation of point symmetry.

The method of manufacturing the circuit substrate module using this conventional long tape-like flexible circuit original substrate 20 is as follows. The completed long tape-like flexible circuit original substrate 20 is set to the component mounting line while being wound in the reel intact, and intermittently carried by the predetermined length by the carrying device. In the component mounting line, the IC chip is mounted to one side of the tape-like flexible circuit original substrate 20, e.g., onto the circuit pattern part 22R regularly formed in the right side of the drawing. Additionally, the terminals of the quartz oscillator are mounted onto the circuit pattern part 22 such that the quartz oscillator is disposed

inside the component disposing hole 24.

If the mountings of the IC chips to all the circuit pattern parts 22R formed in the right side of the tape-like flexible circuit original substrate 20 and the mounting of the terminals of the quartz oscillator to the circuit pattern part 22R are completed, it is carried from the component mounting line to the press line. In the press line, all the circuit pattern parts 22R formed in the right side of the tape-like flexible circuit original substrate 20 are blanked through by the press, and here the circuit substrate module utilizing the right side of the tape-like flexible circuit original substrate 20 is completed. At the same time, the tape-like flexible circuit original substrate 20 from which the circuit pattern parts 22R in the right side have been all blanked through is reeled to the reel. In this manner, a manufacture of the circuit substrate module utilizing the right side of the tape-like flexible circuit original substrate 20 is finished.

Subsequently, the tape-like flexible circuit original substrate 20 from which the circuit pattern parts 22R in the right side have been all blanked through and which has been reeled to the reel is presented to a manufacture of the circuit substrate module utilizing its left side. That is, though the mountings of the IC chips to all the circuit pattern parts 22L formed in the left side of the tape-like flexible circuit original substrate 20, the mounting of the terminals of the

quartz oscillator to the circuit pattern part 22L and the blanking of all the circuit patterns 22L formed in the left side by the press in the press line, the circuit substrate module utilizing the left side of the tape-like flexible circuit original substrate 20 is completed. In this manner, a manufacture of the circuit substrate module utilizing in order the left and the right of the tape-like flexible circuit original substrate 20 is finished.

As mentioned above, the circuit substrate module incorporated into the movement of the timepiece is effectively manufactured by an automatic manufacturing line, but an additional reduction in manufacturing cost is demanded.

A 1st problem that the present invention is to solve is to reduce the manufacturing cost of the circuit substrate module using a tape-like flexible circuit original substrate in which circuit substrate forming parts having a circuit pattern part and a component disposing hole are regularly formed in left and right two rows in a longitudinal direction, wherein the adjoining left and right circuit substrate forming parts are mutually in a disposition relation of point symmetry. A 2nd problem that the present invention is to solve is to reduce a raw material cost of the circuit original substrate.

SUMMARY OF THE INVENTION

A circuit original substrate concerning the present

invention possesses a circuit substrate forming part which has a circuit pattern part formed with a wiring and a component disposing hole for escaping an electronic element connected to the wiring, and is characterized in that the circuit substrate forming parts are regularly formed in left and right two rows in a longitudinal direction, and the adjoining left and right circuit substrate forming parts are formed with the component disposing hole being intermediately disposed and commonly used. The component disposing hole is formed while being slanted with respect to the longitudinal direction.

Further, a circuit original substrate concerning the present invention may be a tape-like flexible shape, whose raw material is made polyimide.

Further, a method of manufacturing a circuit substrate module, which concerns the present invention, has a step of disposing, in the aforesaid circuit original substrate, in which circuit substrate forming parts having a circuit pattern part and a component disposing hole are regularly formed in left and right two rows in a longitudinal direction, an electrical component to the component disposing hole of any one of the circuit substrate forming part between the left and right circuit substrate forming parts to thereby mount it to the circuit pattern part, a step of cutting off the circuit pattern part of any one of the circuit substrate forming part from the circuit original substrate, a step of disposing the electrical component

to the component disposing hole of the other of the circuit substrate forming part between the left and right circuit substrate forming parts in the circuit original substrate to thereby mount it to the circuit pattern part, and a step of cutting off the circuit pattern part of the other of the circuit substrate forming part from the circuit original substrate.

And, an electronic timepiece concerning the present invention has a time instant counting part which counts the time instant and has a circuit substrate cut off from the aforesaid circuit original substrate, a drive part which drives for displaying a state measured by the time instant counting part, and a display part which displays a time instant by the drive part.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

A preferred form of the present invention is illustrated in the accompanying drawings in which:

Fig. 1 is a partial enlarged plan view of a tape-like flexible circuit original substrate of an Embodiment 1 of the present invention;

Figs. 2 are diagram explaining manufacturing processes of a circuit substrate module for timepiece, which use the tape-like flexible circuit original substrate of the Embodiment 1 of the present invention;

Fig. 3 is a partial enlarged plan view of a conventional

tape-like flexible circuit original substrate.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The tape-like flexible circuit original substrate used in a manufacture of the circuit substrate module of the timepiece, which concerns the present invention, is a tape-like flexible circuit original substrate in which circuit substrate forming parts having a circuit pattern part and a component disposing hole are regularly formed in left and right two rows in a longitudinal direction and, in the tape-like flexible circuit original substrate wherein the adjoining left and right circuit substrate forming parts are mutually in a disposition relation of point symmetry, the adjoining left and right circuit substrate forming parts are formed with the component disposing hole being intermediately disposed and commonly used.

<Embodiment 1>

A long tape-like flexible circuit original substrate 10, of the Embodiment 1, used in the manufacture of the circuit substrate module for the timepiece, which is constituted with the component disposing hole being commonly used, is one in which, as shown in Fig. 1, there are regularly formed, in left and right two rows in its longitudinal direction, in a left side a circuit substrate forming part 11L respectively having a circuit pattern part 12L and a common use component disposing hole 14, and in a right side a circuit substrate forming part

11R respectively having a circuit pattern part 12R and the common use component disposing hole 14. A circuit substrate attaching hole 13L is formed in the circuit pattern part 12L, and a circuit substrate attaching hole 13R in the circuit pattern part 12R, respectively. Additionally, carrying slots 15L, 15R are formed in the tape-like flexible circuit original substrate 10 in its end parts of both sides.

As apparent from the drawing, the adjoining left and right circuit pattern parts 11L and 11R are mutually in the disposition relation of point symmetry. Further, the adjoining left and right circuit pattern parts 11L and 11R are formed with the component disposing hole 14 being intermediately disposed and commonly used. The common use component disposing hole 14 is approximately a rectangle, and formed while being slanted with respect to its longitudinal direction.

The long tape-like flexible circuit original substrate 10 shown in Fig. 1 is produced by such a method as mentioned below. First, the carrying slots 15L and 15R, the circuit substrate attaching holes 13L and 13R and the component disposing hole 14 for disposing the quartz oscillator are punctured in a long tape-like flexible plate of polyimide, which becomes a raw material, by the blanking of the press. Subsequently, the copper foil or the like is adhered onto the surface of the above tape-like flexible plate, and the conductor pattern containing the predetermined circuit pattern part and the plated

lead part is formed by applying the publicly-known photolithography technique. Next, the electrolytic plating of Au or the like is applied to the surface of the above circuit pattern part by using the plated lead part. Through the above processes, the long tape-like flexible circuit original substrate 10 is completed.

As apparent if compared with the conventional tape-like flexible circuit original substrate shown in Fig. 3, the tape-like flexible circuit original substrate concerning the present invention, in which the component disposing hole has been constituted while being commonly used, is reduced in its width by about 30% than the conventional one. Since the component disposing hole which had been necessary in each of the left and the right has been commonly used, a space has been saved by for one component disposing hole. For this reason, a raw material expenditure of the tape-like flexible circuit original substrate 10 concerning the present invention has been extremely reduced.

Next, a method of manufacturing the circuit substrate module using the long tape-like flexible circuit original substrate 10 concerning the present invention, which has been constituted with the component disposing hole being commonly used, is explained by referring to Figs. 2. Such a long tape-like flexible circuit original substrate 10 as shown in Fig. 2A is set to the component mounting line while being wound in the

reel intact, and intermittently carried by the predetermined length by the carrying device. In the component mounting line, an IC chip 16 is mounted onto the circuit pattern part 12R regularly formed in the right side of the tape-like flexible circuit original substrate 10. Additionally, terminals of a quartz oscillator 17 are mounted to the circuit pattern part 12R such that the quartz oscillator 17 is disposed inside the component disposing hole 14.

Fig. 2B shows the long tape-like flexible circuit original substrate 10 in which the mountings of the IC chips 16 to all the circuit pattern parts 12R formed in the right side and the mounting of the terminals of the quartz oscillator 17 to the circuit pattern part 12R have been completed. That is, it shows the long tape-like flexible circuit original substrate 10 under a state that one side mounting has been completed.

Subsequently, the long tape-like flexible circuit original substrate 10 in which the one side mounting has been completed is carried from the component mounting line to the press line. In the press line, all the circuit pattern parts 12R formed in the right side of the tape-like flexible circuit original substrate 10 are blanked through by the blanking of the press. The IC chip 16 and the quartz oscillator 17 are respectively mounted to the individual circuit pattern part 12R having been blanked through, and the individual circuit substrate module is completed at the same time as the blanking.

Further, the tape-like flexible circuit original substrate 10 from which the circuit pattern parts 12R in the right side have been all blanked through is reeled to the reel. In this manner, the manufacture of the circuit substrate module utilizing the right side of the tape-like flexible circuit original substrate 10 is finished.

Fig. 2C shows the long tape-like flexible circuit original substrate 10 from which all the circuit substrate pattern parts 12R formed in the right side have been blanked through by the blanking. As apparent from Fig. 2C, the common use component disposing hole 14 is left in the long tape-like flexible circuit original substrate 10.

Additionally subsequently, the tape-like flexible circuit original substrate 10 from which the circuit pattern parts 12R in the right side have been all blanked through and which is reeled to the reel is presented to the manufacture of the circuit substrate modules utilizing all the circuit substrate forming parts 11L formed in its left side. That is, the tape-like flexible circuit original substrate 10 from which the circuit pattern parts 12R in the right side have been all blanked through and which is reeled to the reel is set to the component mounting line, and intermittently carried by the predetermined length by the carrying device. In the component mounting line, the IC chip 16 is mounted onto the circuit pattern part 12L regularly formed in the left side of the tape-like

flexible circuit original substrate 10. Additionally, the terminals of the quartz oscillator 17 are mounted to the circuit pattern part 12L such that the quartz oscillator 17 is disposed inside the common use component disposing hole 14.

Fig. 2D shows the long tape-like flexible circuit original substrate 10 in which the mountings of the IC chips 16 to all the circuit pattern parts 12L formed in the left side and the mounting of the terminals of the quartz oscillator 17 to the circuit pattern part 12L have been completed. That is, it shows the long tape-like flexible circuit original substrate 10 under a state that a remaining one side mounting has been completed.

Finally, the long tape-like flexible circuit original substrate 10 in which the remaining one side mounting has been completed is carried from the component mounting line to the press line. In the press line, all the circuit pattern parts 12L formed in the left side of the tape-like flexible circuit original substrate 10 are blanked through by the blanking of the press. The IC chip 16 and the quartz oscillator 17 are already, respectively mounted to the individual circuit pattern part 12L having been blanked through, and the individual circuit substrate module is completed at the same time as the blanking. Further, the tape-like flexible circuit original substrate 10 from which the circuit pattern parts 12L in the left side have been all blanked through is reeled to the reel. In this manner, the manufacture of the circuit substrate module utilizing the

left side of the tape-like flexible circuit original substrate 10 is finished and, accordingly, the manufacture of the circuit substrate module using the long tape-like flexible circuit original substrate 10 concerning the present invention, which has been constituted with the component disposing hole being commonly used, is all completed.

Fig. 2E shows the long tape-like flexible circuit original substrate 10 in which all the circuit pattern parts 12L and 12R formed in the left and the right have been blanked through by the blanking of the press. That is, it shows a spent state of the tape-like flexible circuit original substrate 10 which has been constituted with the component disposing hole being commonly used.

By the present invention, since a width of the tape-like flexible circuit original substrate could be reduced by about 30% of the prior art, the raw material cost could be reduced. Further, by the present invention, it is intended to reduce the manufacturing cost of the circuit substrate module using the tape-like flexible circuit original substrate and, as a result, a reduction in price of the movement of the timepiece has been realized as well.

What is claimed is:

1. A circuit original substrate comprising:

a circuit pattern part formed with a wiring;

a circuit substrate forming part having a component disposing hole for escaping an electronic element connected to the wiring;

wherein the circuit substrate forming parts are regularly formed in left and right two rows in a longitudinal direction, and

the adjoining left and right circuit substrate forming parts are formed with the component disposing hole being intermediately disposed and commonly used.

2. A circuit original substrate according to claim 1, wherein the component disposing hole is formed while being slanted with respect to the longitudinal direction.

3. A circuit original substrate according to claim 1, wherein the circuit original substrate is a tape-like flexible shape, whose raw material is made polyimide.

4. A circuit original substrate according to claim 2, wherein the circuit original substrate is a tape-like flexible shape, whose raw material is made polyimide.

5. A method of manufacturing a circuit substrate module, which has:

a step of disposing, in a circuit original substrate according to any of claims 1 to 4, in which circuit substrate

forming parts having a circuit pattern part and a component disposing hole are regularly formed in left and right two rows in a longitudinal direction, an electrical component to the component disposing hole of any one of the circuit substrate forming part between the left and right circuit substrate forming parts to thereby mount it to the circuit pattern part,

a step of cutting off the circuit pattern part of any one of the circuit substrate forming part from the circuit original substrate,

a step of disposing the electrical component to the component disposing hole of the other of the circuit substrate forming part between the left and right circuit substrate forming parts in the circuit original substrate to thereby mount it to the circuit pattern part, and

a step of cutting off the circuit pattern part of the other of the circuit substrate forming part from the circuit original substrate.

6. An electronic timepiece comprising:

a time instant counting part for counting the time instant and having a circuit substrate cut off from a circuit original substrate according to any of claims 1 to 4;

a drive part for driving for displaying a state measured by the time instant counting part; and

a display part for displaying a time instant by the drive part.