

DESCRIPTION

ELECTRONIC APPARATUS COMPRISING AUXILIARY STORAGE DEVICE

5 CROSS-REFERENCE TO RELATED APPLICATIONS

This application is national stage application of International Application No. PCT/JP2015/079187, filed October 15, 2015, which designates the United States, incorporated herein by reference, and which claims the
10 benefit of priority from Japanese Patent Application No. 2014-217503, filed October 24, 2014, the entire contents of which are incorporated herein by reference.

FIELD

15 An embodiment described herein relates generally to an electronic apparatus comprising an auxiliary storage.

BACKGROUND

An electronic apparatus comprising an auxiliary
20 storage, for use in the industrial field of social infrastructure, has been required to have a front replaceable structure which enables replacement of the auxiliary storage from the front face of a housing of the electronic apparatus without disassembling the housing,
25 aiming for facilitating maintenance work.

Generally, the electronic apparatus and the auxiliary storage are not firmly fixed to each other inside the housing of the electronic apparatus, so that the auxiliary storage of a front detachable structure may suffer larger
30 vibration than applied acceleration when the electronic apparatus receives vibration from outside and collide with the auxiliary storage.

In addition, an auxiliary storage, such as a hard disk

drive (HDD), is mechanically operated, therefore, susceptible to vibration and impact. In view of this, various techniques have been developed for improving a vibration-proof performance and a shock resistant performance of the electronic apparatus.

For example, a known vibration-proof structure of the electronic apparatus including such a front replaceable auxiliary storage is such that the auxiliary storage and a tray as a mount for the auxiliary storage are integrally fixed to each other, the tray is inserted from an opening in the front face of a housing, and fixed to a frame on the rear face of the housing and to the front face of the housing with long knurled-head screws (see Patent Literature 1, for example).

Another vibration-proof structure of an electronic apparatus including a detachable auxiliary storage in the housing of the electronic apparatus includes a holder on which the auxiliary storage is mounted, and a vibration damping means between the auxiliary storage and the holder. In the vibration-proof structure, when joining a connector of the housing or a connector of the holder, one of them is attached to the other in a floating state so as to be displaceable (see Patent Literature 2, for example).

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Patent Application Laid-open No. 2013-77343

Patent Literature 2: Japanese Patent No. 4116322

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SUMMARY OF THE INVENTION

Problem to be Solved by the Invention

However, the front replaceable structure disclosed in

Patent Literature 1 is a complex detachable structure since the front face of the tray on which the auxiliary storage is mounted is fixed to the front face of the housing and the rear of the tray is fixed inside the housing with
5 screws.

Although the vibration-proof structure of the electronic apparatus disclosed in Patent Literature 2 is a easily detachable structure, the vibration-proof structure of the auxiliary storage (HDD unit) is complex. The
10 auxiliary storage is supported by a large number of vibration damping means, such as a rubber material, which is a complex vibration-proof supporting structure.

In view of solving the above problems, an object of the present invention is to provide an electronic apparatus
15 comprising an auxiliary storage easily detachable from the front face of a housing of the electronic apparatus, and an easily settable vibration-proof structure.

Means for Solving Problem

20 According to one embodiment, an electronic apparatus comprises an auxiliary storage detachably attached to a housing, the electronic apparatus comprises a tray in which the auxiliary storage is fixed; a compartment including a guide rail to guide the tray inserted from an opening in a
25 front face of the housing of the electronic apparatus, to house the auxiliary storage in the electronic apparatus; a pair of first movable plates horizontally rotatably supported by a rotational shaft at top of both rear corner ends of the compartment; and a connector attachment plate
30 provided to a rear side face of the compartment, the connector attachment plate including a second connector connectable to a first connector provided to the auxiliary storage, wherein the first movable plate has a first

rotational face and a second rotational face disposed at a right angle to follow an outer face of a perpendicular rear corner end of the tray, for connecting the first connector and the second connector to each other when the

5 tray is inserted from the front face of the compartment to a fixed position in the opening, a rear end of the tray presses and rotates the first rotational face, and a vibration impact absorption

member attached to the second rotational face presses a side face of the tray, the second rotational face rotating with the first rotational face.

BRIEF DESCRIPTION OF DRAWINGS

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

FIG. 2A is a view for explaining a detachable structure of the electronic apparatus as viewed from above.

FIG. 2B is a view for explaining the detachable structure of the electronic apparatus as viewed from above.

FIG. 3A is a view for explaining the detachable structure of the electronic apparatus as viewed laterally.

FIG. 3B is a view for explaining the detachable structure as viewed laterally.

FIG. 4A is an explanatory view of a movable part of a vibration-proof structure including a position sensor.

FIG. 4B is an explanatory view of the movable part of the vibration-proof structure including the position sensor.

FIG. 5A is an explanatory view of a vibration-proof structure including a heat dissipation mechanism for an auxiliary storage device.

FIG. 5B is an explanatory view of the vibration-proof structure including the heat dissipation mechanism for the auxiliary storage device.

DETAILED DESCRIPTION

Hereinafter, a vibration-proof structure of an electronic apparatus including an auxiliary storage according to the present embodiment will be explained with reference to the accompanying drawings.

First Embodiment

Although the auxiliary storage of a first embodiment is exemplified by a hard disk drive (HDD), the

auxiliary storage of the embodiment may be any storage as long as storage medium including magnetism and light can be physically changed to record and reproduce data.

The constitution of the embodiment is first explained with reference to a perspective external view of an electronic apparatus 100 illustrated in FIG. 1.

The electronic apparatus 100 has a structure of which a connector connection-type auxiliary storage 2 is fixed to a tray 4, inserted into and drawn from an opening 1a in the front face of the housing 1 along guide rails 3a of a compartment 3 to attach or detach the auxiliary storage device 2 to or from the housing 1.

Hereinafter, the structure of the electronic apparatus is specifically explained with reference to FIG. 2A, FIG. 2B, FIG. 3A, and FIG. 3B. FIG. 2A and FIG. 2B are views from above in the A direction, FIG. 2A illustrates a state of the tray 4 when starting inserting from the opening 1a, and FIG. 2B illustrates a state of the tray 4 when inserting into the compartment 3 till a fixed position thereof and fixed to the front face of the housing 1.

As illustrated in FIG. 1 and FIG. 2A, the opening 1a in the front face of the housing 1 may be, for example, formed by fixing a front panel of the compartment 3 to a front panel of the housing 1. In FIG. 1, the front panel of the compartment 3 is illustrated as the front panel of the housing 1.

FIG. 3A and FIG. 3B are views of the compartment 3 as viewed laterally in the B direction illustrated in FIG. 1, FIG. 3A illustrates a state of the tray 4 when starting inserting from the opening 1a, and FIG. 3B illustrates a state of the tray 4 when inserting into the compartment 3 till the fixed position thereof and fixed to the front face of the housing 1.

FIG. 2A, FIG. 2B, FIG. 3A, and FIG. 3B illustrate only the frame of the compartment 3 as a cross section by hatching for the sake of simple understanding of the individual structures of the compartment 3, the tray 4, and first movable plates 6.

The vibration-proof structure of the electronic apparatus 100 comprising the auxiliary storage 2 in the present embodiment includes the tray 4 whose bottom plate is integrally fixed to the auxiliary storage 2, the compartment 3 into which the tray 4 is inserted and guided along the guide rails 3a from a front side of the opening 1a of a rectangular shape in the front face of the housing 1 of the electronic apparatus, to accommodate the tray 4 in the housing 1, a pair of first movable plates 6a and 6b horizontally rotatably supported by rotational shafts at both rear corner ends of the compartment 3 to be horizontally rotatable above both rear corner ends of the compartment 3, and a connector attachment plate 3b disposed to be displaceable on the rear side face of the compartment 3.

One of the first movable plate pair 6, the first movable plate 6a has an L shape including a first rotational face C1 and a second rotational face C2 disposed at a right angle about a rotational shaft 16a to follow the outer faces of the perpendicular rear corner ends of the tray 4.

The other of the pair of the first movable plates 6, the first movable plate 6b has an L shape including a first rotational face C1 and a second rotational face C2 disposed at a right angle about a rotational shaft 16b to follow the outer faces of the perpendicular rear corner ends of the tray 4. The pair of the first movable plates 6a and 6b are arranged plane-symmetrically relative to each

other in the longitudinal direction of the tray 4.

The tray 4 is inserted from the front face of the compartment 3, the rear end of the tray 4 presses and rotates the respective first rotational faces C1 of the first movable plates 6a and 6b, to connect a connector 8 (first connector) fixed to the rear side face of the auxiliary storage 2 and a connector 9 (second connector) of the connector attachment plate 3b when the tray 4 is fixed to the opening 1a in the front face of the housing 1 of the electronic apparatus 100.

That is, the positions of the pair of the connector 8 and the connector 9 in the tray 4 and the compartment 3 and the shape of the pair of the first movable plates 6 (6a and 6b) are set in advance such that both the rear corner ends of the tray 4 press the respective first rotational faces C1 of the first movable plates 6a and 6b and hence, vibration impact absorbers 7 attached to the respective second rotational faces C2 rotating together with the first rotational faces C1 press the side faces of the tray 4.

Such structure and positioning make it possible to easily attach and detach the tray 4 to and from the front face of the electronic apparatus 100 and provide ease of the maintenance of the auxiliary storage 2. Also, properly selecting the property of the vibration impact absorbers 7 adhering to the second rotational faces C2 of the first movable plates 6a and 6b makes it possible to provide the vibration-proof structure of the electronic apparatus comprising the auxiliary storage, the vibration-proof structure which enables simple setting of damping properties of vibration and impact applied to the auxiliary storage 2 through the housing 1 of the electronic apparatus 100..

Next, the structure of a pair of second movable plates 26a and 26b for vertically placing the auxiliary storage therebetween for fixation is described with reference to FIG. 3A and FIG. 3B. The second movable plate 26a is placed at the top side of the auxiliary storage 2, and the second movable plate 26b is placed at the bottom side of the auxiliary storage 2.

In FIG. 3A and FIG. 3B, the pair of second movable plates 26a and 26b are vertically rotatably supported by rotational shafts at both top and bottom rear ends of the compartment 3, respectively, to be vertically rotatable at the top and bottom rear ends, respectively.

A rotational shaft 36a and a rotational shaft 36b are arranged in the frame (not illustrated in the drawings) of the compartment 3 placed above and below the auxiliary storage 2, respectively.

The second movable plate 26a placed above the auxiliary storage 2 has a third rotational face C3 and a fourth rotational face C4 that are disposed around the rotational shaft 36a at a right angle to follow the outer face of the perpendicular cross section of the rear center (central area) of the auxiliary storage 2 fixed to the tray 4. The second movable plate 26b placed below the auxiliary storage 2 has a fifth rotational face C5 and a sixth rotational face C6 that are disposed around the rotational shaft 36b at a right angle to follow the outer face of the perpendicular shape of the rear corner end of the bottom of the tray 4.

In the vibration-proof structure of the auxiliary storage 2 as above, the tray 4 is inserted from the front of the opening 1a of the housing 1, and the rear end of the auxiliary storage 2 in the tray 4 presses the third rotational face C3 of the upper second movable plate 26a,

thereby rotating the upper second movable plate 26a.

At the same time, the rear bottom end of the tray 4 presses the fifth rotational face C5 of the second movable plate 26b to rotate the lower second movable plate 26b. While the tray 4 is fixed in the opening 1a in the front face of the housing 1, the connector 8 (first connector) fixed to the rear side face of the auxiliary storage 2 is connected to the connector 9 (second connector) mounted on the connector attachment plate 3b.

The rear top corner end (rear center (central area)) of the auxiliary storage 2 fixed in the tray 4 presses the third rotational face C3 of the second movable plate 26a and simultaneously rotates the fourth rotational face C4 to press the top face of the auxiliary storage 2 with the vibration impact absorption member 7 attached to the fourth rotational face C4.

Likewise, the rear bottom corner end of the tray 4 presses the fifth rotational face C5 of the second movable plate 26b and simultaneously rotates the sixth rotational face C6 to press the bottom face of the bottom plate of the tray 4 with the vibration impact absorption member 7 attached to the sixth rotational face C6.

Such positional setting is feasible by setting, in advance, the positions of the connector pair 8 and 9 respectively provided to the tray 4 and the compartment 3, and the shape of the second movable plate pair 26a and 26b.

Owing to such a structure, the electronic apparatus 100 comprising the auxiliary storage 2 allows the tray 4 to be easily attached to and detached from the front face of the housing of the electronic apparatus, thereby facilitating the maintenance of the auxiliary storage 2. Furthermore, the impact and vibration damping properties applied to the auxiliary storage 2 through the housing 1 of

the electronic apparatus 100 can be easily set by properly selecting the property of the vibration impact absorption members 7 that press the auxiliary storage 2 vertically and laterally.

Second embodiment

Next, a second embodiment of a vibration-proof structure of an electronic apparatus comprising an auxiliary storage is explained with reference to FIG. 4A and FIG. 4B. The same elements in the second embodiment as those in first embodiment are denoted by the same reference numerals, and their repeated explanations are omitted.

The second embodiment differs from the first embodiment in including a position sensor 10 on at least one of the first movable plate pair 6a and 6b and the second movable plate pair 26a and 26b (second rotational face C2, fourth rotational face C4, or sixth rotational face C6), the position sensor 10 that detects a fixation of a movable plate in normal position (posture) on the auxiliary storage 2 or the tray 4.

The position sensor 10 may be either an optical sensor or a contact-type switch. An output of the position sensor 10 is output to a display, such as a light-emitting diode (LED), disposed on the front face of the housing 1. The display displays the state of the vibration-proof structure normally set (operated) or not in the electronic apparatus comprising the auxiliary storage 2.

Third embodiment

Next, a third embodiment of a vibration-proof structure of an electronic apparatus comprising an auxiliary storage is explained with reference to FIG. 5A and FIG. 5B. The same elements in the third embodiment as those in the first embodiment are denoted by the same reference numerals, and their repeated explanations are

omitted.

The third embodiment differs from the first embodiment in that the second movable plate 26a (fourth rotational face C4) above the auxiliary storage 2 includes a heat sink 15 so as to dissipate heat generated from the auxiliary storage 2 to outside the compartment 3.

The heat sink 15 is integrally formed on the top face (face not to contact with the auxiliary storage 2) of the fourth rotational face C4 of the second movable plate 26a that is brought into contact with the auxiliary storage 2. In addition, a heat conducting sheet 14 may be attached onto the contact face of the fourth rotational face C4 with the auxiliary storage 2 for improving heat conduction.

The auxiliary storage 2 configured as above can be improved in heat dissipation.

Note

Structure 1

A vibration-proof structure of an electronic apparatus comprising a connector connection-type auxiliary storage attached detachably to a front face of a housing of the electronic apparatus, the vibration-proof structure comprising:

- a tray including a bottom plate integrally fixed to the auxiliary storage;

- a compartment including guide rails to house the tray in the electronic apparatus, the tray being inserted from a front side of a rectangular opening provided in the front face of the housing of the electronic apparatus;

- a pair of first movable plates horizontally rotatably supported by shafts at both rear corner ends of the compartment, to be horizontally rotatable above both the rear corner ends of the compartment; and

a connector attachment plate disposed to be displaceable on a rear side face of the compartment, wherein

one of the pair of the movable plates having a shape
5 to have a perpendicular rotational face about a rotational shaft to follow an outer face of a perpendicular rear corner end of the tray,

the tray is inserted from the front face of the compartment to press and rotate, at the rear end, one
10 rotational face of the first movable plates,

a connector fixed on the rear side face of the auxiliary storage tray is connected to a connector provided to the connector attachment plate when the tray is fixed in the opening of the front face of the housing of electronic
15 apparatus,

positions of the tray and the pair of connectors provided to the tray and the compartment, and the shape of the first movable plates are set in advance so that both rear corner ends of the tray press one rotational face of
20 the pair of first movable plates and concurrently, a vibration impact absorption member attached to the other rotational face presses the side face of the tray, and

the tray can be attached to and detached from the front face of the electronic apparatus for easy
25 maintenance of the auxiliary storage, and selecting the vibration impact absorption member makes it easier to set the damping of impact and vibration applied to the auxiliary storage through the housing of the electronic apparatus.

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Structure 2

The vibration-proof structure of the electronic apparatus comprising the auxiliary storage according to

Structure 1, the vibration-proof structure further comprising:

a pair of second movable plates vertically rotatably supported by shafts above and below both rear ends of the compartment, to be vertically rotatable above and below both rear ends of the compartment, the second movable plate provided above including a perpendicular rotational face about a rotational shaft to follow an outer face of a perpendicular cross-section of a rear center of the auxiliary storage fixed to the tray, the second movable plate provided below including a perpendicular rotational face about a rotational shaft to follow an outer face of a perpendicular rear corner end of the tray, wherein

the tray is inserted from the front face of the housing of the electronic apparatus, and the rear end of the auxiliary storage in the tray presses one rotational face of the second movable plate provided above, and rotates the second movable plate provided above,

concurrently, a rear bottom end of the auxiliary storage in the tray presses one rotational face of the second movable plate provided below, and rotates the second movable plate provided below,

the connector fixed to the rear side face of the auxiliary storage is connected to the connector provided to the connector attachment plate when the tray is fixed to the opening in the front face of the housing of the electronic apparatus, and simultaneously, the rear top corner end of the auxiliary storage fixed to the tray presses one rotational face of the second movable plate,

the positions of the connectors provided to the tray and the compartment, and the shape of the first movable plates are set in advance so that the vibration impact absorption member attached to the other rotational face

presses the top face of the auxiliary storage, and so that the rear bottom corner end of the tray presses one rotational face of the second movable plate, and the vibration impact absorption member attached to the other rotational face presses the bottom face of the bottom plate of the tray, and

the tray is attached to and detached from the front face of the electronic apparatus for easy maintenance of the auxiliary storage, and selecting the vibration impact absorption member makes it easier to set the damping of impact and vibration applied to the auxiliary storage through the housing of the electronic apparatus.

Structure 3

The vibration-proof structure of the electronic apparatus comprising the auxiliary storage according to Structure 2, wherein one of the pair of first movable plates and the pair of second movable plates includes a position sensor configured to detect a state and a position of the attachment of the tray, and the electronic apparatus includes a display configured to display the state of the attachment of the tray.

Structure 4 The vibration-proof structure of the electronic apparatus comprising the auxiliary storage according to Structure 2 or Structure 3, wherein the second movable plate provided above to be pressed by the auxiliary storage includes a heat sink to dissipate heat generated from the auxiliary storage to outside the compartment.

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.

CLAIMS

1. An electronic apparatus comprising an auxiliary storage detachably attached to a housing, the electronic apparatus comprising:

a tray in which the auxiliary storage is fixed;

a compartment including a guide rail to guide the tray inserted from an opening in a front face of the housing of the electronic apparatus, to house the auxiliary storage in the electronic apparatus;

a pair of first movable plates horizontally rotatably supported by a rotational shaft at top of both rear corner ends of the compartment; and

a connector attachment plate provided to a rear side face of the compartment, the connector attachment plate including a second connector connectable to a first connector provided to the auxiliary storage, wherein

the first movable plate has a first rotational face and a second rotational face disposed at a right angle to follow an outer face of a perpendicular rear corner end of the tray,

for connecting the first connector and the second connector to each other when the tray is inserted from the front face of the compartment to a fixed position in the opening, a rear end of the tray presses and rotates the first rotational face, and a vibration impact absorption member attached to the second rotational face presses a side face of the tray, the second rotational face rotating with the first rotational face.

2. The electronic apparatus comprising the auxiliary storage according to claim 1, the electronic apparatus further comprising:

a pair of second movable plates vertically rotatably

supported by rotational shafts at top and bottom of both rear ends of the compartment, wherein

an upper one of the second movable plate pair has a third rotational face and a fourth rotational face disposed
5 at a right angle to follow an outer face of a perpendicular top part of a rear central area of the auxiliary storage,

a lower one of the second movable plate pair has a fifth rotational face and a sixth rotational face disposed at a right angle to follow a perpendicular outer face of a
10 rear corner end of a bottom of the tray,

for connecting the first connector and the second connector to each other when the tray is inserted from the front face of the compartment to a fixed position in the opening, the rear end of the auxiliary storage presses and
15 rotates the third rotational face, and a vibration impact absorption member attached to the fourth rotational face presses a top face of the auxiliary storage, the fourth rotational face rotating with the third rotational face, and

20 a rear bottom end of the tray presses and rotates the fifth rotational face, and a vibration impact absorption member attached to the sixth rotational face presses a bottom face of a bottom plate of the tray, the sixth rotational face rotating with the fifth rotational face.

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3. The electronic apparatus comprising the auxiliary storage according to claim 2, wherein

at least one of the first movable plate pair and the second movable plate pair includes a position sensor
30 configured to detect an attachment of the tray, and

the electronic apparatus comprises a display configured to display a state of the attachment of the tray.

4. The electronic apparatus comprising the auxiliary storage according to claim 2 or 3, wherein the upper one of the second movable plate pair includes a heat sink configured to dissipate heat generated from the auxiliary storage to outside the compartment.